Netherlands Enterprise Agency

Borssele Wind Farm Zone

Wind Farm Sites I and II

Project and Site Description

Version 2, August 2015

>> *Sustainable. Agricultural. Innovative. International.*

Contents

Foreword

The Dutch government wants to promote energy conservation and renewable energy. The aim is to make the Netherlands less dependent on coal, oil and gas, while securing the country's energy supply and keeping energy costs under control.

The Energy Agreement for Sustainable Growth, agreed by the government with employers organisations, trade unions, environmental organisations and others, sets out key actions and goals for energy conservation, boosting energy supply from renewable sources and job creation. The government regards the agreement as a major step towards achieving a fully sustainable energy supply.

The agreement sets a target for 14% of all energy to be generated from renewable sources by 2020, rising to 16% by 2023. Offshore wind energy will play a significant role in meeting the targets. The government wants cumulative installed offshore wind capacity to reach 4,500 MW by 2023, up from the 1,000 MW currently operational or under construction.

To assist in this, a new market framework and subsidy support system has been designed in consultation with the wind energy sector. Under the new framework, the government is responsible for grants, project consents and grid connection. Project development rights will be awarded to companies via five planned tenders. Companies will be invited to submit bids to develop projects in each round, with the company bidding the lowest price awarded a permit to build and operate the wind farm and granted the associated subsidy.

To help companies fully prepare competitive bids, the government provides the relevant site data regarding the physical conditions of the wind farm sites.

The wind farm sites which will be tendered are located in three designated offshore wind farm zones off the Dutch west coast. The first to be developed will be the BWFZ, located 12 nautical miles off the coast of the province of Zeeland. Allowing for a total capacity of 1,400 MW (to be developed in two 700 MW phases), the BWFZ comprises four sites for development. It lies in a part of the North Sea with relatively little other activity (there are no oil and gas platforms in proximity, for example).

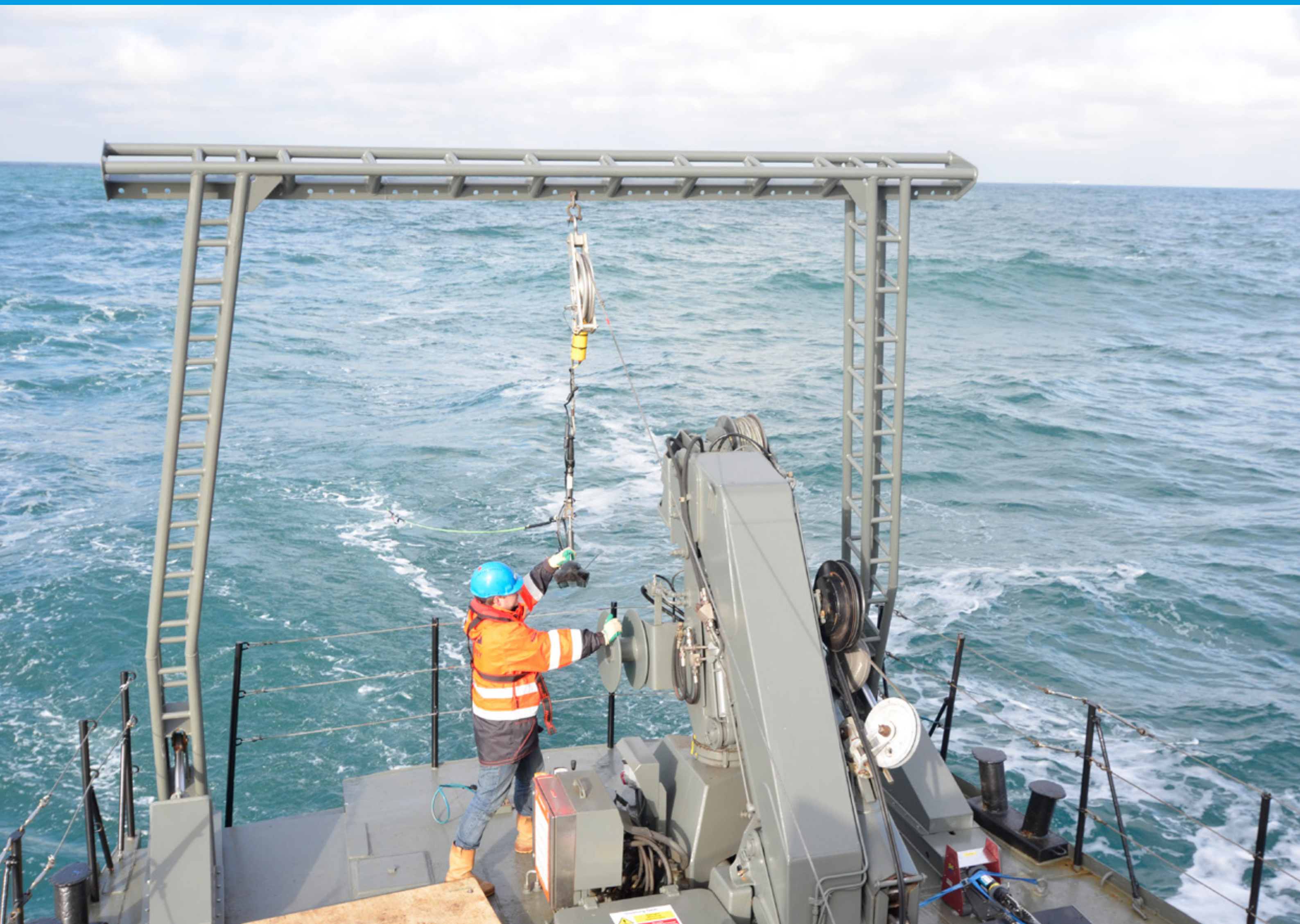
This revision of the Project and Site Description (PSD) for the BWFZ - BWFS I and II (combined capacity of 700 MW) provides an overview of the relevant site data for the first two sites to be offered up for development via the national request for tenders.
While some metocean measurement work remains ongoing, site data for these two sites is now complete.

The PSD also includes information about the legal framework and grid connection rules relating to planned offshore wind developments. If appropriate an update will be issued in December 2015.

A PSD for BWFS III and IV of the BWFZ is also planned by the end of 2015.

We trust this PSD provides useful information to help companies prepare a winning bid and complete the successful development of the planned offshore wind capacity.

1. Objectives and reading guide



1.1 Objectives

This Project and Site Description (PSD) is designed to help any party with an interest in participating in the planned SDE+ grant and permit tender for Borssele Wind Farm Sites I and II (BWFS I and II) in the Borssele Wind Farm Zone (BWFZ) in the Netherlands. This document summarises:

- A description of the site, surroundings and characteristics of WFS I and II.
- All data collected by the Netherlands Enterprise Agency (RVO.nl) regarding the physical environment of the Borssele area.
- A selection of constraints, technical requirements and grant related issues that are deemed to be most relevant for development of the Borssele area.
- The process for the SDE+ grant and permit and the legal framework.

This document has been produced for information purposes only and is not intended to replace any legal or formally communicated rules, regulation or requirements. More information on the site studies, including all reports mentioned in this PSD, can be found at ***offshorewind.rvo.nl***

1.2 Reading guide

The PSD presents an overview of all relevant information for parties interested in preparing a bid for the SDE+ grant and permit to build and operate the wind farms. This version replaces version 1 (December 2014) of the PSD, which was based on desk studies only. A geophysical and geotechnical survey and some new studies have since been completed. Using this latest information, some studies have been updated. In addition, the PSD now includes an overview of the legal framework and a list of requirements that are relevant to developers.

This report covers the following aspects in the different chapters:

- Chapter 1: Objectives and reading guide (this chapter)
- Chapter 2: Background - a general introduction to the history and current state of Dutch offshore wind development, including an outline of the process and approach towards the large-scale rollout of offshore wind.
- Chapter 3: BWFZ - Site Description - general information on the BWFZ, the location, surroundings, its bathymetry (submarine topography), and existing cable and pipeline infrastructure.
- Chapter 4: Site Data - a summary of all the studies and measuring campaigns performed to date on the BWFZ, covering the following aspects:
    - Morphodynamic characteristics
    - Archaeological assessment
    - UXO risk assessment
    - Geophysical survey
    - Geotechnical survey
    - Metocean characteristics
    - Metocean survey
    - Wind resource assessment
- Chapter 5: Legal framework - an overview of the legal framework that is and will be implemented to facilitate the Dutch offshore wind programme rollout and how this affects an offshore wind developer.
- Chapter 6: Specific requirements - an overview of the most relevant design parameters, coordinates, and SDE+ grant and permit requirements found in the various acts, decrees and ministerial orders, described in chapter 5. This overview is not complete and does not replace any legal documents, but it aims to provide information that is relevant to prepare a tender bid in early 2016.
- Chapter 7: Next steps - an overview of the process for submitting a tender for Borssele WFS I and II in late 2015. This chapter also provides information on where future updates will be published.
- Chapter 8: Applicable documents.

The report also contains a number of appendices, some of which can be found in a separate document.

- Appendix A: Site investigation procedure (this document).
- Appendix B: Translation of applicable law (in a separate document).
- Appendix C: Summary of Environmental Impact Analysis (in a separate document).

2. Background

2.1 Offshore wind farms in the Netherlands

The Netherlands' existing offshore wind farms and those currently under construction have a combined capacity of approximately 1,000 MW. The first two wind farms built in the North Sea are the Offshore Wind Farm Egmond aan Zee (OWEZ, 2006) and the Princess Amalia Wind Farm (2008). The 108 MW Offshore Wind Farm Egmond aan Zee lies 10-18 km off the coast and comprises 36 Vestas 3 MW turbines. It is owned by NoordzeeWind, a joint venture between energy company Nuon and energy supplier Shell. Energy Company Eneco owns the 120 MW Princess Amalia Wind Farm, located outside the 12-mile nautical zone, 23 km off the coast. It consists of 60 Vestas 2 MW turbines.

Two further offshore projects are currently under construction. The 129 MW Luchterduinen wind farm is a 50:50 joint venture between Eneco and Mitsubishi Corporation. Comprising 43 Vestas 3 MW turbines, it is located 23 km off the coast and is expected to be fully operational late 2015.

The second project under construction is the 600 MW Gemini offshore wind farm. Expected to be fully operational in 2017, it will consist of 150 Siemens 4 MW turbines installed across two locations (Buitengaats and Zee-Energie) 85 km off the coast. Northland Power, Siemens, Van Oord and HVC are the main shareholders in the project.

2.2 The roadmap towards 4,500 MW offshore wind power

In 2013 more than 40 organisations laid the foundations for a robust, future-proof energy and climate policy for the Netherlands by approving the Energy Agreement for Sustainable Growth (Energieakkoord voor Duurzame Groei, September 6th 2013) [1]. An important part of this agreement includes scaling up of offshore wind power development. In September 2014 the Minister of Economic Affairs presented a road map [2] to parliament, outlining how the Government plans to achieve its offshore wind goals in accordance with the time line agreed upon in the Energy Agreement.

The road map sets out a schedule of tenders offering 700 MW of development each year in the period 2015 – 2019, under the condition that the cost of offshore wind power will decrease by 40% in 2024, compared to 2014.

The Dutch Government has developed a systematic framework under which offshore wind farm zones are designated. Any location outside these wind farm zones are not eligible to receive a permit. Within the designated wind farm zones the government decides the specific sites where wind farms can be constructed using a so-called Wind Farm Site Decision ('Kavelbesluit'). This contains conditions for building and operating a wind farm on a specific site. The Dutch Government provides all relevant site data and Dutch transmission system operator TenneT is responsible for grid connection.

Winners of the site development tenders will be granted a permit to build a wind farm according to the Offshore Wind Energy Act (Wet Windenergie op zee), a SDE+ grant and offered a grid connection to the main land. The Ministry provides site data, which can be used for the preparation of bids for these tenders. This system is expected to contribute to cost savings.

2.3 Wind Farm Zones

The Government has decided that three offshore Wind Farm Zones, within the appointed designated areas for offshore wind, will be used for the deployment of the 3,500 MW of new offshore wind power as agreed upon in the Energy Agreement: Borssele (1,400 MW), Hollandse Kust ZH (1,400 MW) and Hollandse Kust NH (700 MW). Figure 1 shows a schematic representation of these wind farm zones and the planned timetable for related tenders to be issued.

The tender timetable for this rollout will follow the schedule below. To ensure the required cost reduction for offshore wind, the government has introduced a price cap on projects for each Wind Farm Zone (the price cap decreases each year).

In 2015 and 2016, tenders to develop the BWFZ will be issued under the subsidy programme, Stimulation of Sustainable Energy Production (SDE+, or Stimulering Duurzame Energieproductie). The remainder of this PSD provides information on the projects and site data for the first tender round which is planned for December 2015. This tender round comprises two WFS of approximately 350 MW[1] each: BWFS I and BWFS II.

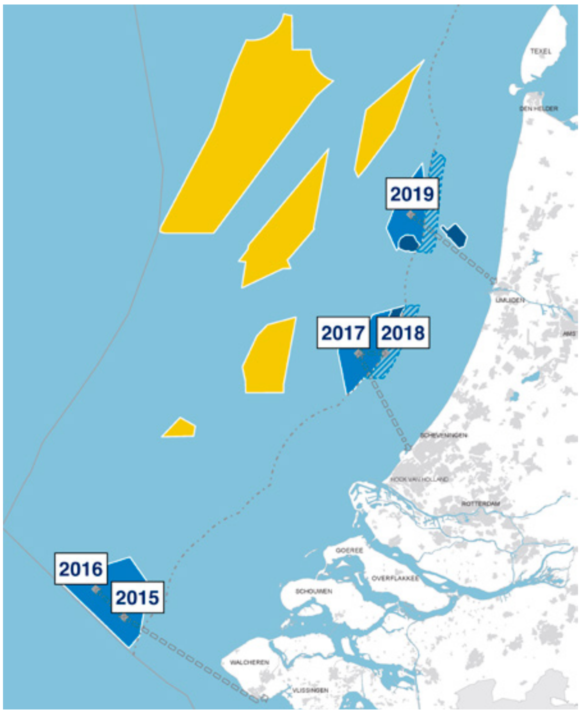


Figure 1. Tender timetable for the Dutch Offshore Wind Rollout. Wind farm zones to be tendered are marked light blue, realised wind farms in dark blue, future wind farm zones in yellow.

Year	Power	Wind Farm Zone	Price cap (eurocent/kWh)
2015	700 MW	Borssele Wind Farm Zone, Wind Farm Site I and II	12.400
2016	700 MW	Borssele Wind Farm Zone, Wind Farm Site III and IV	11.975
2017	700 MW	Hollandse Kust ZH Wind Farm Zone	10.750
2018	700 MW	Hollandse Kust ZH Wind Farm Zone	10.320
2019	700 MW	Hollandse Kust NH Wind Farm Zone	10.000

1) Depending on the type of turbine, an operator is allowed to install 342-380 MW per site (See chapter 6 for more information). For the sake of simplicity, the remainder of this PSD assumes a fixed capacity of 350 MW.

3. Borssele Wind Farm Site I and II – site description

3.1 General description of the Borssele Wind Farm Zone

The BWFZ, shown in figure 2, is located at the southern border of the Netherlands Exclusive Economic Zone (EEZ); 0.5 km from the Belgium EEZ. The zone borders a sand extraction area in the southeast and a piloting area in the east. Anchoring areas and a shipping lane are located at the north side of the zone. The Belgian dedicated offshore wind zone is located directly to the southwest.

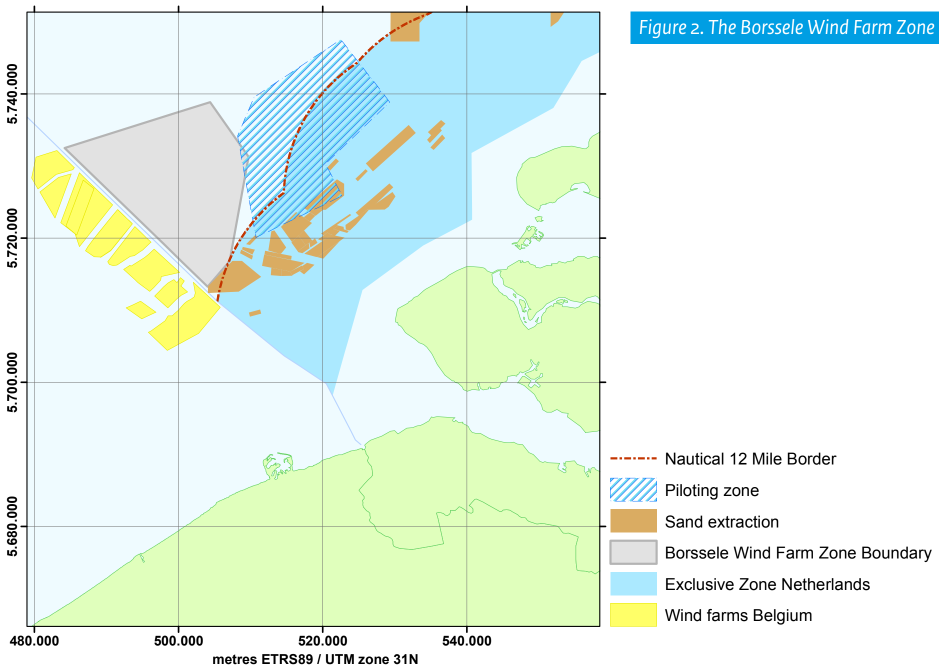


Figure 2. The Borssele Wind Farm Zone and surrounding areas.

The BWFZ of approximately 344 km^2 (234 km^2 excluding maintenance and safety zones) is located 22.2 km from shore (12 nautical miles) and will be sub-divided into four[2] BWFS. Water depth is approximately 16-38 m. In total, approximately 1,400 MW offshore wind capacity is planned in the zone.

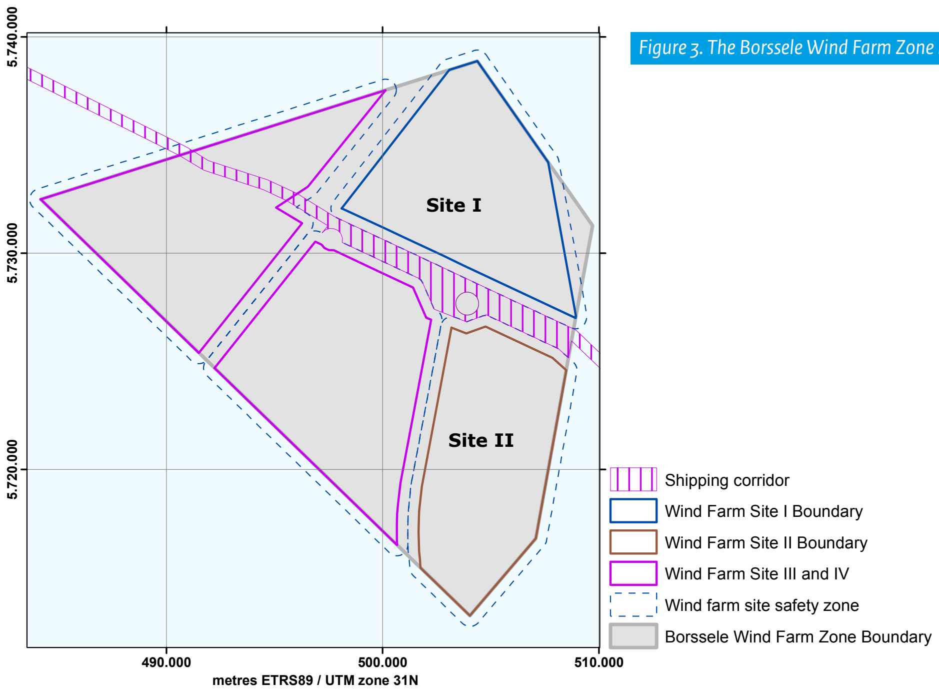


Figure 3. The Borssele Wind Farm Zone including the safety zones.

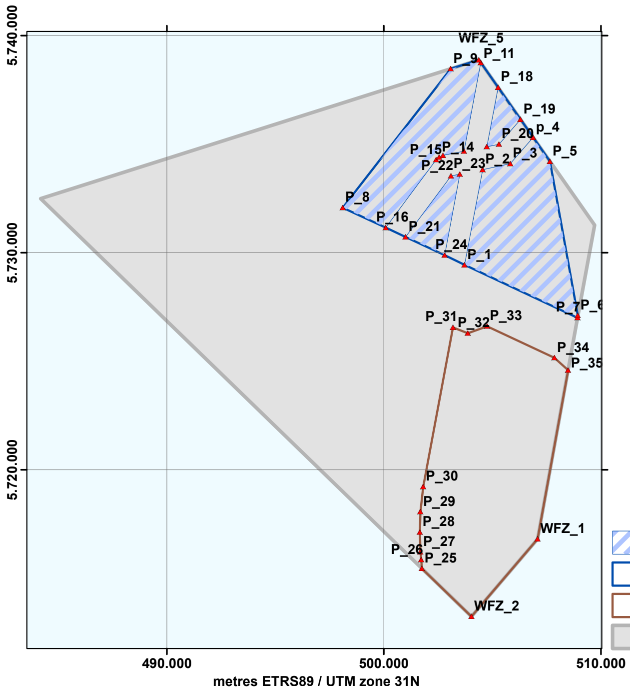
2) One of the BWFS III and IV will be split into an innovation BWFS (20 MW) and a production BWFS (330 MW).

3.2 Layout and coordinates of WFS I and II

Site I is 64.8 km² in size but has an effective area for development of 49.1 km². Due to existing pipelines and cables that cross the site, it has been subdivided into 4 parcels (25.2 km², 17.7 km², 2.1 km², and 4.1 km²). Site II does not have the complication of existing cable or pipelines to consider so this site consists of one parcel with an effective area of 62.6 km². The surface areas referred to above exclude the locations of safety zones, export cables and and TenneT's grid connection system.

Figure 4 shows the boundaries of WFS I and II and the maintenance corridors within site I. This figure can also be found in chapter 6. A complete overview of all relevant coordinates of WFS I and II is located in a memo [3] issued by the Netherlands Enterprise Agency (RVO.nl).

Figure 4. The Borssele Wind Farm Zone and the corner coordinates of the Borssele Wind Farm Sites I and II.



The basic bathymetry of WFS I and II is shown in figure 5. More detailed bathymetry, morphodynamical and metocean information relating to the zone is provided in following chapters.

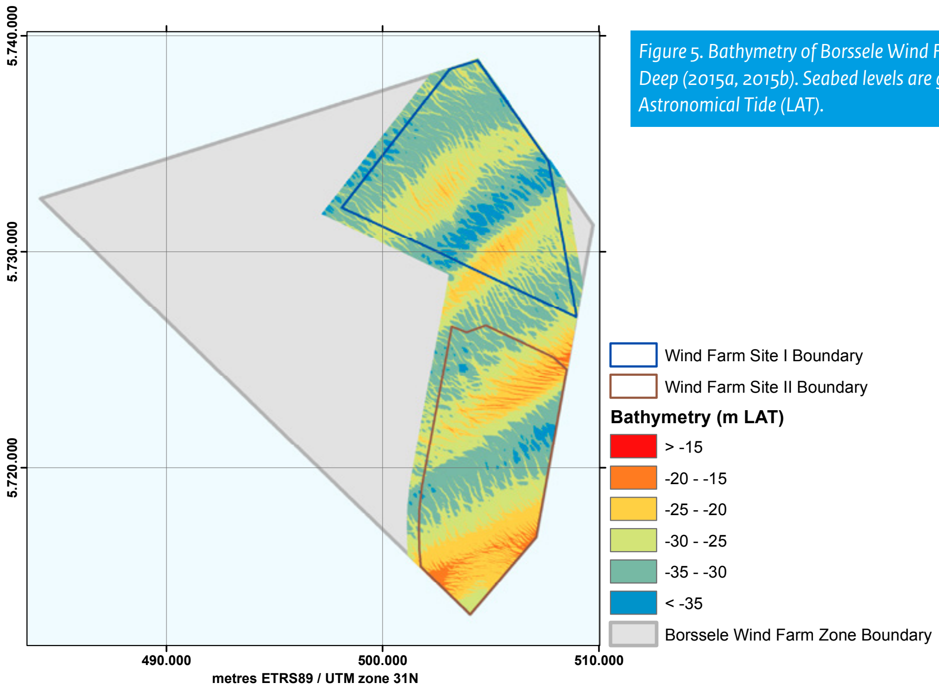


Figure 5. Bathymetry of Borssele Wind Farm Sites I and II as recorded by Deep (2015a, 2015b). Seabed levels are given in metres relative to Lowest Astronomical Tide (LAT).

3.3 Existing infrastructure

Several operational cables and pipelines cross the wind farm zone. Figure 6 shows the BWFZ and operational cables and pipelines crossing the zone.

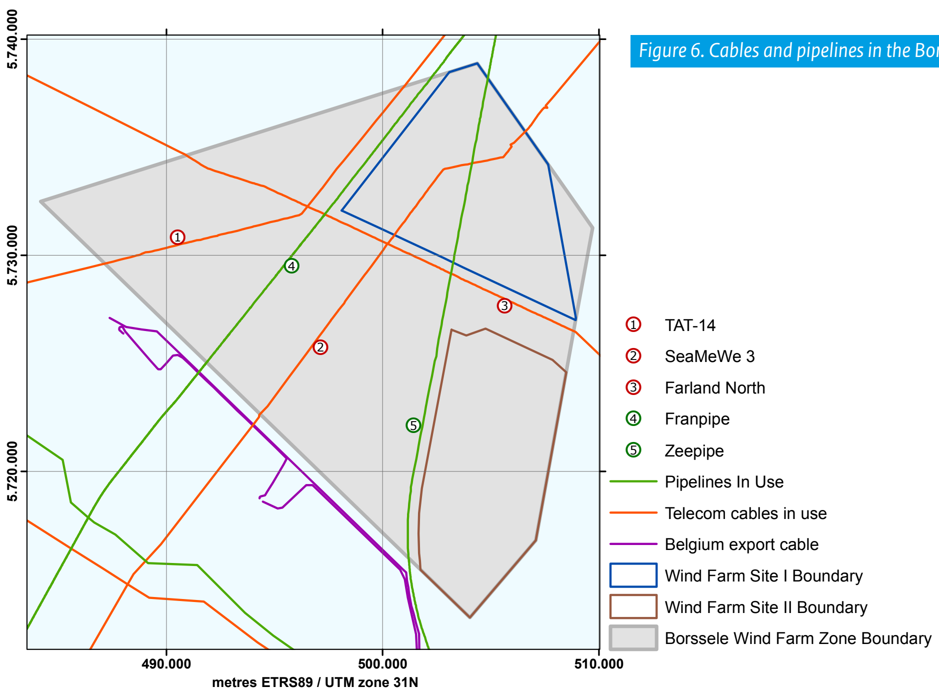


Figure 6. Cables and pipelines in the Borssele Wind Farm Zone.

A description of the different cables and pipelines can be found in table 1.

Table 1. Description of pipelines and cables in the BWFZ.

Name	Description	Status
TAT-14	Transatlantic telecommunications cable - does not border or cross WFS I or II	In use
Franpipe	Natural gas pipeline from a Norwegian gas field to France	In use
SeaMeWe 3	Segmented telecommunications cable between Western Europe and South East Asia	In use
Farland North	Telecommunications cable between the UK and the Netherlands	In use
Zeepipe	Natural gas pipeline from a Norwegian gas field to Zeebrugge (Belgium)	In use

Netherlands Enterprise Agency (RVO.nl) has investigated the feasibility of relocating some of the telecom cables in the area. The investigation concluded it is not feasible to relocate these cables from the perspective of planning, cost and risks of relocation. Therefore, this process has not been pursued further.

Several abandoned cables and/or pipelines also run through the Borssele area. An overview of these can be found at: ***offshorewind.rvo.nl***.

3.4 Nearby Belgian Wind Farms

The Dutch Belgian border is located immediately south of the BWFZ. The Belgian dedicated offshore wind zone is directly opposite this border - this is where several Belgian wind farms are operational or under development (figure 7).
Table 2 provides an overview of Belgium's offshore wind farms. This information is subject to change, with the latest information available from the Belgian Authorities [26].

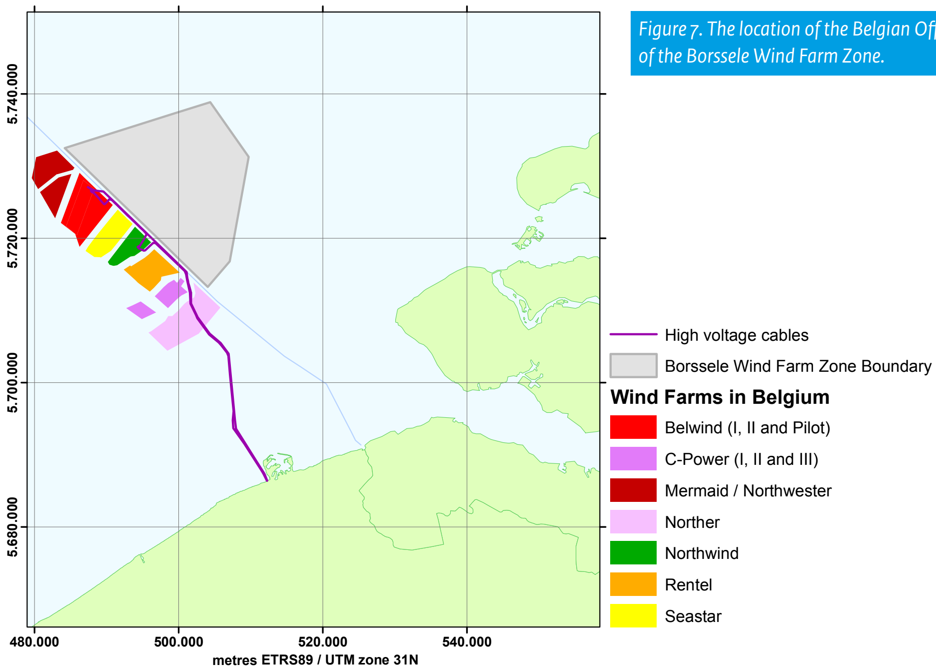


Figure 7. The location of the Belgian Offshore Wind Farms directly south of the Borssele Wind Farm Zone.

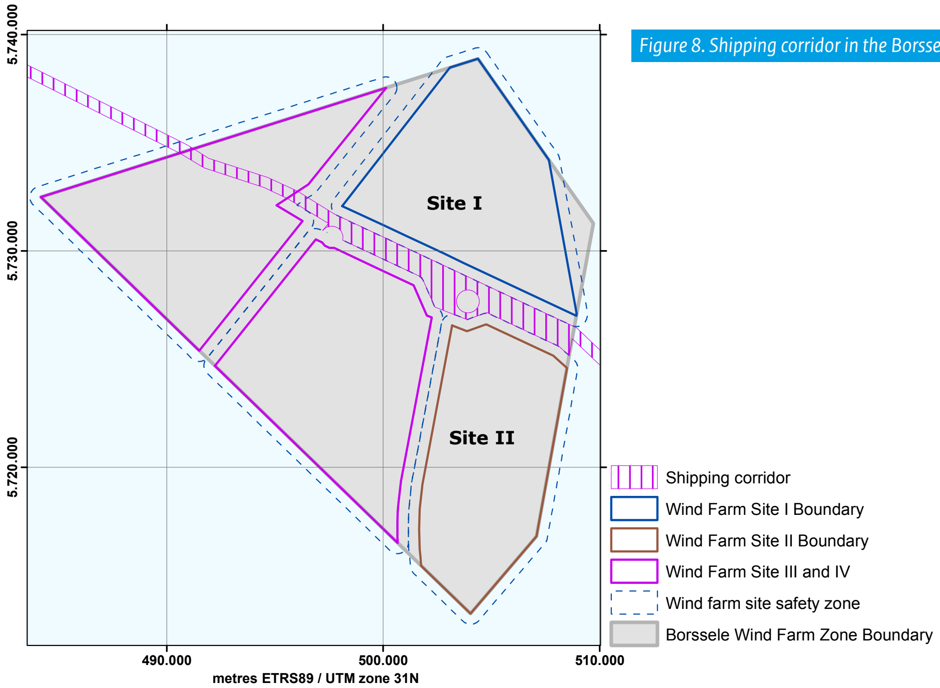
Table 2. Characteristics of the Belgian Wind Farms.

Name	Hub-height / rotor diameter [m]	Turbine type	Individual turbine rating [MW]	No. of turbines	Total capacity [MW]	Status
Belwind I	76/90	V90	3	55	165	Fully commissioned
Belwind II	72/112	V112	3.3	50	165	Under development
Belwind-Pilot	100/150	Haliade	6	1	6	Fully commissioned
Northwind	71/112	V112	3	72	216	Fully commissioned
C-Power I	94/126	Senvion 5M	5	6	30	Fully commissioned
C-Power II	95/126	Senvion 6.2M	6.15	30	185	Fully commissioned
C-Power III	95/126	Senvion 6.2M	6.15	18	111	Fully commissioned
Rentel	?/?	ND	4-10	47-78	288	Under Development
Seastar	?/?	ND	4-10	41-62	246	Consent received
Norther	?/150	ND	6-8	44-48	350	Consent received
Mermaid	?/?	ND	3.3-10	24-80	266	Consent received
Northwester 2	?/?	ND	3-10	22-70	224	Early planning

3.5 Exclusion zones

Between the Belgian Wind Farm Zone and BWFZ, a safety zone of 500 m is in place on both sides of the border.
To the east, the zone is bordered by the 12-mile zone and the pilotage zone 'Steenbank'. Pipelines and cables, plus their maintenance zones (500 m on both sides of the pipes/cables), are excluded from the different parcels. Due to the overlap of the BWFZ with the pilotage zone, the boundaries of BWFS I have been set such that the safety zone of 500 m borders the piloting zone. Turbine blades are not allowed outside the BWFS boundaries. Between BWFS I and II, a shipping corridor also runs from east to west, as shown in figure 8. Vessels up to 45 m are allowed to cross this corridor. Under the National Water Plan 2 [13], which is currently in draft, vessels up to 24 m are allowed to cross the entire BWFZ.

Figure 8. Shipping corridor in the Borssele Wind Farm Zone.



3.6 TenneT offshore grid connection system

The planned Borssele Alpha and Beta Offshore Substations are shown in figure 9. Infield cables from the wind farms will connect directly to these stations. Borssele Alpha will transform the power of BWFS I and II from 66 kV to 220 kV and transport the electricity to shore. Borssele Beta will do the same for BWFS III and IV.

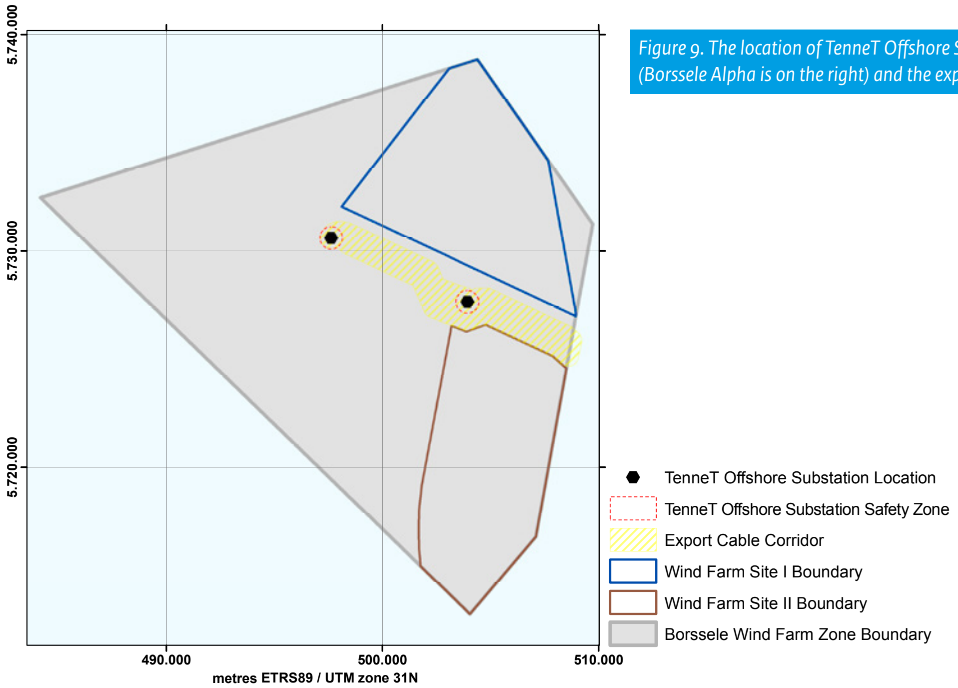


Figure 9. The location of TenneT Offshore Substations Alpha and Beta (Borssele Alpha is on the right) and the export cable corridor.

4. Site data

The Netherlands Enterprise Agency (RVO.nl) is responsible for collecting the most relevant site information that companies require to prepare bids for the SDE+ tenders for the BWFZ. The site information package should be of sufficient detail and quality to be used as input for, as an example, front end engineering design studies.
BLIX Consultancy assisted Netherlands Enterprise Agency (RVO.nl) as the primary consultant in managing the process of site investigations for the BWFZ WFS I and II. BLIX is an offshore wind consultant, specialised in project management of large (offshore) wind energy projects.
A detailed overview of the approach, procurement of the studies and quality assurance can be found in Appendix A.

For studies relevant for foundation, infield cables and wind turbine design, a certifying authority (DNV GL) reviewed the reports and provided a statement of compliance (Metocean, Morphodynamics, Geophysical Survey, and Geotechnical Survey) to assure that the results were acquired in compliance with the DNV-OSJ101 and/or other applicable industry standards. Where applicable, these statements of compliance are added to the report.

In the following paragraphs the scope and results of the studies and investigations are summarised.

4.1 Geological desk study

This study was the starting point for several other studies. However, more in depth geophysical and geotechnical site investigations have since been conducted and so the desk study is not described further in this PSD.

4.2 Morphodynamical desk study

4.2.1 Introduction

This study assesses the seabed dynamics at the BWFZ and is designed to:

1. Improve understanding of the seabed morphology at the BWFZ.
2. Improve understanding of the seabed morphodynamics at the BWFZ over the consent period for the BWFS (30 years, including building and decommissioning).
3. Determine the design reference minimum and maximum seabed levels at the BWFZ and help predict potential seabed level changes over the consent period for the offshore wind farms.

4.2.2 Supplier

Research institute Deltares performed an initial morphodynamical desk study for the BWFZ [4] using existing data. Based on the geophysical survey [5], the institute provided an update of this study [6], specifically aimed at the Borssele WFS I and II. Deltares has previously conducted similar studies for other offshore wind farms, including Princess Amalia, Butendiek, Luchterduinen, Nordergründe and Belwind. The Belwind project is adjacent to the Borssele site, on the Belgian side of the border. Therefore, Deltares has developed in depth knowledge of the morphology of this specific part of the North Sea.
DNV GL performed a review of both studies and issued a Statement of Compliance for them.

4.2.3 Results

The studies consisted of two phases. In the first phase, existing bathymetry data from 2000 and 2010 was used to create a preliminary assessment of the morphodynamical phenomena at the wind farm zone. The study provided recommendations for the geophysical survey (See chapter 4.5). One of the deliverables of this survey is a high-resolution bathymetrical dataset that has been used to update the morphodynamical desk study.

The high-resolution bathymetrical dataset from the 2015 geophysical survey was then also assessed alongside the 2000 and 2010 bathymetry data to provide an indepth insight into the seabed morphodynamics at the site.
The site is characterised as highly dynamic, consisting of static, shore-parallel sand banks overlaid with dynamic shore-perpendicular sand waves. Within the area, opposing migration directions were found, as shown in figure 10.

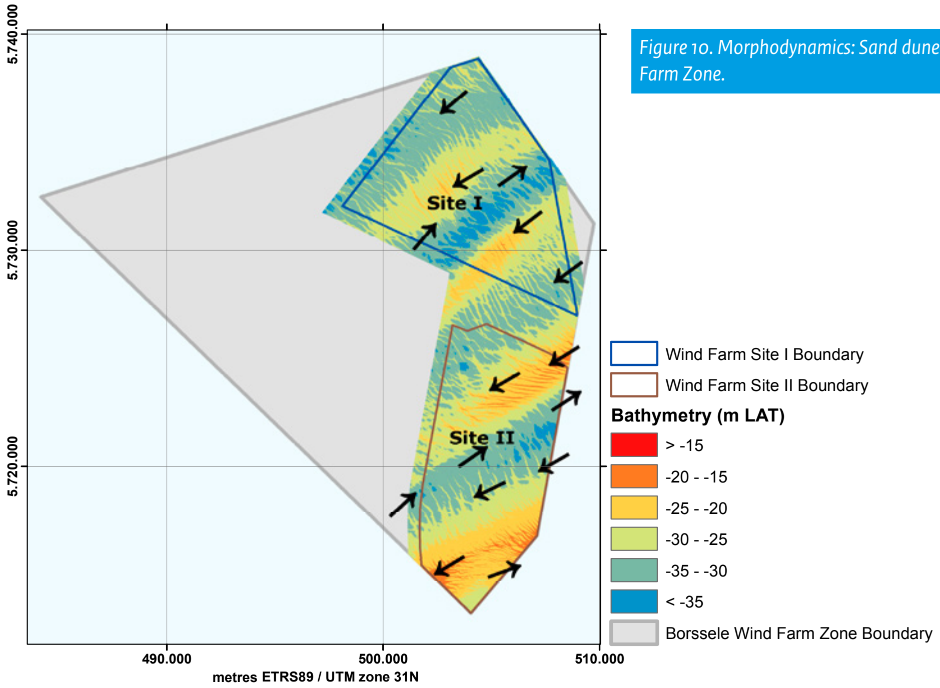


Figure 10. Morphodynamics: Sand dune movement in the Borssele Wind Farm Zone.

Sand wave characteristics were determined for the combined area of BWFS I and II as well as for the individual sites by means of consistent tracking of crest and through points of individual sand waves from various transects of 1750 m equally distributed throughout the BWFZ. The sand waves have a typical length of 230 m, height of 4 m and migration speeds in the order of -1.7 m/y (in NE-direction) to 3.2 m/y (in the governing SW-direction).

Next, the minimum reference seabed level (RSBL) and maximum seabed level (MSBL) were determined, indicating the predicted lowest and highest seabed levels during the period 2015-2046 in the Borssele area, as shown in figure 11.

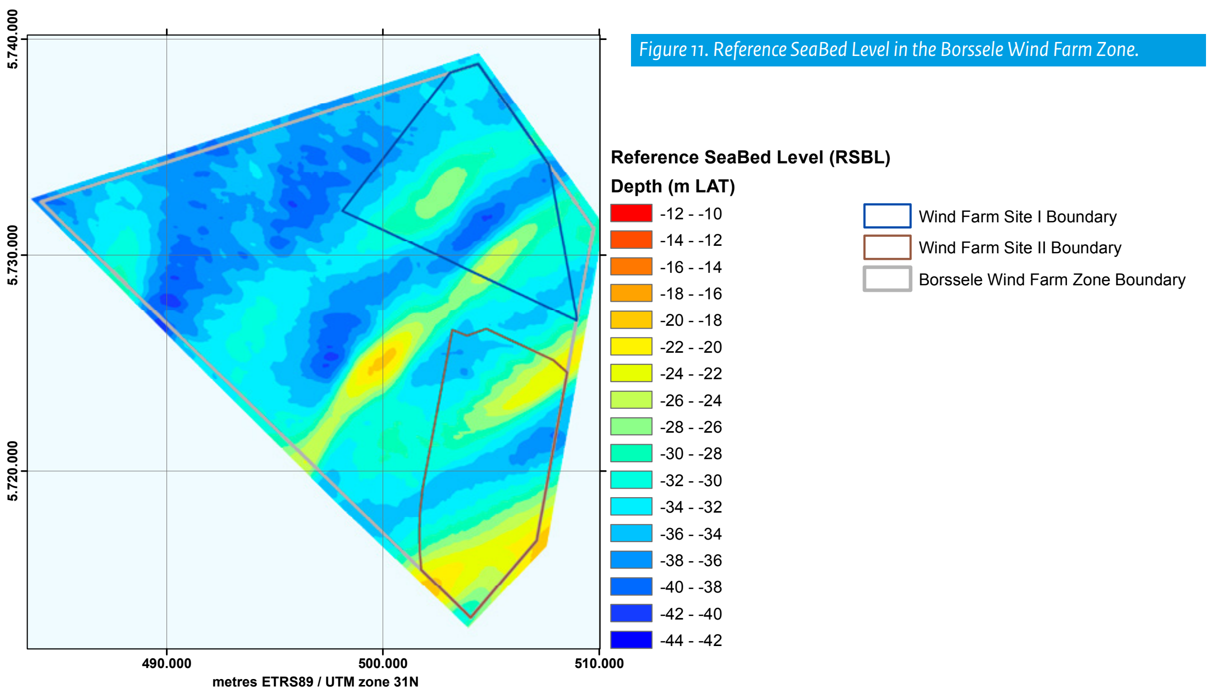


Figure 11. Reference SeaBed Level in the Borssele Wind Farm Zone.

Comparison of the RSBL with the most recent bathymetry from 2015 showed a potential maximum lowering of the seabed of approximately 5 m. The largest potential seabed lowering occurs at locations where wave crests are present. A comparison of the RSBL with the base of the Holocene Formation showed that no unrealistic - by means of assuming dynamic soil behaviour (sand) for non-dynamic soils (clay) - values for the seabed lowering were computed in this study.

The predicted seabed level changes presented in this study follow from the applied morphological analysis techniques, describing the (uncertainty of the) physics and the natural variability of the analysed morphological system. No additional safety margins for design purposes have been applied.

4.3 Archaeological assessment

4.3.1 Introduction

The purpose of the study is to provide insight into any archaeological aspects that impact the development of the BWFZ. The main objectives of the study are:

1. Assess whether there are (indications for) areas with specific archaeological interest (wrecks and prehistoric life) at the BWFZ.
2. If present, specify expected locations, size and dating of the areas with specific archaeological interest.
3. Determine possible effects of offshore wind farm installation on the areas with specific archaeological interest.
4. Assess options to mitigate disturbance on areas with specific archaeological interest.
5. Identify whether further archaeological risk assessments should be carried out and make a recommendation on the scope of future investigations.
6. Specify obligations and requirements for any activity carried out in the wind farm zone (including site investigations or monitoring activities, installation activities, operational activities) that could have an effect on archaeological aspects.

4.3.2 Supplier

Vestigia Coastal and River Archaeology was selected to perform the archaeological desk study [7]. This subsidiary of Vestigia combines the offshore archaeology expertise of Vestigia and its cooperating partners. Vestigia has a track record in maritime archaeological preparatory research, such as for Nuon's offshore wind prospects, the Maasvlakte 2 and the COBRA-cable between the Netherlands and Denmark.

4.3.3 Results

The desk study was performed prior to the geophysical and geotechnical investigations. The report assesses the presence of early prehistoric sites from an era when the North Sea was still land, as well as historic shipwrecks, lost cargo and crashed airplanes.

Prehistoric sites:

1. No early prehistoric sites have been identified within the wind farm zone itself, the nearest being 9 miles southeast of zone.
2. If present at all, prehistoric remains are located at a depth of about 30 to 40 m below present day sea level.
   This means the site has been submerged by the expanding North Sea around 7000 BCE and therefore possible settlements will most likely be older. However, population density in North-western Europe during these early stages of prehistory was very low. Therefore, the density of archaeological traces of those people is also very low while the chance of any traces being well preserved is even lower. In conclusion, the chances of encountering prehistoric archaeology within the wind farm zone are small (low sensitivity).

Historic shipwrecks:

1. Three shipwrecks have previously been identified within the wind farm zone, one of which is located in site I or II. There are a number of unidentified obstructions reported within the wind farm zone, three of which are located in zone I or II. These could either be wrecks, part of wrecks or anchors, cargo or garbage. They may also be the remains of aircraft lost in the World War II. The recorded shipwrecks and objects may or may not be of archaeological significance. As long as it is impossible to determine the significance, these locations are best avoided during development. During the geophysical survey (see paragraph 4.5), only two of the obstructions/ shipwrecks were found.
2. Vestigia has found no records of systematic surveys using side-scan sonar or other geophysical techniques within the wind farm zone, mainly because the area has not been of commercial interest until now. The reported discoveries are considered random discoveries although their low number is in no way a reflection of the actual density of historic archaeological sites however. More undiscovered shipwrecks and other historical objects are likely to be present within the wind farm zone. Therefore, the chance of encountering further historic archaeology (shipwrecks, airplanes, etc.) within the entire BWFZ is considered to be average (medium sensitivity).

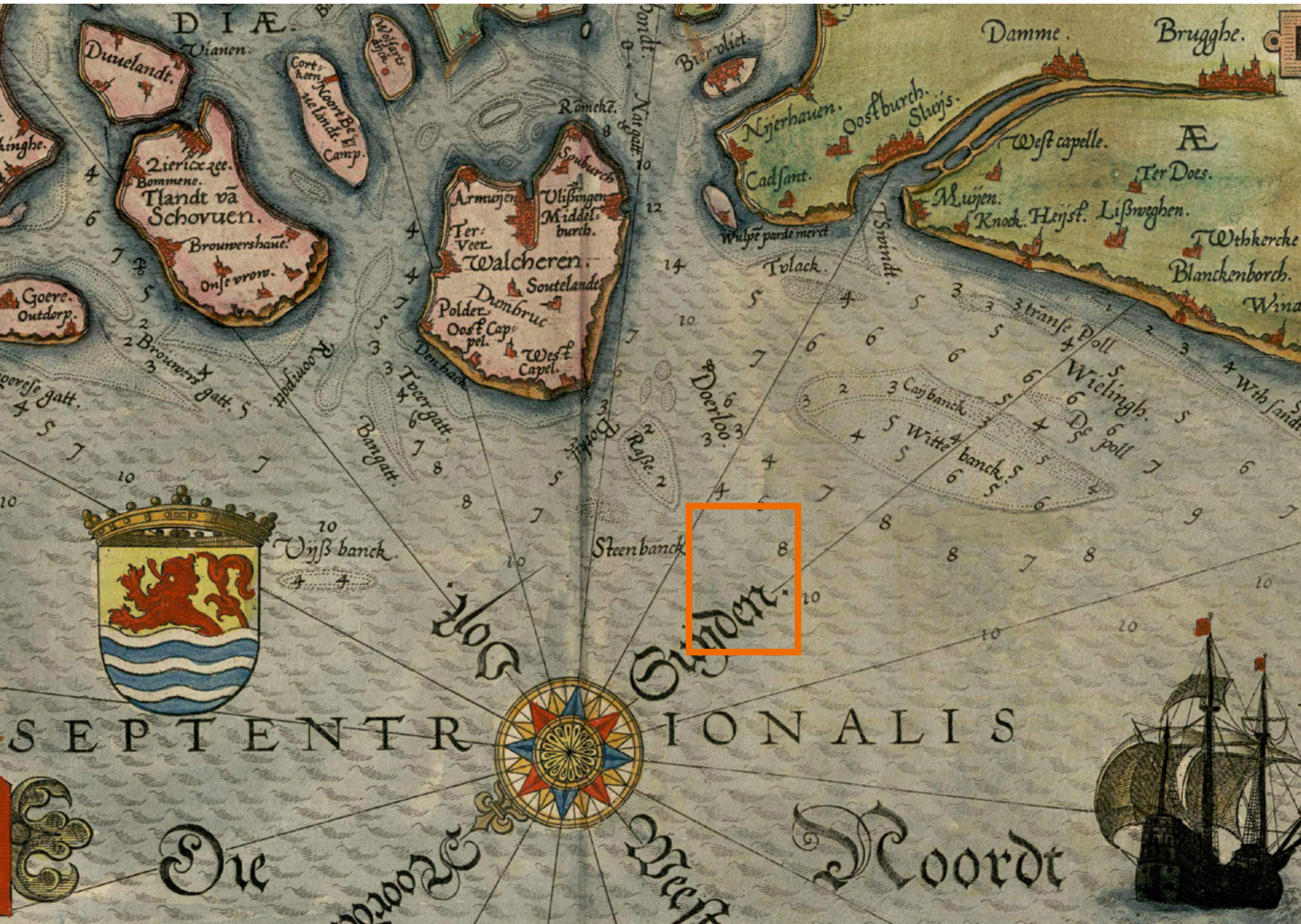


Figure 12. Chart from 'Spiegel der Zeevaerdt' (1588).
Borssele Wind Farm Zone is approximately located inside the orange rectangle. Note: the North is in the left bottom corner.

4.3.4 Conclusions and recommendations

No early prehistoric sites have been identified within the wind farm zone itself and the likelihood of encountering prehistoric archaeology within the zone is small. Therefore, further archaeological surveys are not recommended.

Historic shipwrecks have been identified in the area and shipwrecks of high archaeological significance have been found in the vicinity, leading to an average chance of encountering historic archaeology. The recommendations of Vestigia were taken into account during the geophysical survey carried out by Netherlands Enterprise Agency (RVO.nl). However, no further specific investigations have been carried out on (suspected) archaeological findings. Therefore further investigations should possibly be carried out before construction of wind farms in the zone. Upon discovery of an archaeological site, its historic and scientific value has to be assessed. In the case of archaeological significance, one can either avoid the site or salvage the remains, the latter incurring high costs.

4.4 Unexploded Ordnance (UXO) assessment

4.4.1 Introduction

The UXO desk study looks at areas in the BWFZ with an increased risk of encountering unexploded ordnances (UXOs). The main objectives of this study are:

1. Identify constraints for offshore wind farm related activities in the BWFZ as a result of the presence of UXOs.
2. Identify areas within the BWFZ where wind farm or cable installation should be avoided.
3. Identify requirements from an UXO perspective that should be taken into account for:
   a. Determining the different concession zones in the wind farm zone.
   b. Carrying out safe geophysical and geotechnical investigations.
   c. Safe installation of wind turbine foundations.
   d. Safe installation of cables.

4.4.2 Supplier

REASEuro has performed the UXO desk study [8].
The company is specialised in offshore UXO studies, serving dredging, wreck recovery and offshore wind construction. Since 2012, REASEuro has been involved with several offshore projects in the Persian Gulf, performing data analysis, project risk assessment and coordination of demining activities.

The project team members for this assessment have specific North Sea experience from their previous employment at Van Oord Dredging and the demining department of the Royal Dutch Navy.

4.4.3 Results

The BWFZ and surrounding areas were the scene of many war-related activities during World War I and World War II. In both wars a large number of naval mines were deployed in the North Sea, but they were only partially recovered after the war. In addition, the BWFZ is located along the main flight path of Allied bomber raids - many bombs were dropped and a large number of aircrafts have crashed in the North Sea (see figure 13).

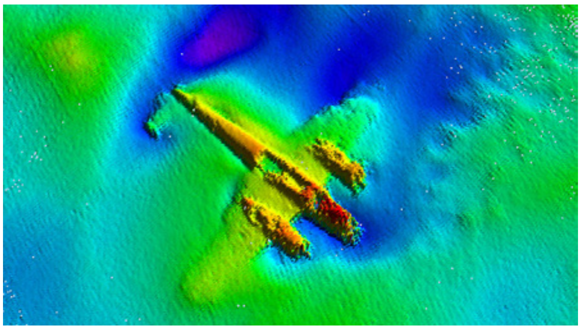


Figure 13. A scan of the sea bed in the English Channel shows the Dornier-17 German bomber, buried under the sand since World War II.

After the war, some ordnances are likely to have moved as a result of fishing, tidal streams and seabed migration. Overall, the entire wind farm zone is considered an UXO risk area. This conclusion is validated by the fact that since 2005 fishermen have found over 20 UXOs.

An UXO can be sensitive to hard jolts, change in water pressure and acceleration with an amplitude >1m/s².
A detonation can lead to serious damage to equipment and injuries to crewmembers. The possible presence of UXOs in the area, however, is no constraint for offshore wind farm related activities. With proper UXO Risk Management risks can be reduced to a level that is as low as is reasonably practicable.

A main challenge in UXO Risk Management at BWFZ is movement of the UXO over the seabed. This can lead to resurfacing UXOs that were buried during preliminary scanning and introduction of new UXOs by sea currents or fishing activities. Therefore, monitoring needs to be a crucial aspect of all development phases, closely integrated into UXO Risk Management.

The report provides a number of recommendations for each phase in the development:

1. Preparation phase
   a. A geophysical (bathymetric) survey should be conducted to assess geomorphology and identify objects - Netherlands Enterprise Agency (RVO.nl) has already conducted this survey (See chapter 4.5)
   b. In case of any soil intrusive operations, an UXO search of the area affected should be conducted and any discovered UXOs should be cleared. The clearance operation should be conducted by a certified EOD company.
2. Execution Phase
   a. UXO-related risk assessment based on the first draft of the wind farm design and optimisation of the design based on the outcomes.
   b. UXO risk mitigation strategy, which includes a search for and safe removal of UXOs. Because the validity of the collected data is time-limited, it is recommended that the period between the survey and installation work is minimised.
3. Operational phase
   a. After completion of construction activities it is still important for wind power companies to remain vigilant and remember that UXOs can move as a result of tidal streams, mobility of sand waves and seabed usage.
   b. Maintenance and Monitoring Plan.

4.4.4 Conclusion and recommendations

UXOs from both world wars are likely to be present at the site, which is therefore considered an UXO risk area. However, with proper UXO Risk Management the risks can be minimised.
Due to the highly dynamic soil morphology, it is recommended companies conduct UXO search and removal operations immediately prior to construction activities at specific locations. The validity of the collected magnetometer survey data in regards to tidal streams, mobility of sand waves and seabed usage should be taken into account when planning survey and construction operations. The time lapse between project phases should be limited. Due to the time-limited nature of findings, a dense magnetometer survey to detect UXOs was not part of the geophysical survey objectives [5].

4.4.5 UXO removal procedure

If a wind farm developer identifies an UXO on a location where a foundation of a wind turbine is planned, it should be reported to the Dutch Coastguard. The Dutch Navy will remove the UXO and detonate it on a safe location. No costs will be charged to the wind farm developer.

4.5 Geophysical survey

4.5.1 Introduction

The objective of the geophysical survey is to:

1. Improve the geological and geotechnical understanding of the BWFS; and
2. Obtain geophysical information which is suitable for the preparation of geotechnical investigations and for progressing the design and installation requirements of offshore wind farms, including (but not limited to) foundations and cables.

4.5.2 Supplier

Netherlands Enterprise Agency (RVO.nl) contracted Deep BV to conduct geophysical surveys [5] in the BWFS I and II and a small area around them ('Investigations Areas'). Deep BV has a track record in bathymetric, geophysical, UXO and archaeological surveys, especially off the Dutch coast in the North Sea. DNV GL provided a Statement of Compliance for the results of the study.

4.5.3 Results

Deep BV performed a full geophysical and bathymetric survey, consisting of the following activities:

1. Bathymetric mapping with multibeam echosounder for full seafloor cover within the survey area;
2. Side-scan sonar (SSS) mapping with full seafloor cover within the survey area, to detect man-made objects on the seabed as well as for seabed feature classification;
3. Magnetometer profiling with an 100m line distance to detect ferro-magnetic objects (≥ 5 nano Tesla (nT)). Note: this survey was not intended for the detection of UXOs;
4. Sub-bottom profiling with two systems: one high-resolution parametric echosounder to image the upper part of the seabed and a multi-channel sparker seismic system for deeper penetration into the seabed.

The surveys have provided:

1. Accurate bathymetric charts of the development areas;
2. Information on seabed features including:
   - natural objects such as boulders;
   - non-natural objects such as wrecks, debris or UXOs;
3. Isopach charts to show the thickness of the main geological formations including mobile sediments and other significant reflector levels which might impact engineering design;
4. Locations of structural complexities or geohazards within the shallow geological succession such as faulting, accumulations of shallow gas, buried channels;
5. Detailed geological interpretation to show facies variations and structural feature changes via appropriate maps and sections;
6. The position of existing cables and pipelines;
7. Input into the specification and scope for a geotechnical sampling and testing programme following the completion of the geophysical survey;
8. A comprehensive interpretative report on the survey results obtained to assist design of the offshore foundations/structures and cable burial.

Bathymetry and seabed classification

The bathymetric data shows water depth ranging between -17.8 and -39.7 m LAT (BWFS I) and -14.0 and -38.5 m LAT (BWFS II). Large sand dunes are present throughout both areas, as are smaller sand waves, creating a dynamic seabed.

The backscatter data derived from the multibeam echosounder (MBES) survey was used for seabed classification purposes, classifying the soil within six possible soil classes. The sediment classes found nearly all fall within the two neighbouring classes, 'sands' and 'muddy sands'. The finer sediments were found sheltered from the currents between the sand waves. Coarser sediments were found on the exposed tops of the sandbank. The classification shows that there is little large-scale sediment difference between the tops and bottoms of the large sand dunes. Patches of coarse sand or gravel are found sporadically.

Man-made objects and cables

The SSS survey provided full data coverage of both areas. The magnetometer survey was executed along survey lines with 100 m line spacing. Both surveys indicated the presence of several objects as shown in the contact chart (figure 14). It must be noted that the magnetometer survey results provide an indication of the presence of ferromagnetic objects. However, given the line spacing of the survey and the high mobility of the seabed within the BWFZ, these results are not suitable for an UXO analysis.

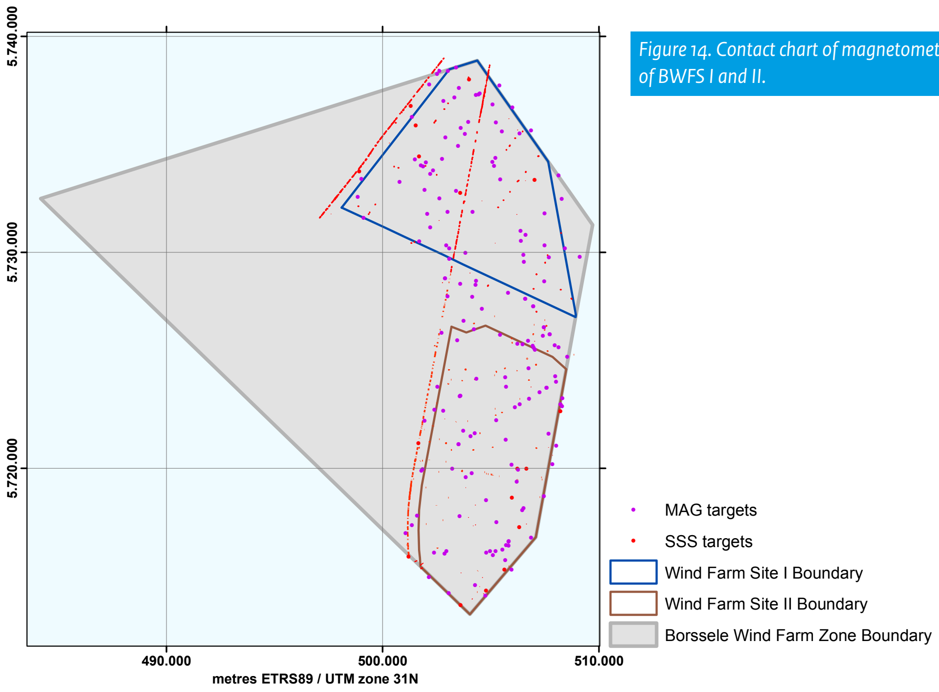


Figure 14. Contact chart of magnetometer and side-scan sonar survey of BWFS I and II.

A number of cables and pipelines have been discovered, some with an offset in relation to their theoretical charted position (Aldenburg-Domburg, Farland N, UK-NL3). In addition, 111 (BWFS I) and 180 (BWFS II) seabed contacts not associated with pipelines, cables or wrecks have been detected. Two magnetic lineations, that might be related to unknown or uncharted cables, have been found in BWFS II. Both have an east-west orientation. Meantime, two known wrecks are present in the wind farm zone. However, only one of each wrecks has been detected. No previously unknown wreck locations were identified from interpretation of the SSS and magnetometer data.

Sub-bottom profile
A high-resolution sub-bottom profiler survey was executed with 100 metre line spacing. The resulting dataset was used to create an isopach of the base of the mobile, subaqueous dunes on the seabed. The base of this layer has been found in the large majority of the sub-bottom profiler survey lines. The deep penetrating multi-channel sparker survey executed with a 400 m line spacing with some 200 m infill lines showed the presence of two major units within 100 m below seabed, horizontally stratified marine and coastal Tertiary deposits and shallow marine and fluvial Quaternary deposits within the Tertiary deposits. Five seismic units were identified based on their seismic facies and stratigraphical boundaries. The boundary between Tertiary and Quaternary deposits is of erosional behaviour. The Quaternary units are formed of river and shallow marine deposits. They consist of sand deposits with patches of gravel or clay present.

4.5.4 Conclusion
Based on the sub-bottom profiling datasets, Deep BV has developed a proposed borehole location plan. RVO has developed this plan into a more extensive Borehole and Seabed PCPT Plan, which has been applied to the geotechnical survey (See paragraph 4.6).

4.6 Geotechnical survey

4.6.1 Introduction
The objective of the geotechnical soil investigation is to improve the geological and geotechnical understanding of the wind farm sites and to obtain geotechnical information on these locations, which is suitable for progressing the design and installation requirements of offshore wind farms, including (but not limited to) foundations and cables.

The geotechnical survey uses intrusive techniques, such as boreholes and Piezo Cone Penetration Testing (PCPT), to gain an insight into the characteristics of the subsoil. The results of the geotechnical survey have been used to:
- Confirm the geological and geophysical model;
- Determine the vertical and lateral variation in seabed conditions;
- Provide the relevant geotechnical data for design of the wind farm, including foundations and cables;
- Update the geological desk study and provide a geological model.

4.6.2 Supplier
Fugro Engineers B.V., a member of the Fugro global group of companies and responsible offshore geotechnical surveys, performed the survey [9]. The Fugro group is a large offshore and nearshore geotechnical company and offers experience in geotechnical investigations. Fugro has previously performed investigations for many other offshore wind farm projects in The Netherlands, Belgium, UK, Denmark and Germany. Therefore, the company is familiar with the local conditions and technical requirements for geotechnical survey of the BWFZ.
The survey has been performed according to ISO 19901-8 (2014) Marine Soil Investigations, using the vessels MV Bucentaur and MV Fugro Commander from 10 April to 26 May 2015. DNV GL has provided a Statement of Compliance for the results of the study.

4.6.3 Results
Fugro performed a geotechnical survey, which consisted of borehole drilling, downhole sampling, downhole in situ testing and seafloor in situ testing. For WFS I, Fugro executed six boreholes (with downhole sampling with alternating PCPT testing including a limited number of seismic PCPT tests), and 29 seafloor Seabed PCPT's (including a limited number of dissipation tests).
For BWFS II, Fugro performed eight boreholes and 27 Seabed PCPT's respectively. The results of the survey can be found in three reports for each site:

1. A geotechnical report containing geotechnical logs, (P) CPT, SCPT and geotechnical laboratory-based tests on the boreholes.
2. A geotechnical report containing CPT interpreted geotechnical logs and PCPT and PPDT results from the seafloor in situ tests.
3. A geotechnical report containing a geological ground model, geotechnical parameters per borehole and an assessment of suitability of selected types of structures.

A combined report presenting the results of a limited programme of advanced Static and Cyclic Laboratory Tests is also provided (Planned to be available September 2015).

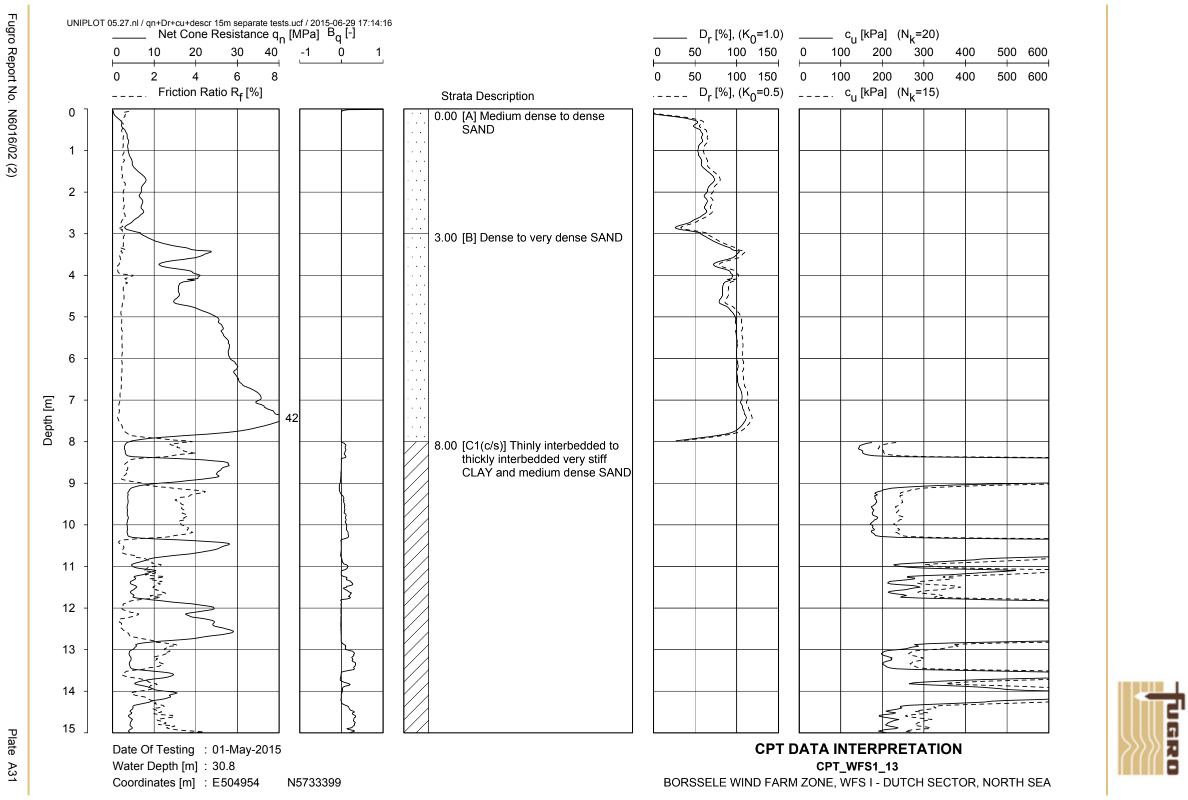
The reports include:

Geotechnical logs for borehole locations and seafloor PCPT locations:
- Interpretation of soil profile, strata description and PCPT-derived relative density and shear strength.
- Selected results of laboratory tests.

Results of Piezo and Seismic CPT and Pore Pressure Dissipation tests:
- Cone resistance (net/total), sleeve friction, pore pressure, friction ratio and pore pressure ratio.
- Recorded shear waves (X and Y) and derived shear wave velocity.
- Dissipation Tests, i.e. cone resistance and pore pressure versus time.

An example of CPT data interpretation provided in the reports is shown in figure 15.

Figure 15. CPT data interpretation of testing point CPT_BWFS1_13.



Results of on-site and laboratory test programmes:
- Geotechnical Index Testing (sample description, water content, unit weight, particle size distribution, Atterberg limits, particle density, min/max index unit weight).
- Geochemical Index Testing (carbonate content and organic content).
- (Index) Strength Testing (pocket penetrometer, unconsolidated undrained (UU) triaxial compression, isotropically consolidated undrained (CIU) triaxial compression).
- Compressibility Testing (incremental loading and constant rate of strain oedometer tests).

Results of an advanced static and cyclic laboratory test programme (expected September 2015)
- Coarse-grained soils (CIU triaxial compression, selected tests with Bender Element (BE), Cyclic Undrained Triaxial (CTXL)).
- Fine-grained soils (Direct Simple Shear (DSS), Cyclic Simple Shear (CSS), CIU triaxial compression, selected tests with BE, CIU triaxial extension).

A geological ground model
- Depth to top of unit maps and contours;
- Thickness of Unit maps and contours;
- Selection of Isopachs;
- Geotechnical Parameter per borehole location and per unit;
- Assessment of suitability of selected types of structures.

An example of a cross section of BWFS I is shown in figure 16.

The remaining samples will be stored and hand over to the winners of the tenders.

Figure 16: An example of MCS seismic line of BWFS I from southwest (left) to northeast (right) with four boreholes.

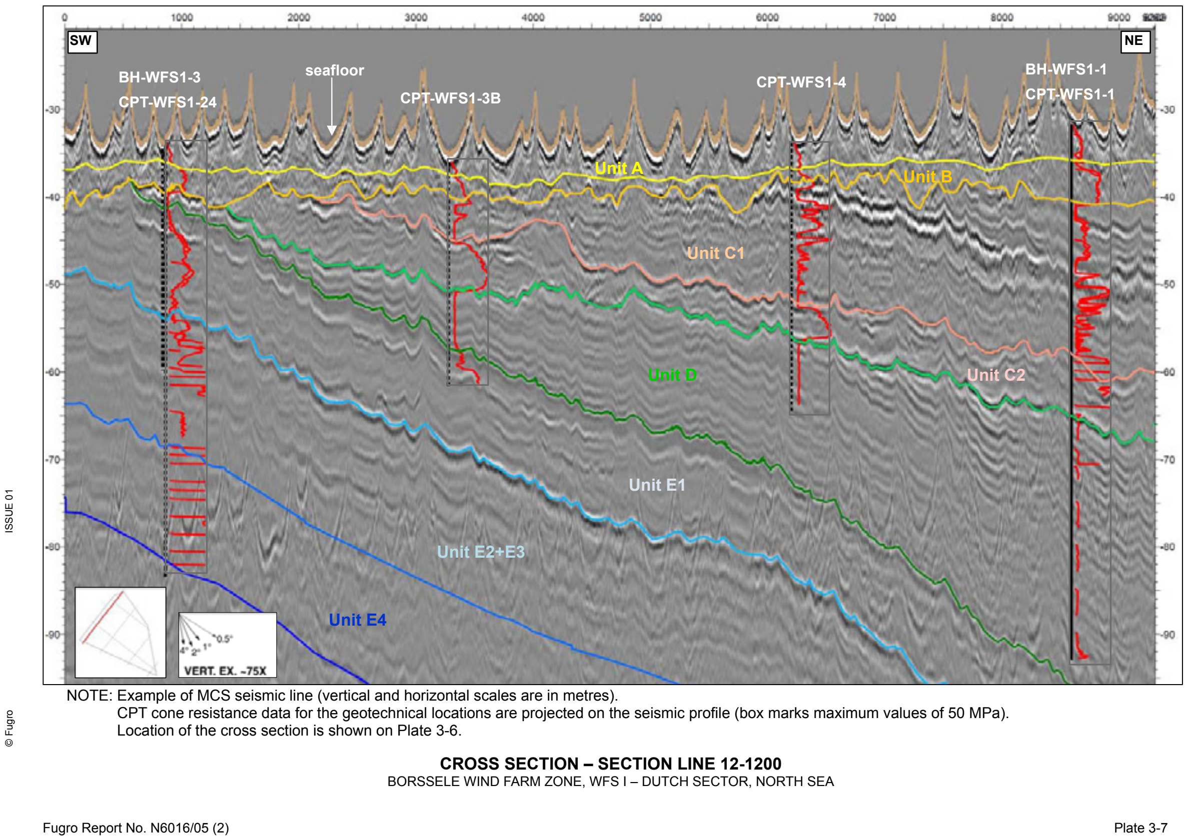


Figure 17 shows a bedform zonation classification of the site created using the geotechnical data.

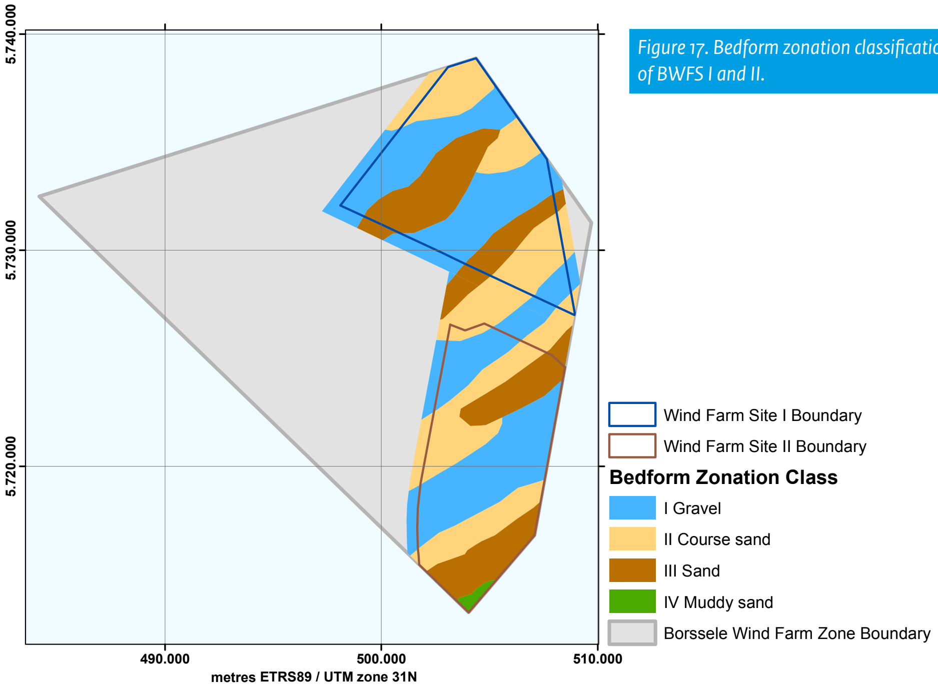


Figure 17. Bedform zonation classification using the geotechnical site data of BWFS I and II.

Figure 18 shows an example of a geologic chart created using the geotechnical data, in this case the depth of the Tongeren foundation below the seabed.

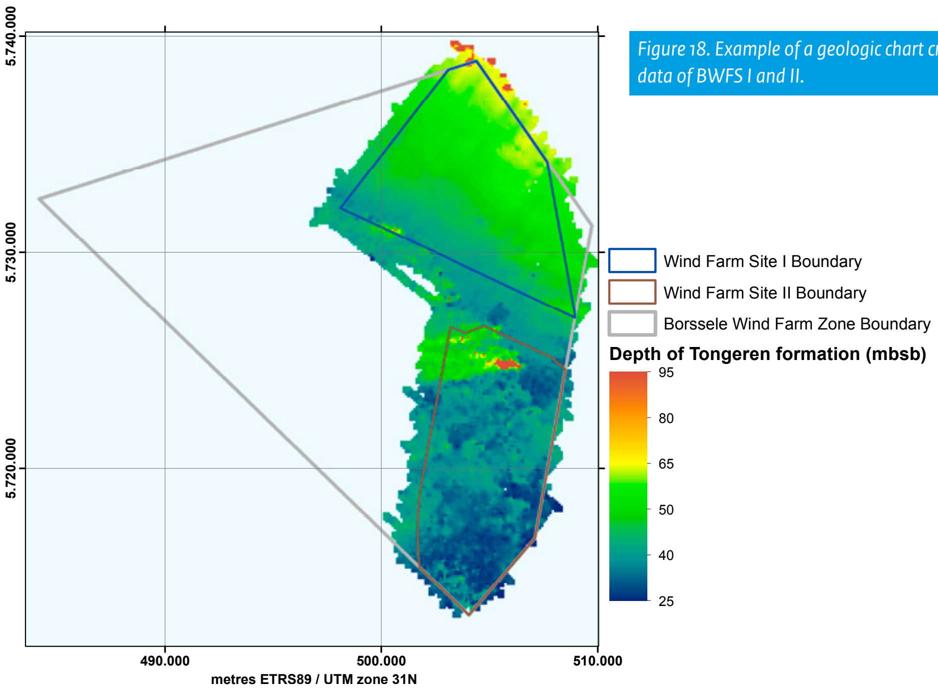


Figure 18. Example of a geologic chart created using the geotechnical site data of BWFS I and II.

4.6.4 Conclusion

All relevant geotechnical parameters for the zone have been measured and an overall geological model has been created using the data.

4.7 Meteorological and oceanographic (metocean) desk study

4.7.1 Introduction

The metocean desk study defines the relevant meteorological and oceanographic data used for design and installation calculations made by companies submitting bids to develop projects in the BWFZ. The study covers the following:

1. Identification of all meteorological and oceanographic parameters required to carry out design calculations for offshore wind farms in the BWFZ.
2. Wave and wind persistence tables relevant for operational assessments relating to wind farms and offshore high voltage station installations in the BWFZ.

4.7.2 Supplier

Deltares performed the metocean desk study [10].
The institute has an extensive track record in offshore wind, with studies related to topics such as scour prediction and protection, metocean conditions, wave loads, cable burial depth and morphodynamics. Deltares also has an extensive track record on offshore wind farms in the near vicinity of the BWFZ. DNV GL has certified the methodology and the results of the study.

4.7.3 Results

The general objective of this study is to determine the metocean conditions (wind, wave, current and other meteorological parameters) present at the BWFZ.
A metocean report has been produced for each of the four BWFS within the zone. In each report, the data presented is related to a specific reference point selected as representative point for the overall site.

To determine local variations in the four BWFZ sites, dedicated numerical modelling was required for wave, water level and current related parameters. The local modelling simulations cover a relatively long period (20 years), sufficient for deriving the requested Metocean parameters. Local variations in metocean parameters are mainly caused by variation in bathymetry, i.e. the presence of sand banks and sand waves. Therefore, the numerical modelling takes into account the bed level variation in detail. The wind conditions are based on the high resolution HARMONIE data from the Koninklijk Nederlands Meterologisch Instituut (KNMI). The project was conducted, partly in collaboration with KNMI. Information from KNMI was also used for the Wind Resource Assessment conducted by Ecofys [11], which conducted its study later than the Metocean desk study (See § 4.9 for more information).

The metocean conditions were assessed by means of detailed re-analysis of available model and measurement data. The data was statistically analysed for each selected output location. The analyses comprised normal conditions and extreme conditions, for several recurrence periods of 1, 2, 5, 10, 50 and 100 years, as per the requirements of the DNV GL standard. Wind, wave and current normal conditions were computed empirically and given in terms of frequencies of joint occurrences and the extreme climate in terms of return values obtained by means of extreme value analyses. The parameters specifically related to hub height were determined for heights of 70 m, 80 m, 90 m, 100 m and 150 m.

Figure 19 shows an example of dedicated numerical modelling results: the 50-year return value of the significant wave height. The effect of the presence of sandbanks and sand waves on the wave propagation can be observed.

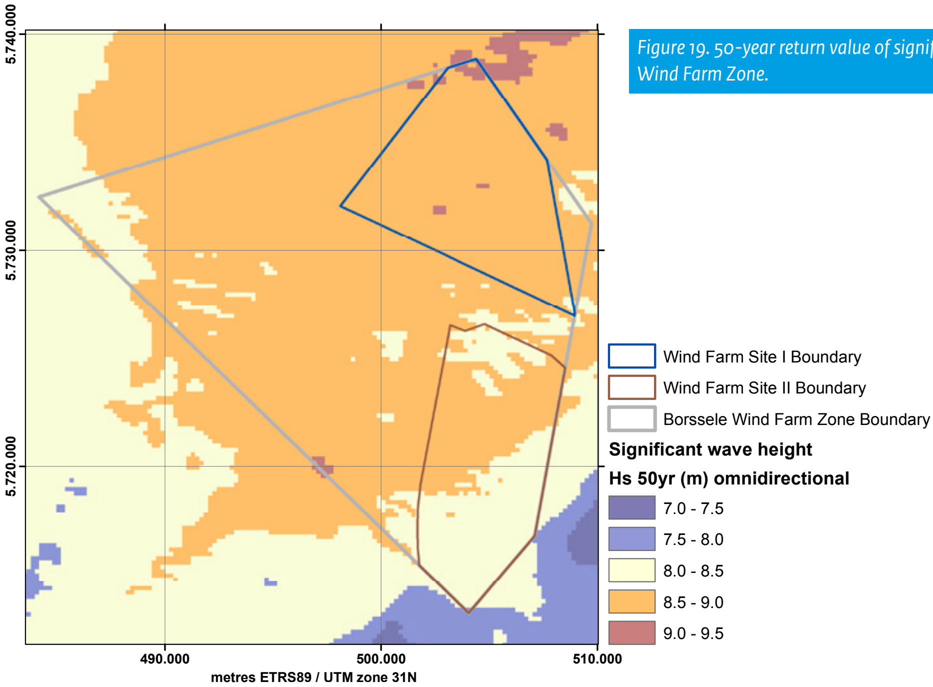


Figure 19. 50-year return value of significant wave height for the Borssele Wind Farm Zone.

4.8 Meteorological and oceanographic (metocean) measurement campaign

4.8.1 Introduction

More accurate Metocean data would most likely lead to a lower risk surplus and therefore lower cost of capital (strengthening the business case) for an offshore wind farm. Therefore, DNV GL was asked to perform an assessment of the different options for a metocean measurement campaign [12]. The aim of the study was to investigate the possibility of improving wind resource data in the Dutch North Sea so it could be used in the project development and design studies of the five wind farm zones under development.

Publicly available offshore meteorological mast data is available from the existing IJmuiden and OWEZ masts (~130-140 km from the BWFZ). Combined with publicly available data from Europlatform, Goeree LE and Vlakte van de Raan stations (~30-50 km from the BWFZ), this is expected to provide 'bankable' wind data for the BWFZ. Fixed LiDAR measurements at Lichteiland Goeree also started in October 2014 and this information will further increase the 'bankability' of wind data for the BWFZ.

The data collected since 2014 from Goeree LE plus the results of six months of floating LiDAR measurements provides the best possible dataset that can be used for production calculations for the first round of tenders in the BWFZ. Based on DNV GL's assessment, Netherlands Enterprise Agency (RVO.nl) has contracted Fugro OCEANOR to deploy an onsite floating LiDAR which can provide on-site metocean data for the BWFZ.
The improved data should allow developers to:

- Carry out more accurate calculations for annual energy production;
- Improve/validate metocean models used for wind farm design.

4.8.2 Supplier

The metocean measurement campaign is being conducted by Fugro OCEANOR, a limited company owned by the Dutch Company Fugro NV. Fugro OCEANOR specialises in the design, manufacture, installation and support of environmental monitoring, ocean observing and forecasting systems.

4.8.3 Results

Fugro has placed a metocean buoy in the BWFZ (figure 20), which will provide one year of meteorological and oceanographic data.

The measurement campaign started on June 10th 2015. Monthly results are being made available on ***offshorewind.rvo.nl***. A summary of findings will be added to any further revisions of the PSD.

At the end of 2015 a second buoy will be installed for a period of three months, close to the southern border of the BWFZ. This will help assess any wake effects from the neighboring Belgium wind farms.

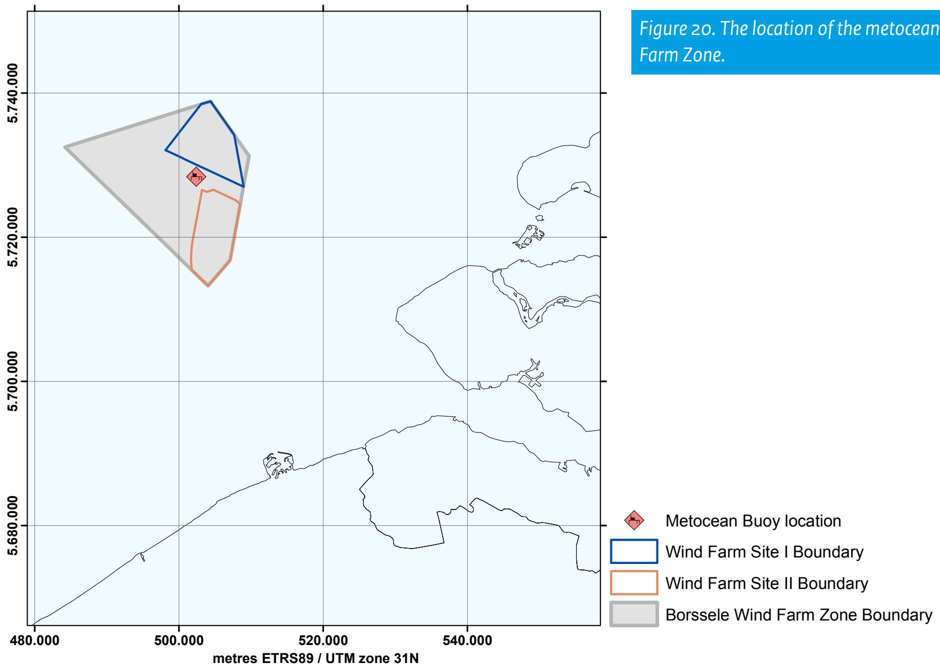


Figure 20. The location of the metocean buoy in the Borssele Wind Farm Zone.

4.9 Wind Resource Assessment

4.9.1 Introduction

The goal of this study was to provide a preliminary wind resource assessment for the BWFZ and its four sites. At the time of the assessment (May 2015), there were no specific on-site measurement records available.

Therefore, the results are based on mesoscale modelling, validated against nearby offshore wind measurements. Note: wind measurement data will become available from the metocean measurement campaign. This data may be used to perform further wind resource assessments. However, this task shall not be carried out by Netherlands Enterprise Agency (RVO.nl).

4.9.2 Supplier

Netherlands Enterprise Agency (RVO.nl) selected Ecofys to conduct the Wind Resource Assessment [11]. Ecofys has experience in offshore wind resource assessments, having prepared bankable reports on several large offshore wind farm, often at sites where wind measurements were not available. Moreover, the company is skilled in the validation and application of mesoscale model data, including detailed uncertainty assessment.

4.9.3 Results

The report presents a wind climate assessment for the planned BWFZ. This assessment is based on the combined use of offshore wind measurement campaigns and mesoscale model data. No specific on-site measurement records were used for this study. The Meteomast IJmuiden offshore mast is the primary source of data for this assessment, based on the overall greater accuracy of the wind measurements the mast provides, including the horizontal extrapolation to the BWFZ. The extrapolation is based on the KNMI KNW mesoscale model, selected due to validation being based on the need for four offshore met mast datasets. KNMI provided six relevant grid points. Ecofys attributed one representative grid point with each of the four BWFS.
These four grid points enable sufficient information to be attained to assess the variation in wind speeds across the zone.

The results indicate that the wind resource is reasonable for an offshore site in the Dutch North Sea and consistent across the modelled heights. Based on the assessment, the mean wind speed at a hub height of 100 m MSL at the Borssele zone centre is calculated to be 9.6 ± 0.5 m/s.

The variation across the site is about 0.3 m/s, as seen in figure 21.
Note the wind speeds found in the Ecofys report differ from the wind speeds found by Deltares in the metocean study. These differences are related to the use of the Harmonie model by KNMI. The differences between the studies are within uncertainty tolerance range and can be explained. Therefore, the metocean report(s) already published will not be updated.

4.9.4 Conclusion

Based on previously available KNMI data, Ecofys has created a wind resource assessment. However, tender applicants are advised to create their own assessment. For example, new metocean data will be available from the metocean measurement campaign.

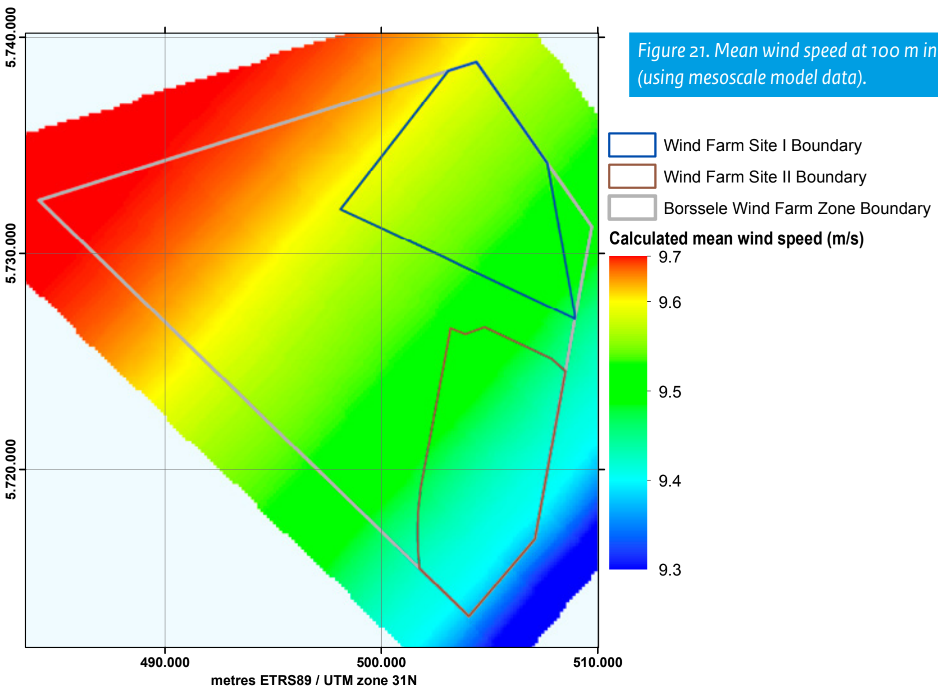


Figure 21. Mean wind speed at 100 m in Borssele Wind Farm Zone (using mesoscale model data).

5. Legal framework and specific requirements of the Borssele WFS I and II SDE+ grant and permit tender

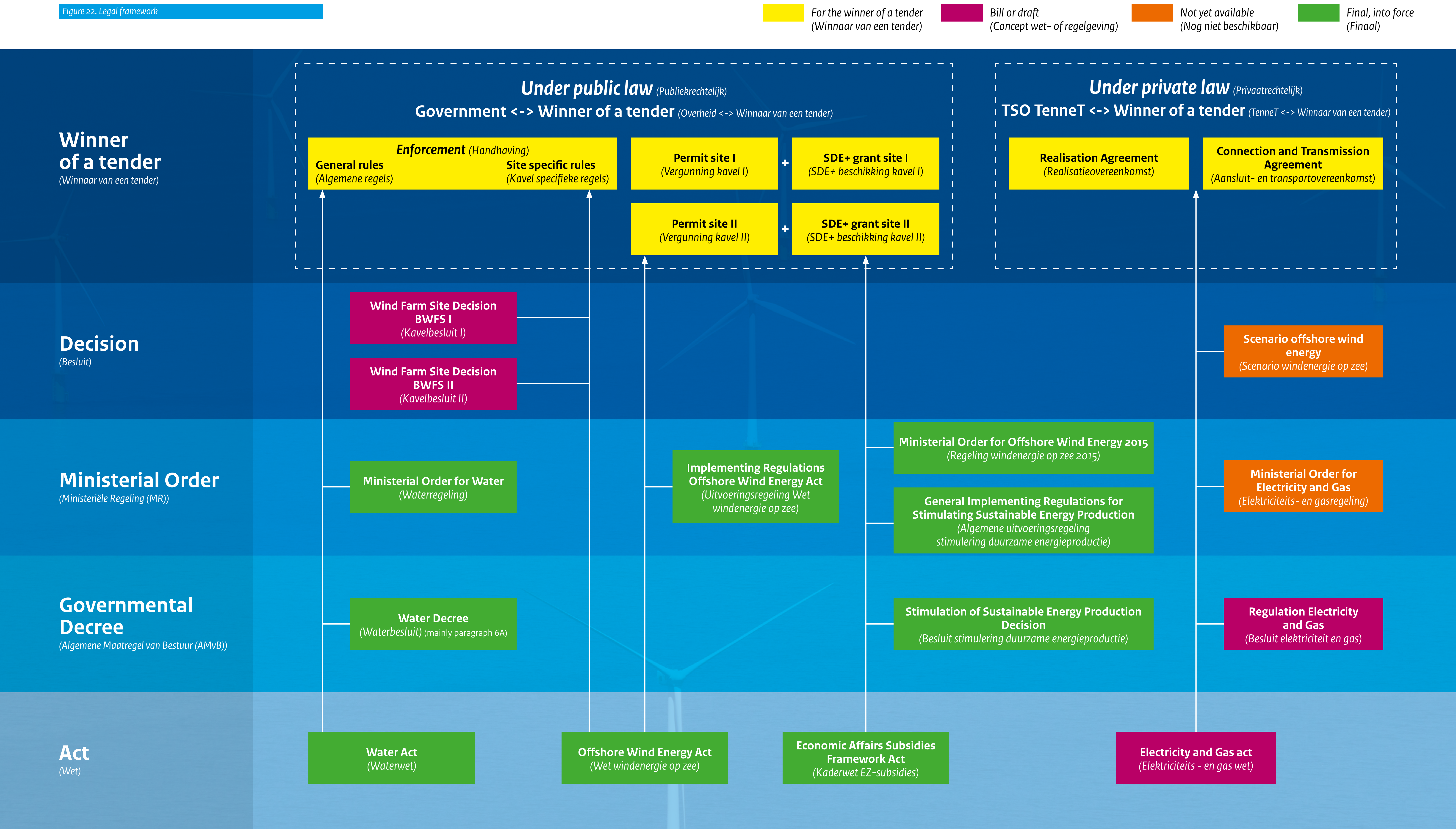
Introduction

A legal framework has been or will be put into place to facilitate and manage the Dutch offshore wind programme rollout. The system consists of several distinct aspects:

- The construction of wind farms will only be allowed in wind farm zones that have been designated in the National Water Plan [13], Any project planned outside these zones will not be consented.
- The government allocates specific sites where wind farms can be built and operated within the wind farm zones. In the Water Decree [16] general rules are prescribed for building and operating offshore wind farms. The Ministries of Economic Affairs and Infrastructure and the Environment will prepare so-called Wind Farm Site Decisions (kavelbesluiten), which will outline the specific rules for building and operating a wind farm on a given site. An Environmental Impact Assessment (EIA) is required for the government to prepare its final Wind Farm Site Decisions. This means that no additional EIA will be required by companies bidding to develop projects.
- The Dutch transmission system operator TenneT will develop and operate the offshore grid connections.
- The government will issue a call for tenders for a site once a Wind Farm Site Decision has been prepared. The winner of a tender is allowed to build a wind farm on the specific site and therefore receives:
    - A SDE+ grant
    - A permit, based on the Offshore Wind Energy Act, allowing it to build, operate and decommission a wind farm
- The winner and TenneT agree upon respectively a Realisation Agreement and a Connection and Transmission Agreement, required prior to realization resp. operation of the connection.

The legal framework can be found in figure 22. An informal translation of the relevant law in English can be found in Appendix B.

Figure 22. Legal framework



5.1 SDE+ grant and permit tendering

Grants and permits for the BWFS I and II will be awarded through dedicated calls for tender by the Netherlands Enterprise Agency (RVO.nl) under the Stimulation of Sustainable Energy Production (SDE+, Stimulering Duurzame Energieproductie) [14].
The company that tenders the lowest bid for a project will receive both the grant and the permit to build, operate and decommision a wind farm.

5.1.1 SDE+

The SDE+ (Stimulering Duurzame Energie Productie/ Stimulation of Sustainable Energy Production) is an operating grant. Producers receive financial compensation for the renewable energy they generate. Compensation will be available for a period of 15 years. The price for the production of renewable energy is capped (base sum). For BWFS I and II in the BWFZ the base sum is set at € 124/MWh. The yield of fossil energy is established in the correction sum. The SDE+ contribution = base – correction sum. This makes the level of the SDE contribution dependant on energy-price developments.

5.1.2 Permit

A tender winner also receives a permit which is valid for a 30-year period (the permit is irrevocable). The wind farm must be operating within five years, but it can start production in year three and operate to year 29. Decommissioning can start in year 25 and should be completed in year 30. The permit also outlines details for the financial guarantee for decommissioning.

5.2 Enforcement

Rijkswaterstaat (Ministry of Infrastructure and the Environment) is expected to be appointed as the overseeing authority charged with enforcing the general rules that stem from the Water Act (mainly § 6A of the Water Decree) and specific rules that stem from the Wind Farm Site Decisions.

5.2.1 General Rules for offshore activities and offshore wind farms (Water Decree)

The Water Act [15] is applicable for all locations within the Dutch EEZ, including sites with a Wind Farm Site Decision. Paragraph 6A of the Water Decree [16] provides general requirements for the construction of offshore wind farms. These requirements are listed in chapter 6.2.

5.2.2 Site specific rules and requirements

The Offshore Wind Energy Act (Wet windenergie op zee) [17] came into force on the 1st of July 2015. It is designed to encourage greater efficiency in the use of the North Sea, cost reductions and accelerate the deployment of offshore wind energy. The act introduces so called Wind Farm Site Decisions (kavelbesluiten). A Wind Farm Site Decision specifies the location for a wind farm and the conditions under which it may be constructed and operated. These conditions give developers flexibility regarding the design and operational aspects of the wind farm. This should give commercial parties opportunities for choosing the best technical options within the design parameters and realise a project at the lowest possible costs.

Wind Farm Site Decisions are subject to an environmental impact assessment (EIA), which is commissioned by the Ministries of Economic Affairs and of Infrastructure and the Environment.

The EIAs for WFS I and II are completed [18] - a summary can be found in Appendix C. The results of the EIAs have been taken into account in the Wind Farm Site Decisions. Moreover, the Wind Farm Site Decisions include all considerations and prescriptions based on the Flora and Fauna Act and the Nature Conservation Act. As of August 2015, draft decisions for BWFS I and II of the BWFZ are available [19].

Apart from the permit granting consent to build and operate (see 5.1.2) no further consents are required. Proposals submitted in response to request for tenders to build projects will be assessed to ensure they can comply with the general and site specific rules and requirements. The vast majority of the rules and requirements will be subject to enforcement, starting with the obligatory execution plan that has to be submitted to the authorities at least eight weeks prior to the start of the construction (companies are advised to submit a draft execution plan for verification at a much earlier stage however).

5.3 Connection to the TenneT offshore substation

The Dutch Government plans to appoint transmission system operator TenneT as the developer and operator of the offshore grid network in the Netherlands [20]. This will be formalised in the new Electricity and Gas Act [21], now being considered by Parliament. The act is expected to enter into force on 1st January, 2016.

TenneT will build grid connections for the planned 3,500 MW of new offshore wind capacity. The new Electricity and Gas Act introduces a 'Scenario' which gives a technical framework and outlines the future development of offshore wind energy in the Netherlands. This is due to be published by the Ministry of Economic Affairs once the Act has entered into force.
To create economies of scale, TenneT will construct five standardised offshore substations, each with a capacity of 700 MW. The substations will be connected to the national EHV grid with two 220 kV export cables. Output from WFS I and II will be connected to a single platform (Borssele Alpha).

In close consultation with the offshore wind industry, TenneT has started the development of an offshore legal framework consisting of so-called model agreements and a proposal for future offshore codes. Consultation sessions of the draft model agreements are open to all stakeholders of the offshore grid and are scheduled for September and October.

The model agreements consist of a Realisation agreement and a Connection and Transmission Agreement supported by Offshore General Terms and Conditions. ***Draft model agreements*** are available for public consultation.

The generic technical requirements for offshore wind farm connections will be established as technical code requirements, and as such be based on public law.
The formal process to introduce this 'offshore code' can only start after the Electricity and Gas Act has entered into force. For now, TenneT is providing the proposed generic and uniform technical requirements as an appendix to the model agreements. This appendix is expected to be overruled and become dispensable once the offshore code is concluded by the regulator.

6. Specific requirements and relevant information from the legal framework

This chapter outlines the specific information that is relevant or needs to be adhered to when competing in the tender to design and build a wind farm in the BWFS I and/or II. These requirements originate from the legal framework (an English translation of the legal framework can be found in Appendix B).

6.1 Coordinates and exclusion zones

BWFS I is divided into four parcels (to accommodate the maintenance zones of planned or pre-existing cables and pipelines that cross the area), while BWFS II is a single undivided site. The rotor blades of installed wind turbines are only allowed within the border coordinates of the specific zone. No turbines or rotor blades are allowed within the maintenance zones. Subsea infield cables are allowed in the maintenance zones and a specified corridor toward the TenneT Offshore Substations Alpha and Beta. However, crossing agreements with the cable or pipeline owner need to be agreed. Both sites and their maintenance zones are shown in figure 23.

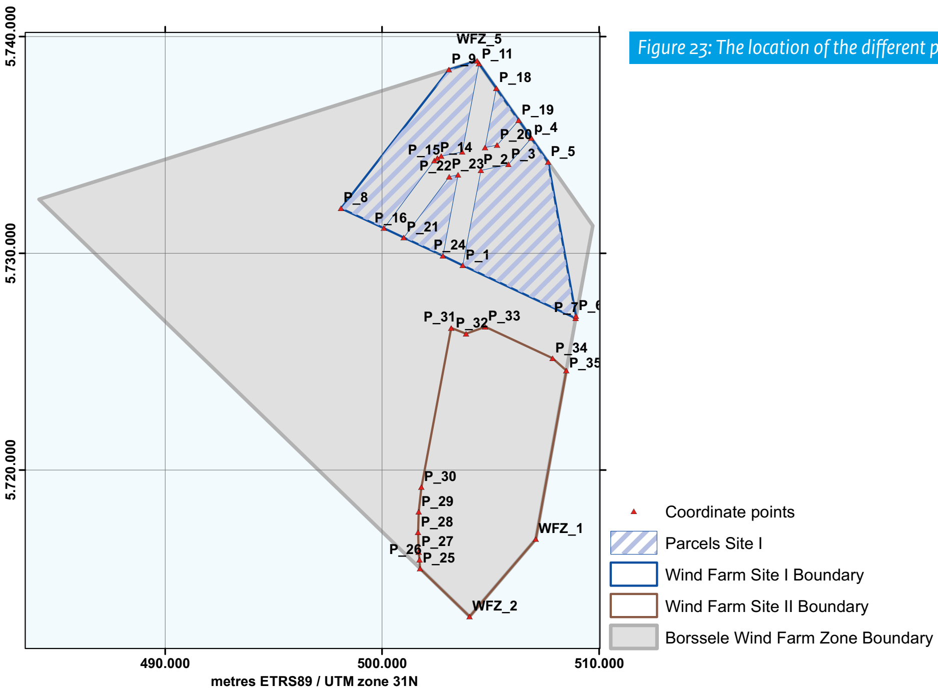


Figure 23: The location of the different parcels of BWFS I and II.

BWFS I and II are bordered by the coordinates provided in table 3.

Table 3. Border coordinates of Borssele Wind Farm Site I and II. Rotor blades of all turbines are not allowed outside these coordinates.

		Geographic coordinates (ETRS89)		UTM (ETRS89, zone 31)	
Location	**Point**	**Degrees N**	**Degrees E**	**Easting**	**Northing**
BWFS II	P_5	51,75865	3,11088	507652,83	5734201,11
BWFS II	P_6	51,69484	3,12939	508942,80	5727106,64
BWFS II	P_7	51,69392	3,12912	508924,37	5727004,39
BWFS II	P_8	51,73957	2,97255	498104,84	5732074,10
BWFS II	P_9	51,79708	3,04475	503086,14	5738470,62
BWFS II	WFZ_5	51,80074	3,06343	504373,70	5738878,38
BWFS II	P_25	51,59019	3,02531	501753,27	5715460,51
BWFS II	P_26	51,59378	3,02483	501720,03	5715858,61
BWFS II	P_27	51,59698	3,02430	501683,41	5716214,87
BWFS II	P_28	51,60519	3,02397	501660,00	5717128,62
BWFS II	P_29	51,61365	3,02438	501687,85	5718068,69
BWFS II	P_30	51,62398	3,02611	501807,34	5719218,17
BWFS II	P_31	51,68999	3,04614	503189,53	5726559,57
BWFS II	P_32	51,68759	3,05602	503872,42	5726293,42
BWFS II	P_33	51,69045	3,06880	504755,88	5726612,09
BWFS II	P_34	51,67733	3,11358	507853,40	5725156,81
BWFS II	P_35	51,67216	3,12275	508488,01	5724583,64
BWFS II	WFZ_1	51,60230	3,10233	507087,05	5716811,66
BWFS II	WFZ_2	51,57027	3,05829	504039,56	5713246,09

The maintenance zones (only in BWFS I) are bordered by the coordinates provided in table 4.

Table 4. Border coordinates of the maintenance zones of the SeaMeWe cable and Zeepipe. Rotor blades are not allowed inside these zones.

		Geographic coordinates (ETRS89)		UTM (ETRS89, zone 31)	
Location	Point	Degrees N	Degrees E	Easting	Northing
BWFS I	P_1	51,71586	3,05391	503724,12	5729437,47
BWFS I	P_2	51,75529	3,06600	504555,58	5733823,62
BWFS I	P_3	51,75775	3,08437	505822,88	5734098,66
BWFS I	P_4	51,76855	3,09973	506881,90	5735300,75
BWFS I	P_11	51,79959	3,06473	504463,29	5738750,59
BWFS I	P_12	51,76293	3,05350	503692,46	5734672,90
BWFS I	P_13	51,76117	3,03959	502732,40	5734476,14
BWFS I	P_14	51,76041	3,03685	502543,54	5734391,19
BWFS I	P_15	51,75938	3,03498	502413,97	5734276,60
BWFS I	P_16	51,73128	3,00122	500084,47	5731151,28
BWFS I	P_17	51,76476	3,06874	504743,54	5734876,75
BWFS I	P_18	51,78932	3,07632	505263,83	5737608,72
BWFS I	P_19	51,77599	3,09134	506301,87	5736128,09
BWFS I	P_20	51,76582	3,07687	505304,31	5734994,96
BWFS I	P_21	51,72736	3,01452	501002,92	5730715,50
BWFS I	P_22	51,75270	3,04492	503100,96	5733534,09
BWFS I	P_23	51,75347	3,05072	503500,72	5733620,46
BWFS I	P_24	51,71988	3,04051	502798,13	5729883,97

The infield cable corridor towards the TenneT Offshore Substation is bordered by the coordinates provided in table 5.

Table 5. Border coordinates of the infield cable corridor towards the TenneT Offshore Substation. Subsea cables towards the TenneT Offshore Substation are allowed within these coordinates.

		Geographic coordinates (ETRS89)		UTM (ETRS89, zone 31)	
Location	Point	Degrees N	Degrees E	Easting	Northing
Corridor BWFS I	P_1	51,71586	3,05391	503724,12	5729437,47
Corridor BWFS I	T_9	51,70766	3,08205	505669,13	5728527,44
Corridor BWFS I	T_10	51,70105	3,05671	503919,02	5727790,34
Corridor BWFS I	T_1	51,69992	3,05671	503919,02	5727665,34
Corridor BWFS I	T_12	51,70196	3,04975	503438,05	5727891,18
Corridor BWFS II	T_1	51,69992	3,05671	503919,02	5727665,34
Corridor BWFS II	T_11	51,69925	3,05671	503919,02	5727590,34
Corridor BWFS II	P_33	51,69045	3,06880	504755,88	5726612,09
Corridor BWFS II	P_32	51,68759	3,05602	503872,42	5726293,42
Corridor BWFS II	P_31	51,68999	3,04614	503189,53	5726559,57

6.2 Design and operation requirements

This paragraph contains tables summarising specific requirements that need to be adhered to when competing in call for tenders relating to the design and build of a wind farm in BWFS I or II. The requirements are grouped in line with the five different wind farm development stages (design, finance, build, operate, and decommissioning).

The requirements originate from several acts and decrees (these are referenced in chapter 5 and in the righthand column of each table). These requirements will also feature within the permit, grant agreement and and agreements with TenneT. While these documents are still to be finalised, it is expected that:

- Requirements originating from the Wind Farm Site Decisions, the Offshore Wind Energy Act and the Water Act will be re-enforced as part of the final build and operate permit.
- Requirements originating from the Implementing Regulations for Offhore Wind Energy will be included in the SDE+ grant agreement.
- Requirements originating from TenneT will be included into the Realisation Agreement and Connection and Transmission Agreement.

While Netherlands Enterprise Agency (RVO.nl) has tried its best to provide a complete overview of all relevant requirements, this list may still be incomplete or may be superceded. In any case, the applicable law in Appendix B is leading.

6.2.1 Design other

In order to be compliant with the permit, the design of a wind farm built in the BWFZ shall be compliant with the requirements listed in table 6, which are an abstract of the applicable law (Appendix B).

Table 6. Bandwidth of design characteristics for BWFS I and II

Requirement	Applicable Law
Two 350 MW sites can be connected to the Borssele Alpha Offshore Substation. However, the Ministry of Economic Affairs has approved the installation of up to 380 MW at each site. TenneT offers 350 MW fixed connection and transmission capacity but will provide additional flexible capacity if technical conditions allow. Detailed arrangements will be agreed upon in the Connection and Transmission Agreement.	Letter to parliament May 19th 2015 [22]
The wind farm will be situated within the contours of the coordinates listed in [table 3 of this PSD].	DWFSD[3] I and II, III.3.1
The route of the grid connection to the Offshore Substation Borssele Alpha lies within the coordinates shown in [table 5 of this PSD].	DWFSD I and II, III.2.2
No wind turbines will be installed in the maintenance zones of the pipe 'Zeepipe' and the cable 'SeaMeWe'. These zones are within the coordinates shown in [table 4 of this PSD].	DWFSD I, III.2.3
The rotor blades of the wind turbines must remain completely within the contours cited in [table 3 of this PSD] and completely outside of the maintenance zone cited in [table 4 of this PSD].	DWFSD I, III.2.4
The rotor blades of the wind turbines must remain completely within the contours cited in [table 4 of this PSD].	DWFSD II, III.2.3
The maximum number of wind turbines to be installed is 95.	DWFSD I, III.2.5 DWFSD II, III.2.4
The maximum total swept area permitted is 1,346,157 m^2.	DWFSD I, III.2.6 DWFSDII, III.2.5
The minimum total swept area permitted is 921,055 m^2.	DWFSD I, III.2.7 DWFSD II, III.2.6
Each wind turbine rotor should have a minimum swept area of 10,526 m^2.	DWFSD I, III. 2.8 DWFSD II, III. 2.7
The minimum distance between wind turbines must be 4 times the rotor diameter expressed in metres.	DWFSD I, III.2.9 DWFSD II, III.2.8
The minimum tip lowest level is 25 m above sea level (MSL).	DWFSD I, III.2.10 DWFSD II, III.2.9
The maximum tip highest level is 250 m above sea level (MSL).	DWFSD I, III.2.11 DWFSD II, III.2.10
The cables from the wind turbines must be connected to the Borssele Alpha Offshore Substation.	DWFSD I, III.2.12 DWFSD II, III.2.11
The permitted foundations for the wind turbines are: monopiles, tripods, jackets, gravity based and suction bucket. If the permit holder wishes to deploy a type of foundation that is not cited in this paragraph, then the environmental impact of that must be determined and submitted to the Minister of Economic Affairs for review. The environmental impact must not exceed the limits set out in this Decision.	DWFSD I, III.2.13 DWFSD II, III.2.12
The permit holder must make demonstrable efforts to design and build the wind farm in such a way that it actively enhances the sea's ecosystem, helping to foster conservation efforts and goals relating to sustainable use of species and habitats that occur naturally in the Netherlands. In this respect the company is required to create an action plan, to be delivered to the Ministry of Economic Affairs no later than eight weeks before the planned start of construction. Construction work must adhere to this plan.	DWFSD I, III.2.16 DWFSD II, III.2.15
The permit as referred to in Section 12 of the Offshore Wind Energy Act will be issued for a period of 30 years.	DWFSD I and II, III.3
If it is determined by the Water Decree that a measure must be taken for the protection of the North Sea, then another measure can be taken if Our Minister has decided that at least an equal level of protection of the North Sea will be achieved by means of that measure. The person or entity who intends to take another measure should submit an application to Our Minister for that purpose, containing details from which it can be demonstrated that at least an equal level of protection of the North Sea will be achieved by means of that other measure. Our Minister will make a decision within eight weeks regarding an application to take another measure (to protect the North Sea), determining whether or not it will ensure an equal or improved level of protection. Our Minister may extend this period once by six weeks at most.	Water Decree[5]/ Article 6.16b
The operator will report its intention to install and/or change a wind farm to Our Minister at least eight weeks before the start of the construction period and will provide the following data thereby: its location, the type of turbines, cabling, expert assessment on quality and security provisions. Within three months after installation an operator will provide Our Minister the position of foundations and export cables and related works.	Water Decree/ Article 6.16d

3) DWFSD: Draft Wind Farm Site Decision BWFS I and II [19]

5) Please note: The requirements of the Water Decree mentioned are a selection of importance for the design phase.

6.2.2 Financial and legal requirements

Table 7. Financial and legal requirements BWFS I and II

Requirement	Applicable Law
The nominal capacity of the offshore wind farm, amounts to: a) at least 351 MW per wind farm site minus the number of MW of the wind turbine with the least capacity, and b) at most 380 MW per wind farm site.	MOOWE 2015[6], §2.3
The deadline for tender submissions is March 31st 2016 at 17:00. Companies can submit a single application covering both sites and one separate application for each individual site (three in total)	MOOWE 2015, § 2.4
The Minister will reject an application if the total equity of the lead party requesting the SDE+ subsidy and permit is less than 10% of the total investment cost of the requested site.	MOOWE 2015, § 2.5
The insight into equity will be offered by the provision of the most recent annual accounts of the applicant, its parent company of the participants in the collaborative venture.	GIR SDE+[7] Art. 2 § 3c
If an applicant will invest less than 20% equity in the project itself a letter of intent from a financier for the financing of the remaining part of the 20% is included.	GIR SDE+ Art. 2 § 3c
The maximum grant available is € 2,500,000,000 per Wind Farm Site.	MOOWE 2015, §2.6.1
A combined application will only be entitled to a grant if the application is ranked at least equally high in the ranking for both Wind Farm Sites as the highest ranked individual application for each site.	MOOWE 2015
If individual applications from the same applicant are ranked the highest for both Wind Farm Sites but the level of own assets held by that applicant is lower than 10% of the combined total investment costs for the two projects, then only the application featuring the lowest bid price per kWh will be entitled to a grant. If the amount bid for each project is equal, then the Minister will determine by means of a lottery which application will be entitled to a grant.	MOOWE 2015, §2.6.8
A price cap of € 0.124/kWh applies.	MOOWE 2015, §2.6.7
Tender winners will be granted the SDE+ subsidy under the following conditions: a. The tender winner shall enter into an execution agreement with the Ministry within two weeks from award of the contract to build and operate the respective wind farm. b. The tender winner shall provide a bank guarantee of € 10,000,000 within four weeks from Award.	MOOWE 2015, §2.8 MOOWE 2015, appendix to §2.8 MOOWE 2015, §2.9 and §2.10
The tender winner shall provide a second bank guarantee of € 35,000,000 within twelve months from award of contract, unless the Dutch State withdraws, on request of the tender winner, the Award within that period.	GIR SDE+, MOOWE art. 8 (appendix)
The grant will be provided for a period of 15 years. The wind farm should be commissioned within 5 years after the subsidy is granted or 5 years after the Wind Farm Site Decision is irrevocable.	MOOWE 2015, §2.9.1 MOOWE 2015, §2.10
The SDE+ subsidy programme subsidises the difference between the market price of electricity and the tender price offered by the lowest bidder. If the market price falls, the subsidy amount rises, so the overall income of an operator remains the same. However, if the market price falls below the base electricity price (floor price), the subsidy will not increase any further, so the overall income of an operator will be lower.	Stimulation of Sustainable Energy Production decision.
The base electricity price (floor price) for the BWFS I and II tender will be € 0.029/kWh.	MOOWE 2015, §2.11.1
The maximum number of full load hours [eligible for subsidy] is equal to the net P50-value full load hours that is included in the application.	
When calculating this P50 value, only wind farms that are operational as of July 1st 2015, should be taken into account.	MOOWE 2015 §3.13.1.3.6

6) MOOWE = Ministerial Order for Offshore Wind Energy 2015 [24]

7) voeg toe GIR SDE+ = General Implementing Regulations for Stimulating Sustainable Energy Production [25]

6.2.3 Construction

Table 8. Construction requirement parameters for BWFS I and II

Requirement	Applicable Law
Tender winners are obliged to provide an execution plan to the Ministry of Infrastructure and the Environment no later than eight weeks before planned construction start. The plan should address all relevant issues related to safety and environment during the construction and operational phase. More information can be found in the WFSD.	DWFSD I and II/§ 4.4.2
The permit holder will produce a piling plan, which should be submitted for approval at least 8 weeks at the latest before the start of construction to the Minister of Economic Affairs. The work will be carried out in accordance with the approved piling plan. The permit holder may only start construction of the wind farm when a piling plan has been approved. The permit holder will make every effort to generate as little subsea sound as possible and as short a continuous period of time as possible.	DWFSD I and II, III.4.2
Prevention of permanent physical harm and/or effects on porpoises, seals and fish: a. Companies must use an acoustic deterrent device during piling and 30 minutes before piling work starts. b. Piling work should adopt a soft start, to enable porpoises to swim to a safe location.	DWFSD I and II/par 4.1
Measures to limit and prevent disturbance to porpoises, seals and fish (Sound level): during the construction of the wind farm, the sound level under water at any given time during piling work may not exceed the sound levels cited in the table in this paragrapgh. From Jan-May the maximum piling sound level is lowest. (Appendix B)	DWFSD/Reg. 4.2.1.
The use of heavy metals in galvanic anodes used as cathodic protection is not permitted.	DWFSD/I reg 2.14, II reg. 2.13
When carrying out work under the scope of the construction, maintenance or decommissioning of a wind farm or of an export cable, measures will be taken to prevent any adverse effects in terms of safety and efficient use of the sea.	Water Decree 6.16e1
If, during the construction of a wind farm or during other work relating to wind turbines in the Dutch exclusive economic zone, a monument is found, or what is possibly a monument, as defined in the Monuments and Historic Buildings Act 1988, then the first subsection of Sections 53, 56, 58, and 59 of that Act are equally applicable.	Water Decree 6.16f1
An export cable must lie: a. at a depth of at least three metres under the sea floor for any part of the cable which is within a distance of three kilometres from the low-water mark as referred to in Section 1 of the Netherlands Territorial Sea (Demarcation) Act, or where the shoreline as referred to in ***Section 2 of that Act***, is situated; b. at a depth of at least one metre under the sea floor for any part of the cable which is situated at three kilometres or more from the shoreline referred to in part a; c. at the point of crossing a seaway, at least one metre below the maintenance depth set by the manager of the seaway.	Water Decree 6.16j
1. A wind turbine and any other installation that forms part of a wind farm must be sufficiently strong to withstand the expected forces resulting from wind forces, waves, sea currents and use of the turbine itself. 2. At least four weeks before putting the wind farm into operation, the operator will provide Our Minister with a statement confirming that the construction/installation of the wind turbines and other balance of plant components forming part of the wind farm comply with the first subsection.	Water Decree 6.16g 1 and 2
1. In order to ensure the safety of air traffic and shipping traffic, a wind farm will be equipped with identification marks and beacons. 2. The identification marks and beacons referred to in the first subsection must comply with the IALA recommendation O-139 (the marking of manmade offshore structures) and with the guideline published by the British Civil Aviation Authority CAP 764 (policy and guidelines on wind turbines).	Water Decree 6.16h 1 and 2

6.2.4 Operation

Table 9. Operational requirements for BWFS I and II

Requirement	Applicable Law
Vessels used by or on behalf of the permit holder must take into account the presence of seals in the shallows and designated resting areas. The measures cited in the Voordelta Management Plan and the Delta Water Management Plan must be taken into account hereby. This regulation will be withdrawn once the Voordelta Management Plan and the Delta Water Management Plan have been updated/amended to include these restrictions on ships.	DWFSD I, III.2.15 DWFSD II, III.2.14
During repairs and maintenance of telecommunication cables the number of rotations per minute per wind turbine of the wind turbines that are present within a radius of 1,000 metres of the repair and maintenance location must be reduced to less than 1. Since only site 1 is crossed by telecom cables, this requirement is only applicable to site 1.	DWFSD I, III.2.17
1. Measures to limit the number of victims of collision amongst birds at rotor level during mass bird migration: a) during the nights (between sunset and sunrise) of mass bird migration the number of rotations per minute per wind turbine will be reduced to less than 1; b) a system to record actual bird migration must be included and coupled to the control system of the wind turbines; c) the permit holder will produce a bird management plan outlining which monitoring system will be installed and the basis on which the transect for measuring the density of birds will be determined.	DWFSD I and II, III.4.3
1. Measures to prevent victims of collision amongst bats at rotor level: a) the cut-in wind speed of turbines will be 5.0 m/s at axis height during the period of 15 August to 30 September between 1 hour after sunset to 2 hours before sunrise; b) in case of a wind speed of less than 5.0 m/s at axis height, during the period referred to in part a, the permit holder will reduce the number of rotations per minute per wind turbine to less than 1; c) the permit holder will produce an annual report outlining how this regulation is implemented.	DWFSD I and II, III.4.4
The Minister of Economic Affairs will create an environmental monitoring and evaluation programme. The permit holder will collaborate as far as possible, without financial compensation. The Minister of Economic Affairs will publish the data arising from the monitoring and evaluation programme. The permit holder will cooperate as follows: providing access to the wind farm for vessels, enabling the installation of equipment (cameras, bat detectors, radar equipment, measurement buoys, C-PODs, etc.).	DWFSD I and II, III.5
The operator is responsible for a good level of maintenance of the wind farm and for this purpose will periodically inspect the wind turbines and other provisions, as well as the security provisions.	Water Decree/Article 6.16i

6.2.5 Decommissioning of the wind farm

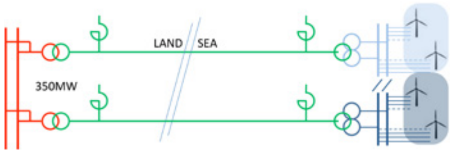
Table 10. Decommissioning requirements for BWFS I and II

Requirement	Applicable Law
The permit holder will dismantle and remove all elements of the wind farm within two years at the latest after the power generation operations have stopped.	DWFSD I and II, III.6
The permit holder will provide financial security of EUR 120,000 per installed MW planned before construction starts. The permit holder will increase the financial security by 2% per annum up to the time the wind farm stops operating and is due for decommissioning.	DWFSD I and II, III 7d
The operator will provide that relates to the decommissioning of a wind farm or an export cable at least four weeks before the start of the work. After a wind farm, cables and scrap metal and other materials have been removed, the operator will report this immediately to Our Minister and will provide supporting data to illustrate that decommissioning is complete.	Water Decree/ Article 6.16l

6.2.6 Electrical infrastructure

Table 11. Electrical infrastructure requirements

Requirements proposed and decided upon by Ministry of Economic Affairs applicable to all five platforms to be realised up to 2023	Source	Status
A power producer is entitled to compensation from TenneT if the offshore grid commissioning is late or if there has been too much downtime during the year.	EGACT/Article 5.27.1	Bill
A downtime of five days per year is allowed without compensation.	EGDECREE/Article 5.29.3	Bill
Compensation consists of consequential damages and damages resulting from lost or postponed revenue.	EGACT/Article 5.27.2	Bill
In case of late commissioning, the compensation is: postponed income from electricity price (E-E/3.87) + postponed SDE-subsidy (SDE-SDE/2.95) + consequential damages. The rationale behind this factor is that this income is not lost, it is only postponed by 16-20 years. The factors are a compensation for the time value of money.	EGDECREE/Article 5.29/5.30	Bill
In case of unavailability, the compensation is: Lost income from electricity sale + Lost SDE + consequential damages. In formula: (Eprice+(SDEprice-SDEprice/1.4)*(kWhmissed-kWhtransported_in_5_days) + consequential damages.	EGDECREE/Article 5.29/5.30	Bill
A connection and transmission capacity of 350 MW per site is guaranteed by TenneT.	Letter to parliament May 19th 2015 [22]	
The connection voltage level of the inter-array systems to the TenneT offshore transformer platform will be standardised at 66 kV.	Letter to parliament May 19th 2015	
Number of bays. With the 66 kV inter-array cables, six 66 kV bays will be available per PPM. This results in four bays with "one string – one bay" and two bays with "two strings – one bay" on the offshore substation. The "two strings – one bay" solution will be executed with two separate cable disconnectors.	Draft Scenario to be published in September 2015	Decided
Access to platform. Boat landing and W2W solutions are the standard access method to the offshore substation. The offshore substation will have a helicopter hoisting facility for emergency response (if allowed by authorities) and no helicopter platform.	Draft Scenario to be published in September 2015	Decided
Organisation of metering. TenneT will centralise the organisation of the accountable metering requirements via one certified party, contracted by TenneT, responsible for the installation, commissioning and maintenance of the metering equipment. The metering responsibilities of the operator of the power park modules (PPMs) as the Connected Party will be dealt with in the Connection and Transmission Agreement.	Draft Scenario to be published in September 2015	Discussion ongoing
Overcapacity. The PPM is allowed to transmit to a maximum of 380 MW, with the requirement for output from the PPM to be curtailed in case the 220 kV export cables reach their maximum allowable temperature limits. Curtailment will be addressed in the Connection and Transmission Agreement.	Draft Scenario to be published in September 2015	Announced by MinEA in letter to parliament, May 19 th, 2015

Requirements proposed and decided upon by Ministry of Economic Affairs applicable to all five platforms to be realised up to 2023		
	Source	Status
Redundancy/Availability. TenneT will apply a topology with a coupling of the PPMs at 66 kV offshore as basis of design for the offshore grid infrastructure. 	***Technical topic T.12***	Decided
Reactive power compensation of the infield grid will preferably be done by the PPM, in order to regulate the reactive power of the offshore grid. Compensation of reactive power is intended by only making use of the WTG reactive power capabilities. In the case the WTG cannot compensate the reactive power component set-up will be adjusted accordingly.	***Technical topic T.7***	Decided
Installation interface management	***Consultation process***	Ongoing topic in TenneT's consultation sessions, decision expected in October 2015.
O and M interface management	***Consultation process***	Ongoing topic in TenneT's consultation sessions, decision expected in October 2015.
Harmonics and transients study	***Consultation process***	Ongoing topic in TenneT's consultation sessions, decision expected in October 2015.
Compliance testing	***Consultation process***	Ongoing topic in TenneT's consultation sessions, decision expected in October 2015.
Number of J-tubes and bays. Based on 66 kV inter-array cables and 64 MW per cable - a standard platform shall be equipped with 18 J-tubes for the inter array system: o 2x 8 J-tubes for offshore PPM o 1 J-tube installed for possible test purposes o 1 J-tube installed for the connection to the neighbouring platform.	Draft Scenario to be published in September 2015	Decided
SCADA, communication interface and data links. For the PPM SCADA and communication system (owned by the WPO), TenneT will make available: • A telecommunication room of ~20 m² for each WPO to install WPO owned cabinets with the following services supplied by TenneT: sufficient CT/VT connections, Heat, ventilation, air conditioning (HVAC), a redundant and uninterruptable power supply, fire detection and extinguishing; • A room on the TenneT onshore substation of ~48 m² (~6x~8) with the following services supplied by TenneT: HVAC, a redundant and uninterruptable power supply, fire detection (no fire extinguishing); • Sufficient patch panels to connect the fibres of all array cable strings (maximum amount to be determined, but patch panel capacity will be at least sufficient for 24 fibres per string). If required patch panels for array cable fibre optic cables may be installed in the WPO room; • Sufficient optical fibre pairs in both export cables to connect the main switches to the onshore communication interface point. Exact amount to be determined, but as an indication in each export cable 24 fibres will be available for each WPO (48 fibres in total per WPO).	Draft Scenario to be published in September 2015	Decided

Requirements proposed and decided upon by TenneT applicable to all five platforms to be realised up to 2023		
	Source	**Status**
Point of Common Coupling. The connection point (CP) between the offshore power park module (PPM) and TenneT is specified at the cable termination of the inter-array cables and the switchgear installation on the platform.	Draft Scenario to be published in September 2015	Decided
Access to platform. TenneT will allow access for representatives of wind plant operators (WPOs) to the offshore platform without accompaniment. However, only specific rooms (WPO equipment rooms and general rooms) will be accessible. This will be done under safety and operational regulations and requirements, as (to be) determined by TenneT. If WPO's representatives need access to other areas (e.g. switchgear rooms where inter array cables are connected), accompaniment by a TenneT representative is required. TenneT and WPO's will make operational agreements regarding response time of accompanying staff in the offshore agreements.	***Technical topic T.4***	Decided
Operation of Bays. The operation of bays for the offshore platform is standardised in the same manner as current practice for the operation of switchgear onshore for the connected parties. I.e. the switchgear installation with connections to the offshore PPM is fully operated by TenneT, as the owner of the switchgear.	***Technical topic T.5***	Decided
Protection. TenneT will standardise the protection equipment of the offshore PPM inter-array cable strings to the TenneT offshore platform by implementing a standard protection system, aligned with the connected party, owned, operated and maintained by TenneT. TenneT will decide post award of bid, in consensus with the selected project developer, on details for protection systems and arrange this in the offshore agreements between TenneT and Connected Party.	Draft Scenario to be published in September 2015	Decided

Requirements proposed and decided upon by TenneT applicable to all five platforms to be realised up to 2023		
	Source	**Status**
Stranded asset mitigation. TenneT is inclined towards: (i) not installing, nor make provisions for, a (diesel engine powered) back-up generator plant on the offshore platform to provide auxiliary power for the PPMs; and (ii) installing a wireless communication interface (emergency facility) between in the offshore platform and onshore substation, only in case a firm and significant delay in realisation of such communication through the export cable fibres.	(i): Draft Scenario to be published in September 2015 ***(ii): Other topic***	Decision expected October 2015
Planning. For every offshore wind farm (OWF), three dates will be agreed upon individually in the model agreements: 1. Jacket and cable deck ready for pull in and storage of inter-array cables. 2. Grid connection ready for connection with the first turbines. 3. Grid connection ready for power supply and transport. A tight cooperation with the winning OWF-developers will be pursued to mitigate and anticipate possible delays or accelerations.	Draft Scenario to be published in September 2015	Decision expected October 2015

Specific Information from TenneT regarding Grid Connection System Borssele		
	Source	**Status**
Location platform Alpha: 503919, 5727665 (in ETRS_1989_UTM_Zone_31N)	***Technical topic T.16***	Decided
Planning. TenneT plans to have the grid connection for Borssele Alpha ready 31 August 2019. The jacket will be ready 30 September 2018.	Draft Scenario to be published in September 2015	Decision expected October 2015
Draft spatial plan and draft licenses for Grid Connection System Borssele expected Q1 2016 as part of Rijkscoordinatieregeling.	***Grant rules***	Ongoing

7. Final steps towards the tender opening late 2015

On the 1st of December 2015 preparations for the first Borssele wind farm tender will be finalised and the tender will be issued. This Project and Site Description (PSD) is the final version, which contains all site data and requirements that are relevant to prepare a tender bid in early 2015. However, when this PSD was published in August 2015, some documents such as the Wind Farm Site Decisions and decisions by either the Ministry of Economic Affairs or TenneT as a result of TenneT's consultation sessions were still in draft. In addition, the metocean measurement campaign is ongoing and will continue to provide information on wind and oceanographic characteristics of the BWFZ until May 2016.

Several websites provide the most up-to-date information and status of all relevant studies and the legal framework. Some of these are listed below.

- The most up-to-date information on site data, including the results of the Borssele metocean campaign can be found at ***offshorewind.rvo.nl***. The site also contains maps, minutes of workshops, a Q&A and revision log.
- More information on the SDE+ grant and permit can be found at ***www.rvo.nl/sde/windopzee*** (Dutch) or ***english.rvo.nl/subsidies-programmes/stimulation-sustainable-energy-production-sde*** (English)
- (Draft) Wind Farm Site Decisions will be published at ***www.rvo.nl/subsidies-regelingen/wind-op-zee-kavels-borssele-i/ii-fase-1***
- An overview of all relevant wind measument locations in the North Sea: ***www.windopzee.net***
- General information about offshore wind energy from the Dutch Government: ***www.rijksoverheid.nl/onderwerpen/duurzame-energie/windenergie***
- "Noordzeeloket" provides information on several spatial topics concerning the North Sea, including offshore wind ***www.windopzee.nl*** and ***www.noordzeeloket.nl/functies-en-gebruik/windenergie/***
- Information on the permitting procedure for the grid connection: ***www.rvo.nl/subsidies-regelingen/transmissiesysteem-op-zee-borssele***
- All information resulting from TenneT's consultation process with the offshore wind sector (technical, legal, planning and other topics): ***www.tennet.eu/nl/grid-projects/projects-in-the-netherlands/grid-at-sea.html****

* End of November, 2015 (date to be confirmed) TenneT will organise a public event regarding TenneT's offshore grid concept. More information will become available via TenneT's website.

8. Applicable documents

8.1 Bibliography

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[14] Besluit SDE (Stimulation of Sustainable Energy Production Decision).
[15] Waterwet (Water Act).
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[19] Draft Wind Farm Site Decision Borssele, site I and II.
[20] Kamerbrief Wetgevingsagenda STROOM (Letter to Parliament Energy Legislative Agenda), June 18th 2014 (Available in Dutch).
[21] Electriciteits- en gaswet (Electricity and Gas Act, available in draft).
[22] Kamerbrief SDE+ Wind op Zee 2015 (Letter to parliament SDE+ Offshore Wind), May 19th 2015.
[23] Policy Document on the North Sea 2009-2015, December 2009.
[24] Regeling windenergie op zee (Ministerial Order Offshore Wind Energy 2015).
[25] Algemene uitvoeringsregeling Stimulering Duurzame Energieproductie (General Implementing Regulations for Stimulating Sustainable Energy Production.)
[26] Belgian Wind Farms: ***www.mumm.ac.be/NL/Management/Sea-based/windmills.php***

Appendices

A: Site investigation QA-QC procedures
B: Translation of applicable law
C: Summary Environmental Impact Analysis

Appendix A

Site investigation QA-QC procedures

Procedure

The Netherlands Enterprise Agency (RVO.nl) has sought guidance and information by consulting with different sources. Energinet.DK , the organisation in Denmark responsible for organising the Danish offshore wind tenders, has shared lessons learned and shown Netherlands Enterprise Agency (RVO.nl) how these projects are managed in Denmark. Further, Netherlands Enterprise Agency (RVO.nl), the Ministry of Economic Affairs, Rijkswaterstaat (part of the Ministry of Infrastructure and the Environment) and TenneT organised several workshops on various subjects with market parties, invited via the Dutch Wind Energy Association (NWEA) and other communication channels.

Procurement

The procurement of the different studies was carried out in compliance with the applicable procurement procedures within Netherlands Enterprise Agency (RVO.nl). The desks studies have been procured through a limited tender where, for each study, at least two expert parties were invited to submit their proposal.
The site investigations, which exceeded the expected maximum budget for a limited tender, were procured through a public European tender. All proposals have been selected on the basis of determining the most economic advantageous offer.

Quality assurance

Netherlands Enterprise Agency (RVO.nl) and BLIX maintained a quality assurance procedure to provide accurate and usable studies. First, the scope of the different studies was determined using the following steps:

1. Netherlands Enterprise Agency (RVO.nl) and BLIX determined the preliminary scope of the different studies.
2. Where applicable, input was provided on these scope descriptions by internal experts of other governmental departments, agencies or external experts.
3. At market consultation sessions, the scope descriptions were discussed with market parties with input on completeness provided by the attendees at these workshops.

In the case of studies where the results will become part of the design basis for the developer, the certifying authority DNV GL was contracted to confirm the completeness of the scope.
After the tender, during the execution of the work by the specific executor, quality assurance was performed as follows:

1. The project team and experts of other ministries reviewed several drafts of the report, provided feedback and assured the execution of the scope was in compliance with the scope description.
2. The draft report was reviewed by independent internal and external experts.
3. The certifying authority (DNV GL) reviewed the report and provided a statement of compliance to assure the results were acquired in compliance with the DNV-OSJ101 and other applicable industry standards. These statements of compliance are added to the report if applicable.

Internal experts that have provided input in the process include:

1. The Cultural Heritage Agency (Archaeological desk study).
2. The Ministry of Infrastructure and the Environment (Morphodynamical desk study).

External experts that have provided input into the process include:

1. Windsupport Ltd (Geotechnical site investigations).
2. Reynolds International Ltd (Geophysical site investigations).
3. RPS Energy Ltd (Geophysical and geotechnical investigations).
4. ECN (metocean measurements).
5. Carbon Trust (metocean measurements).

Appendix B

Translation of applicable law

Appendix C

Summary Environmental Impact Analysis

Contact
Netherlands Enterprise Agency (RVO.nl)
Croeselaan 15 | 3521 BJ | Utrecht | The Netherlands
P.O. box 8242 | 3503 RE | Utrecht | The Netherlands
T +31 (0) 88 042 42 42
E woz@rvo.nl
offshorewind.rvo.nl
Grant and permit: http://www.rvo.nl/subsidies-regelingen/wind-op-zee-sde

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Netherlands Enterprise Agency (RVO.nl) is an agency of the Dutch Ministry of Economic Affairs. Netherlands Enterprise Agency implements policy for various ministries in the areas of sustainability, agricultural, innovation and international business and cooperation. Netherlands Enterprise Agency is the contact point for businesses, knowledge institutions and government bodies for information and advice, funding, networks and legislation and regulations.