Anholt Offshore Windfarm– Stabilisation of Cable Protection Systems and Cables at Scour Protected Monopile Locations and the Offshore Substation

Works Description and Environmental Assessment

Prepared	Stuart Grindlay (XSTUG), Gundula Fischer (GUNFI)
Checked	Gundula Fischer (GUNFI)
Approved	Michael McGenity (MIMCG)
DORECO No.	08038423_A
Document Date	09 March 2023

Table of contents

Table of figures

Table directory

1 Introduction

Anholt Offshore Windfarm (ANH01), commissioned in 2013, is showing degradation of existing cable protection systems (CPS) associated inter-array cables and platform connector cables. Thus, Ørsted is planning to undertake cable stabilisation around 42 wind turbine monopiles, and 14 cables at the offshore substation (OSS) in 2023.

A continued degradation of the inter-array cables as a result of unrestrained lateral motions combined with abrasion of the CPS on the already installed rock scour foundations will occur (which could result in power transmission loss, and subsequent emergency cable repairs). The risk of degradation in the CPS and associated cable systems can be mitigated by the introduction of stabilisation by means of rock berms on the existing scour protected sites. The objective of the planned work is therefore to conduct stabilisation from the seabed touch down point of the CPS at the foundation, out to the seabed burial point, stopping the systems from moving and sliding. This mitigation action will reduce the risk of cable/CPS abrasion and fatigue and subsequent cable failures. It is expected that this precautionary measure will minimize the likelihood of future works, specifically cable replacements. In effect, conducting the stabilisation works now will result in reduced environmental effects at the seabed compared to a full cable replacement campaign.

The planned stabilisation includes placement of permanent rock berms since rock placement is expected to be the best solution, providing most stability for the CPS and associated array cables and allowing the most accurate placement.

According to Section 25 of the Renewable Energy Act (*VE-loven*) significant changes to existing installations can only be carried out with the prior permission of the Minister for Climate, Energy and Utilities (*Klima-, Energi- og Forsyningsministeren*), represented by the Danish Energy Agency (DEA) (*Energistyrelsen*). Moreover, according to Annex 2, no. 13a, in the Environmental Assessment Act, amendments or extensions to projects in Annex 1 (which are not covered by Annex 1, no. 29) or Annex 2 that have already been approved, have been carried out or are in the process of being carried out must undergo screening when they may have significant adverse effects on the environment.

This document contains a description of the planned stabilisation by rock placement on the CPS and associated array cables at the scour protected wind turbine positions and the offshore substation. In addition, it presents an assessment of the potential environmental effects, and any impacts, from the planned stabilisation (‘screening’). Therefore, the document is intended to provide sufficient information to the Danish Energy Agency to enable them to decide whether the planned work constitute a significant change to the existing Anholt Offshore Windfarm and whether a detailed Environmental Impact Assessment is required.

2 Project Description

2.1 Anholt Offshore Windfarm

Anholt Offshore Windfarm was commissioned in 2013 and is located in the waters between Djursland and Anholt in the Kattegat strait, approximately 21 km off the north-east coast of Jutland, Denmark. The location of the wind farm area is shown in Figure 1.

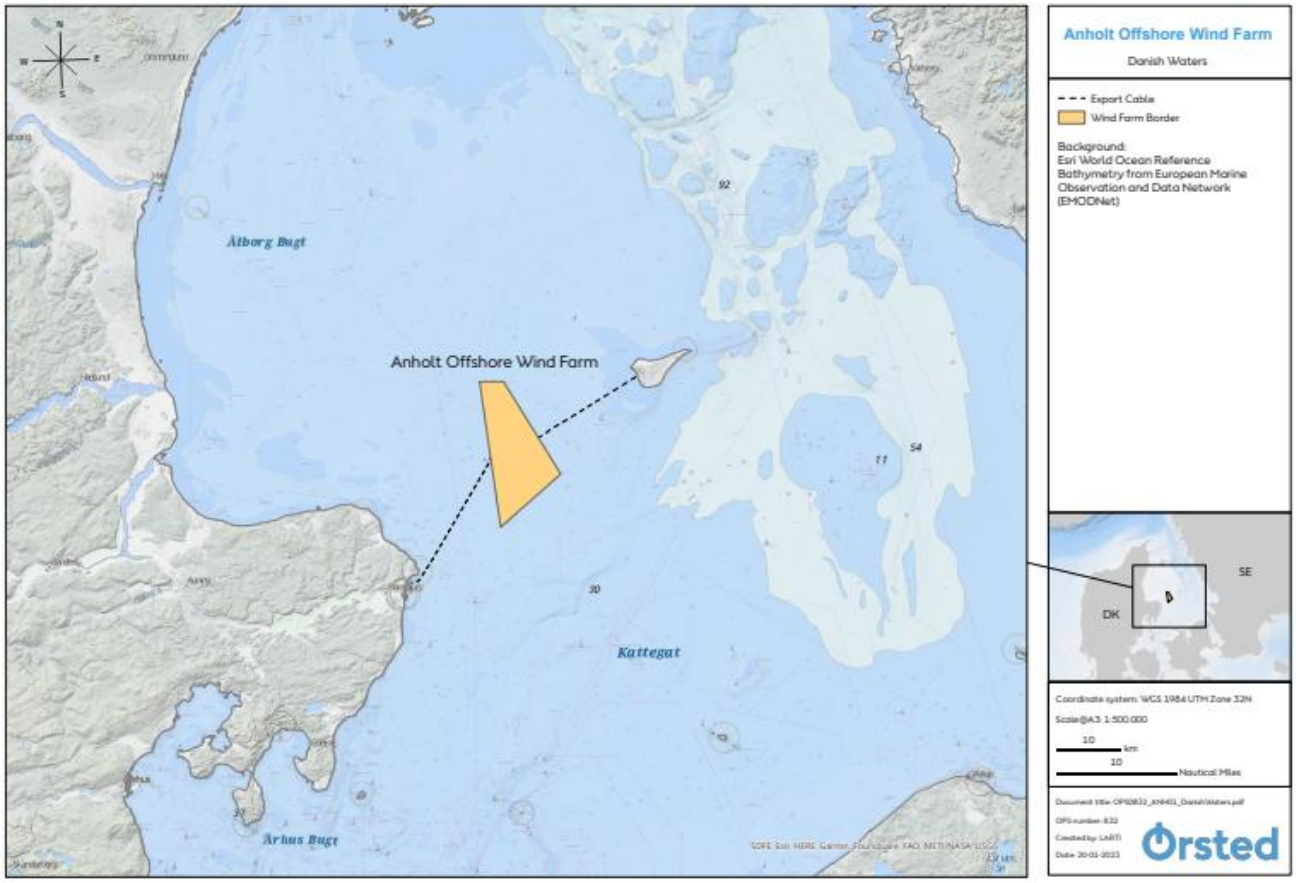

Figure 1: Location of Anholt Offshore Windfarm. Anholt Offshore Windfarm is located in the waters between Djursland and Anholt in the Kattegat strait.

The offshore wind farm consists of 111 offshore wind turbines with a capacity of 3,6 MW each and has a total capacity of 400 MW. Figure 2 shows the layout of the windfarm.

2.2 Turbine foundations and layout

The wind turbine foundations with scour protection pad are placed in different parts of the offshore wind farm. In all, 42 of the foundations have scour protection pads and 69 are unprotected due to high laying clay soil. Positions coloured in purple indicate the wind turbine (WTG) positions with scour protection. Figure 3 shows a typical monopile foundation with scour protection pad. The wind turbine positions included in the scope are depicted in Figure 2, coloured in purple. UTM coordinates per position can be found in the appendix in 8.1.

The water depths at the site varies between -15.40 and -18.54 m with reference to MSL. Seabed sediments comprises a both outcropping Glacial till, Yoldia Clay and Holocene sand cover. This is also evident in the seabed morphology, which is occasionally uneven, and with high relief. The difference in seabed sediment, is reflected in where scour protection has been included in the foundation design [1].

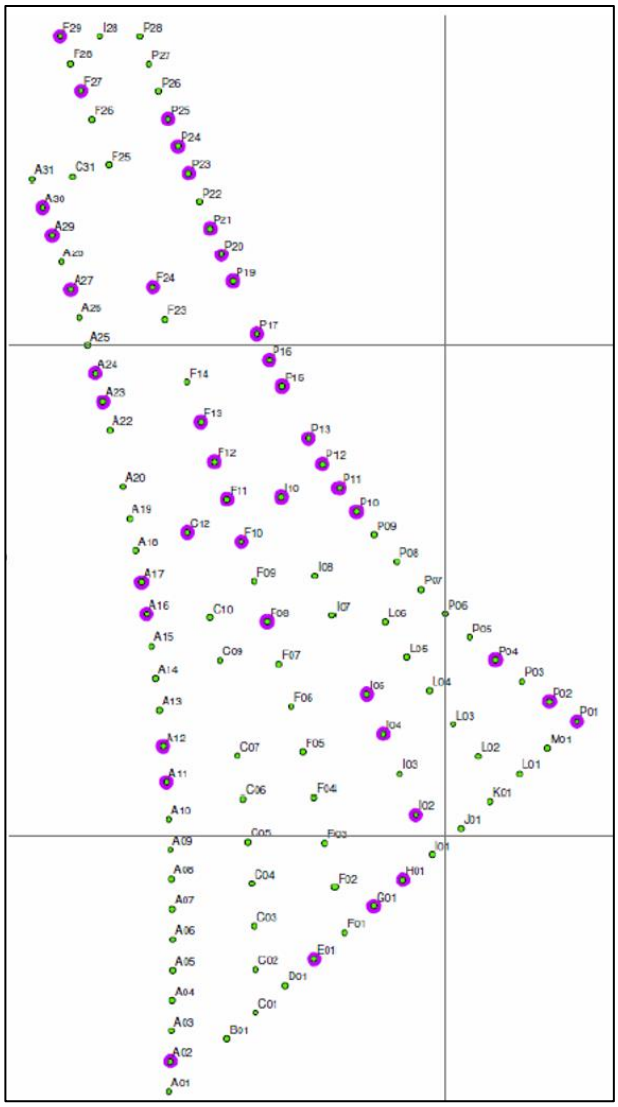

Figure 2: Layout and position of turbines in Anholt Offshore Windfarm. Positions coloured in purple indicate the WTG positions with scour protection.

Figure 3: Typical monopile foundation with scour protection pad.

2.2 Offshore Substation

Within Anholt Offshore Windfarm an offshore substation (OSS) is placed in the central eastern side of the wind farm area. The substation is constructed with the inclusion of scour protection foundation. It was installed and is operated by Energinet DK. An agreement with Energinet DK will be concluded prior to any rock installation activities.

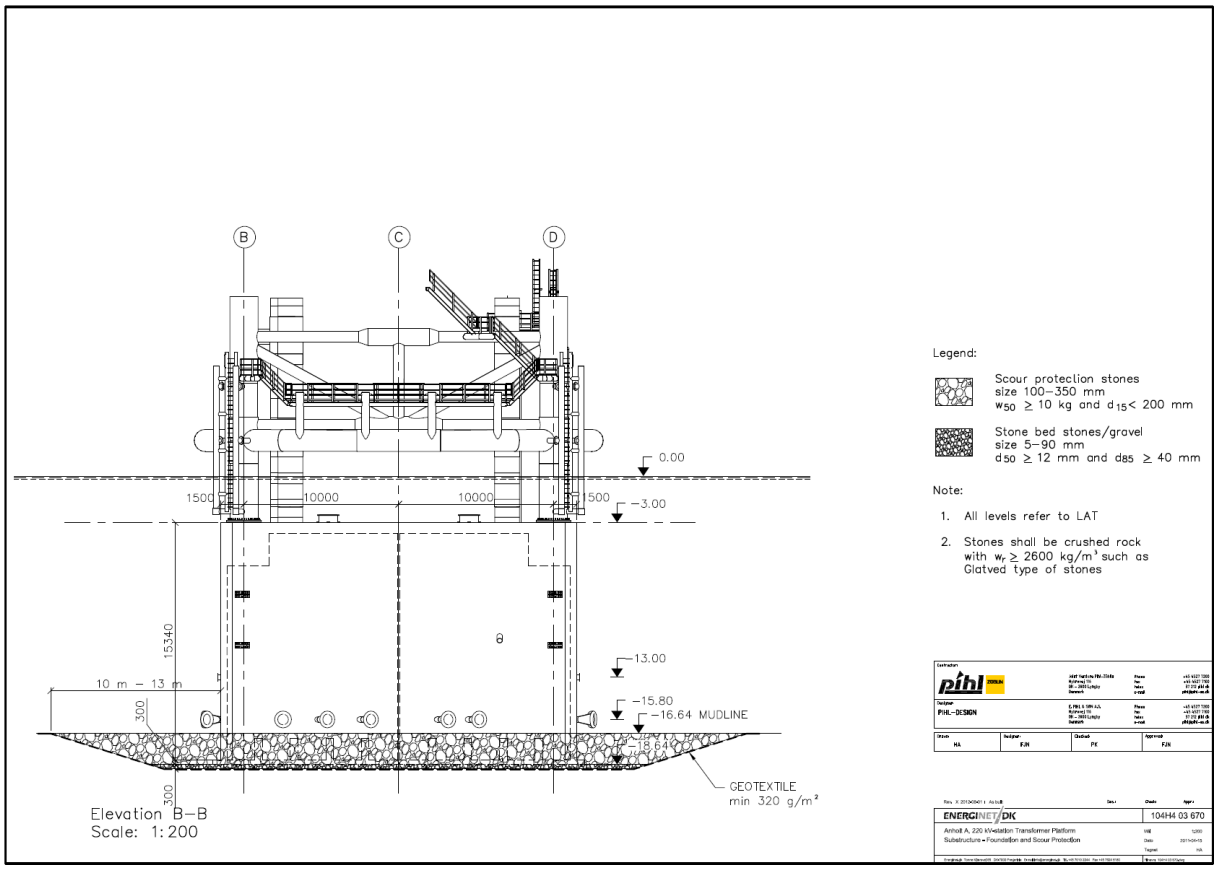

Figure 4: Design drawing of the Anholt OSS jacket structure (including scour protection design).

3 Scope of Work

Anholt Offshore Windfarm has existing scour protection pads associated with 42 WTG foundations. Each of the 42 WTGs is connected by one, two or three array cables to the neighbour position(s), resulting in a total of 92 CPS locations at the scour protected foundations. In addition, there are 12 inter array cable locations and 2 export cable locations at the OSS. This results in a total of 106 cable protection systems (CPS) locations that are planned to be stabilised.

Similar work to those planned in Anholt Offshore Windfarm have been conducted at Ørsted's other European Offshore Wind Farms. Figure 5 shows an example of a scour protection pad before and after placement of two rock berms on top of the scour pad up to the cable burial point. The multibeam echo sounder images demonstrate that the planned rock berm construction / placement considered in this document is technically feasible; with the berm able to be located accurately on top of a scour protection pad and extending to the cable burial point as per design.

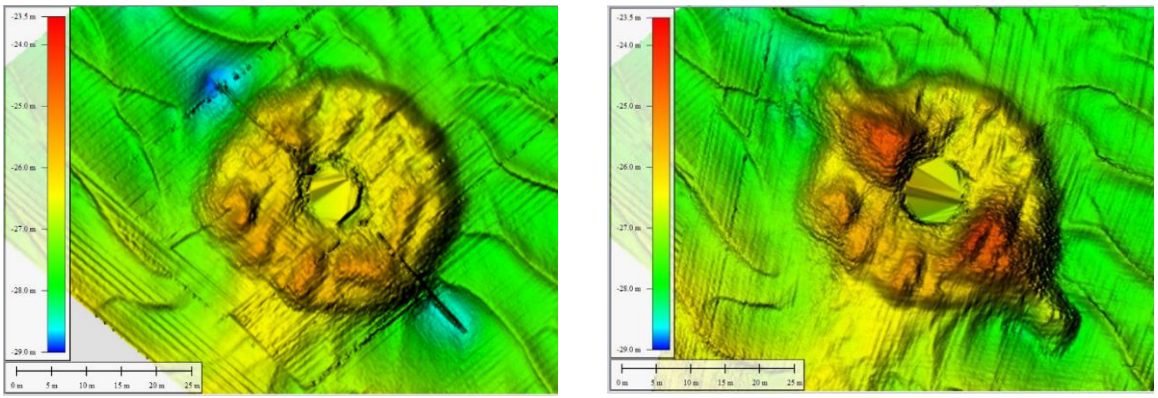

Figure 5: Survey images of an example WTG scour protection pad before (left) and after (right) rock placement.

Figure 6 shows shows the footprint and location of the OSS, the location of the inter array and export cables (IAC and EC respectively) and the footprint of the rock works intended for installation.

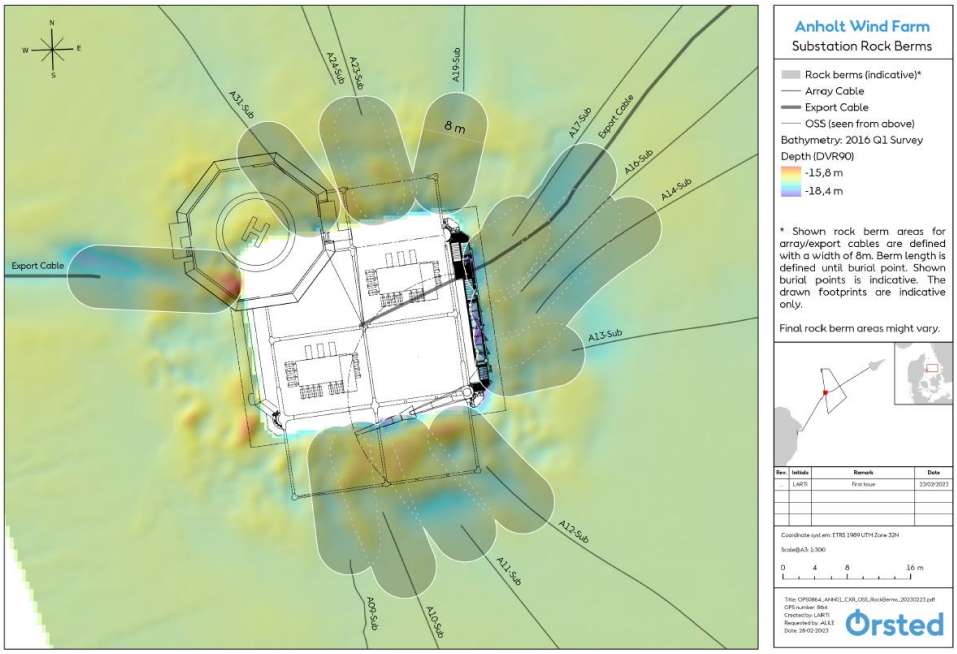

Figure 6: OSS footprint and location, inter array and export cable location and footprint of the rock works intended for installation.

3.1 Existing scour protection and planned rock berms

The planned stabilisation will include placement of permanent rock berms to stabilise cable ends at the 42 WTG foundations with existing scour protection pads as well as the 12 platform connector cables (PCCs) and 2 export cables (ECs) at the OSS

Rock placement is expected to be the best solution, providing berms with the most stability for the CPS and associated array cables as they extend from the WTG foundation, across the existing scour pad and seabed, to each cable burial position. Use of rocks also allows the most accurate placement onto the scour pad/seabed and construction of each berm.

The rock material for use as scour protection shall be armour stone rock as defined in Ref. [2]. All armour stone will be obtained from approved sources of sound, compact, hard durable, natural stone/rock resistant to action of sea water and free of cracks and fissures detrimental for the proper performance of the material in question.

The planned stabilisation will involve construction of rock berms onto the existing scour pad, with the rock berms extending off the toe of the scour pad onto surrounding seabed. Figure 6 shows a generic plan and section views of the monopile (D) and the existing scour protection (dark shaded area). Rock placement described in this document will be installed on top of previous scour protection and extend off the scour protection pad (light shaded area).

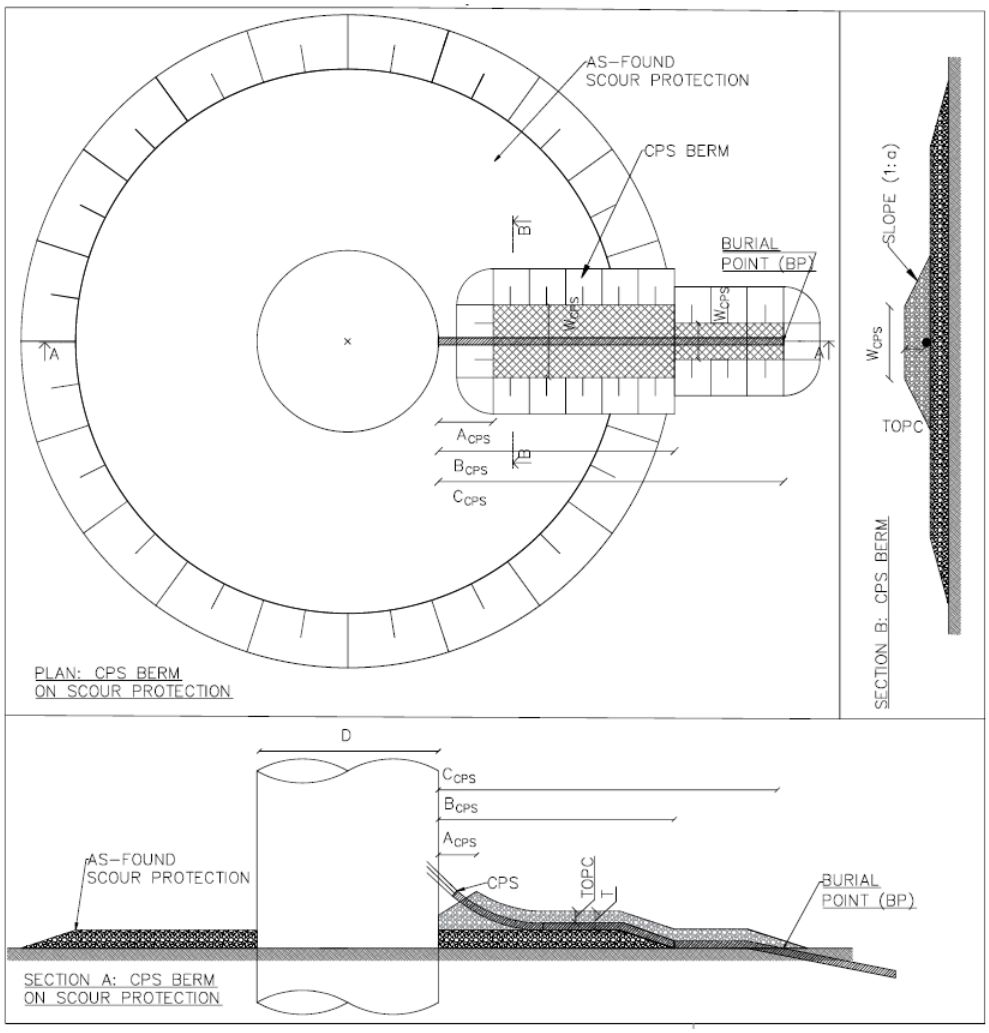

Figure 7: Design drawing. Cable protection system (CPS) with rock berms on the existing scour protection. Generic plan and section views [2].

3.1.1 Expected coverage of seabed area (WTG)

The following outline provides a description of maximum total seabed area coverage of the proposed CPS stabilisation based on a design dimension for the 92 CPS locations. This includes the rock berm area outside the existing scour protection pads. This dimension shall be verified during the in-survey of the rock installation vessel and an assessment shall be made in each case as to the quantity of rock to install in order to meet the minimum design requirements.

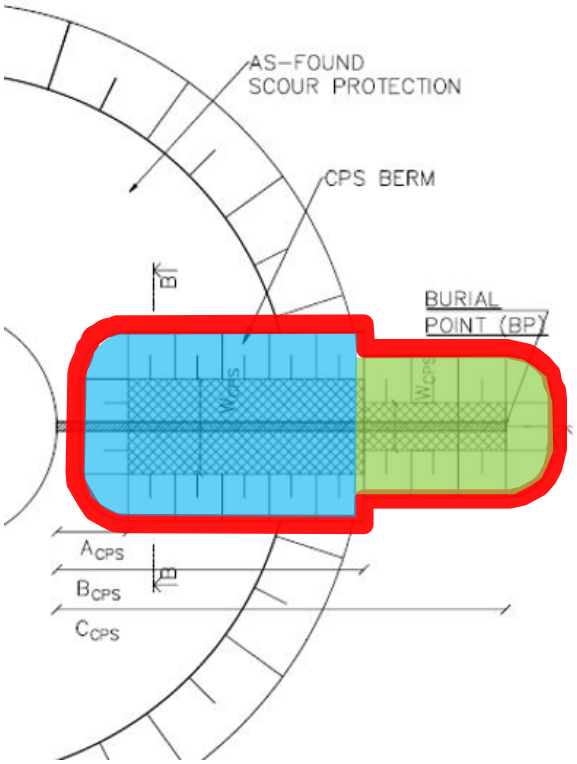

Figure 8: Depiction of new rock placement for on and off scour pad areas at WTG foundations

The seabed effected area for the WTG locations is described as follows using Figure 8 above as reference:

- The total berm area with the red outline depicts the full stabilisation berm to be installed which is a total seabed area of approx. **22.080 m²**
- The berm area shown with the blue shade is the rock berm to be installed within the existing scour pad areas which is an area that equates to approx. **12.806 m²**
- The berm area shown with the green shade is the rock berm to be installed on virgin seabed from the edge of the existing scour pad out to the as found seabed burial point of the CPS which is estimated to be approx. **9.274 m²** (approx. 100m² at each of the 92 locations)

3.1.2 Expected installation volume (WTG)

The total expected rock volume to be used at each location is estimated to approx. 162m³ per location, with 92 locations the total volume is estimated at **14.904 m³.** This includes all rock installed on top of the existing scour protection pads and beyond until the burial point at the 92 CPS locations.

3.1.3 Expected coverage of seabed Area (OSS)

The OSS location is also constructed with the inclusion of a foundation scour protection resulting in the same risk of failure mode as the CPS at the WTG locations. The existing scour protection design dimensions are indicated in the figure below.

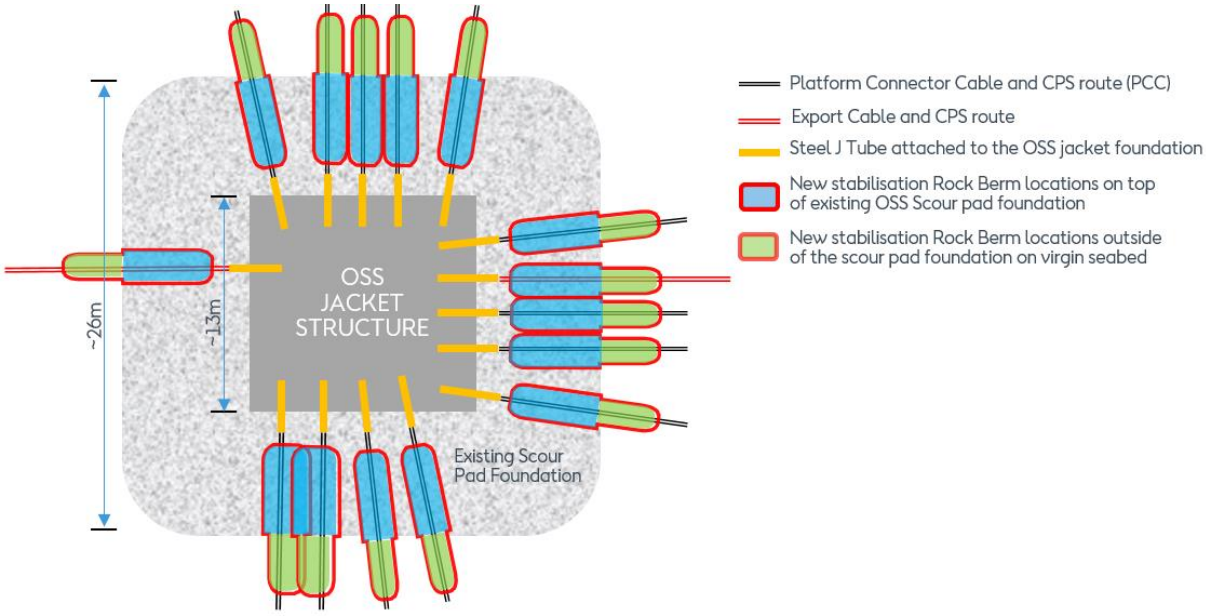

Figure 9: Indicative OSS Location stabilisation layout (not to scale and for illustration purposes only)

- The total estimated berm area with the red outline (both Blue and Green shaded locations combined) depicts the full stabilisation berm to be installed which is a total seabed area of approx. **4.200 m²**
- The berm area shown with the blue shade is the rock berm to be installed within the existing scour pad areas which is an area that equates to approx. **2.520 m²**
- The berm area shown with the green shade is the rock berm to be installed on virgin seabed from the edge of the existing scour pad out to the as found seabed burial point of the CPS which is estimated to be approx. **1.680 m²**

3.1.4 Expected installation volume (OSS)

The total expected rock volume to be used at each location is estimated to approx. 285m³ per location, with 14 locations the total volume is estimated at **4.000 m³.** This includes all rock installed on top of the existing scour protection pads and beyond until the burial point at the 14 CPS locations.

3.2 Total seabed area (WTG + OSS)

The total seabed area, which will be additionally covered by rock in future, will amount to a total of 10.954 m² (see Table 1).

Table 1: Total seabed area of rock to install, on top auf existing scour pads and on virgin seabed

	WTG	OSS	Total
Total seabed area of rock to install (Green +Blue)	22.080 m²	4.200 m²	26.280 m²
Total seabed area on top of existing scour protection layers (Blue Only)	12.806 m²	2.520 m²	15.326 m²
Total seabed area outside of existing scour protection on virgin seabed (Green only)	**9.274 m²**	**1.680 m²**	**10.954 m²**

3.3 Total estimated rock volume (WTG + OSS)

The total estimated volume of rock to be installed for both the 92 WTG CPS locations and the 14 OSS locations (including export cables) will amount to **14.904 m³ + 4.000 m³ = 18.904 m³**.

3.4 Installation strategy

The planned work will be executed with proven technology and contractors. Execution experience will be drawn from several similar projects within Ørsted and in the industry in general.

For the execution of the planned works, an inclined fall pipe rock installation vessel will be used as shown in Figure 10. This is a dedicated DP2 class vessel for the accurate injection of rocks near structures under water.

Figure 10: Example inclined fall pipe rock installation vessel showing the at deployment of the fall pipe next to a monopile.

During the works the Ørsted operated Marine and Helicopter Coordination Center (MHCC) will maintain a 500m safety zone at all times around the vessel when entering the offshore wind farm site. Prior to positioning the vessel next to the desired location, the vessel will request permission to access

a 100m safety zone around the structure via the local Ørsted operated MHCC. After approval of access the vessel will perform the following:

1 Positioning the vessel at location in DP2 mode next to the structure/cable end position.

2 At location the Contractor will perform a multibeam pre-survey at all positions prior to commencing the dumping of rock.

3 Following the pre-survey and the agreement with the Company's Representative, the Contractor will use the pre-survey data to conduct the installation of the rocks using a vessel with fall pipe and/or an inclined fall pipe. The vessel survey team will follow the installation live via multibeam monitors to control the accuracy of the installing rocks compared to the design.

4 The Contractor will upon completion of the rock installation at each location conduct a multi beam survey of the affected seabed. The multibeam survey will be conducted to validate the installation tolerances of the rock berms, and to compare with the pre-survey to confirm that the required coverage of the cables and rock berm profile has been accomplished.

5 After post survey is completed, the vessel will relocate to the next location and start at point 1.

The vessel will be working 24/7 and be in continued contact with the Marine and Helicopter Coordination. At any time, the vessel can abort the rock installation and leave the 100m safety zone around the structure. At no time will the vessel be in direct contact with any offshore structures and no personnel will be transferred between the vessel and any structures.

At the end of the installation work scope the vessel will report completion of work to the Marine and Helicopter Coordination and leave the location and the site.

The actual rock installation takes place in the immediate vicinity of the Wind Turbines. Throughout the operation, the standard safety zone for this type of vessel at Ørsted's wind farms will be 500 meters. Both the work vessel and MHCC will observe the surrounding shipping traffic and ensure that no violation of the safety zone occurs.

Marking of the wind turbines for navigation and aviation will not be affected by the works.

The installation will be done according to the high Ørsted QHSE standard and Marine Coordination procedures. Purpose built vessels and industry proven contractors with proved QHSE track records will be used. The safety of Personnel, the Environment and the Assets are in focus during the operation. All works will be carried out based on method statements including risk assessments.

In good time before the start of the work, the persons responsible for the stabilisation will be named, including contact details.

3.5 Ordnance (UXO)

During development of the Anholt Offshore Windfarm, surveys were performed, and processes and procedures adopted to mitigate the unexploded ordnance (UXO) risk to the project. Any potential unexploded ordnance (pUXO) which would restrict the construction of the windfarms, including but not limited to, scour protection and foundations, was inspected and if confirmed as unexploded ordnance (cUXO), subsequently removed. UXO overreaching reports provide assurance that the data collected applies to the correct standards to address this risk. From the data ALARP certification has been published which identifies any remaining pUXO within the windfarm which is not a construction risk. These remaining pUXOs are assessed and exclusion zones established.

3.6 Time Schedule

The stabilisation work is planned being conducted between 1st April 2023 and 31st October 2023 aiming for final consent approval and completion of the associated tender process to select the appropriate contractor to complete the work.

The total duration for the stabilisation works in Anholt Offshore Windfarm is approximately 26 days. This includes mobilisation, rock loading at the quarry in Norway, stabilisation works on site and demobilisation. Each of the 106 berm stabilisation will take between 2 and 5 hours to complete.

An installation schedule will be established in good time before the start of the work.

4 Environmental Impact Assessment

The environmental impact of constructing and operating the wind farm has been assessed prior to construction of the Anholt Offshore Windfarm and was completed in January 2010. The EIA report and associated documents can be accessed on the Danish Energy Agency's website under www.ens.dk. In the earlier environmental assessment placing of rocks for scour protection was also assessed as part of the overall construction works (please see following sections).

The planned stabilisation work is done separate to the construction of the wind farm and is small-scale and short-term work associated with the existing in situ infrastructure, and earlier conducted construction of the wind farm.

In the below is described the environmental impacts that can represent the most significant impacts both in the construction phase and in the operational phase. The sources of impact will be:

- General activity (above and under water)
- Physical structures (rock placement on the seabed)

The environmental impacts that these activities may cause are:

- Noise (airborne and underwater noise)
- Suspended sediment
- Permanent disturbance of seabed
- Light during nocturnal activities
- Temporary access restriction to safety zones around the work vessel

In addition, potential impacts on protected areas, cumulative impacts and mitigations measures are considered.

4.1 Underwater noise

Both the placing of rocks as well as the rock dumping vessel will increase the noise levels both below and above water for a limited period of time. Noise levels will by far not reach the construction noise levels (pile driving) and only slightly and temporarily increase operational noise levels by one additional vessel and rock dumping.

4.1.1 Marine Mammals

Underwater noise by vessels and rock dumping will be heard by marine mammals (harbour porpoises, harbour seals, grey seals). Temporary disturbance effects (scaring effects) by the construction works are possible. However, impairments (damages) caused by construction noise are not to be expected.

In a European Protected Species (EPS) Assessment Report [3], rock placement noise was estimated to be below a threshold for lethal effects or physical injury for porpoises. Although seals are not directly assessed (no EPS species), this assessment can be applied seals as well. Noise associated

with rock placement and vessel activity has the potential to disrupt communication for species such as harbour porpoise or to temporarily affect hearing. However, it is likely that marine mammals will move away from the area of the works and thus the works are considered to pose minimal threat to marine mammals. The effects are considered time-limited events and predicted to be short-term and reversible, with marine mammal activity returning to baseline levels after the vessel has passed and rock dumping has ceased. Also, the initial EIA concluded that - except for pile driving – all other noise impacts from construction and operation are expected to be minor [4].

4.1.2 Fish (demersal, pelagic)

The construction works may lead to temporary disturbance effects (scaring effects). Fish may leave the area during the works, but it is expected that they will quickly return when the construction work has ceased. Impairments (damages) caused by construction noise are not to be expected. The environmental monitoring programme carried out at Horns Rev and Nysted wind farms indicates that the construction itself only has short-term effects on fish [5].

4.1.3 Birds

Temporary disturbance (scaring effect) to resting birds in the area as a result of the planned work is possible within this region, although any disturbance is expected to be short-term and localised to the area of cable stabilisation work. In particular, no direct loss of habitat is expected due to the limited period of disturbance.

4.2 Airborne noise

For airborne noise, it is expected that the temporary noise from the additional vessel as well as from rock dumping will not significantly affect people on the coastlines on Djursland and Anholt. The additional noise will mainly be noticeable in the immediate vicinity of the offshore wind farm, also depending on distance, wind direction and ambient noise. It is expected that the overall significance of noise impact will still be minor as assessed in the EIA for construction, operation and decommissioning of the wind farm [7].

4.3 Suspended sediment

The rock dumping will temporarily increase the suspension of sediment, which will spread in the water column and on the sediment. Compared to digging or cable burial works, the effect caused by rock dumping is negligible. Since the top layer of the seabed consists primarily of sand with only a small content of finer particles, the suspended material will quickly sediment. No significant effects on plant and marine life are expected, neither as a result of the suspension in the water nor as a result of sedimentation on the seabed.

4.4 Permanent disturbance of the seabed

The planned work will have a local impact on benthos, sediments and bottom-dwelling fish as a result of the rock beams outside the existing scour protection. In the initial EIA, the assessment concluded that the areas covered by turbine foundations, scour protection and cables between the turbines together constitute a very small area of the total project area. Thus, the immediate loss of habitat for animals and plants was assessed to be limited and of minor importance. By the proposed rock placement additional seabed areas of approximately 10.954 m^2 will be covered (see also section 5). After completion of the works, the total area affected by turbine foundations and scour protections will amount to less than 0,06% of total wind farm area (88 km^2). Also, any impact on potential feeding ground for birds is assessed not to be significant.

On the other hand, the rock placement will cover a seabed consisting mainly of sand and lead to the formation of additional artificial reefs. From previous studies it has been documented that the introduction of hard substrate in the form of scour protection has resulted in an increased number of species of both algae and fauna as well as an increase in biomass [5]. This can potentially benefit fish [6] and birds. In addition, the artificial reefs with cave-forming elements could be beneficial for crabs and lobsters. Such changes to the fish fauna and productivity are likely to be neutral or even positive to opportunistic feeders like seal and porpoise.

4.5 Light emissions

The works are planned to be carried out both during night time and day time. This means that the work vessel will be illuminated during the night for safety reasons with regard to vessel traffic and working environment. This effect is mainly relevant above water.

For migratory birds, temporary impairments due to attraction effects (ship lighting during night time) may occur. This is considered to be negligible due to the limited period of time.

4.6 Navigational safety and temporary access restrictions

A 500m safety zone will be established around the work vessel when entering the Anholt site. It will be maintained at all times until the vessel leaves the site. This means that all other sailing, commercial and recreational activities will be prohibited in the vicinity of the work vessel over a relatively short period of time and thus the impact is negligible.

4.7 Natura 2000 and annex IV species

Natura 2000 sites are situated in the vicinity of Anholt Offshore Windfarm. The Natura 2000 site N46 "Anholt og havet herfor " consists of habitat protection area H42 and bird protection area F32. Moreover, the area was appointed as a Ramsar area R12. The bird protection area was in 2021 expanded to include the northwestern Kattegat. The Natura 2000 site N263 consists of bird protection area F127 “Nordvestlige Kattegat” which covers bird protection area F32, see Figure 11. The distance from the wind farm border to the nearest protected areas and/or international nature conservation area (NATURA 2000 sites, habitat areas, bird protection areas and Ramsar areas is listed in Table 2).

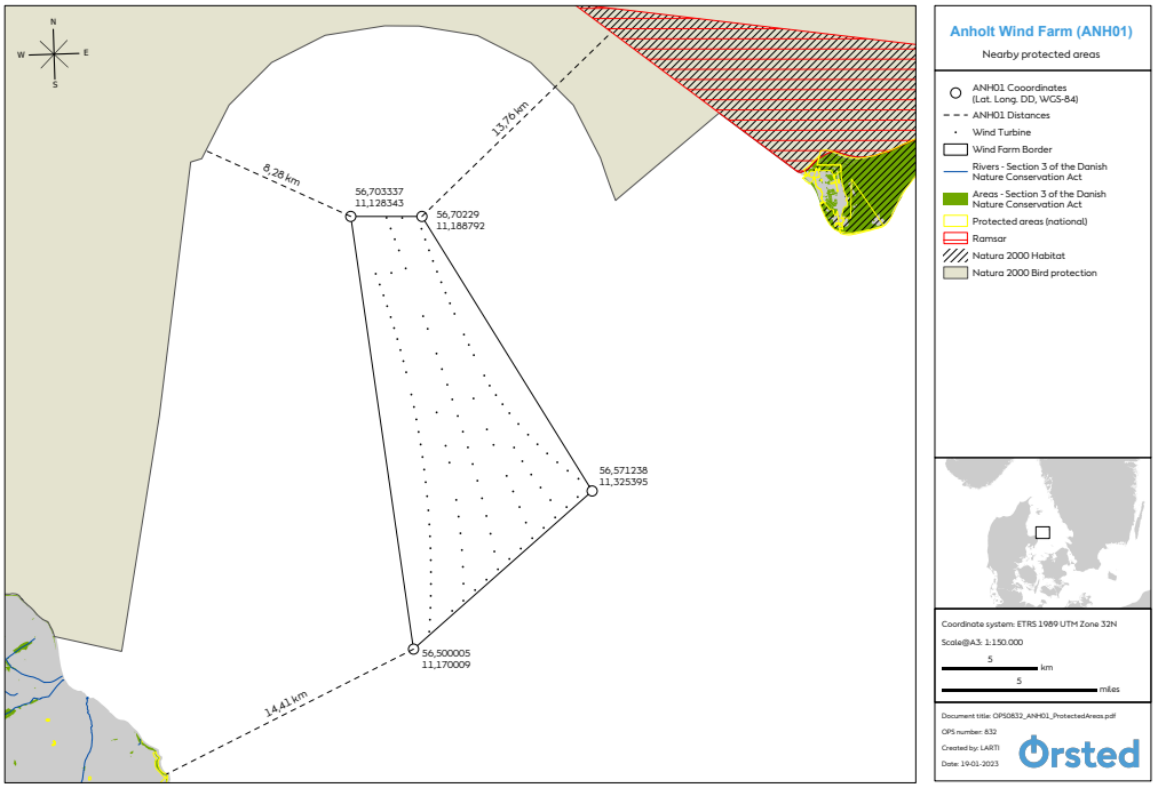

Figure 11: Anholt Offshore Windfarm is situated approximately 8-14 km from the nearest Natura 2000 site.

Table 2: Natura 2000 sites in the vicinity of Anholt Offshore Windfarm

Natura 2000 sites					
Natura 2000	**Protection**	**Location**	**Site**	**Name**	**Distance to windfarm site**
N46	H42	SAC42	DK00DX146	Anholt og havet nord for	14 km
N46	F32	SPA32	DK00DX032	Anholt og havet nord for	14 km
N46	R12	-	RAMSAR12	Anholt og havet nord for	14 km
N263	F127	SPA127	DK00FC371	Nordvestlige Kattegat	8 km

The marine protection within N46 ”Anholt og havet for” consists of both marine species, nature types and birds. Furthermore, additional bird species was added with the expansion of protection with N263 being appointed, ensuring a better protection of several bird species.

Table 3: Marine protected nature types and species (Miljøstyrelsen, 2021) [8]

Marine nature types and species protection within H42 Anholt og havet for		
Nature types:	Sandbanke (1110)	Sandbank
	Lagune (1150)	Lagune
Species:	Gråsæl (1364)	Grey seal
	Marsvin (1351	Harbour porpoise
	Spættet sæl (1365)	Common seal

Table 4: Protected bird species (Miljøstyrelsen, 2021; Miljøstyrelsen, 2022) [8], [9]

Bird species protected within F32 Anholt og havet for		
Birds:	Edderfugl (T)	Common eider
	Fløjlsand (T)	Velvet Scoter
	Havterne (Y)	Arctic Tern
	Dværgterne (Y)	Little Tern
	Sortand (T)	Common scoter
Bird species protected within F127 Nordvestlige Kattegat		
Birds:	Almindelig ryle (Y/T)	Dunlin
	Klyde (Y/T)	Avocet
	Dværgterne (Y)	Little Tern
	Havterne (Y)	Arctic Tern
	Mosehornsugle (Y)	Short-eared Owl
	Rødrygget tornskade (Y)	Red-backed Shrike
	Splitterne (Y)	Sandwich Tern
	Tinksmed (Y)	Wood Sandpiper
	Trane (Y)	Crane
	Edderfugl (T)	Eider
	Fløjlsand (T)	Velvet Scoter
	Lille Kobbersneppe (T)	Bar-tailed Godwit
	Lysbuget knortegås (T)	Brant Goose (Branta bernicla bernicla)
	Mørkbuget knortegås (T)	Brant Goose (Branta bernicla hrota)
	Rødstrubet lom (T)	Red-throated Diver
	Sortand (T)	Common scoter

The planned work will not impact any protected nature types due to the distance to the Natura 2000 sites. No work will be carried out within the Natura 2000 area and possible sedimentation in connection with rocks dumping will not constitute any risk for impacting the marine nature types. Therefore, potential impacts on nature types will not be assessed any further.

The planned work is assessed to potentially cause a temporary impact of birds and marine mammals due to temporary displacement of individuals that might be in area during the time of construction work.

Birds

Based on the planned work it is assessed not to impact any breeding sites or cause any risk of collisions and barrier effect for migratory birds. Resting birds can be displaced with an increasing risk of mortality; however the planned work is determined not to have any significant impact to any surrounding protected areas, due to the local and temporary effect of the work and the large distance to the closest protected area, see Figure 11. Therefore, it is assessed that the planned work can be conducted without risk of adverse effects on stocks of resting sea ducks or significant negative impact on breeding and migratory birds. Moreover, it is assessed that the works within Anholt Offshore Windfarm cumulatively with other projects in the area will not affect birds or constitute any risk of negative impact on the biogeographical population.

Harbour porpoise

Harbour porpoise (Phocoena phocoena) is listed under the Annex II and Annex IV of the European Habitats Directive (Directive 92/43/CEE) and is protected in its entire distribution.

Harbour porpoises are likely to be present and forage throughout the Natura 2000 site and the adjacent area in and around Anholt Offshore Windfarm, and hereby the project area.

As mentioned in Section 4.1.1 underwater noise can increase noise levels while placing rocks and operation of the vessel used during the work operation. However underwater noise associated with these activities are not to such a magnitude that the activities can cause hearing damage in harbour porpoises. Both vessel traffic and underwater activity can however temporarily displace individuals from an area (Nabe-Nielsen, 2014) [10]. Since harbour porpoises move over great distances in their foraging it is therefore assessed that the species have good opportunities to move away from the area during the planned work, and thereby not significantly impact the species. Furthermore, harbour porpoises are assessed to return to the area after finishing construction, and the work is therefore not expected to have a long-term impact on species or constitute any risk of negative impact on the population.

Seals

Both harbour seals and grey seals have breeding and resting places in the Natura 2000 area near Anholt, which is approximately 18 km from the offshore windfarm area. The species move over long distances in their foraging, and it must be assumed that both species forage within Anholt Offshore Windfarm and thereby the project area. However, for same reason the species will be able to go to other foraging areas during the construction work, and that species are only impacted very locally and temporarily. The work is therefore not expected to have a long-term impact on either harbour seal or grey seal or impact breeding areas due to the long distance to the project area. The impact is considered time-limited and predicted to be short-term and reversible, with marine mammal activity returning to baseline levels after the vessel has passed and rock dumping has ceased as mentioned in Section 4.1.1.

5 Cumulative Effects

It is expected that most of the impacts assessed before will not cause any cumulative effects as they are likely to be temporary, small-scale or localized, and there are no other plants/activities that are considered to give rise to cumulative effects. By using one additional vessel for a limited period of time, it is considered that neither wind farm vessel traffic nor commercial or recreational vessel traffic will be significantly increased.

The only additive effect is the increase in seabed loss/change due to placement of additional rock berms within the same area (see also Section 4.3). As shown in Table 5, currently an area of approximately 38.570 m² is used by 111 monopiles and 42 scour protection pads in the Anholt Offshore Windfarm. By the planned rock placement an additional area of approximately 9.274 m² on virgin seabed will be covered by rocks (+24%). However, even after the stabilisation campaign the area used for monopiles and scour pads will be less than 0,06% of the total wind farm area of 88 km² and still well below the area considered in the original EIA (0.1 to 0.4% of 88 km²).

Considering the planned rock placement as well at the OSS, an additional area of 2.187 m² is planned to be covered by rocks. After the stabilisation campaign the total area covered by rocks will amount to 50.031 m² which is still less than 0,06% of the total wind farm area.

Table 5: Cumulative Area used for Monopiles, OSS and Scour Protection

	WTG	OSS	Total
Current area used for foundations and scour protection	38.570 m²	507 m²	39.077 m²
New area used for scour protection by stabilisation campaign	9.274 m²	1.680 m²	10.954 m²
Future (cumulative) area used for foundations and scour protection	**47.844 m²**	**2.187 m²**	**50.031 m²**
Total area of Anholt Offshore Windfarm	88 km²		
Percentage of wind farm area used for foundations and (future) scour protection	**0,054%**	**0,002%**	**0,057%**

6 Mitigation Measures

It is fundamental to note that the proposed CPS stabilisation via berms is expected to minimize the likelihood of future works, specifically cable replacements. In effect, conducting the stabilisation works now will mitigate the requirement for cable replacement works. Cable stabilisation, primarily via rock berms will result in reduced environmental effects at the seabed compared to a full cable replacement campaign. The latter would result in a much greater impact i.e. direct removal and associated seabed excavation associated with failed cables, potential trenching or use of mass flow excavators for ‘new’ cable burial, and then potentially greater lengths of associated rock berms (compared to stabilisation berms).

Wind turbines positions to be stabilised were assessed carefully and limited to positions that already have a scour protection (42 out of 111 positions). By limiting the number of positions to the ones with highest damage risks, actual mitigation has already taken place.

Only natural rocks will be applied to prevent the release of chemicals or plastic particles (by artificial rocks or rock nets).

7 References

[1] ANH01 Seabed and scour protection integrity assessment 2012-2018 (02396279_B).pdf. Orsted

[2] Anholt Offshore Windfarm - Rock berm cover layer for CPS stabilisation – WTG scour protected foundations (07957603_A).pdf. Orsted,

[3] EPS Risk Assessment for Work Proposed in 2018 Caithness to Moray HVDC Project. Document No. 1156585. Issue A. Natural Power, 2017.

[4] Anholt Offshore Windfarm – Marine Mammals. Ramboll / DHI, December 2009

[5] Offshore Wind Farms and the Environment - Danish Experiences from Horns Rev and Nysted. Published by the Danish Energy Authority, November 2006

[6] Danish Offshore Wind – Key Environmental Issues – a Follow-up. Published by The Environmental Group: The Danish Energy Agency, The Danish Nature Agency, DONG Energy and Vattenfall February 2013.

[7] Anholt Offshore Windfarm - Tourism and Recreational Activities, Ramboll Oil & Gas. December 2009

[8] Miljøstyrelsen (2021). Natura 2000-plan 2022-2027. Anholt og havet nord for. Natura 2000-område nr. 46. Habitatområde H42. Fuglebeskyttelsesområde F32. Miljøstyrelsen Midtjylland. ISBN: 978-87-7564-494-0. https://mst.dk/media/235442/n46-natura-2000-plan-2022-27-anholt-og-havet-nord-for.pdf

[9] Miljøstyrelsen (2022). Udpegningsgrundlag for Natura 2000-områderne. Gældende udpegningsgrundlag – 2022. Oversigt over Fuglebeskyttelsesområdernes udpegningsgrundlag maj 2022. https://mst.dk/service/nyheder/nyhedsarkiv/2021/dec/nye-marine-fuglebeskyttelsesomraader-er-udpeget/

[10] Nabe-Nielsen, J. S. (2014). Effects of noise and by-catch on a Danish harbour porpoise population. Ecological Modelling.

8 Appendix

8.1 UTM coordinates of wind turbine positions and OSS included in the scope

WTG ID	E - ETRS89 UTM32	N -ETRS89 UTM32	WTG ID	E - ETRS89 UTM32	N - ETRS89 UTM32
A02	634426.5	6265371.2	H01	639155.0	6269079.0
A11	634343.5	6271072.2	I02	630421.0	6270433.0
A12	634280.5	6271072.2	I04	638755.0	6272056.0
A16	633943.3	6274505.1	I05	638418.0	6272966.0
A17	633836.6	6275158.0	I10	636695.0	6276901.0
A23	633045.0	6278846.0	P01	642718.0	6272315.2
A24	632892.0	6279243.0	P02	642154.5	6272717.4
A27	632386.0	6281140.0	P04	641052.7	6273574.4
A29	632011.0	6282274.0	P10	638204.8	6276600.2
A30	631812.0	3282837.0	P11	637061.0	6277079.1
C12	634775.2	6276173.0	P12	637533.7	6277568.1
E01	637389.0	6267456.0	P13	637253.9	6278095.0
F08	636402.5	6274351.4	P15	636711.0	6279161.0
F10	635875.2	6275987.0	P16	636451.0	6279695.0
F11	635589.0	6276850.0	P17	636196.0	6280232.0
F12	635330.7	6277616.9	P19	635705.0	6281314.0
F13	635051.9	6279429.7	P20	635469.0	6281859.0
F24	634072.0	6281199.0	P21	635239.0	6282406.0
F27	932598.3	6285195.1	P23	634797.0	6283509.0
F29	632169.0	6286316.0	P24	634585.0	6284064.0
G01	639560.0	6268538.0	P25	634380.0	6284621.0
H01	639155.0	6269079.0			

Asset ID	E - ETRS89 UTM32	N - ETRS89 UTM32
OSS	632182	6274469

Ørsted

Anholt Offshore Windfarm– Supplement to Cable Stabilisation Memo

Additional assessment in relation to

- the environmental effect of hard substrate
- water quality
- Water Framework Directive

Prepared Gundula Fischer (GUNFI)

Checked Signe Dons (SIGDO)

DORECO No. 08175078_A

Document Date 24 April 2023

Table of contents

1 Introduction

For the planned stabilisation of cable protection systems and cables, a memo [1] was drafted and submitted to the Danish Energy Agency. The memo contains a description of the planned stabilisation by rock placement on the CPS and associated array cables at the scour protected wind turbine positions and the offshore substation. In addition, it presents an assessment of the potential environmental effects, and any impacts, from the planned stabilisation ('screening').

This document will provide additional information on the aspect of the existing hard substrate introduced by offshore windfarms, the epifauna that has developed on the foundation and scour protection within the offshore windfarm and the potential impact of the planned additional rock placement.

Further, this document will address the comments made by the Environmental Protection Agency and focus on potential impacts on water quality and the good state according to the Water Framework Directive (WFD).

2 Background

In the memo "*Anholt Offshore Windfarm - CPS and Cable Stabilisation at Scour Protected Monopile Locations*" [1] the environmental impact assessment regarding permanent disturbance of the seabed came to the following conclusion:

"*The planned work will have a local impact on benthos, sediments and bottom-dwelling fish as a result of the rock berms outside the existing scour protection. Any impact on potential feeding ground for birds is assessed not significant. In the initial EIA, the assessment concluded that the areas covered by turbine foundations, scour protection and cables between the turbines together constitute a very small area of the total project area. Thus, the immediate loss of habitat for flora and fauna was assessed to be limited and of minor importance".*

By the proposed rock placement additional seabed area of approximately 10.954 m^2 will be covered. The rock placement will cover a seabed consisting mainly of sand and lead to the formation of additional artificial reefs. Thereby, a total area affected by turbine foundations and scour protections will amount to less than 0,06% of total wind farm area (88 km^2).

The current document describes the established benthic flora and fauna in relation to the existing foundations and scour protection both in relation to Anholt Offshore Windfarm and learnings from other studies and findings within other offshore windfarms. It also includes additional information on a potential impact on water quality and the good state according to WFD.

3 Benthic flora and fauna around wind turbines

From previous studies it has been documented that the introduction of hard substrate in the form of scour protection has resulted in an increased number of species of both algae and fauna as well as an increase in biomass [1]. This can potentially benefit fish [3] and birds. In addition, the artificial reefs with cave-forming elements could be beneficial for crabs and lobsters. Such changes to the fish fauna and productivity are likely to be neutral or even positive to opportunistic feeders like seal and porpoise. [1].

3.1 Anholt Offshore Windfarm

Within Anholt Offshore Windfarm marine surveys of the cable protection systems, cables and scour protection around turbines have identified several positions at which stabilisation is needed.

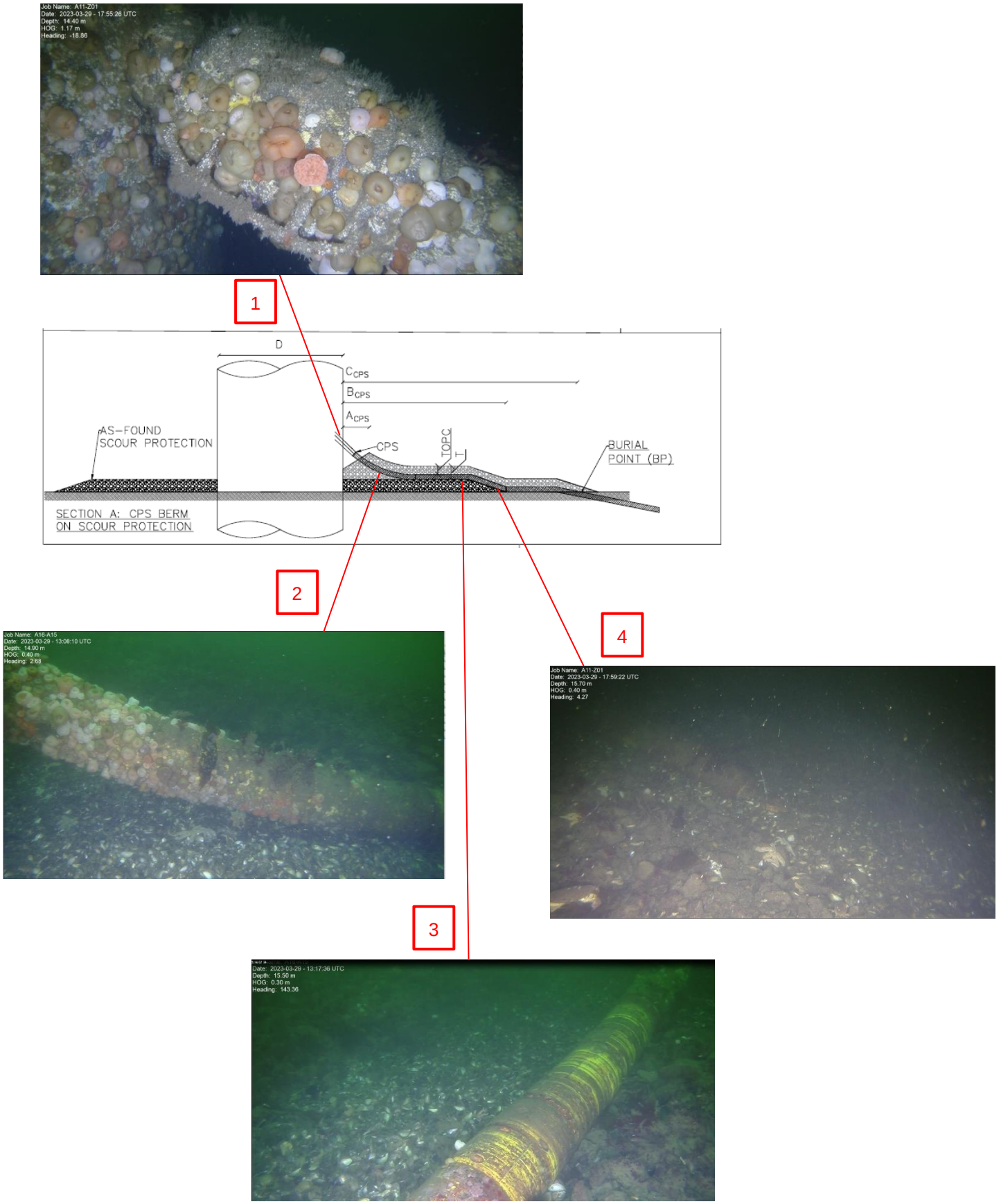

Figure 1: Monopile, cable protection system and scour protection in Anholt Offshore Windfarm (ROV pictures)

During the marine surveys with ROV different species were registered in different parts of the structures. Picture 1 shows marine growth of different species of mainly sea anemones on both the monopile and the upper part of the cable protection system where it leaves the monopile. Picture 2 shows, that the marine growth decreases in the area where the cables touches the scour protection pad. Further down the cable, on picture 3, only limited marine growth can be observed on the cable protection system (red and yellow part). This indicates the abrasion of the cable protection system; cables that are more stable are more colonized by phytobenthos on the surface. At many of the examined positions the scour protection pad beneath the cable is covered by blue mussels and mussel shells. Sea stars and crabs were present in these areas. But there are also positions, where no or only few mussels were registered. Some parts of the cables were found to be almost buried by sediments, rocks and mussel shells (Picture 4).

It should be noted that the survey was conducted in March where least marine growth is present.

However, when Ørsted built Anholt Offshore Wind Farm in Denmark in 2012, around 5,800 boulders on the seabed had to be moved to make way for foundations and cables. These boulders were placed within the offshore windfarm as 25 boulder reefs, see Figure 2.

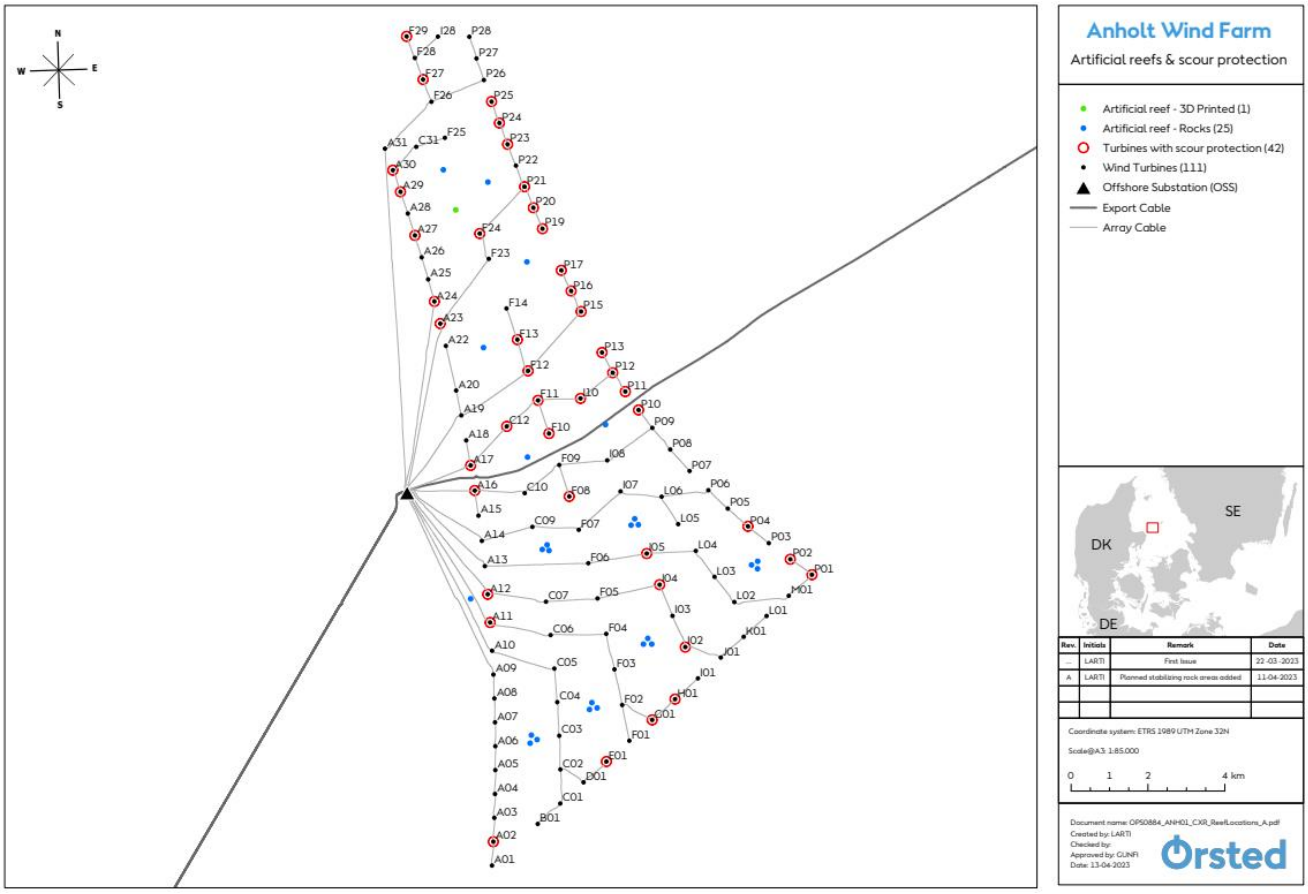

Figure 2: Location of boulder reefs in Anholt Offshore Windfarm

Today, a decade later, marine life is thriving and the boulder reefs have become a breeding and nursery ground for fish [6]. There is a large biomass of red, green and brown macroalgae like sea beech, spaghetti algae and sugar kelp, various sea anemones, star fish, crabs as common shore crab, and fish as goldsinny wrasse typical for reef environments, see Figure 3.

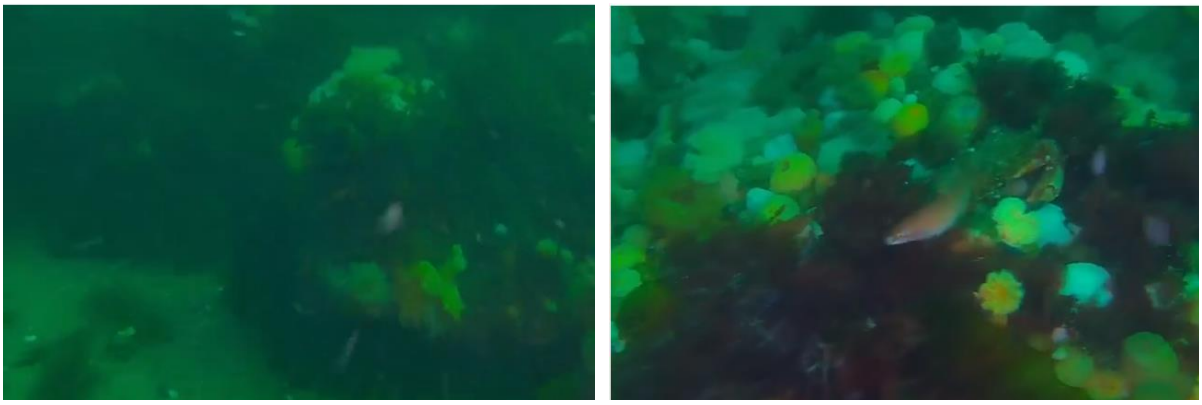

Figure 3: ROV Images from boulder reef in Anholt Offshore Windfarm [6]

Although the boulders are of a much larger size than the rocks placed for scour protection around the monopile foundations, it shows that hard substrate can support an increase of biomass and biodiversity of benthic organisms and fish.

3.2 Other studies

3.2.1 Danish studies in Horns Rev 1 and Nysted

On the Danish offshore wind farms Horns Rev 1 and Nysted, commissioned in 2002 and 2003, a monitoring programme was carried out in 2000-2006 to assess the impacts of the construction of the wind farms [2].

The monitoring programmed showed that the wind turbine foundations introduced hard bottom structures that changed benthic communities from typical infauna communities to hard bottom communities. Before construction of the wind farms, the seabed almost exclusively consisted of sandy sediments. Overall, the wind farms increased habitat heterogeneity as well as the abundance and biomass of benthic communities.

During the monitoring programme researchers also monitored fish abundance and diversity at both wind farm sites as well as at a reference area. However, concerning fish and fish populations the monitoring programme showed few effects on the fish fauna. Moreover, the programme showed that some species were attracted. A follow-up programme concerning fish was initiated focusing on long-term and cumulative effects on fish, marine mammals and birds. Extending seven years after the deployment of the wind farm in 2003, the follow-up study [3] carried out in 2009/2010 on Horns Rev was the first long-term study of the effects of offshore wind farms on fish communities. The extended programme showed that a number of fish species were attracted towards the wind turbine foundations, and this has now resulted in a higher number of species inside the wind-farm area compared to areas outside the wind farm.Overall the studies showed that offshore wind farms did not have any negative impact on fish abundance, and a number of species appears to use the foundations and associated scour protection as refuge areas for hide and forage.

The positive effect may be enhanced by exclusion of commercial fishing inside the wind farm area and thus function as a small marine protected area. However, the area occupied by an offshore wind farm is relatively small compared the spatial use of most migratory species with a broad distribution pattern. The cumulative effect of multiple wind farms located close together within the same region might therefore be beneficial to fish communities.

3.2.2 Research project “SeeOff”

Within the framework of the research project “SeeOff” (Strategieentwicklung zum effizienten Rückbau von Offshore-Windparks - Development of efficient strategies for offshore wind farm decommissioning), a consortium of science and industry examined the decommissioning of offshore wind farms in detail. The final report also addresses the topics of sustainability and biodiversity.

It concluded that “Man-made offshore structures attract hard-substrate species, thereby altering the community composition within the area. Increased food availability attracts mobile predators, changing the trophic composition and energy flow and thus altering the local foodweb (Dannheim et al. 2017; van Hal et al. 2017). Offshore structures can also act as steppingstones, thereby increasing habitat connectivity and benefitting pelagic dispersal and movement of mobile marine species (Dannheim et al. 2017; Hyder et al. 2017). Some species profit from the refugium effect of the offshore structures by using them as feeding, spawning and nursing grounds (Krone et al. 2017; Stenberg et al. 2015; Reubens et al. 2013). Offshore Windfarm decommissioning consequently directly or indirectly impacts the associated benthic communities.“ [4].

This correlates with the conclusion of a literature review carried out by Vattenfall that was presented in one of the SeeOff workshops 23.04.2021 [5]. The review concluded that offshore wind farms have been found to be associated with

- increased diversity of benthic organisms (e.g. Lindeboom et al. 2011)
- increased abundance of reef-dwelling fish species and potential increased fish production at local scale (e.g. Glarou et al. 2020) and
- even in some cases increased occurrence of marine mammals in OWF or foraging among the foundations. (e.g. Scheidat et al. 2011; Russel et al. 2014).

It also concluded that scour protection of offshore wind farms can provide ecosystem services resembling artificial reefs, offering shelter, nursery, reproduction and feeding opportunities, while the loss of sub-bottom habitat from introduction of hard substrate in offshore wind farms is generally considered insignificant.

The combination of typical size of scour protection and distance between individual foundations in offshore wind farms is likely to increase per-capita food availability for fishes (Ogawa et al. 1977; Champion et al. 2015).

At the same time scour protection could potentially facilitate introduction of invasive species by functioning as steppingstones or attract indigenous species not naturally residing in the area.

3.3 Summary of potential effect of hard substrate

The studies and findings referenced in this document support the conclusion, that rock placement on a formerly sandy seabed does not have a significant negative impact on the environment. The effect will most likely be rather neutral and even has a potential to positively impact flora and fauna. Moreover, scour protection of offshore wind farms can provide ecosystem services resembling artificial reefs, offering shelter, nursery, reproduction and feeding opportunities, while the loss of sub-bottom habitat from introduction of hard substrate in offshore wind farms is generally considered insignificant due to the limited area affected in relation to the overall wind farm area.

In the current case introduction of hard substrate in the form of scour protection around turbines and cables has resulted in a minor increase of benthic flora and fauna, if assessing the available ROV data from the latest marine survey and depending on the location of the underwater parts of the structures (foundation, cable protections system, scour protection pad).

In summary it can be concluded that additional scour protection in areas with existing protection will only have a minor impact on existing benthic flora and fauna, and that additional scour protection can increase habitat heterogeneity as well as the abundance and biomass of benthic communities.

4 Water quality

Anholt Offshore Wind Farm is located in the territorial waters. The Law on Water Planning (LBK No. 126 of 26/01/2017) requires preventing deterioration of and achieve good condition for surface and groundwater bodies. For territorial waters it is required to assess the objective on the fulfilment of good chemical status regarding EU priority substances (which appears inter alia by Annex 2 of BEK no. 1625 of 19/12/2017).

The rock material used for the planned cable stabilisation will be obtained from approved sources of sound, compact, hard, durable, natural stone/rock resistant to action of sea water and free of cracks and fissures detrimental for the proper performance of the material in question.

The rock material used will be natural rock from Norway that is seawater resistant, meaning that there are no concerns of any chemicals being released to the territorial water. Thus, it is assessed that the chemical status of the seawater will not be impacted by the planned rock placement.

Rock placement associated with cable stabilisation works could result in a short-term (hours), localised (tens and hundreds of metres from works) increase in suspended sediment concentration in the area of the works. Since the top layer of the seabed at the positions to be stabilised consists primarily of sand with only a small content of finer particles, the suspended material will quickly sediment. Impacts relating to cable stabilisation works will be of lower magnitude than those assessed for foundation and cable installation and therefore considered negligible.

Further, contracting requires contractors and vessels to minimise the risk of contamination during the works, including requirements for HSE (Health, Safety and Environment) such as strict requirements for the handling of pollutants and waste. In addition, vessels and equipment are supervised along the way.

To summarise, the planned rock placement associated with cable stabilisation works will not affect the environmental status in relation to water quality.

5 Environmental assessment in relation to the Water Framework Directive (WFD)

The Water Framework Directive (WFD) is a European environmental legislation that aims at maintaining and improving the aquatic environment in the Community. It requires all Member States to protect and improve water quality in all waters so that good ecological status is achieved by 2015 or, at the latest, by 2027.

The main goal of the Marine Directive is to achieve Good Environmental Status (GES) of EU marine waters. To help Member States interpret what GES means in practice, the Directive sets out, in Annex I, eleven qualitative descriptors which describe what the environment will look like when GES has been achieved.

The Marine Strategy Act, which is the Danish implementation of the EU Marine Strategy Directive, contains a total of 11 qualitative descriptors for describing good environmental status. Therefore, an assessment is made of the possible impact of rock placement associated with cable stabilisation works on the individual qualitative descriptors (D1-D11).

Table 1: Assessment of the potential environmental impact on the eleven qualitative descriptors (D1-11) in the Marine Directive

Qualitative Descriptors	Description of qualitative descriptor	Assessment of impact of the planned rock placement on the descriptors as defined in the Water Framework Directive (WFD)
Descriptor 1 - Biodiversity is maintained	Biodiversity has been maintained. The quality and availability of habitats, as well as the distribution and abundance of species, correspond to the prevailing physiographic, geographical and climatic conditions.	The planned rock placement associated with cable stabilisation works will have a local impact on the aquatic environment by introducing a limited volume of hard-bottom substrate to the rock placement areas. Both original soft-bottom communities on virgin seabed as well as established hard-bottom fauna on the scour protection pad will be covered by rocks. It is expected that on the newly introduced rocks new hard-bottom communities will restore quickly and areas with originally soft-bottom communities will be replaced by hard bottom communities. Latter may lead to the formation of artificial reefs with an increased number of species of both algae and fauna as well as an increase in biomass. Compared to the entire wind farm area, these changes are small in scale and very local and biodiversity in the area is assessed to be maintained. The rock placement will not add pollutants (nutrients and heavy metals) or result in climate change. Thus, it is assessed that the environmental status of the area in relation to D1 can be maintained.
Descriptor 2 - Non-indigenous species do not adversely alter the ecosystem	Non-native species introduced by human activities are at levels that do not adversely alter ecosystems.	The planned rock placement associated with cable stabilisation works is not considered to entail a risk of introducing non-native species because vessels that may be used in connection with the planned work will follow all national and international guidelines during any planned operations. Thus, it is assessed that the rock placement will not affect the environmental status of the area in relation to D2.
Descriptor 3 - The population of commercial fish species is healthy	The populations of all commercially exploited fish and shellfish species are within safe biological limits and show an age and size distribution indicative of a healthy population.	The planned rock placement associated with cable stabilisation works are not considered to entail a risk of affecting commercially exploited fish and/or shellfish species since impairments (damages) to fish caused by the works are not to be expected. The rock placement works may lead to temporary disturbance effects (scaring effects) where fish may leave the area during the works, but it is expected that they will quickly return when the stabilisation work has ceased. It is therefore assessed that the rock placement works will not change the populations of the area's fish and shellfish species, including changes in age or size distribution. Thus, it is assessed that the rock placement will not affect the environmental status of the area in relation to D3.

Qualitative Descriptors	Description of qualitative descriptor	Assessment of impact of the planned rock placement on the descriptors as defined in the Water Framework Directive (WFD)
Descriptor 4 - Elements of food webs ensure long-term abundance and reproduction	All elements of the marine food web – to the extent known – are present and occur at normal density and diversity and at levels capable of maintaining the full reproductive capacity of the species and a stable species density.	The planned rock placement associated with cable stabilisation works are not considered to cause any impact on the marine food web since the work will only constitute a local impact within the existing offshore wind area, and the planned work is very limited in scope both in time and space. The introduction of hard substrate will temporarily cover existing soft- and hard-bottom biogenic communities, but communities will quickly recover and potentially contribute positively to the area's species diversity. However, it is assessed that the planned rock placement will only constitute a local impact within the existing offshore wind area and is very limited in scope both in time and space. Thus, it is assessed that any work will not affect the environmental status of the area in relation to D4.
Descriptor 5 - Eutrophication is minimised	Anthropogenic eutrophication is minimised, in particular its negative effects, such as biodiversity loss, ecosystem degradation, harmful algae deposits and lack of oxygen on the water floor.	The planned rock placement associated with cable stabilisation works are not considered to result in the addition of nutrients that could contribute to eutrophication since the rock placement does not provide nutrients, in particular nitrates and phosphates, which can contribute to the growth of phytoplankton and thus contribute negatively and create imbalances in marine ecosystems. Thus, it is assessed that the rock placement will not affect the environmental status of the area in relation to D5
Descriptor 6 - The sea floor integrity ensures functioning of the ecosystem	The integrity of the seabed is at a level that ensures that the structure and functions of ecosystems are preserved and that benthic ecosystems in particular are not adversely affected.	The planned rock placement associated with cable stabilisation works are considered likely to locally alter the integrity of the seabed by replacing limited areas of soft bottom substrate by hard bottom substrate. Due to its limited spatial extent, the impact is assessed to be negligible in proportionality to the overall wind farm area. It is therefore considered that the structure of the ecosystem and the functions of the area are preserved without a negative impact. Thus, it is assessed that the rock placement will not affect the environmental status of the area in relation to D6.
Descriptor 7 - Permanent alteration of hydrographical conditions does not adversely affect the ecosystem	Permanent alteration of hydrographic characteristics does not adversely affect marine ecosystems.	The planned rock placement associated with cable stabilisation works are considered likely to lead to an interaction between the hydrodynamic regime (waves and currents) and the rock berms. This interaction is assessed to be of limited and local extent, similar to the interaction already incurred by the existing scour protection pads. It is therefore considered that this interaction will have a very limited and local effect which is assessed to not adversely affect the overall marine ecosystem. Thus, it is assessed that the rock placement will not affect the environmental status of the area in relation to D7.

Qualitative Descriptors	Description of qualitative descriptor	Assessment of impact of the planned rock placement on the descriptors as defined in the Water Framework Directive (WFD)
Descriptor 8 - Concentrations of contaminants give no effects	Concentrations of pollutants are at levels that do not give rise to pollutant effects.	The planned rock placement associated with cable stabilisation works are not considered to cause any pollution effects in the area since only hard, durable, natural rock largely resistant to action of sea water is introduced to the area. Further, contracting requires contractors and vessels to minimise the risk of contamination during the works, including requirements for HSE (Health, Safety and Environment). In addition, vessels and equipment are supervised along the way. Thus, it is assessed that the rock placement will not affect the environmental status of the area in relation to D8.
Descriptor 9 - Contaminants in seafood are below safe levels	Contaminants in fish and shellfish intended for human consumption do not exceed the levels laid down in Community legislation or other relevant standards.	The planned rock placement associated with cable stabilisation works are not considered likely to lead to changes in the levels of contaminants in fish and shellfish intended for human consumption since only hard, durable, natural rock largely resistant to action of sea water is introduced to the area. Further, the contractor is subject to strict requirements for the handling of pollutants. Thus, no pollutants that can be absorbed by marine organisms, including shellfish for human consumption, will be emitted. Thus, it is assessed that the rock placement will not affect the environmental status of the area in relation to D9.
Descriptor 10 - Marine litter does not cause harm	The properties and quantities of marine litter do not harm the coastal and marine environment.	The planned rock placement associated with cable stabilisation works are not considered likely to result in an increased amount of marine waste since the contractors and vessels will be required to bring all waste ashore and ensure disposal in accordance with the current rules and regulations. Moreover, vessels and contractors are supervised during any marine operation. Thus, it is assessed that any work will not affect the environmental status in relation to D10.
Descriptor 11 - Introduction of energy (including underwater noise) does not adversely affect the ecosystem	The introduction of energy, including underwater noise, is at a level that does not adversely affect the marine environment.	The planned rock placement associated with cable stabilisation works are considered likely to cause underwater noise in connection with the rock placement. Both the rock dumping and the operating vessel will cause the spread of underwater noise. However, the noise levels emitted during the works will by far not reach the construction noise levels (pile driving) and only slightly and temporarily increase operational noise levels. The expected noise levels are not considered to pose a threat to marine mammals or other marine organisms. Thus, it is assessed that the rock placement will not affect the environmental status of the area in relation to D11.

6 References

[1] Anholt Offshore Windfarm – Stabilisation of Cable Protection Systems and Cables at Scour Protected Monopile Locations and the Offshore Substation. Works Description and Environmental Assessment. Ørsted Document No. 08038423_A, 09 March 2023

[2] Offshore Wind Farms and the Environment - Danish Experiences from Horns Rev and Nysted. Published by the Danish Energy Authority, November 2006
https://naturstyrelsen.dk/media/nst/Attachments/havvindm_korr_16nov_UK.pdf

[3] Danish Offshore Wind – Key Environmental Issues –a Follow-up. Published by The Environmental Group: The Danish Energy Agency, The Danish Nature Agency, DONG Energy and Vattenfall. February2013.
https://ens.dk/sites/ens.dk/files/Vindenergi/havvindmoellebog_web1.pdf

[4] Handbook of offshore wind farm decommissioning. Final report of the research project “SeeOff” (Development of efficient strategies for offshore wind farm decommissioning). May 2022.
https://www.seeoff.de/data/publications-20220621-1-kNEpoY1G.pdf

[5] Vattenfall Presentation at SeeOff Workshop on 23.04.2021
https://www.seeoff.de/data/events-20210531-1-pDehSGt6.pdf

[6] Ørsted underwater video from boulder reefs in Anholt Offshore Windfarm 2023
https://www.linkedin.com/posts/orsted_boulder-reefs-at-anholt-offshore-wind-farm-activity-7023590463223824384-_SaI/?utm_source=share&utm_medium=member_desktop