Netherlands Enterprise Agency

Borssele Wind Farm Zone

Wind Farm Sites III & IV

Project and Site Description

Final version, August 2016

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

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Foreword

With this Project and Site Description for Wind Farm Sites III and IV of the Borssele Wind Farm Zone, the Netherlands is taking the second step towards fulfilling its goal for 4,500 MW of offshore wind power. Last year we started the process with 700 MW of development offered up to tender across Borssele Wind Farm Sites I and II. We are delighted to now be taking the next step in achieving our ambitions as set out in the nation's Energy Agreement for Sustainable Growth by offering up a further 680 MW across Borssele Sites III and IV. (An additional 20 MW at Borssele Site V will be tendered under a separate regime to accommodate new offshore turbine innovations).

Overall, our five-year programme aims to work with industry to boost offshore wind capacity in the Netherlands by end 2024 by adding 3,500 MW of new capacity to the 1,000 MW already operating or under construction, while reducing costs. Following our discussions with the industry, we are confident this can be achieved. As well as meeting our commitment under the Energy Agreement for Sustainable Development, our offshore wind power programme will also help towards meeting long term targets for 2050 as agreed at the Paris climate conference in 2015.

The Netherlands has an excellent offshore wind resource, good seabed conditions in the North Sea that are ideal for wind farm development and maintenance, well-equipped ports and a strong existing offshore industry. The government is actively helping to drive down costs. We have introduced a stable market framework under which subsidies, project consents and grid connection are streamlined.

National grid operator TenneT is already progressing well on grid connection infrastructure development and transmission network requirements. Meanwhile RVO.nl is providing all the relevant data regarding site conditions to ensure companies can prepare strong competitive bids, as it did for the previous tender round. Again, with all else being equal, the lowest tender bid to develop project sites III and IV of the Borssele Wind Farm Zone will be awarded the associated subsidies and permits.

There are, however, some key differences for this year's tender that companies should be aware of when preparing their bids. The price cap for this tender round has been set at 11.975 Eurocent/kWh, down from 12.400 Eurocent/kWh last year, in line with our stated aim to reduce costs. Meanwhile, to reduce potential impact on birds, as of this round turbines used for projects must have a nominal capacity of 6 MW at least, in line with market trends.

We fully expect companies to rise to the challenge we have set in a socially responsible manner. That means helping to safeguard the local ecosystem while bringing economic benefits to the local and regional economy as part of the project development and operational process. To that end, before the construction starts the winner should include two plans: one outlining how its project proposal will actively contribute to enhancing the local sea ecosystem and the other detailing how the project will benefit the local economy in terms of job creation and so forth. With our strong port infrastructure and existing skilled offshore workforce, we expect local job creation to be high. Both plans are not part of the final assessment criteria when it comes to ranking bids. Nonetheless, ensuring these two plans are as robust as possible will, of course, serve the industry well in fostering a higher level of social and political support for these specific projects and for further offshore wind development generally.

We are determined to make the Netherlands a leading force in offshore wind power and together with industry we are confident we can make that happen. With this launch of the next round of project development, we look forward to working with the industry in taking the next steps to making that a reality.

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 III and IV (BWFS III and IV) in the Borssele Wind Farm Zone (BWFZ) in the Netherlands.

BWFS V was originally included as part of BWFS III. Site investigations conducted prior to the separation of the sites included BWFS V and therefore all information gathered for this site is included in this PSD.

This document summarises:

- A description of the site, surroundings and characteristics of BWFS III and IV.
- 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, 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 and other deliverables mentioned in this PSD, can be found at ***offshorewind.rvo.nl***.

1.2 Reading guide

This is the final version of the PSD for BWFS III and IV. It presents an overview of all relevant information for parties interested in preparing a bid for an SDE+ grant and permit to build and operate wind farms at these sites.

This PSD covers the following aspects in the different chapters:

- Chapter 1: Objectives and reading guide.
- 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 rollout of offshore wind.
- Chapter 3: Borssele Wind Farm Site III and IV - site description - general information on the BWFZ, the location, surroundings, its bathymetry (submarine topography), existing cable and pipeline infrastructure, nearby Belgian wind farms and TenneT grid connection system.
- Chapter 4: Site data - a summary of all the studies and measuring campaigns performed to date on the BWFZ, covering the following:
  - Morphodynamic characteristics
  - UXO risk assessment
  - Geophysical survey
  - Archaeological assessment
  - Geotechnical survey
  - Metocean characteristics
  - Metocean measurement campaign
  - 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.
- Chapter 6: Specific requirements - an overview of the most relevant design parameters, coordinates, permit requirements found in the various acts, decrees, ministerial orders and Wind Farm Site Decisions, described in chapters 3 and 5. It also provides an overview of the status of the SDE+ framework. 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 submission by September 2016.
- Chapter 7: Steps preparing a bid - an overview of the process for granting a subsidy and permit, including key dates.
- Chapter 8: Applicable documents.

This PSD contains three appendices, which can be found as separate documents;

- Appendix A: Applicable Law
- Appendix B: Summary of Environmental Impact Assessment
- Appendix C: Boundaries and coordinates Borssele Wind Farm Zone.

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 three wind farms built in the North Sea are the Offshore Wind Farm Egmond aan Zee (OWEZ, 2006), the Princess Amalia Wind Farm (2008) and Luchterduinen Wind Farm (2015).

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. The 129 MW Luchterduinen wind farm is a project of Eneco and Mitsubishi Corporation. Comprising 43 Vestas 3 MW turbines, it is located 23 km off the coast.

One other offshore project is currently under construction - the 600 MW Gemini offshore wind farm. Expected to be fully operational in 2016, it will comprise 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 timeline 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 zones is not eligible to receive a permit. Within the designated zones the Government decides the specific sites where wind farms can be constructed, as outlined in 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 mainland. The Ministry of Economic Affairs 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 two offshore Wind Farm Zones 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) and Hollandse Kust (zuid: 1,400 MW and noord: 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 site.

In 2016, tenders to develop the BWFZ will be issued under the subsidy programme, Stimulation of Sustainable Energy Production (SDE+, or Stimulering Duurzame Energieproductie). The first tender BWFS I and II has been awarded to Dong Energy. The remainder of this PSD provides information on the projects and site data for the second tender round BWFS III (330 MW) and BWFS IV (350 MW)[1]. This second tender will open on 16 September 2016 and will close on 29 September 2016 at 17:00 hours.

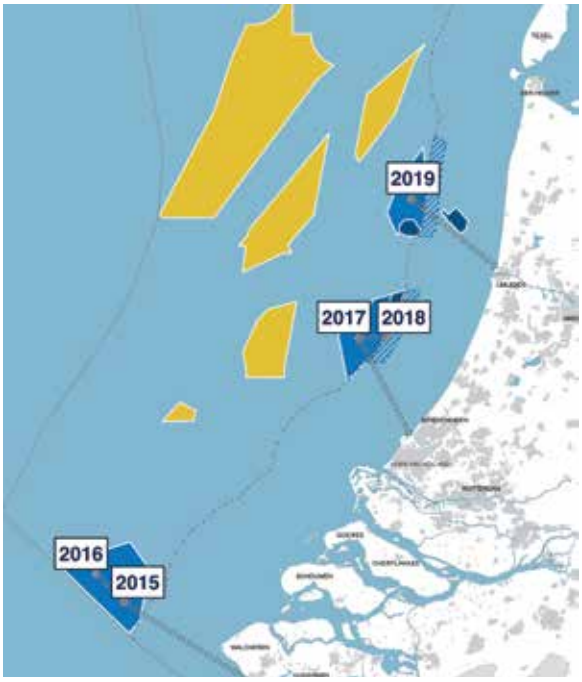

Figure 1 Tender timetable for the Dutch offshore wind rollout. Wind Farm Zones to be tendered are marked light blue, realised wind farms in dark blue, future Wind Farm Zones in yellow

Table 1: Opening tenders and price cap subsidy according to road map.

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	680 MW	Borssele Wind Farm Zone, Wind Farm Site III and IV	11.975
2017	700 MW	Wind Farm Zone Hollandse Kust (zuid)	10.750
2018	700 MW	Wind Farm Zone Hollandse Kust (zuid)	10.325
2019	700 MW	Wind Farm Zone Hollandse Kust (noord)	10.000

1) Depending on the type of turbine, an operator is allowed, based on the Wind Farm Site Decisions III and IV, to install 322-360 MW on BWFS III and 342-380 MW on BWFS IV (See chapter 6 for more information). For the sake of simplicity, the remainder of this PSD assumes a fixed capacity of 330 MW for BWFS III and 350 MW for BWFS IV.


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HYDROHAMMER
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3. Borssele Wind Farm Site III and IV - 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.

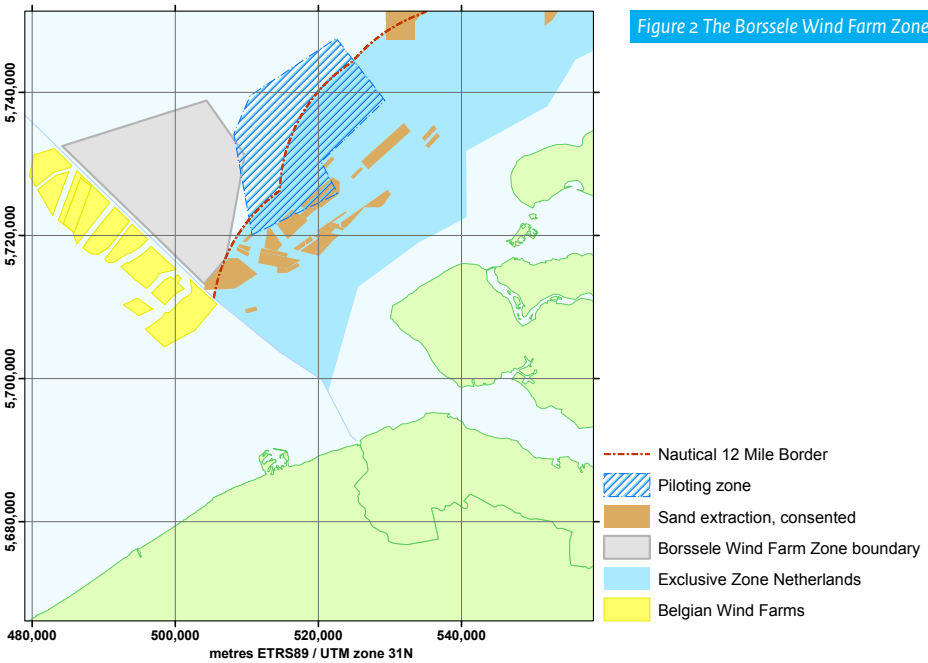


Figure 2 The Borssele Wind Farm Zone and surrounding areas

The BWFZ of approximately 344 km² (235 km² excluding maintenance and safety zones) is located 22.2 km from shore (12 nautical miles) and is sub-divided into five sites. Water depth is approximately 16-38 m. In total, 1,400 MW offshore wind capacity is planned in the zone.

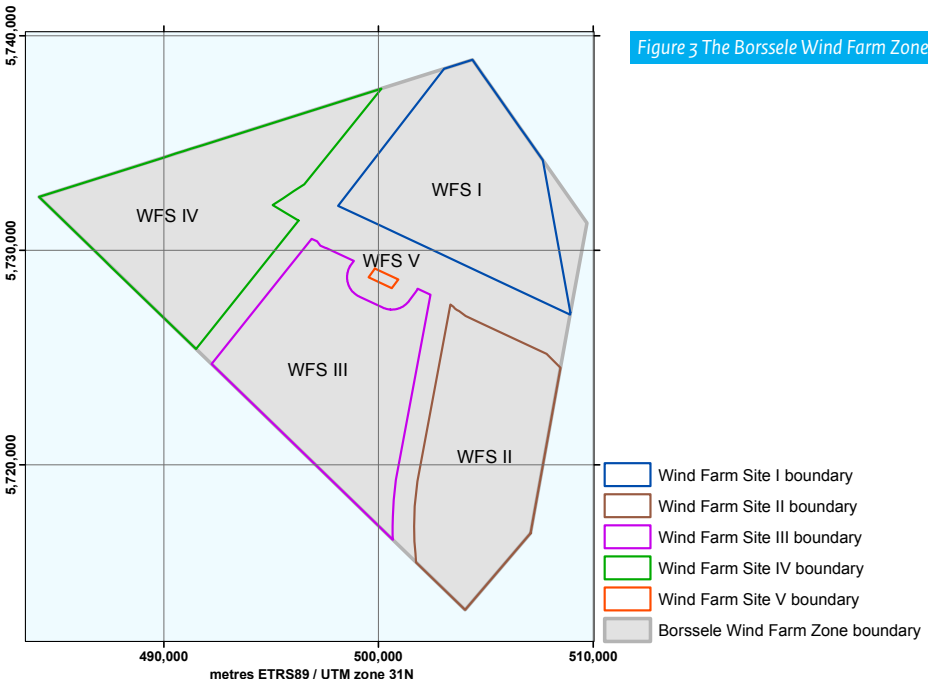


Figure 3 The Borssele Wind Farm Zone

3.2 Layout & coordinates of BWFS III and IV

BWFS III is 71.4 km² in size and has an effective area for development of 64 km². Due to existing pipelines and cables that cross the site, it has been subdivided into 2 parcels (46,1 km², and 17.9 km²). BWFS IV is 74.6 km² in size and has an effective area for development of 57.9 km². Due to existing pipelines and cables that cross the site, it has been subdivided into 3 parcels (23.4 km², 20.9 km² and 13.6 km²). The surface areas referred to above exclude the locations of export cables and TenneT's grid connection system including its safety and maintenance zones.

Figure 4 shows the boundaries of BWFS III and IV. The coordinates of the boundaries, maintenance zones, infield cable corridor and safety zones are given in Appendix C. The cable entry zone to Substation Alpha and Beta are shown in § 3.7 of this document. All coordinates are published in Appendix C; Boundaries and coordinates Borssele Wind Farm Zone.
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 and proximity agreements with the cable or pipeline owner need to be agreed.

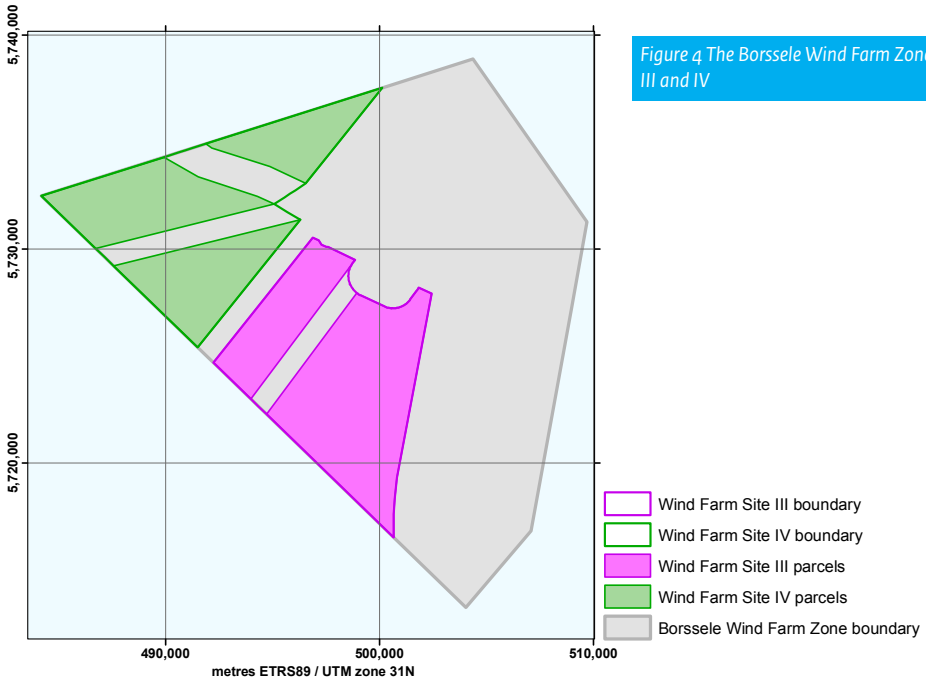


Figure 4 The Borssele Wind Farm Zone and the Borssele Wind Farm Sites III and IV

The basic bathymetry of BWFS III and IV is shown in Figure 5. More detailed bathymetry, morphodynamical and metocean information relating to the zone is provided in following chapters.

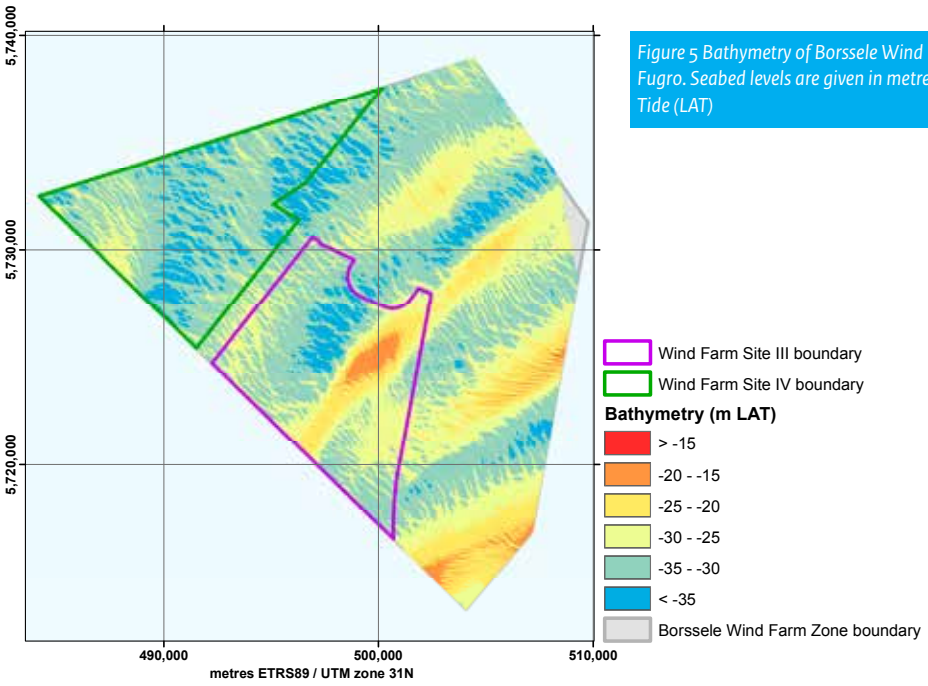


Figure 5 Bathymetry of Borssele Wind Farm Sites III and IV as recorded by Fugro. Seabed levels are given in metres relative to Lowest Astronomical Tide (LAT)

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.

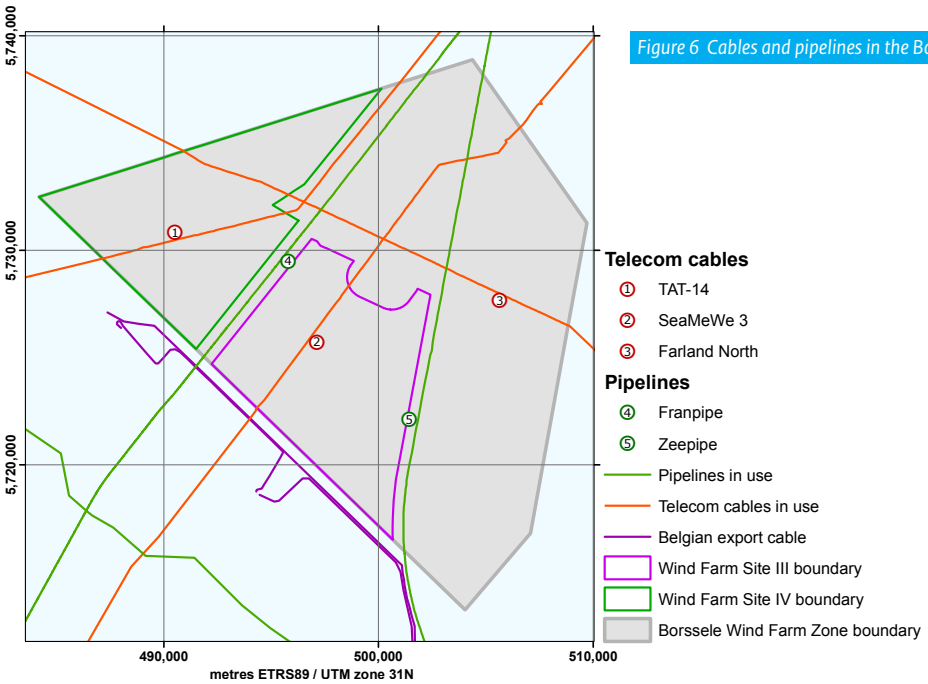


Figure 6 Cables and pipelines in the Borssele Wind Farm Zone

A description of the different cables and pipelines can be found in Table 2.

Table 2: Description of pipelines and cables in the BWFZ.

Name	Description
TAT-14	Transatlantic telecommunications cable
Franpipe	Natural gas pipeline from a Norwegian gas field to France
SeaMeWe 3	Segmented telecommunications cable between Western Europe and South East Asia
Farland North	Telecommunications cable between the UK and the Netherlands
Zeepipe	Natural gas pipeline from a Norwegian gas field to Zeebrugge (Belgium)

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 (Table 3). This information is subject to change, with the latest information available from the Belgian authorities.

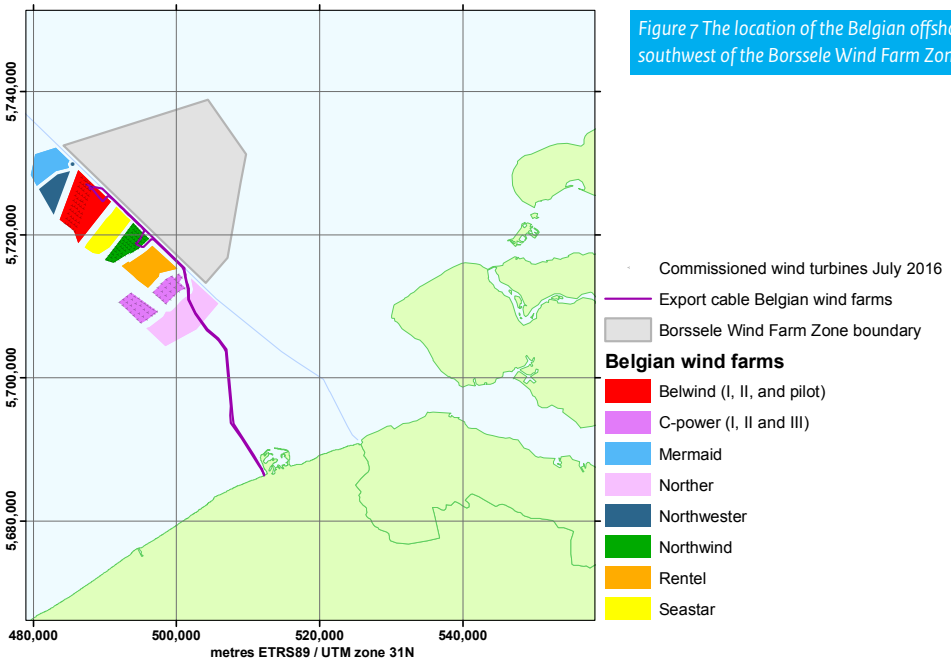


Figure 7 The location of the Belgian offshore wind farms directly southwest of the Borssele Wind Farm Zone

Table 3: 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	Vestas 90	3	55	165	Fully commissioned
Belwind II	72/112	Vestas 112	3.3	50	165	Under development
Belwind-Pilot	100/150	Haliade	6	1	6	Fully commissioned
Northwind	84/112	Vestas 112	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	24	147,6	Fully commissioned
C-Power III	95/126	Senvion 6.2M	6.15	24	147,6	Fully commissioned
Rentel	106/154	Siemens SWT-7.0-154	7	42	294	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

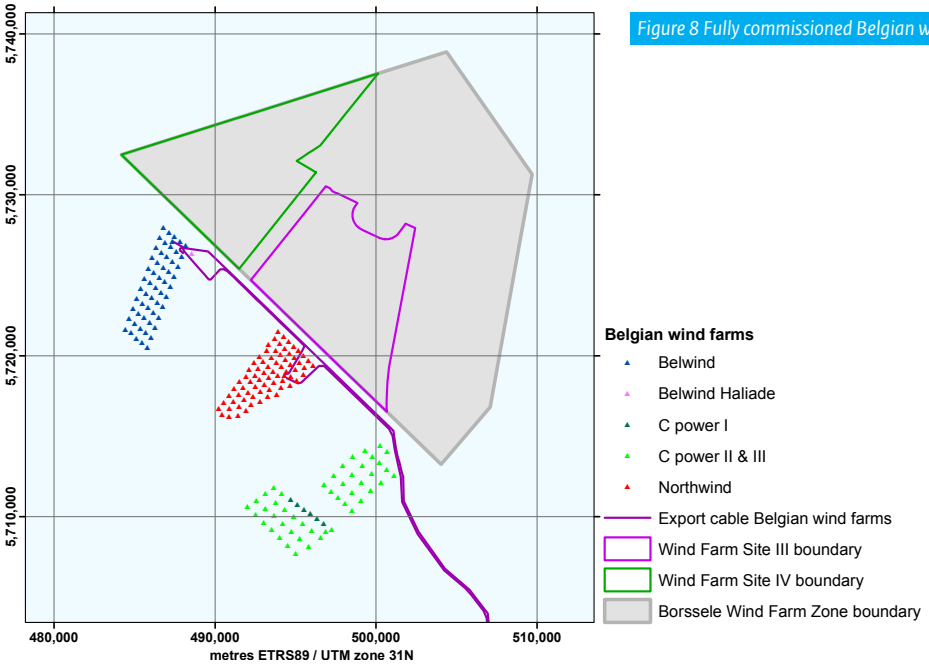


Figure 8 Fully commissioned Belgian wind farms

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 (table in Appendix C). Pipelines and cables, plus their maintenance zones (500 m on both sides of the pipes/cables), are excluded from the different parcels. Turbine blades are not allowed outside the BWFS boundaries. As shown in Figure 9, a shipping corridor also runs through BWFZ from east to west. Under the National Water Plan 2 [13] vessels up to 24 m are allowed to cross the entire BWFZ.

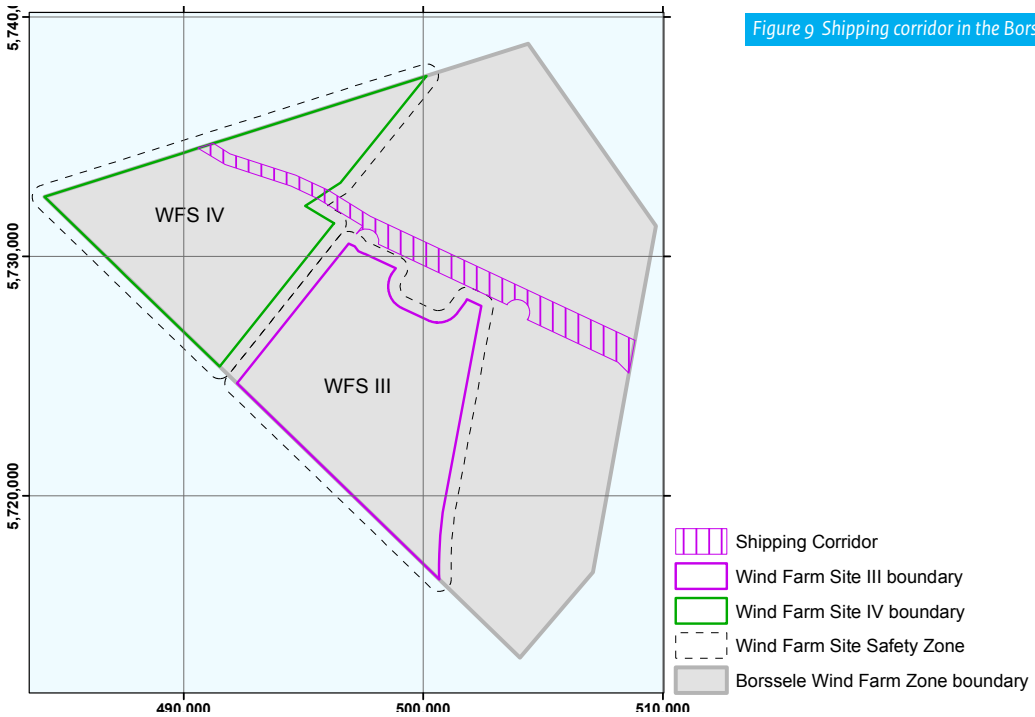


Figure 9 Shipping corridor in the Borssele Wind Farm Zone

3.6 TenneT offshore grid connection system

The planned Borssele Alpha and Beta Offshore Substations are shown in Figure 10. Infield cables from the wind farms will connect directly to these platforms. 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, IV and V. Appendix C (Boundaries and coordinates Borssele Wind Farm Zone) shows the border coordinates of the infield cable corridor.

Platform Beta, its 220 kV export cables and the 66 kV link with platform Alpha are part of the offshore grid Borssele. They connect to sites III, IV and V and transmit the electricity generator to shore. Borssele Beta is also included in the ongoing Rijkscoordinatieregeling. The preferred alternative for the trajectory of the export cables and location of the platforms are determined in formal decisions made by the Government, as laid out in figure 10. The final decision making took place in early July and final permits and the final spatial plan have been published by the Ministry of Economic Affairs. Only those parties that submitted their views earlier in the process are allowed to comment or raise objections again. These must be lodged by 26 August 2016 with the Raad van State.

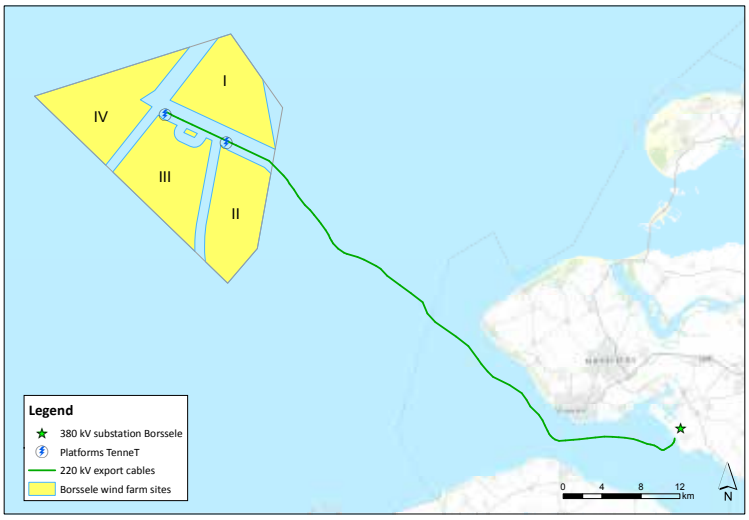


Figure 10 The location of TenneT Offshore Substations Alpha and Beta (Borssele Alpha is on the right) and the export cable

The procurement process by public tender of TenneT's 220 kV export cables and platforms is ongoing. According to planning, these contracts will be awarded in Q4 2016. The Ministry of Finance approved the project budget for the offshore grid in July 2016.

Construction will start in 2017 and Borssele Beta will start operating in 2020. More information regarding the current status can be found via the websites:

1. http://www.rvo.nl/subsidies-regelingen/transmissiesysteem-op-zee-borssele (draft decisions and MER net op zee)
2. http://netopzee.eu/borssele/ (more information regarding offshore grid Borssele)
3. http://www.tennet.eu/nl/grid-projects/projects-in-the-netherlands/grid-at-sea.html (Frequently asked questions, Offshore model agreements)

3.7 Cable Entry Zone

The cable entry zone from BWFS III and from IV towards TenneT offshore substation Beta is shown in Figure 11.

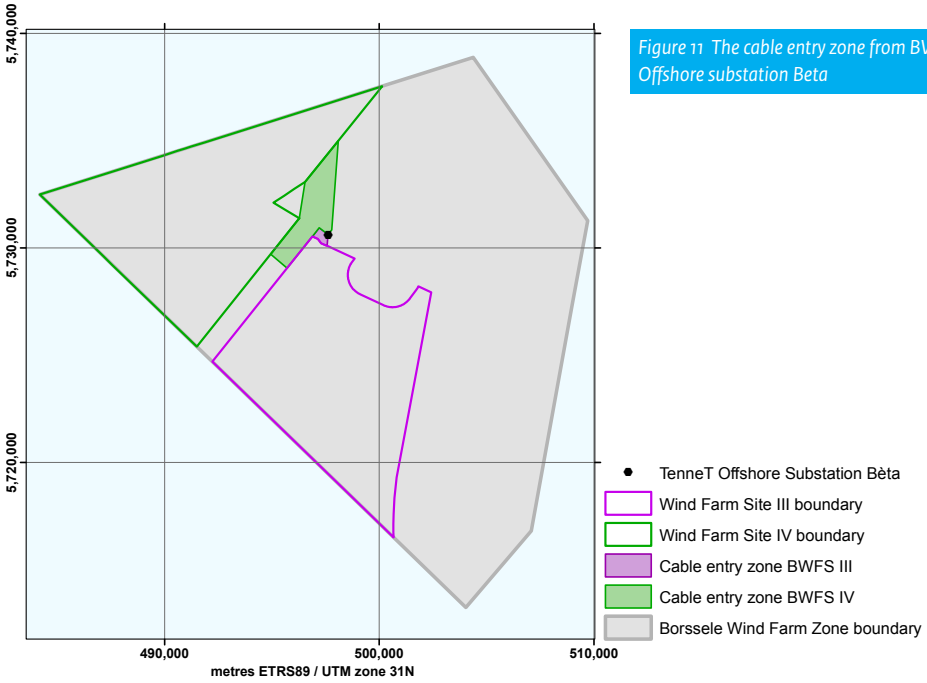


Figure 11 The cable entry zone from BWFS III and IV towards TenneT Offshore substation Beta


TENNET
BORSSELE ALPHA
BORSSELE ALPHA

4. Site data

The Netherlands Enterprise Agency (RVO.nl) is responsible for collecting site information that companies require to prepare bids for the SDE+ subsidy and permit 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. A detailed overview of the approach, procurement of the studies and quality assurance can be found in § 4.11.

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, statements of compliance and/or statements of conformity 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
4.2 Morphodynamical desk study
4.3 Archaeological desk study
4.4 Unexploded ordnance (UXO) assessment
4.5 Geophysical survey
4.6 Archaeological assessment
4.7 Geotechnical survey
4.8 Meteorological and oceanographic (Metocean) desk study
4.9 Meteorological and oceanographic (Metocean) measurement campaign
4.10 Wind resource assessment
4.11 Site investigation QA-QC procedures

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 BWFS III, IV and V. 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 BWFZ, 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 the morphodynamical studies and issued a Statement of Compliance for them.

4.2.3 Results

The studies consisted of two phases: One of the deliverables of this survey is a high resolution bathymetrical dataset that has been used to update the morphodynamical desk study.

- Phase 1: desk study (December 2014 [4]) prior to the geophysical survey which was performed mid-2015;
- Phase 2: update of the report of phase 1 (January 2016) based on the findings from the geophysical study. This report ((phase IIb), [6]) supersedes the report from phase 1.

The morphology of the system is classified as highly dynamic, with a complex bathymetry consisting of static (in the timespan between 2000 and 2015), shore-parallel sandbanks overlain with dynamic shore perpendicular sand waves. Within the area, opposing migration directions for the sand waves were found with sand going towards SW-direction and to the opposing NE-direction (with a variation of up to 30° in both directions), as shown in Figure 12.

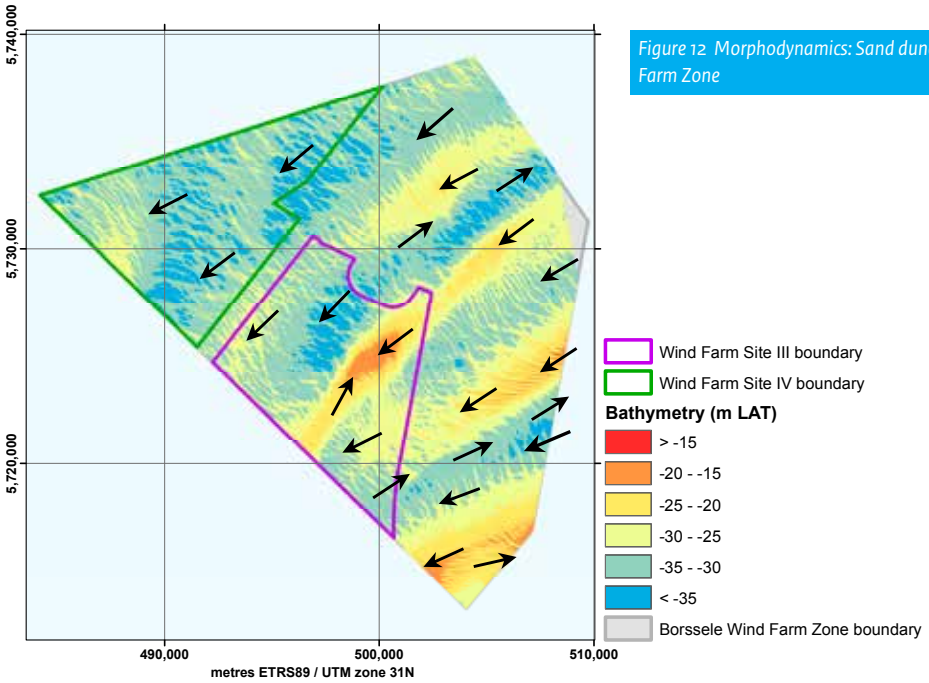


Figure 12 Morphodynamics: Sand dune movement in the Borssele Wind Farm Zone

Sand wave characteristics were determined for the combined area of BWFS III, which includes the newly appointed innovation site BWFS V, and BWFS IV as well as for the individual sites by means of consistent tracking of crest and trough points of individual sand waves from various transects of 1,750 m, equally distributed throughout the BWFZ. The sand waves in BWFS III and BWFS IV have a wavelength between 120 and 430 m, a wave height between 1.6 and 7.0 m and migration speeds in the order of -1.6m/yr (i.e. in NE-direction) to 1.8m/yr (in the governing SW-direction).

Next, the reference seabed level (RSBL) and maximum seabed level (MSBL) were determined, indicating the predicted lowest and highest seabed levels during the lifetime of the wind farms in the Borssele area (see Figure 13).

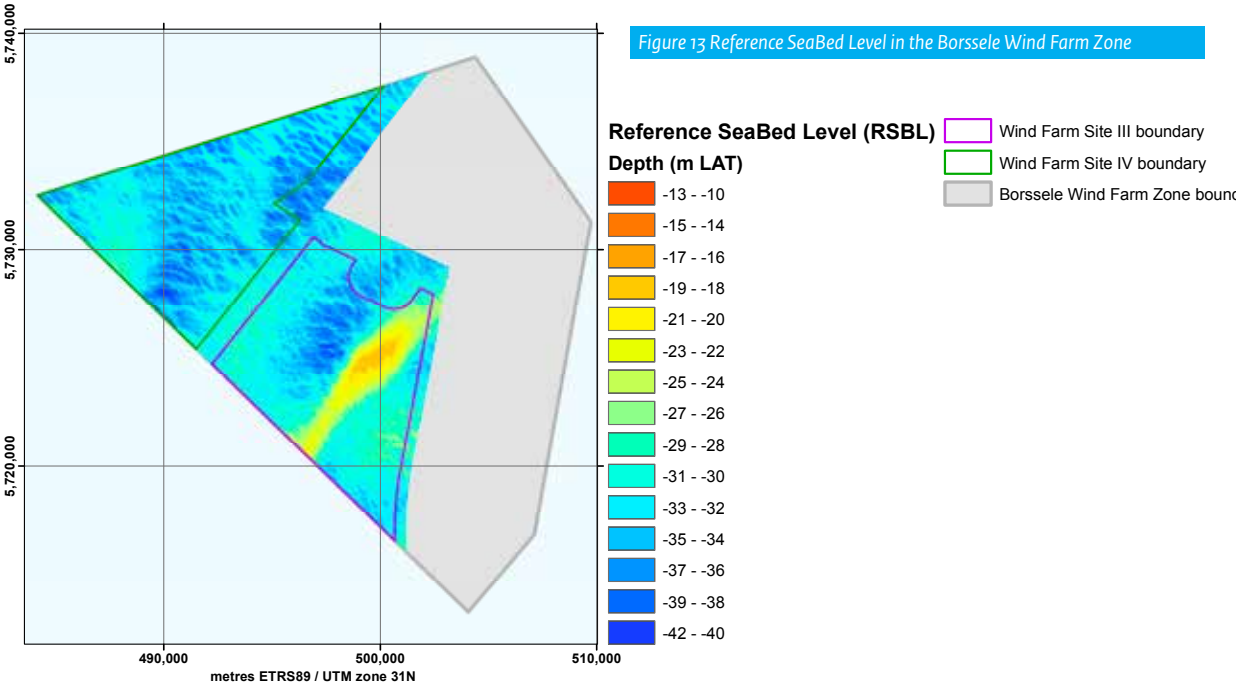


Figure 13 Reference SeaBed Level in the Borssele Wind Farm Zone

Comparison of the RSBL with the most recent bathymetry from 2015 showed a potential maximum local lowering of the seabed of approximately 5 m. A comparison of the RSBL with the base of the Holocene Formation showed that no unrealistic values for the seabed lowering were computed in this study.

The predicted seabed level changes follow from the applied morphological analysis techniques, describing the (uncertainty of the) physics and the natural variability of the analysed morphological system. Uncertainty ranges (e.g. representing measurement inaccuracy and amplitude of fast morphological features such as (mega-)ripples) have been taken into account in the analysis, but no additional safety margins for design purposes have been applied.

4.2.4. Webinar

The study has been presented and discussed at a webinar in February 2016. The webinar can be found at; ***offshorewind.rvo.nl/workshopborssele***.

4.3 Archaeological desk study

4.3.1 Introduction

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

4.3.2 Supplier

Vestigia Coastal and River Archaeology, a subsidiary of Vestigia, was selected to perform the archaeological desk study [7]. This subsidiary combines the offshore archaeology expertise of Vestigia and its cooperating partners. Vestigia has a track record in maritime archaeological preparatory research, including Nuon's offshore wind prospects, 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 BWFZ itself, the nearest being 9 miles southeast of zone.
2. Where present, prehistoric remains are located at a depth of 30-40 m below 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 low while the chance of any traces being well preserved is even lower. In conclusion, the chances of encountering prehistoric archaeology within the BWFZ are small (low sensitivity).

Historic shipwrecks:

1. Three shipwrecks have previously been identified within the BWFZ, one of which is located in site III and/or IV. There are also a number of unidentified obstructions, four of which are located in site III and/or IV. These could either be wrecks, part of wrecks, 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 it is impossible to determine the archaeological significance of these obstructions, these locations are best avoided during development.
2. Vestigia found no record of systematic surveys using side-scan sonar or other geophysical techniques within the BWFZ, mainly because the area has not been of commercial interest until now. The reported discoveries are considered random ones. The low number is, however, in no way a reflection of the actual density of historic archaeological sites. More undiscovered shipwrecks and other historical objects are likely to be present within the zone. Therefore, the chance of encountering further historic archaeology (shipwrecks, airplanes, etc.) within the BWFZ is considered to be average (medium sensitivity).

Figure 14 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 BWFZ 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 while other shipwrecks of high archaeological significance have also 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 (chapter 4.5) and the archaeological assessment (chapter 4.6), carried out by Netherlands Enterprise Agency (RVO.nl).

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 activities relating to offshore wind farm development in the BWFZ due to 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:
   - Determining the different concession zones in the Wind Farm Zone.
   - Carrying out safe geophysical and geotechnical investigations.
   - Safe installation of wind turbine foundations.
   - Safe installation of inter array cables.

4.4.2 Supplier

REASEuro performed the UXO desk study [8]. The company is specialised in offshore UXO studies, serving clients involved in 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 focus 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 removed after the war. The BWFZ is also 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 15).

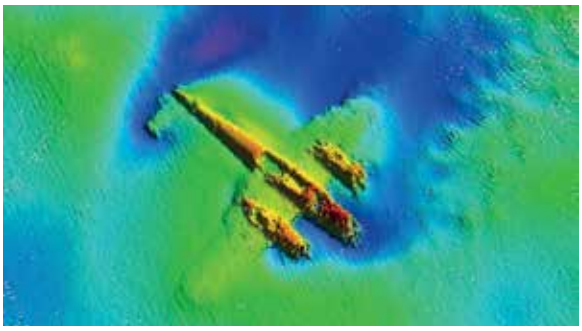


Figure 15 A scan of the sea bed in the English Channel shows the Dornier-17 German bomber, buried under the sand since World War II

Since World War II some ordnances are likely to have moved as a result of fishing, tidal streams and seabed migration. Overall, the whole of the BWFZ is considered an UXO risk area. This has been validated by the fact that since 2005 over 20 UXOs have been found by fishermen.

An UXO can be sensitive to hard jolts, change in water pressure and acceleration with an amplitude >1m/s^2. A detonation can lead to serious damage to equipment and injuries to crewmembers. The possible presence of UXOs in the area, however, is not considered a constraint for offshore wind farm related activities. By using proper UXO Risk Management strategies. risks can be minimised as reasonably practicable.

A 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 the UXO Risk Management plan.

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]. Chapter 4.6 (archeological assessment) advises to have active archaeological supervision onboard during the UXO research.

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 Coast guard. A developer is not allowed to undertake UXO removal with a qualified contractor. The Royal Netherlands Navy is responsible for the disposal (removal) of all UXO encountered. Dutch authorities will cover costs of this removal. Rijkswaterstaat Zee en Delta, part of the Ministry of Infrastructure and the Environment, is the competent authority regarding the public security. It is advisable to consult the competent authorities in regards to management measures that can be taken to prevent stagnation in the execution phase. A possible measure is to safely move the UXO outside the work area awaiting destruction.

4.5 Geophysical survey

4.5.1 Introduction

The objective of the geophysical survey is to:

1. Obtain an accurate bathymetric chart of the development areas BWFS III and IV;
2. Identify/confirm the positions of known wrecks, pipelines, possible electrical cables, and natural objects;
3. Produce isopach charts showing the thickness of the main geological formations including any mobile sediments and any other significant reflector levels which might impact on the engineering design;
4. Locate and identify any structural complexities or geohazards within the shallow geological succession such as faulting, accumulations of shallow gas, buried channels, etc.;
5. Provide detailed geological interpretation showing facies variations and structural feature changes via appropriate maps and sections;
6. List the exact position of existing (active & inactive) cables and pipelines;
7. Provide proposed positions for a geotechnical sampling and testing programme following the completion of the geophysical survey;
8. Prepare a comprehensive interpretative report on the survey results in order to assist design of the offshore foundations/structures and cable burial and assist in the preparation of the geotechnical investigation.

4.5.2 Supplier

Netherlands Enterprise Agency (RVO.nl) contracted Fugro Survey B.V. (FSBV) to conduct geophysical surveys [5] in BWFS III and IV. Fugro is an integrator of geotechnical, survey, subsea and geosciences services. Services are designed to support engineering design and large structure building projects. Fugro has previously performed investigations for offshore wind farm projects in The Netherlands, Belgium, UK, Denmark and Germany.
The company is familiar with the local conditions and technical requirements for a geophysical survey of the BWFZ. DNV GL provided a Statement of Compliance for the results of the study.

4.5.3 Results

The geophysical survey was carried out using the survey vessel MV Fugro Pioneer. The geophysical survey was carried out in May and June 2015. Fugro performed the geophysical and bathymetric survey using:

- Side-scan sonar (SSS), magnetometer (MAG), multi- and single beam echo sounder (MBES/SBES), sub-bottom profiler (SBP) with a line spacing of 100 m;
- ultra-high resolution seismic survey (UHR) with a line spacing of 400 m.

The cross lines were planned with 2000 m line spacing, During the survey 151 km of cross lines were added, to better understand the geology of the survey area.

Bathymetry and seabed features

The bathymetric data shows water depth ranging between from -15 m to -37 m aLAT (BWFS III) and -21 m aLAT to -41 m aLAT (BWFS IV). The seabed is characterised by a complex pattern of shore-parallel sandbanks, with superimposed dunes of different orders.

These dunes have a general NW to SE and W to E direction, with an average wavelength between 80 m and 550 m with heights ranging from 2.5 m to 11 m. Superimposed on the major sand dunes, other minor dunes with 10 - 20 m average wavelength and heights ranging from 0.25 m to 0.75 m are present. Sediments found within BWFS III and IV mostly consist of dense to very dense sands and loose sands. Generally, denser material can be found on the top of the sand dunes, while finer material is found between the sand dune troughs.

Wrecks, cables and pipelines

A number of cables and pipelines have been discovered, some with an offset of several hundreds of metres in relation to their theoretical charted position (TAT14 J, UK-NL8). All cables were detected by magnetometer, except the UK-NL3 cable, which crosses only a small part of BWFS IV. Three magnetic lineations, which might be related to unknown or uncharted cables, have been found in BWFS III.

One known wreck and four obstructions are present in the BWFZ. The known wreck was detected with an offset of 75 m from the currently known location. Based on a magnetic anomaly, one of the obstructions might have been detected. No previously unknown wreck locations were identified from interpretation of the SSS and magnetometer data.

Unknown objects

The SSS and magnetometer surveys indicated the presence of several objects as shown in the contact chart (Figure 16). All SSS targets observed and spread throughout the entire survey area were concluded to be only debris patches. No boulders were expected in a palaeo-environmental context and none were identified. A noisy magnetic area was found at the Sandbank Buitenbank 3 location within BWFS IV. There are a number of possible causes for such an anomalous magnetic distribution, such as geological surficial anomalies and/or scattered buried objects. 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.

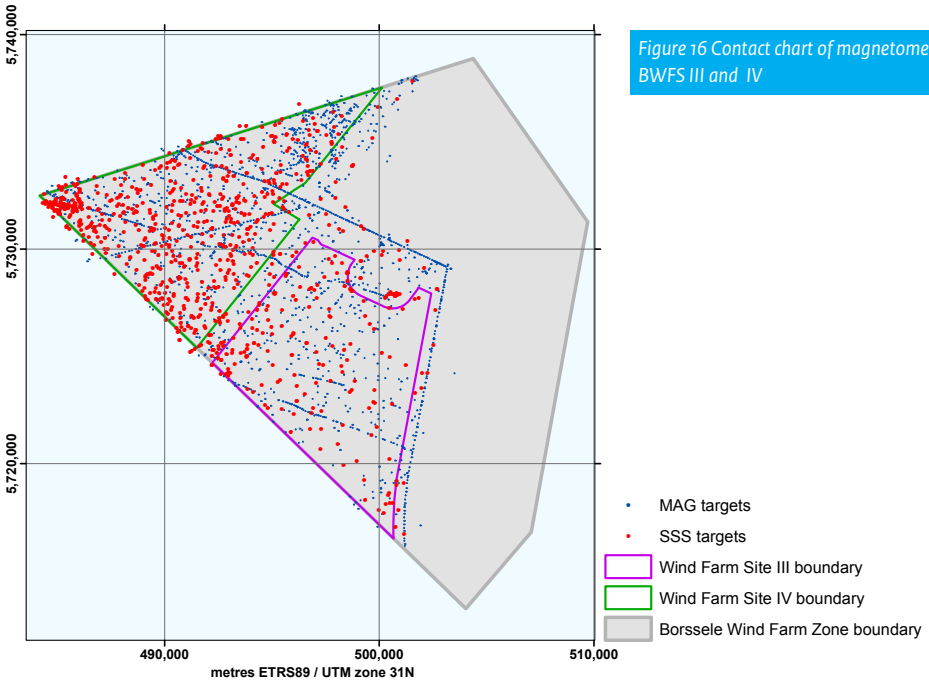


Figure 16 Contact chart of magnetometer and side-scan sonar survey of BWFS III and IV

Geology

The shallow sub-surface geological conditions within the survey area have been interpreted based on pinger and UHR sparker data and information from standard geological charts. Penetration of the pinger SBP was restricted to 20 m below seabed. The limit of interpretation of the UHR data to achieve satisfactory results was set at a depth of 80-100 m, "as pre client's specifications" seems out-of-place and not relevant. A total of six lithological units were identified in in BWFS IV, only four of which were present in BWFS III, as shown in in Table 4.

4.5.4 Conclusion

Based on the sub-bottom profiling datasets, Fugro has developed a proposed borehole location plan. This plan consists of 6 boreholes and 19 CPT for BWFS III and 7 boreholes and 21 CPT for BWFS IV. Netherlands Enterprise Agency (RVO.nl) has developed this into a more extensive Borehole and Seabed PCPT Plan, which has been applied to the geotechnical survey (See chapter 4.7).

Table 4: Geology of BWFZ based on SBP and UHR-data.

Unit	Depth of base	Description
UNIT A	1 to 13 m bsb	Holocene in age and expected to comprise loose to dense SAND and is correlated to the Southern Bight Formation.
UNIT B	-30 m to -72 m aLAT	Pleistocene in age and expected to comprise dense to very dense SAND (sometimes stiff to very stiff CLAY), correlated to the Kreftenheye and Eem Formations, deposited respectively in fluvial and shallow marine environment. The base of this unit is a palaeochannel/erosional surface that cuts the Quaternary (Unit C) and Tertiary formations (Unit D and E).
UNIT C	-42 m to -60 m aLAT	Pleistocene in age and characterized by graded lateral lithological variations from stiff to hard sandy CLAY to very dense SAND. This unit is seen in the north-east corner of BWFS IV only. Unit C is expected to comprise stiff to hard sandy CLAY to very dense SAND correlated to the Westkapelle Formation, deposited in a marine pro-delta and delta-front environment.
UNIT D	from -42 m to -74 m aLAT	Tertiary in age and seen in the north-east corner of BWFS IV only. Unit D consist predominantly of very stiff to hard Clay, with at top locally some dense sand beds. It has been correlated to the middle part of the Rupel Formation which corresponds to the Rupel Clay member.
UNIT E	-45 m to -145 m aLAT	Tertiary in age and expected to comprise dense to very dense SAND. It has been correlated to the Tongeren Formation.
UNIT F	-20 m to -150m aLAT	Tertiary in age and expected to be comprised very stiff to hard CLAY and dense clayey SAND member toward the base. This Unit has been correlated to the Dongen Formation.

4.6 Archaeological assessment

4.6.1 Introduction

Commissioned by RVO.nl, Periplus Archeomare executed a pilot archaeological assessment in March 2016. This pilot assessed whether the geophysical study for BWFS III and IV proved a good case justifying further archaeological analysis. Due to promising results of the pilot, RVO.nl commissioned Periplus Archeomare to execute a more detailed archaeological assessment of the BWFZ based on the geophysical data.

4.6.2 Results

The investigation comprised an assessment of geophysical data and a comparison with known objects in the area in order to identify potential archaeological objects. A large quantity of survey data (side scan sonar, magnetometer and multibeam echosounder) was analysed in order to conduct an archaeological assessment.

A summary of the locations with possible archaeological value are presented in Figure 17.

Side-scan sonar contacts

Periplus Archeomare analysed 234 side-scan sonar contacts in BWFS III and 649 side-scan sonar contacts in BWFS IV. One contact in BWFS III and IV proved to be of possible archaeological value. The wreck of the fishing cutter Alca Torda, positioned in the buffer of BWFS III, which sunk in the 1970s, is not considered to be of archaeological value. The possible wreck s0612 (Length=7.0m; Width=5.0m; Height=0.9m) is located in BWFS IV and is of possible archaeological value.

Concerning the visible structures at the seabed surface, as long as the archaeological value of the remains is not determined, it is advised not to conduct disturbing activities on the locations including a buffer zone of 100 m around. This also applies to cable trenching and anchorages of work vessels.

Magnetometer contacts

In terms of magnetic anomalies, 685 were analysed in BWFS III and 1004 in BWFS IV. Of these, 26 in BWFS III and 28 in BWFS IV were considered a possible archaeological object.

Concerning the buried ferrous structures, companies are advised to avoid such areas whilst installing wind turbines and constructing a trench for the cables. It should be stressed that the origin of the magnetic anomalies is unknown and, in addition to possible archaeological remains, any type of man-made objects could be

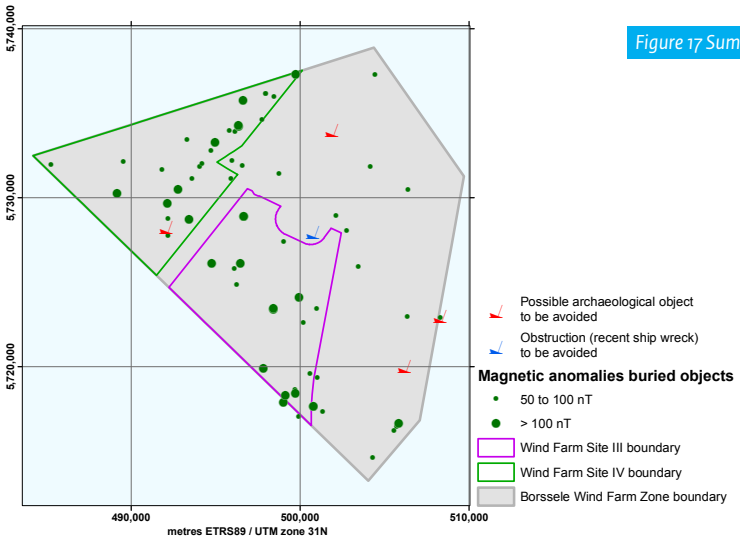


Figure 17 Summary of findings archaeological assessment

encountered, including unexploded ammunition, anchors, pieces of chains and cables, debris, etcetera.

If it is not feasible to avoid the reported magnetometer locations, additional research is required in order to determine the actual archaeological value of the reported locations. It is advised that the UXO research within 100 m of the 65 magnetometer anomalies is carried out under on-board archaeological supervision. Depending on the outcome of the UXO research, it may be decided that additional research (for instance by means of ROV or dive investigations) is needed. If the UXO research indicates the object has no archaeological value, the location can be omitted.

The cumulative surface area occupied by side-scan sonar and magnetometer buffer zones is 0.68% for the magnetometer contacts and nill for the side-scan sonar contacts in BWFS III. Regarding BWFS IV, it is 0.83% for the magnetometer contacts and 0.03% for the side-scan sonar contacts.

During the installation of the wind turbines and cable lay operations, archaeological objects may be discovered which were completely buried or not recognised as an archaeological object during the geophysical survey. Periplus Archeomare recommends passive archaeological supervision based on an approved programme of requirements. Passive archaeological supervision means that an archaeologist is not present during the execution of the work but always available on call. Implementing this recommendation would prevent delays during the work when unexpectedly archaeological remains are found. In accordance with the Monuments Act 1988 (Revised 2007), those finding must be reported to the competent authority. This notification must also be included in the scope of work.

4.7 Geotechnical Survey

4.7.1 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 of BWFS III and IV, 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.

4.7.2 Supplier

Fugro Engineers B.V., a member of the Fugro global group of companies and responsible for offshore geotechnical surveys, performed the survey [9]. Fugro is an integrator of geotechnical, survey, subsea and geosciences services. Services are designed to support engineering design and large structure building projects. 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. DNV GL has provided a Statement of Compliance for the results of the study.

The in situ testing was conducted from the geotechnical vessel Fugro Scout, between October 2015 and November 2015. The geotechnical borehole drilling was conducted from the geotechnical drilling vessel Gargano between September 2015 and October 2015. The survey has been performed according to ISO 19901-8 (2014) Marine Soil Investigations. DNV GL has provided a Statement of Compliance for the results of the study.

4.7.3 Results

Fugro performed a geotechnical survey, which consisted of borehole drilling, downhole sampling, downhole in situ testing and seafloor in situ testing. For BWFS III, Fugro executed twelve boreholes which included alternating downhole sampling and/or Piezo Cone Penetration Testing (PCPT). Of these twelve boreholes, one borehole also included pore pressure dissipation testing (PPDT) and two boreholes included also Seismic Cone Penetration Testing (SCPT). Further 27 seafloor PCPTs, including a limited number of PPDTs were performed.

For BWFS IV, Fugro executed eleven boreholes with alternating downhole sampling and/or PCPT testing, including a limited number of SCPTs, and 27 seafloor PCPTs, including a limited number of PPDTs.

The results of the survey can be found in three reports for each site:

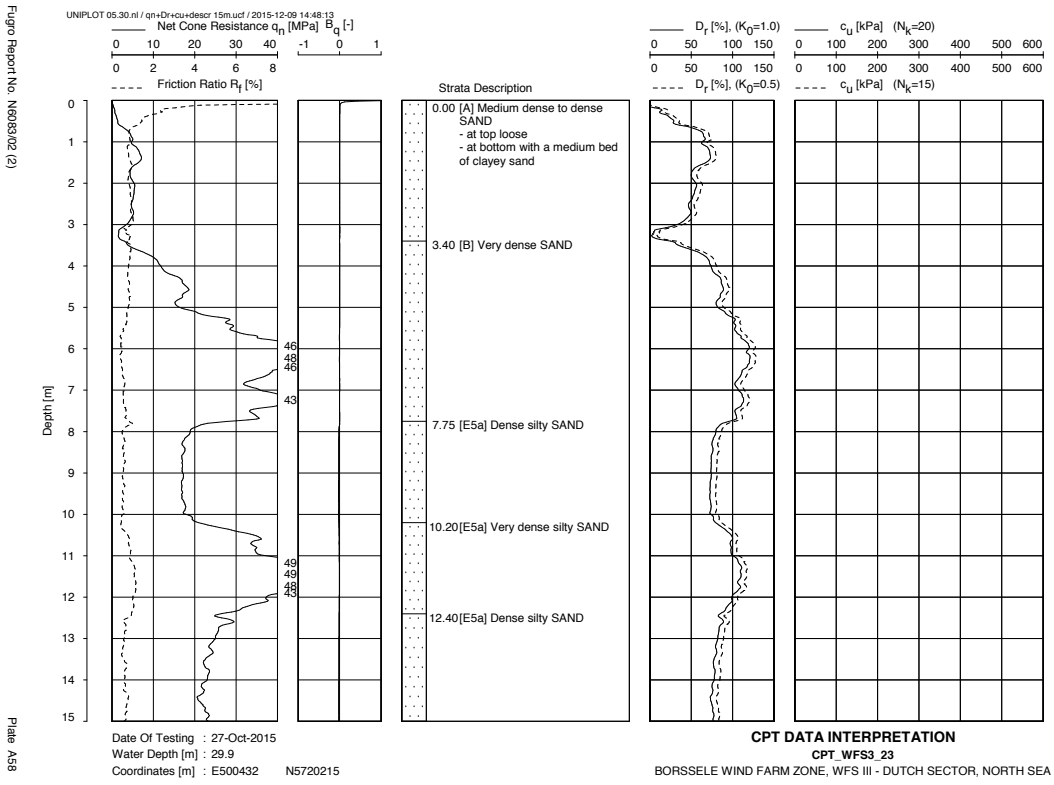
1. A geotechnical report containing geotechnical logs and results from in situ testing (PCPT and SCPT) and laboratory testing on a selection of samples from the borehole locations.
2. A geotechnical report containing geotechnical logs and results from in situ testing (PCPT and PPDT) for the seafloor PCPT locations.
3. A geological ground model report containing a geological ground model, geotechnical parameters per borehole and an assessment of suitability of selected types of structures.

The geotechnical reports include (a selection of) the following:

- Geotechnical logs for borehole locations and seafloor PCPT locations:
  a. Interpretation of soil profile, strata description and PCPT-derived relative density and shear strength.
  b. Selected results of laboratory tests.
- Results of in situ testing consisting of PCPTs, SCPTs and PPDTs:
  a. Cone resistance (net/total), sleeve friction, pore pressure, friction ratio and pore pressure ratio.
  b. Recorded shear waves (X and Y) and derived shear wave velocity.
  c. Results of pore pressure 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 18.

Figure 18 CPT data interpretation of testing point CPT_BWFS3_23



Results of on-site and office laboratory test programmes:

- Geotechnical index testing (sample description, water content, unit weight, particle size distribution, Atterberg limits, particle density, minimum and maximum index unit weight).
- Geochemical index testing (carbonate content and organic content).
- (Index) strength testing (pocket penetrometer, torvane, Unconsolidated Undrained (UU) triaxial compression, Isotropically Consolidated Undrained (CIU) triaxial compression, Isotropically Consolidated Drained (CID) triaxial compression).
- Shear testing (ring shear (soil/soil and soil/steel interface).
- Compressibility testing (incremental loading and constant rate of strain oedometer tests).

Results of an advanced static and cyclic laboratory test programme:

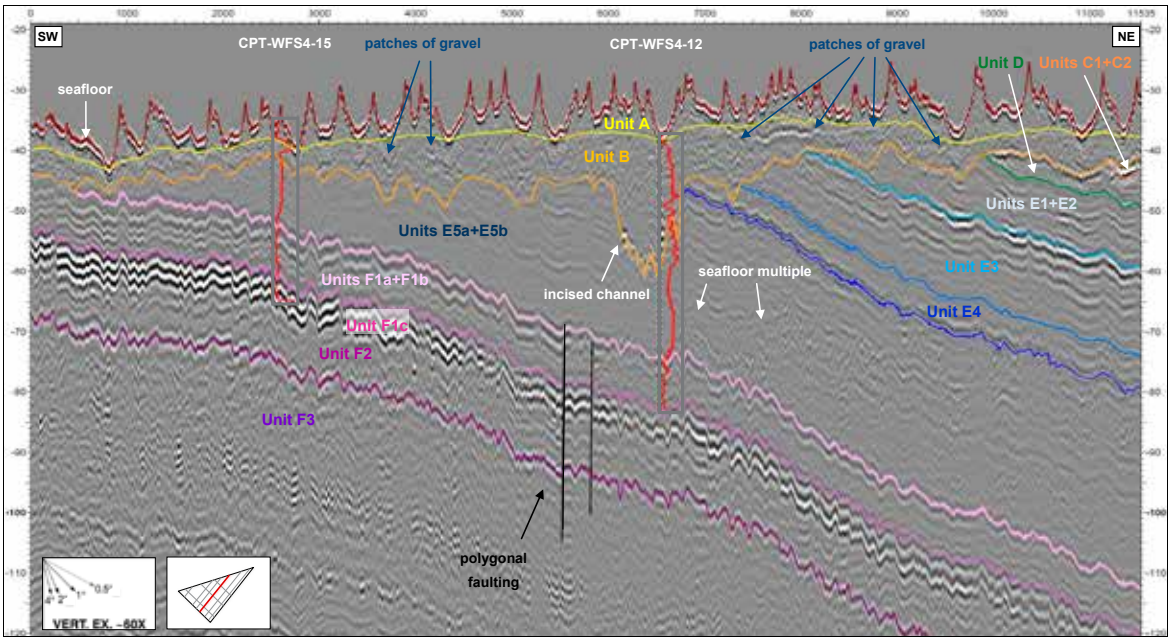
- Coarse-grained soils (CIU triaxial compression, selected tests with Bender Element (BE), Cyclic Undrained Triaxial (CTXL)).
- Fine-grained soils (Direct Simple Shear (DSS), Cyclic Simple Shear (CSS), CIU triaxial compression, selected tests with BE, CIU triaxial extension).

The geological ground model reports include:

- Depth to top of unit maps and contours;
- Thickness of Unit maps and contours;
- Selection of isopachs;
- Geotechnical Parameters per borehole location and per unit;
- Assessment of suitability of selected types of structures.

An example of a cross section of BWFS IV is shown in Figure 19.

Figure 19 An example of MCS seismic line of BWFS IV from southwest (left) to northeast (right) with two seafloor CPTs



NOTE: Example of MCS line. Vertical scale is depth in metres below LAT. Horizontal scale is distance in metres. CPT cone resistance data (red line) for the geotechnical locations are projected on the cross section. Left side of the grey box marks the geotechnical location. The width of the box marks cone resistance values to 50 MPa. Location of the cross section is shown on Plate 3-6.

CROSS SECTION – SECTION LINE A44042
BORSSELE WIND FARM ZONE, WFS IV – DUTCH SECTOR, NORTH SEA

Figure 19 shows a bedform zonation classification of the site created using the geotechnical data.

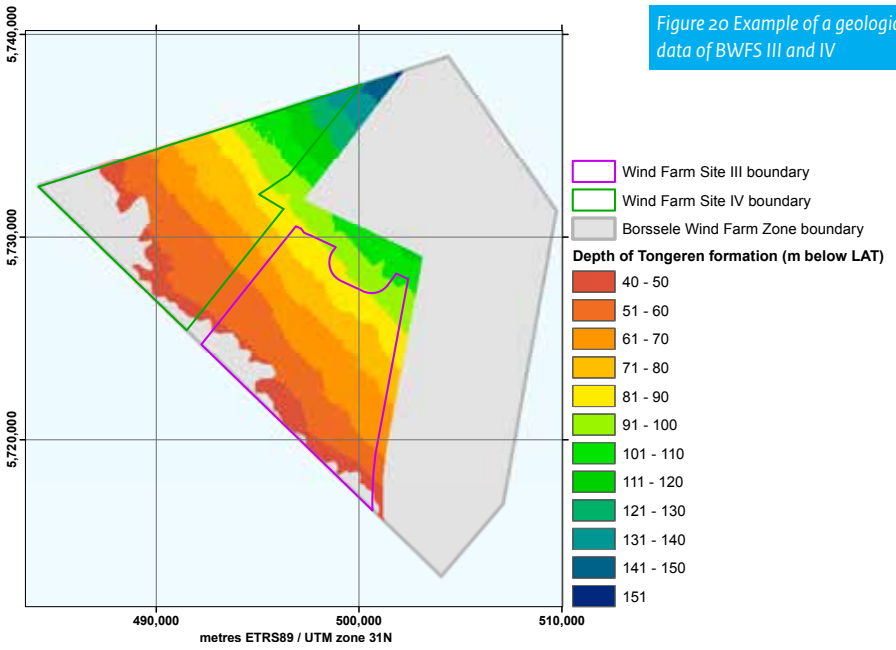


Figure 20 Example of a geologic chart created using the geotechnical site data of BWFS III and IV

The remaining samples will be stored and handed over to the winners of the tenders. All data of the geotechnical survey is disclosed through ***offshorewind.rvo.nl***.

4.7.4 Deliverables following geotechnical data and ground model reports

After issuing the geotechnical reports, following deliverables have been issued;

a. Digital Data Packages – Geological Ground Model (IHS Kingdom® format) – BWFS I to BWFS IV;
b. Technical Note – Geotechnical guidance for cyclic resistance of sandy soils – BWFZ;
c. Geotechnical Report – Seabed temperature and thermal conductivity – BWFS I to BWFS IV;
d. Technical Note – Biostratigraphic analyses – BWFS I to BWFS IV;
e. Technical Note – Supporting information for GIS deliverables – BWFS III.

A) Digital Data Packages – Geological Ground Model (IHS Kingdom® format) – BWFS I to BWFS IV;
In March 2016, a Digital Data Packages was released which consisted of interpreted horizons used for the Geological Ground Model from sub-bottom profiler and multi-channel seismic data together. Data is presented in the IHS Kingdom® format. The provided digital data packages contain information for BWFS I to BWFS IV.
The accompanying technical note provides background information on the digital data packages.

B) Technical Note – Geotechnical guidance for cyclic resistance of sandy soils – BWFZ;
In April 2016, Fugro issued a technical note which provides geotechnical guidance for design verification of monopole foundations at the BWFZ. Specifically, cyclic resistance of sandy soils is addressed, taking the Tongeren Formation as an example. DNV GL confirmed that this technical note forms a reasonable basis for assessment of cyclic degradation of sandy soils, The methodology described in the technical note is in compliance with DNV OS J101.

C) Geotechnical Report – Seabed temperature and thermal conductivity – BWFS I to BWFS IV;
The thermal conductivity and seabed temperature of near-seafloor soils for BWFS I to IV has been assessed. [26]

The presented information serves as input for design, installation and maintenance of planned inter-array and export cable routes at BWFS I to IV. This draft report contains results of assessments of seabed temperature and recommended values for thermal conductivity. A laboratory test programme consisting thermal conductivity testing of is ongoing and results will be incorporated into the future update of this report.

D) Technical Note – Biostratigraphic analyses – BWFS I to BWFS IV;
The results of biostratigraphic analyses, i.e age dating, carried out on selected samples has been presented in this technical note. [27]

Results of the biostratigraphy analyses can be used for verification of the stratigraphic framework used for development of the geological ground model. This technical note includes a paragraph discussing results of the biostratigraphic analyses in comparison to the stratigraphic framework used for the BWFZ.

To verify the stratigraphic framework developed for the BWFZ, an age dating programme was performed. The age dating focussed predominantly on soils believed to be of Tertiary age. Two samples from Quaternary formations were analysed. Age dating used biostratigraphic assessments by means of palynological analyses.

Five borehole locations were selected for biostratigraphic analysis. Results include:
- Chronostratigraphic succession;
- Palynological zonation;
- Biostratigraphic examination with listing of primary age diagnostic events together with selected additional events;
- Stratigraphic discussion.

In general, the biostratigraphic interpretations support the Fugro geological model. Some differences are evident, for which reasoning is provided in the Technical Note. It may be noted that ages of the unit boundaries are not as fixed and unambiguous as may be suggested by the various biostratigraphic tables. Assigning a different age to a geotechnical unit does not influence the geotechnical properties of the unit. Geotechnical unit boundaries as interpreted by Fugro based on results of geophysical and geotechnical site investigations do not require amendments based on the current results of the palynology analyses.

E) Technical Note – Supporting information for GIS deliverables – BWFS III.
This Technical Note provides background information in support of the Geographic Information System (GIS) deliverable which was prepared as part of the Geological Ground Model Reporting for the WFS III and WFSIV. Purpose of this technical note is to provide information on the used methodology for gridding and contouring of the depth to base and thickness of the identified units. It specifically aims to clarify minor differences in grid values and contour positions at the boundary between the Investigation Areas III and IV within the developed Geological Ground Models.

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

4. 8 Meteorological and oceanographic (metocean) desk study

4.8.1 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. Determination of all meteorological and oceanographic parameters required to conduct 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.

4.8.2 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, and provided a Statement of Compliance.

4.8.3 Results

The general objective of this study is to determine the metocean conditions (wind, wave, current and other meteorological parameters) applicable 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 a representative point for the overall site.

To determine local variations in the five 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 § 4.10 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 21 shows an example of dedicated numerical modelling results: the 50-year return value of the significant wave height. The effect of the presence of sand banks and sand waves on the wave propagation can be observed.

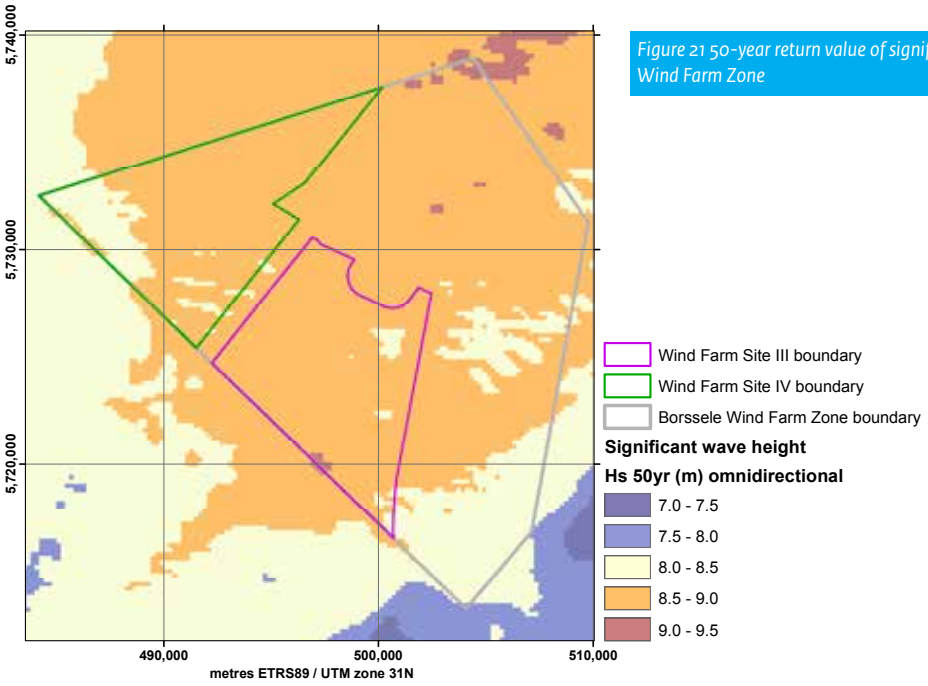


Figure 21 50-year return value of significant wave height for the Borssele Wind Farm Zone

4.9 Meteorological and oceanographic (metocean) measurement campaign

4.9.1 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 two 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 started in October 2014. Fixed LiDAR measurements at Europlatform started may 2015. Data is available at ***www.windopzee.net.*** This information will further increase the 'bankability' of wind data for the BWFZ.

The data collected provides the dataset that can be used for production calculations for the second round of tenders in the BWFZ.

Based on DNV GL's assessment, Netherlands Enterprise Agency (RVO.nl) contracted Fugro OCEANOR in 2015 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.

4.9.2 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.

4.9.3 Results

Fugro OCEANOR has placed two metocean buoys in the BWFZ. The measurement campaign of the buoy positioned in the centre of the BWFZ started in June 2015. Monthly results are being made available on ***offshorewind.rvo.nl***

In November 2015 the second buoy was installed close to the southern border of the BWFZ. This will help assess any wake effects from neighbouring Belgian wind farms. Both buoys have experienced unplanned service needs on shore. The service needs are mainly the effect of unsatisfactory marinisation of the Lidar. In February 2016 both buoys were redeployed. Since February they have delivered high data availability. Available data is quality approved by ECN. See Figure 22 as an example of available data.

Figure 22 Measured wind speeds in the centre of the BWFZ in July and August 2015

4.10 Wind Resource Assessment

4.10.1 Introduction

The goal of this study was to provide a preliminary wind resource assessment for the BWFZ. 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: as mentioned above, wind measurement data will become available from metocean measurement campaigns. 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).

4.10.2 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 previously. Moreover, the company is skilled in the validation and application of mesoscale model data, including detailed uncertainty assessment. The Statement of Conformity has been issued by DNV GL.

4.10.3 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 centre of the BWFZ 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 22. 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.

4.10.4 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 different measurement campaigns.

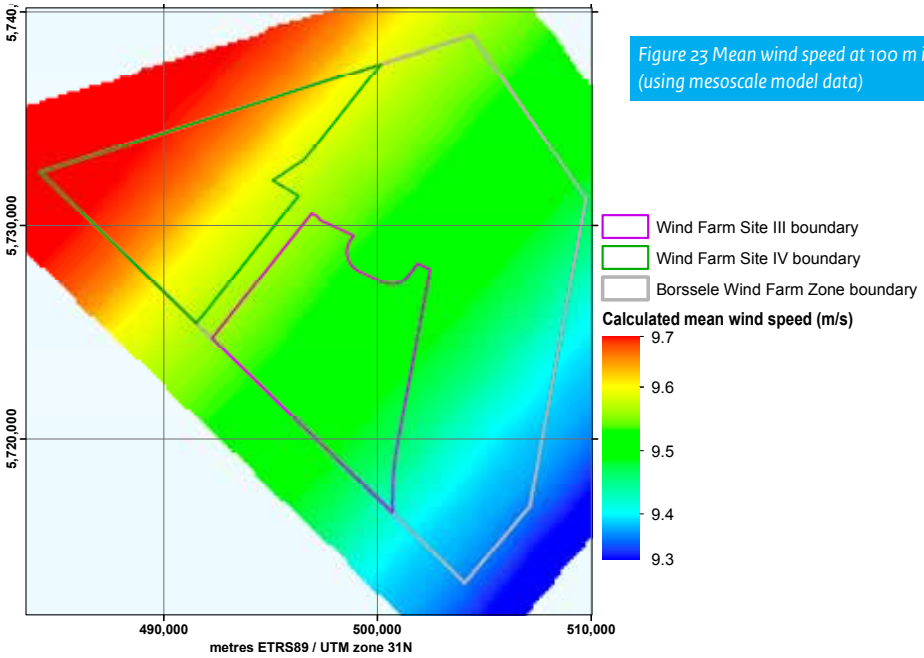


Figure 23 Mean wind speed at 100 m in Borssele Wind Farm Zone (using mesoscale model data)

4.11 Site investigation QA-QC procedures

4.11.1 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 industry stakeholders, invited via the Dutch Wind Energy Association (NWEA) and other communication channels.

4.11.2 Procurement

The procurement of the different studies was carried out in compliance with the applicable procurement procedures within Netherlands Enterprise Agency (RVO.nl). The desk 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.

4.11.3 Quality assurance

Netherlands Enterprise Agency (RVO.nl) supported by BLIX maintained a quality assurance procedure to provide accurate and usable studies. BLIX is an offshore wind consultant, specialised in project management of large offshore wind energy projects. 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 from other governmental departments, agencies or external experts.
3. During market consultation sessions, the scope descriptions were discussed with industry stakeholders who were able to provide input on the completeness of the descriptions.

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 study tenders (and whilst work was being conducted by the specific executor), quality assurance was performed as follows:

1. The project team and experts from 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. Statements of compliance or Statements of Conformity 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 who provided input into the process include:

1. Windsupport Ltd (Geotechnical site investigations).
2. Reynolds International Ltd (Geophysical site investigations).
3. RPS Energy Ltd (Geotechnical site investigations), HSE.
4. ECN (Metocean measurements).
5. Carbon Trust (Metocean measurements).
6. Periplus Group (Geophysical site investigations).


OCE
L1
OAE
A1
OAF
L2

5. Legal Framework and specific requirements of the BWFS III and IV SDE+ grant and permit tender

Introduction

A legal framework has been put into place to facilitate and manage the Dutch offshore wind programme rollout.

The system consists of several distinct aspects:

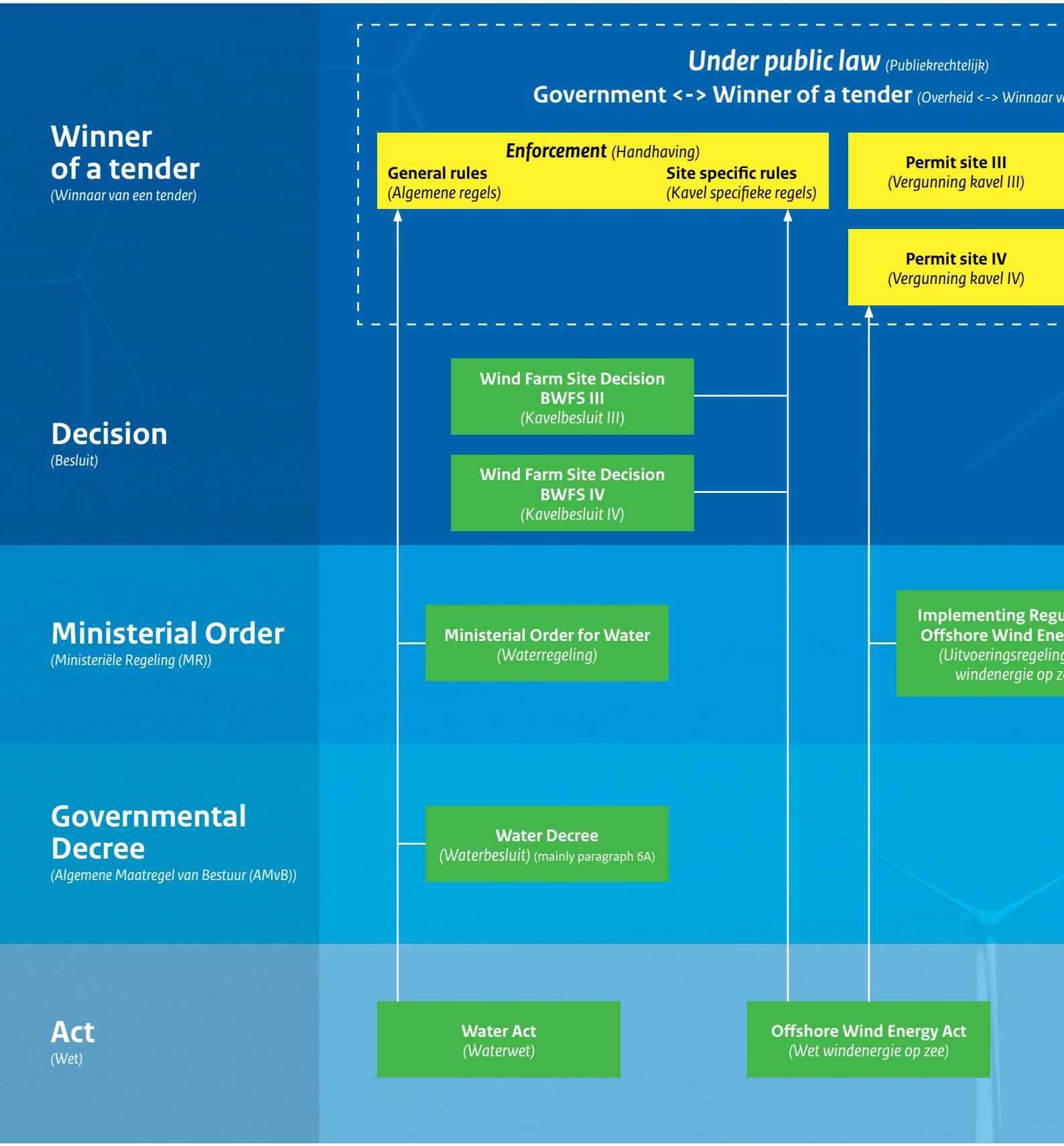
- The construction of wind farms will only be allowed in wind farm zones that have been designated in the National Water Plan [13]. Any project planned outside these zones will not be consented.
- The government allocates specific sites where wind farms can be built and operated within the wind farm zones.
- In the Water Decree [16] general rules are prescribed for building and operating offshore wind farms.
- An Environmental Impact Assessment (EIA) is required for the government to prepare its final Wind Farm Site Decisions (Appendix B). This means that no additional EIA will be required by companies bidding to develop projects.

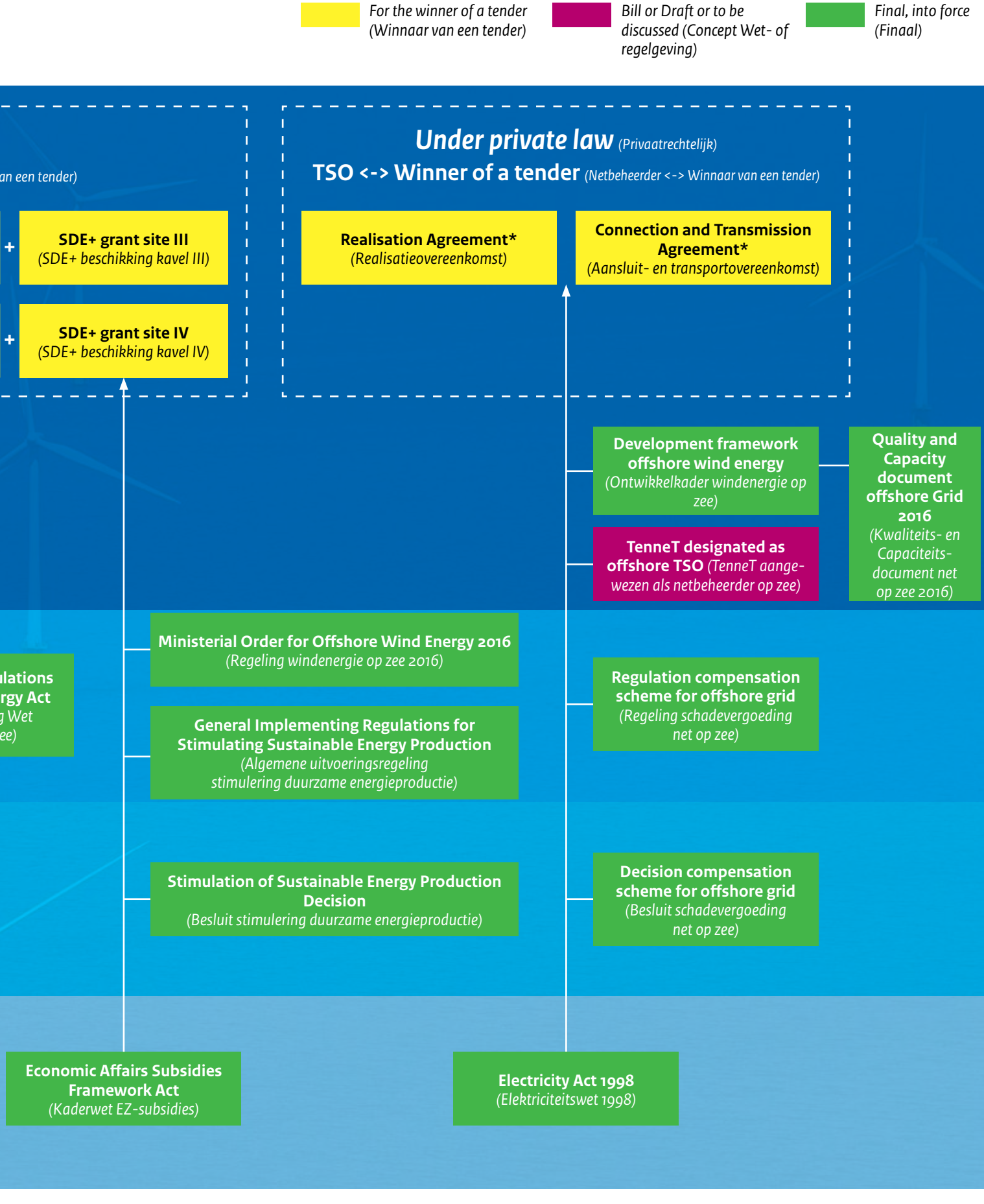
Regarding BWFS III and IV:

- The Ministries of Economic Affairs and Infrastructure and the Environment have issued so-called Wind Farm Site Decisions (kavelbesluiten), which outline the specific rules for building and operating a wind farm on a given site. The WFSD of BWFS III and IV are irrevocable from 21 May 2016.
- Regarding the boundary coordinates, a draft amending decision was published in June 2016. The draft amendment decision is available for inspection from Friday 1 July 2016 until Thursday 11 August 2016. The final amendment decision is expected in September 2016.
- The Dutch transmission system operator TenneT will develop and operate the offshore grid connections.
- The Government opens the call for tender BWFS III and IV on 16 September 2016 and will close the tender on 29 September 2016 at 17:00 hours.
- 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 realisation or operation of the connection.

The legal framework can be found in Figure 24. An informal translation of the relevant law in English can be found in Appendix A.

Figure 24 Legal framework





* TenneT has offshore model agreements available online.

5.1 SDE+ grant and permit tendering

Grants and permits for BWFS III and IV 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. The price for the production of renewable energy is capped (base sum). For BWFS III and IV the base sum is capped at € 119.75/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 dependent on energy-price developments. The application form for BWFS III has been translated for your convenience and can be found in Appendix A. All information to apply will be available online in September 2016. The SDE+ framework for the BWFS III and IV is published in July 2016 [29].

5.1.2 Permit

A tender winner also receives a permit which is valid for a 30-year period. The wind farm must be operational within five years, and can operate till year 29. Decommissioning can start latest end of year 25 and should be completed within two years at the latest after the power generation operations have stopped, but at the latest in year 30.

5.2 Enforcement

Rijkswaterstaat (Ministry of Infrastructure and the Environment) is 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 1st 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 BWFS III and IV are completed [18] - a summary can be found in Appendix B. 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 April 2016, final decisions for BWFS III and IV of the BWFZ are available [19]. The WFSD of BWFS III and IV are irrevocable from 21 May 2016 [28]. However the coordinates indicating the wind farm site boundaries stated in the rules of the decisions for sites III and IV are incorrect. To rectify this an amendment decision is required. This amendment decision indicates the correct coordinates of the boundaries of sites III, IV and V and of the Inter Array Zones between the wind farms on sites III, IV and V and the Borssele Beta TenneT Platform. The draft amendment decision is available for inspection from Friday 1 July 2016 until Thursday 11 August 2016 [28]. The final amendment decision is expected in September.

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 (for the winner only). 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

5.3.1. Framework

The Authority for Consumers and Markets (Regulator) decided to certify TenneT as offshore grid operator. This was a requirement for the Ministry of Economic Affairs to formally designate TenneT as offshore transmission system operator in the Netherlands [20].

The amendment to the Electricity Act [21] 1998 introduced a 'Development framework for the offshore grid' which provides a technical framework and outlines the future development of offshore wind energy in the Netherlands. The Development framework for the offshore grid was published by the Ministry of Economic Affairs in April 2016.

As prescribed in the revised Development framework and elaborated in the offshore Quality and Capacity Document published in May 2016, TenneT will build grid connections for the planned 3,500 MW new offshore wind capacity. 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 Extra High Voltage grid with two 220 kV export cables per substation. The two platforms Borssele Alpha and Borssele Beta will be connected via a 66 kV link. Output from BWFS III and IV will be connected to a single platform (Borssele Beta).

In close consultation with the offshore wind industry, the Ministry, the regulator ACM, and representatives of the Dutch energy market, TenneT has developed an offshore legal framework consisting of so-called model agreements. Consultation sessions of these model agreements were open to all stakeholders of the offshore transmission system and this consultation was finalised ahead of the subsidy tender process. The model agreements consist of a Realisation Agreement and a Connection and Transmission Agreement supported by Offshore General Terms and Conditions, in line with onshore practice. Model agreements are available for parties to be connected to the Borssele Beta Platform.

The model for these agreements will be the same for all winners of the tenders mentioned above (and for any other future tenders). All agreements will be entered into force according to the model agreements published by TenneT.

The agreements will be concluded on an equal basis with the parties concerned in accordance with the model which has been consulted. For the sake of completeness: the content of these agreements is non-negotiable.

The missing data in these agreements will be completed in close consultation with the parties with whom TenneT enters into agreements.

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' could only start after the Electricity Act 1998 entered into force and has now been initiated. For now, TenneT is providing the proposed generic and uniform technical requirements as annexes to the model agreements. These annexes are expected to be overruled and become dispensable once the offshore code is concluded by the regulator.

By entering into the agreements, the connection process starts with the necessary steps for connecting a wind farm to the offshore transmission system:

- TenneT will (as soon as possible after the award of the grant is announced), contact the winner(s) of the tender, being the entity to whom the SDE + subsidy is granted.
- Within four weeks after being invited by TenneT, the winner of the tender will provide TenneT with the missing data as indicated by TenneT in the Realisation Agreement and the Connection and Transmission Agreement.
- TenneT will process the data received in the agreements and provide fully completed agreements to the winner.
- Signing of both agreements by both the winner and TenneT will take place within two months after TenneT has invited the winner to supply the missing data.
- After the agreements have been signed by both parties, the parties will consult on the joint planning, and further information exchange and coordination will take place in the project working group (as referred to in Article 6 of the Realisation Agreement).
- Timely conclusion of the agreements is vital to effecting the connection to the offshore transmission system according to the planning.

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 BWFS III and IV. These requirements originate from the legal framework (an informal English translation of the legal framework can be found in Appendix A).

6.1 Boundaries and Coordinates

The boundaries of the BWFZ are published in the final Wind Farm Site Decisions. No appeals have been filed against the Wind Farm Site Decisions, therefore they are now irrevocable.

However the coordinates indicating the wind farm site boundaries stated in the rules of the decisions for sites III and IV are incorrect. To rectify this an amendment decision is required. This amendment decision indicates the correct coordinates of the boundaries of sites III, IV and V and of the Inter Array Zones between the wind farms on sites III, IV and V and the Borssele Beta TenneT Platform. The draft amendment decision is available for inspection from Friday 1 July 2016 until Thursday 11 August 2016 [28]. The final amendment decision is expected in September 2016. In these amending decisions the coordinates will be aligned with 'Appendix C: Boundaries and coordinates Borssele Wind Farm Zone'. Please note this Appendix confers no rights and is provided for convenience only.

This Appendix C contains the coordinates of:
- The Borssele Wind Farm Zone;
- The Borssele Wind Farm Sites;
- Infrastructure (pipelines, telecom and export cables, and infield cable entry zones); and
- The shipping corridor

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 III and/or IV. The requirements are grouped in line with the five different wind farm development stages (design, finance, build, operate, and decommissioning).

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 superseded. In any case, the applicable law 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 5, which are an abstract of the applicable law (Appendix A).

Table 5: Bandwidth of design characteristics for BWFS III and IV.

Requirement	Applicable Law
BWFS III is appointed as a location for wind farms with a total minimum capacity of 322 MW and a Total maximum capacity of 360 MW.	Wind Farm Site Decision (WFSD) III, I 2.1
BWFS IV is appointed as a location for wind farms with a total minimum capacity of 342 MW and a Total maximum capacity of 380 MW.	WFSD IV, I 2.1
The wind farm will be situated within the contours of the coordinates listed in Table 5 of this PSD.	WFSD III and IV 2.1
The route of the grid connection to the Offshore Substation Borssele Beta is within the coordinates shown in Table 7 of this PSD.	WFSD III and IV, III 2.2
No wind turbines will be installed in the maintenance zones of the telecom cable 'SeaMeWe'. These zones are within the coordinates shown in Table 6 of this PSD.	WFSD III 2.3
No wind turbines will be installed in the maintenance zones of the telecom cables TAT 14 en Farland North. These zones are within the coordinates shown in Table 6 of this PSD.	WFSD IV 2.3
The rotor blades of the wind turbines must remain completely within the contours cited in Table 5 of this PSD WFSD III and IV and completely outside of the maintenance zones cited in Table 6 of this PSD.	WFSD III and IV, III
The maximum number of wind turbines to be installed: 60 in BWFZ III and 63 in BWFZ IV.	WFSD III and IV, III 2.5
The maximum total swept area permitted: 1,430,772 m² in BWFZ III and 1,461,542 m² in BWFZ IV.	WFSD III and IV, III 2.6
Only wind turbines of 6 to 10 MW nominal capacity per wind turbine are to be installed in the wind farm.	WFSD III and IV, III 2.7
The minimum distance between wind turbines must be 4 times the rotor diameter expressed in metres.	WFSD III and IV, III 2.8
The minimum tip lowest level is 25 m above sea level (MSL).	WFSD III and IV, III 2.9
The maximum tip highest level is 250 m above sea level (MSL).	WFSD III and IV, III 2.10
The cables from the wind turbines must be connected to the Borssele Beta Offshore Substation.	WFSD III and IV, III 2.11
The permitted foundations for the wind turbines are: monopile, tripod, jacket, 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. The environmental impact must not exceed the limits set out in this Decision.	WFSD III and IV, 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. Extra installations are not allowed if they are not directly related to the wind turbines to be constructed. In this respect the company is required to create an action plan, to be delivered to the Ministry of Economic Affairs no later than 8 weeks before the planned start of construction. Construction work must adhere to this plan.	WFSD III and IV, III 2.15

Requirement	Applicable Law
The permit holder must make a demonstrable effort to design, build, and operate the wind farm, while taking into account the prevailing laws, in such a manner that the wind farm actively contributes to strengthening the local and regional economy. For that purpose, the permit holder prepares an action plan and submits it to the Minister of Economic Affairs at least 8 weeks before the commencement of the construction. The work will be performed in accordance with this action plan.	WFSD III and IV, III 2.16
The permit as referred to in Section 12 of the Offshore Wind Energy Act will be issued for a period of 30 years.	WFSD III and IV, III 3.1
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 / 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 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

6.2.2 Financial and legal requirements

Table 10: Financial and legal requirements BWFS III and IV.

Requirement	Applicable Law
The nominal capacity of the offshore wind farm on site III, amounts to: a) at least 331 MW per wind farm site minus the number of MW of the wind turbine with the least capacity, and b) at most 360 MW. The nominal capacity of the offshore wind farm on site IV, 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 2016[5], §2.3
The deadline for tender submissions is 29 September 17.00 Dutch time. Companies can submit a single application covering both sites and one separate application for each individual site (allowing three applications in total).	MOOWE 2016, §2.4
The Minister will reject an application if the level of applicants own assets is less than 10% of the total investment cost of the requested site.	MOOWE 2016, §2.5.1
If the applicant or a participant in a collaborative venture is a subsidiary company, the other own assets of the parent company has agreed to this in writing.	MOOWE 2016, §2.5.3
The own assets of a participant in a collaborative venture or the own assets of a parent company are included in the own assets of no more than two applicants.	MOOWE 2016, §2.5.4
The insight into equity will be offered by the provision of the most recent annual accounts of the applicant, its parent company and/or the participants in the collaborative venture.	GIR SDE+[6] Art. 2 §7
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 grant available is capped at € 2,400,000,000 for site III and € 2,600,000,000 for site IV	MOOWE 2016, §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 2016, §2.6.5
If several combined applications are ranked higher in the ranking for both wind farm sites than the highest ranked individual application, then the ranking of these combined applications will be based on the average amount of the tender price bid per kWh of the relevant applications, whereby the tender bid price for Wind Farm Site III has a weight of 33/68 and the tender bid price for Wind Farm Site IV has a weight of 35/68.	MOOWE 2016, §2.6.6
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 2016, §2.6.7
A price cap of € 0.11975/kWh applies.	MOOWE 2016, §2.7
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 2016, §2.9 MOOWE 2016, appendix to §2.9
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. 9 (appendix)
The grant will be provided for a period of 15 years. The wind farm should be commissioned within 5 years after the date of the Decision to award the grant or 5 years after the Wind Farm Site Decision is irrevocable.	MOOWE 2016, §2.10.1 MOOWE 2016, §2.11

Requirement	Applicable Law
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 III and IV tender will be € 0.030/kWh.	MOOWE 2016, §2.12.1
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.	MOOWE 2016 §3.14.1a
When calculating the P50 value for net electricity generation per annum of the wind farm, the following losses should be taken into account: availability, proximity effects, electricity losses, own consumption, environmental effects on the turbine, turbine yield and curtailment losses.	MOOWE 2016 §3.14.1c
When calculating the wake effect for the P50 value, only Belgian wind farms that are operational as of July 1st 2016 and the site itself should be taken into account.	MOOWE 2016, §2.12.2

5) MOOWE = Ministerial Order for Offshore Wind Energy 2016 [24]

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

6.2.3 Construction

Table 6: Construction requirement parameters for BWFS III and IV (BWFS V gets other requirements).

Requirement	Applicable Law
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 all relevant issues related to safety and environment during the construction and operational phase.	Water Decree/§ 6.16d1
Prevention of permanent physical harm and/or effects on porpoises, seals and mortality of fish: a. Companies must use an acoustic deterrent device during piling and half an hour before piling work starts. b. Piling work should adopt a soft start, to enable porpoises to swim to a safe location.	WFSD III and IV, III 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. From Jan-May the maximum piling sound level is lowest. The permit holder prepares a piling plan and submits this to the Minister of Economic Affairs at least 8 weeks before the commencement of the construction. The work must be performed in accordance with the piling plan. 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.	WFSD III and IV, III 4.2
Measures to protect archaeology and cultural history: a. Exploratory field research to assess the presence of archaeological monuments is required prior to cable laying and placement of the turbine foundations. b. The results will be presented to the Minister no later than 3 months before construction of the wind farm starts. c. Depending on the conclusions of the study: a. the work can proceed without changes; b. a follow-up study is required; c. physical measures must be taken to protect archaeological sites; d. sites are to be excluded from interference taking into account a buffer zone; e. the work must be supervised archaeologically.	WFSD III and IV, III 4.5
Concerning the visible structures at the seabed surface, as long as the archaeological value of the remains is not determined, it is advised not to conduct disturbing activities on the locations including a buffer zone of 100 m around. This also applies to cable trenching and anchorages of work vessels. The buffer zone of 100 m is a standard that applies to the protection of cultural heritage, this distance may be reduced if it can be substantiated that the applied disturbance has no effect on the archaeological object. If it is not feasible to avoid the reported magnetometer locations, additional research is required in order to determine the actual archaeological value of the reported locations. It is advised that the UXO research within 100 m of the 65 magnetometer anomalies is carried out under on-board archaeological supervision. Depending on the outcome of the UXO research, it may be decided that additional research (for instance by means of ROV or dive investigations) is needed. If the UXO research indicates the object has no archaeological value, the location can be omitted. During the installation of the wind turbines and cable lay operations, archaeological objects may be discovered which were completely buried or not recognised as an archaeological object during the geophysical survey. Periplus Archeomare recommends passive archaeological supervision based on an approved programme of requirements. In accordance with the Monuments Act 1988 (Revised 2007), those findings must be reported to the competent authority.	Archaeological Assessment

Requirement	Applicable Law
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 6.16f.1
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

6.2.3 Operation

Table 7: Operational requirements for BWFS III and IV.

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.	WFSD III and IV, III 2.14
During repairs to and maintenance of telecommunication cables, the number of rotations per minute per wind turbine of those wind turbines that are situated within a radius of 1,000 metres from the site of the repairs or maintenance must be reduced to less than 1.	WFSD I, III and IV 2.17
Measures to limit collision victims among birds at rotor height during mass bird migration: a) at night (between sunset and sunrise), during the period in which mass bird migration effectively takes place, the number of rotations per minute per wind turbine will be reduced to less than 1; b) for the purpose of implementing this regulation, referred to in subparagraph a, the control system of the wind turbines will be linked to a system that effectively observes bird migration; c) in a plan, the permit holder describes the system to which the wind turbines will be linked and the transect line based on which bird density will be determined. The permit holder must submit this plan to the Minister of Economic Affairs at least 8 weeks before the commencement of the construction; d) the connection mentioned in part b of this regulation will be executed within the plan mentioned in part c; e) July 1st and January 1st of each year the permit holder reports how and in what way the regulation rules have been executed. Government will pay for the system that effectively observes the bird migration and its maintenance (WFSD: II.7.8.4).	WFSD III and IV, III 4.3
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) within two months after the end of the period referred to in part a, the permit holder will produce a report outlining how this regulation is implemented and submit it to the Minister of Economic Affairs.	WFSD III and IV, III 4.4
1. The Minister of Economic Affairs will create an environmental monitoring and evaluation programme. The permit holder will cooperate in the implementation of this programme to a reasonable extent, without financial compensation. In doing so, the safety regulations applicable on the wind farm will be taken into account. 2. The Minister of Economic Affairs will publish the data generated by the monitoring and evaluation programme. 3. The permit holder will cooperate in the implementation of the monitoring and evaluation programme e.g. as follows: · providing access to the wind farm for vessels conducting monitoring and evaluation work; · enabling the attachment of equipment such as cameras and bat detectors to/on (parts of) the wind turbines; · enabling the attachment of radar equipment to/on (parts of) the wind turbines; · enabling the attachment of measurement equipment (for example measurement buoys, C-PODs, etc.) within the wind farm. · making available bandwidth on the data cable.	WFSD III and IV, 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

6.2.4 Decommissioning of the wind farm

Table 8: Decommissioning requirements for BWFS III and IV.

Requirement	Applicable Law
After the power generation operations have stopped the permit holder will dismantle and remove all elements of the wind farm within two years at the latest, but always within the term of validity of the permit.	WFSD III and IV, III 6
1. At the latest at the moment of given proof of produced electricity by the means of so-called 'Garanties van Oorsprong', the permit holder will guarantee the removal of the wind farm by means of a bank guarantee for the State in the amount of €120,000 per MW installed. 2. The permit holder will annually increase the amount referred to under a by 2% as a consequence of indexation during a period of 12 years after the issue of the bank guarantee. 3. After operating for a period of 12 years, operating for a period of 17 years, and 1 year before the date of removal, the permit holder will ask the Minister of Economic Affairs to redetermine the amount referred to under 1 and its indexation.	WFSD III and IV, III 7
A wind farm that is no longer in use, must be removed. This is equally applicable to scrap metal and other materials that are present on site or in the surrounding area as a result of the placement, maintenance, use or decommissioning of the wind farm. Our Minister can set a time limit, within which the obligation for decommissioning must be complied with.	Water Decree 6.16l

6.2.5 Electrical infrastructure

Table 9: Electrical infrastructure requirements.

Requirement	Applicable Law
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.	EACT7, 16f.1
A downtime of five days per calendar year is allowed without compensation.	COMPS8, 2.3
Compensation consists of consequential damages and damages resulting from lost or postponed revenue.	EACT, 16f.2
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 (EACT/Article 16f.2). 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.	COMPS, 4.3
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.	COMPS, 4.2
The connection voltage level of the inter-array systems to the TenneT offshore transformer platform will be standardised at 66 kV.	Development framework offshore wind energy[9], 3.7
Number of bays. With the 66 kV inter-array cables, six 66 kV bays will be available per PPM (Power Park Module). 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.	Development framework offshore wind energy, 3.8
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.	Development framework offshore wind energy, 3.4

9) Development framework, offshore wind energy (Ontwikkelkader windenergie op zee)

Requirement	Applicable Law
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 PPMs as the Connection Party will be dealt with in the Connection and Transmission Agreement.	Development framework offshore wind energy, 3.9
Overcapacity. The power park module (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	Development framework offshore wind energy, 3.6
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.	Development framework offshore wind energy, 3.7
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.	Development framework offshore wind energy
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. Customized wishes will be at cost of the Connected Party.	Development framework offshore wind energy, 3.8
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 the offshore platform and onshore substation, only in case a firm and significant delay in realisation of such communication through the export cable fibres.	Development framework offshore wind energy, 3.5 (i)/ TenneT (ii)
Planning. The indicative date for delivery of Borssele Beta is the third quarter of 2020.	Development framework offshore wind energy, 4.2

For further technical requirements you are referred to TenneT's model agreements published on ***www.tennet.eu***.

7. Next steps preparing a bid

Preparations by the Government for the second Borssele tender are being finalised. This Project and Site Description (PSD, version June) is the first version, which contains all site data and requirements that are relevant to prepare a tender bid in 2016 for BWFS III and/or IV. Key dates are:

- 30 June 2016: publication final Ministerial Order for Offshore Wind Energy 2016 in 'Staatscourant' (Dutch Bulletin of Acts and Decrees)
- August 2016: opening webpage to download application forms ***www.rvo.nl/subsidies-regelingen/sde/windenergie-op-zee/windgebied-borssele-iii-iv-en-v***
- 16 September 2016: opening tender Windenergie op zee 2016 BWFS III and IV
- September 2016, 16 - 29 September 17:00 hours: delivery of printed applications at the RVO office Zwolle is possible

Several websites provide the most up-to-date information and status of all relevant studies, the legal framework and the application for subsidy and permit. The most important 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/subsidies-regelingen/sde/wind-op-zee***
  - FAQ SDE+ grant and permit can be found at ***www.rvo.nl/subsidies-regelingen/sde/faq/wind-op-zee***
- Wind Farm Site Decisions are published at ***www.rvo.nl/subsidies-regelingen/sde/windenergie-op-zee/windgebied-borssele-iii-iv-en-v***
- 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*** ***http://www.tennet.eu/nl/nl/net-projecten/projecten-in-nederland/net-op-zee/frequently-asked-questions.html*** ***http://www.tennet.eu/nl/nl/over-tennet/nieuws-pers-publicaties/publicaties/technische-publicaties.html***
- Draft spatial plan and draft licenses for Grid Connection System Borssele are published under the 'Rijkscoordinatieregeling': ***www.rvo.nl/subsidies-regelingen/bureau-energieprojecten/hoogspanning/noz-borssele/fase-1***

8. Applicable documents

8.1 Bibliography

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[22] Algemene uitvoeringsregeling Stimulering Duurzame Energieproductie (General Implementing Regulations for Stimulating Sustainable Energy Production)
[23] Belgian Wind Farms: Please use provided maps and coordinates of 1 July 2015 to calculate (Appendix A)
[24] Besluit schadevergoeding net op zee (Compensation scheme) (Appendix A)
[25] Regeling schadevergoeding net op zee (Appendix A)
[26] Geotechnical Report Thermal Conductivity and Seabed Temperature Wind Farm Sites I to IV Borssele Wind Farm Zone Dutch Sector, North Sea
[27] Biostratigraphic Analyses Wind Farm Sites I to IV Borssele Wind Farm Zone Dutch Sector, North Sea, Fugro, May 2016
[28] Draft Amendment decision (Appendix A)
[29] Regeling Windenergie op zee 2016 (Ministerial Order for Offshore Wind Energy 2016) (Appendix A)

Appendices

Appendix A: Applicable Law

Appendix B: Summary Environmental Impact Assessment

Appendix C: Boundaries and coordinates Borssele Wind Farm Zone

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