Diamond Transmission Partners

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Hornsea Two Limited

Decommissioning Programme

Document History

Issue	Date	Summary of Changes / Reasons	Author(s)	Approved By (Inc. Job Title)
1	06/10/22	First issue	T Chitifa	G Thornton

TABLE OF CONTENTS

Contents

1 Introduction

This document presents the proposed OFTO Decommissioning Programme ("**DP**") for the Diamond Transmission Partners Hornsea Two Limited ("**DTPHT**") assets and is based upon the DP[1] proposed by Ørsted Wind Power A/S Limited (the **"Developer**"). The DP proposed by DTPHT is informed and supported by the Environmental Statement ("**ES**") produced and issued in 2015 by the Developer.

The project is a wind farm developed by the Developer with a maximum capacity of 1386MW and a Transmission Entry Capacity ("**TEC**") of 1320MW.

The Hornsea Offshore Wind Farm Project Two ("**HOW02**") has been awarded a number of primary consents necessary for its construction and operation. Those consents with provisions relating to decommissioning of the offshore wind farm are shown in Table 1.1.

Table 1.1: Hornsea Offshore Wind Farm Project Two Consents

Regulation	Legislative Context	Achieved Consents	Authority
Secretary of State for the Department for Business, Energy and Industrial Strategy ("**BEIS**") / Planning Inspectorate ("**PINS**")	Development Consent Order ("**DCO**") – The Planning Act 2008	Consent granted 16 August 2016 DCO grants overall consent for the entire scheme, containing the maximum and minimum design parameters that the project must comply with	Secretary of State for BEIS/ PINS
Secretary of State for BEIS / PINS	Development Consent Order ("**DCO**") – The Planning Act 2008	Consent granted 16 November 2016 (Correction)	Secretary of State for BEIS/ PINS
Secretary of State for BEIS / PINS	Development Consent Order ("**DCO**") – The Planning Act 2008	Consent granted 14 March 2018 (Amendment)	Secretary of State for BEIS/ PINS
Marine Management Organisation	Marine and Coastal Access Act 2009 - Part 4 – Marine Licensing	Deemed marine licence granted as part of the DCO awarded 16 August 2016.	Marine Management Organisation

In accordance with Section 105(02) of the Energy Act 2004, the Developer was required to prepare a draft DP for the HOW02 project and to submit the document to BEIS for approval prior to the construction of the wind farm.

The DP outlines the methods for decommissioning, and is consistent with the relevant requirements outlined in the BEIS Guidance: Decommissioning of offshore renewable energy installations under the Energy Act 2004: guidance notes for industry – last updated 21 March 2019. The scope of the decommissioning applies between the mean low water mark and the seaward limits of the territorial sea and waters in a Renewable Energy Zone (Energy Act,

[1] 04.04.70 HOW02 Decommissioning Programme (01139282_D)

2004). Cables on the landward side of the Mean Low Water Springs are considered onshore and outside the scope of this document.

The Developer's DP has been submitted to BEIS on 21 December 2018 for and is awaiting approval in accordance with Section 105 of the Energy Act 2004. In its financial security document, the Developer states that the OFTO assets will be decommissioned by the appointed OFTO. This will remove any obligations the Developer has under the licence and these will pass on to the OFTO.

If possible, the generator assets will be decommissioned at the same time as the DTPHT assets after the expected operational life time of 24 years. At the end of their lifetime, the transmission assets will be decommissioned in order to restore the site as far back to its original conditions as possible.

The DP will be continuously reviewed and revised throughout the life of the project. These reviews will take into account any changes in legislation, circumstances, technological advancements and regulatory requirements.

DTPHT will adopt the principles of the BEIS programme process stages and will follow the process as set out below.

Table 1.2: BEIS Programme Process Stages

Stage	Description
Stage 1	Preliminary discussion between BEIS and the developer
Stage 2	Issue of s 105 notice by Secretary of State requiring a DP be submitted within a specified timescale
Stage 3	Detailed discussions; submission and consideration of a draft programme (including proposed financial security measures)
Stage 4	Consultation with interested parties
Stage 5	Formal submission of a DP and approval under section 106 of the Act
Stage 6	In operation updates: • reviews and modifications of the approved DP (and any financial security) leading up to Secretary of State accepting/requiring any relevant modifications to the final pre-decommissioning version; and • changes in timeline or ownership.
Stage 7	Execution of the final version of the approved DP
Stage 8	Submission of successful post-decommissioning report and conclusion of the Energy Act Process

Structure of this Decommissioning Programme

This document is structured in line with the recommendations outlined in 'Annex C – Model Framework for a decommission programme', which forms part of the BEIS guidance notes for industry (March 2019).

2 Executive Summary

The Developer obtained consents and licences necessary for the construction of the wind farm in 2016. The operational lifetime is approximately 24 years. At the end of this time and within five to 10 years of the end of the operational life of the wind farm, it will be decided whether generation life extension will be pursued, which could postpone the decommissioning phase by up to an additional 26 years. When it is decided that the wind farm has reached the absolute end of its operational lifetime, the objective will be to decommission the asset in accordance with the provisions set out in the various licences obtained and in light of knowledge and data gained through monitoring through the construction and operational phase. This DP and associated financial security statement assumes a decommissioning date after 24 years.

In accordance with section 105(2) of the Energy Act 2004, the Developer submitted its DP for HOW02 to BEIS and is awaiting approval.

The proposed decommissioning measures set out in this DP aim to adhere to the existing UK and international legislation and guidance notes. In addition, decommissioning industry best practice will be applied, taking into account the legislation applying at the time of decommissioning of the DTPHT assets. DTPHT will pay full regard to the "waste hierarchy", which suggests that reuse should be considered first, followed by recycling, incineration with energy recovery and, lastly, disposal.

It is difficult to determine the decommissioning schedule, as unforeseen issues can arise during the installation and operation of the assets, which ultimately could affect the decommissioning. At the time of writing, no offshore wind farms (including offshore transmission assets) worldwide have been decommissioned[2], so direct experience of the potential challenges are limited. Once other projects start to be decommissioned, it will provide valuable insight into the timing, costs and operational challenges to be faced.

The proposed decommissioning measures for the offshore components of the DTPHT assets can be summarised as:

- complete removal of the offshore substation;
- Offshore substation platform ("**OSP**") and Reactive Compensation Substation ("**RCS**") foundations cut off below seabed and removed;
- complete removal of export cable within the jurisdiction of Associated British Ports ("**ABP**");
- complete removal of remaining offshore export cable outside mattress and rock berm locations; and
- lifting off the seabed of all removed components for recycling;

In accordance with the Polluter Pays Principle ("**PPP**"), DTPHT proposes to clear the seabed in accordance with the provisions made in this DP and in the Marine and Coastal Access Act 2009 (Marine Licence), and to collect and provide evidence to reflect this.

DTPHT is committed to restoring the site and cable corridors to the condition they were in prior to construction, as far as it is reasonably practicable. The key restoration work will relate to ensuring that all cut foundations are made safe and adequately covered, and ensuring that the offshore export cable is removed.

DTPHT proposes that, post decommissioning, a full geophysical survey (swath, side scan sonar and magnetometer) is carried out. The survey will be carried out by an independent survey contractor and all results issued to BEIS for review and comment. The area covered by the magnetometer and geophysical surveys will be determined prior to decommissioning, but we are aware of oil and gas installation guidance which specifies a 500 metre radius around any installation.

A cost estimate for the DP has been derived, based on the equipment, personnel requirements and the duration of works. Financial security provisions have been carefully considered to ensure that this liability will be met.

[2] [2] Danish windfarm Vindeby (1.8km from shore 4.95MW) decommissioned in 2017. Swedish windfarm Yttre Stengrund (2km from shore, 10MW) decommissioned in 2016. Blyth Offshore Windfarm (0.8km from shore, 4MW). All projects are small scale and do not include transmission assets. Though they provide valuable insights, these can't be used to benchmark for large offshore transmission systems.

In advance of decommissioning, the EIA within the ES will be reviewed to assess the potential impacts that may arise and to identify any additional impacts that were not covered in the initial EIA process and subsequent reviews.

Once the assets are nearing the end of their agreed operational life, DTPHT will initiate a final review of this document and the proposed programme of works. Once this review is complete, a "Decommissioning Programme of Works" will be developed, and the schedule of works will be determined in agreement with the statutory authorities.

3 Background Information

This section describes the project and gives a brief overview of the biological, physical and human environment in the area.

3.1 Project Location

The site is located in the Hornsea Development Area, or Hornsea Zone, approximately 31km at its closest point (western boundary) from the East Riding of Yorkshire coastline with the eastern boundary only 1km from the median line between UK and Dutch waters. The area within the Hornsea Zone in which the generator's turbines, inter-array cabling and associated infrastructure has been labelled 'Subzone 2'. The Wind Farm site covers an area of approximately 462km^2 and lies within the UK Renewable Energy Zone. The project's nearest boundary is 89km from the Yorkshire coastline and 50 km from the median line between UK and Dutch waters. The location is shown in Figure 3.1, with the onshore cable route shown in Figure 3.2.

Figure 3.1: Hornsea Two Offshore Wind Farm Location

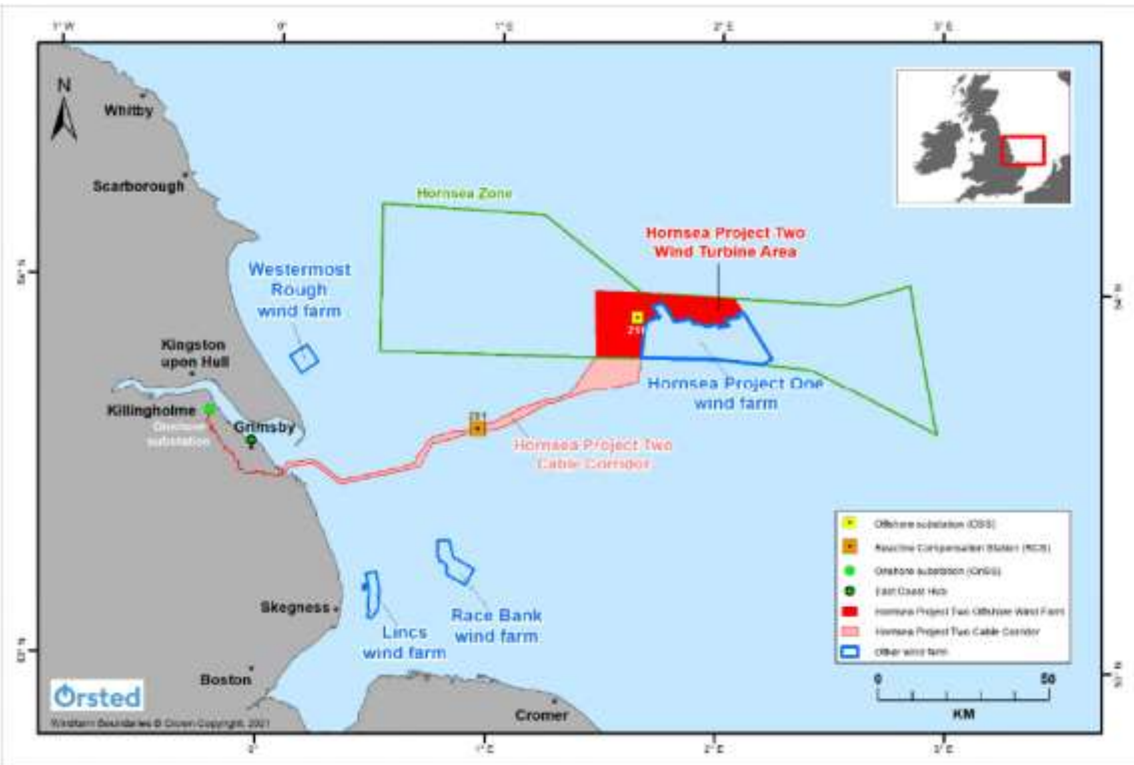


Figure 3.2: Onshore Cable Route Corridor

3.2 Design and Background

HOW02 will have an installed capacity of 1,386MW fed from 165, 8.4MW turbines. Power generated by the turbines will be transmitted through a network of inter-array cables.

The array cables will transmit power to a single offshore substation platform (**"OSP"**).

The OSP connects to a Reactive Compensation Substation ("**RCS**") via three subsea cables with approximate lengths of 62km.

Using a combination of three subsea and land cable with an approximate length of 166km (128km offshore and 38km onshore), power will be transmitted from the RCS to the onshore substation in North Killingholme. The voltage is then stepped up from 220kV to 400kV and transmitted via two 400kV cables to Killingholme Substation where it connects onto the National Grid.

DTPHT will operate and maintain the Offshore Transmission Assets, herein referred to as Hornsea Two ("**HS2**"), associated with the HOW02 wind farm.

3.3 As Built Information

The Construction Design and Management ("**CDM**") Regulations 2015 will apply and will require accurate as-built data as amended during the lifetime of the project to be used as a basis for the decommissioning methodologies. The

Developer is responsible for providing the purchaser with this information via the projects health and safety file. As built information will include as a minimum:

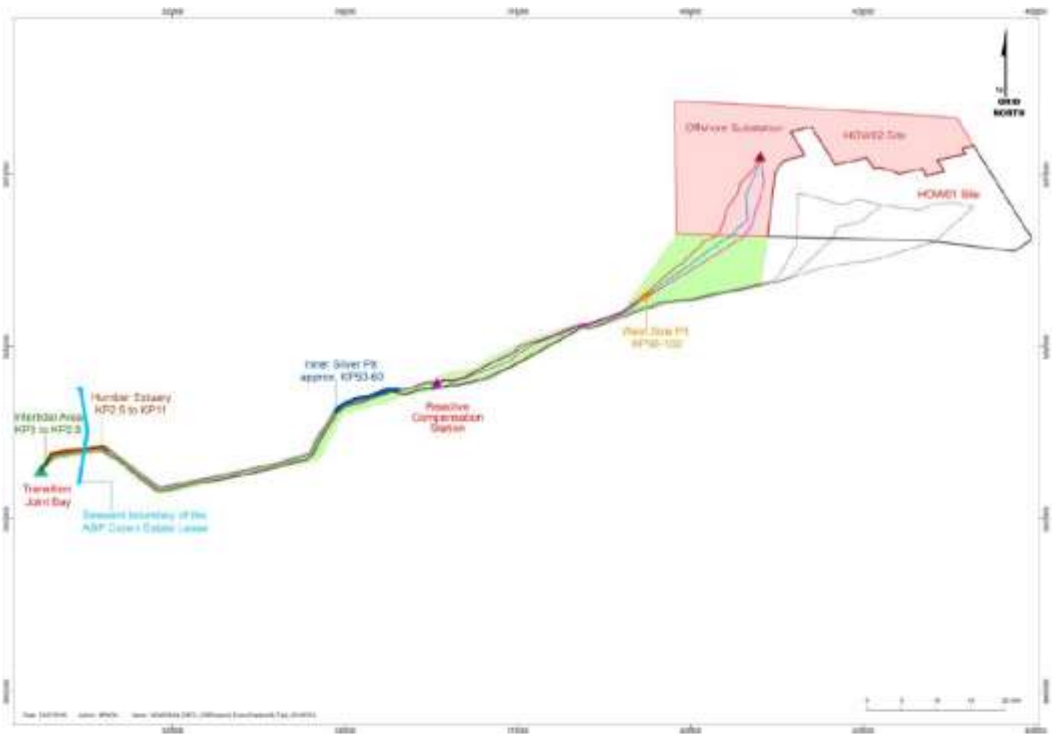
1. as-built position for all structures;
2. details of the construction of all structures; and
3. position depths of burial and other forms of cable protection for all subsea cables (both export cables and inter-array cables).

If at any time during the lifetime of the project the as-built details change, for example, after a repair to a subsea cable, amended details will be prepared for the on-going live status of as-built data.

3.4 Site Characteristics

The site characteristics are described by a comprehensive data set and information collated for the ES. The following sections give a description of the characteristics encountered at different KP locations of the Export Cable Route ("**ECR**"), with major landmarks of the route highlighted in the Figure 3.3.

Figure 3.3: Hornsea Two Export Cable Route Landmarks



3.4.1 Physical Characteristics: Geology, Bathymetry and Morphology.

A brief summary of the key physical characteristics for the offshore locations of HS2 is provided below. These studies informed the EIA for HOW02 and are reported as part of the ES. Further information about the sub-topics is available in the ES and project geotechnical and geophysical reports.

Geology

For the majority of the route, the only geological units, which are encountered, are Holocene sediments, the Boulders Bank Formation and the Botney Cut Formation. Within the Inner Silver Pit and the West Sole Pit areas, the underlying geological units include Sand Hole, Swarte Bank, Chalk and Mudstone, which have been brought closer to the surface due to the erosion. Each of these formations are described in slightly greater detail in the following sections.

It should be noted that the regional geology of the ECR, within the southern North Sea, comprises of Quartenary sediments, i.e. combining the Holocene and the preceding Pleistocene sediments, overlying Pre-Quartenary sediments. Due to the typical depth of lowering of the cable, the Quartenary sediments of the Holocene (11,700 years ago to present) and late Pleistocene (2.588 million years ago to 11,700 years ago) will be covered. However, the exception will be the Inner Silver Pit and West Sole Pit areas where the Quartenary sediments have been eroded by subglacial melt water channels.

Holocene sediment

The nature of Holocene sediments varies considerably and in accordance with the environment in which they are deposited. From KP0 to KP2.5 (intertidal area), the Holocene sediment predominantly comprises of fine sands and tidal flat silts. From KP2.5 to KP11.2 (Humber Estuary), the Holocene sediments comprise all sediments associated with fluvial facies, including sands, gravels, silts, clays and locally occurring peats. Holocene sediments further offshore comprise both fine sand which has been transported by seabed sedimentary processes and shallow Pleistocene glacial material which has been eroded during the Holocene. For the majority of the ECR, the Holocene sediment is present as a thin veneer of fine sand (less than 0.3m) overlying the Bolders Bank or Botney Cut. It is also present in greater thicknesses in larger bedforms e.g. megaripples, sand waves and sand ribbons.

Bolders Bank Formation

This is an extensive ablation till which covers most of the southern North Sea. The thickness of the formation tends to increase in a West to East direction. Within the nearshore area of the ECR, the formation is typically between 5 and 10m thick whereas at the offshore wind farm site it gets to around 15m thick. The formation predominantly comprises of stiff, reddish brown or greyish brown, massive, gravelly sand clay. The sand content of the Bolders Bank Formation and the frequency of sand beds tends to increase with depth.

Botney Cut Formation

The start of the Holocene was preceded by the last glacial period and the Weichselian Glaciation, which affected the northern parts of Europe. The sediments which infilled valleys and channel cuts in the Bolders Bank Formation at the end of the foregoing glaciation belong to the Botney Cut Formation. The thickness and extent of the Botney Cut Formation vary considerably across the ECR. Between KP115 and KP128, the Botney Cut channels can be relatively large – up to 8km wide and 50m deep. However, between KP3 and KP115, the Botney Cut channels are typically much narrower, in the range of hundreds of metres wide and between 0 and 5m deep. Botney Cut comprises glaciofluvial sand and gravels as well as reworked Bolders Bank. Most of the geotechnical samples from the shallow Botney channels between KP3 and KP115 consist of predominantly dense sands and gravels.

Inner Silver Pit Formations

The Inner Silver Pit comprises three tunnel valleys in the southern North Sea and was formed during the Pleistocene by meltwater channels, which eroded the Quartenary deposits underlying the retreating ice sheets. In all the three tunnel valleys, the seabed has been reduced to an elevation below the base of the Bolders Bank Formation. Consequently, the shallow geology comprises of the Egmond Ground Formation, the Sand Hole Formation, the Swarte Bank Formation and Cretaceous Chalk.

West Sole Pit Formations

Like the Inner Silver Pit, the West Sole Pit was formed by a subglacial meltwater channel eroding the underlying Quartenary deposits. The shallow geology within the West Sole Pit comprises Botney Cut overlying Tertiary Mudrock. There is currently limited information on Tertiary Mudrock but it is expected to be a hard to extremely hard material.

Bathymetry and Morphology

Water depths within the Subzone 2 area range from approximately 25m to 76m below LAT. The shallowest areas in Subzone 2 are observed at the top of sand wave crests throughout the site, the shallowest being to the southwest of the subzone. The majority of the site can be classified as gently sloping, with slopes ranging from 0^0 to 6^0.

From the Landfall at Horseshoe Point, water depths gradually increase to around 30m with slight undulations, consistent with the gentle regional gradient and undulating seabed. Water depths increase to a maximum of 63m where the cable route corridor crosses the northern extent of the Silver Pit. Seabed gradients are significantly greater over the flanks of the deep than elsewhere along the cable route corridor.

Between Silver Pit and Sole Pit, water depths range between 21m and 29m and as the route crosses Sole Pit the water depth increases to 51m. The seabed shoals gently from Sole Pit towards Subzone 2, with depths ranging between 25m and 30m. Maximum localised seabed gradients associated with mobile bedforms and the flanks of Silver Pit and Sole Pit can reach up to 10^0. The following sections outline the different features characterising sections of the ECR from landfall towards the OSP.

KP0 to KP2.664

The first part of the ECR crosses the intertidal area comprised by near horizontal flats closest to the shore, and a surface of higher inclination sloping seaward in the outer intertidal area.

KP2.664 to KP46.5

The seabed deepens gently to a depth of 2m and remains relatively flat and smooth up to KP4.0. From here, the seabed deepens gently to approximately 10m Below Sea Level ("**bsl**") at KP6.4. The seabed undulates gently at depths between 8m-10m bsl up to KP22.9. Occasional sand waves are evident throughout this section with maximum heights of approximately 3m.

From KP22.9, the seabed undulates gently and deepens along the route to a depth of 28m bsl at KP46.5. Occasional small sand waves are evident through this section with maximum heights of approximately 2m.

KP46.5 to KP57.748

At KP46.5, the seabed begins to shoal gently from 28m bsl to 25m bsl at KP49. From here, the seabed deepens as the route traverses the depression known as the Silver Pit. Depths of approximately 65m bsl are observed and gradients of up to 10^o are encountered up to KP58.5 where the seabed exits the eastern flank of the Silver Pit depression and shoals to a depth of approximately 23m bsl.

KP57.748 to KP84

From KP58.5 to KP84, the seabed undulates gently between 20m-25m bsl. Occasional sand waves are present along this section, which display heights of up to 5m and gradients of approximately 8^o.

KP84 to KP96

From KP84 the seabed deepens slightly and continues undulating gently between depths of 25m-30m bsl up to KP96.

KP96 to KP100

Between KP96 and KP100, the route transects a depression known as the Sole Pit. The depression is approximately 25m in depth. The seabed deepens from approximately 26m bsl at KP96 to 52m bsl at KP98.7 and then shoaling to a depth of 31m bsl at KP100 as the route exits the eastern flank of the depression. Gradients of approximately 6^{o} are observed through this depression.

KP100 to KP119

From KP100 the seabed is generally flat and smooth undulating between 25m-30m bsl up to KP119. A small depression is observed at KP102.2, which displays a depth of approximately 5m and negligible gradients.

KP119 to KP128

Between KP119 and KP128, the seabed transects an elongated depression. Depths increase from 29m bsl at KP119 and increase to a depth of approximately 39m bsl at KP124.3 and then shoals to a depth of 30m bsl at KP128. Negligible gradients are associated with this depression. From KP128 the seabed is relatively flat and smooth to the end of the route with depths undulating between 28-30m bsl.

3.4.2 Marine Processes

The term 'marine processes' in this context is a collective term for marine and seabed physical processes, geology and geomorphology, hydrodynamics, seabed sediments, bathymetry, tides and waves. The marine processes study area for HS2 is defined as Subzone 2, the cable route corridor, landfall at Horseshoe Point and the seabed and coastal areas surrounding these areas that may be influenced by changes to marine processes due to HS2, see Figure 3.4.

Figure 3.4: HOW02 Marine Processes Study Area

Coastal Processes

A metocean baseline data collection programme has been carried out within the Hornsea Zone. Monitoring has been carried out of tidal heights, currents, waves, suspended sediment concentrations and meteorological parameters at six locations identified as L1 to L6 within the Hornsea Zone and one location outside, L7, which later moved into the zone as L7a. The fully calibrated tidal flow model has been used to define the existing regime of tidal currents.

Current speeds and water levels vary across the southern North Sea. Across HS2, modelled current speeds vary from approximately $0.6ms^{-1}$ (at High Water ("**HW**")) to $1ms^{-1}$ (at Low Water) for peak mean spring tides. While the principal tidal streams run parallel to the shore and current velocities are linear, a more complex pattern of tidal flow exists in the nearshore zone. For example, at the mouth of the Humber Estuary, there is a series of interlinked sandbanks and channels, and both ebb and flood tide dominant sediment transport pathways are observed at the estuary mouth.

Water flows across the Subzone 2 and the cable route corridor vary temporally (as a function of the tide and tidal range) and spatially. In addition, non-tidal effects may alter tidal currents, for example wind or lateral density currents.

A review of the metocean data collected in relation to tidal currents is presented in Technical Annex 5.1.3: Metocean Data of the EIA. In summary, the total current speed was seen to reduce from the west to the east of HS2, with tidally dominated currents at Off Ground being approximately 30% faster than those at Windermere Field. The currents are tidally dominated with most of the energy apportioned to the semi-diurnal harmonics. However, high residual currents (often in excess of the tidal component) were experienced during storm events, indicating the considerable influence of meteorological forcing on current speed.

Table 3.1 summarises the tidal elevations within HS2. Tidal elevations at Metocean measurement position L2 are the most appropriate to Subzone 2. The nearest Standard Port is at Spurn Head and tidal elevations for this location are also provided in the table. The area is affected by tidal surges, with the 50 year return period surge level given as 1.8m to 2.0m.

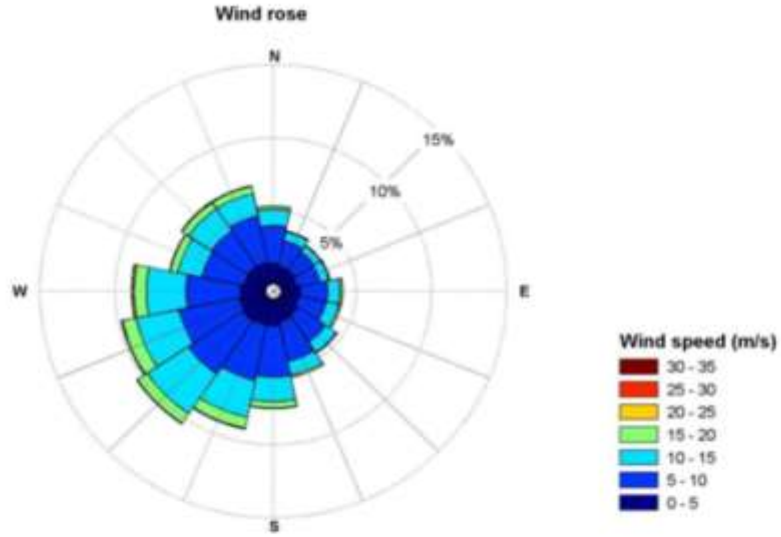
Table 3.1: Tidal Elevations

Level	Spurn Head (m CD)	Subzone 2 (m CD)
Highest Astronomical Tide	+7.7	+3.7
MHWS Tides	+6.9	+3.3
MHWN Tides	+5.5	+2.6
MSL	+4.1	+1.9
OD	+3.9	-
Mean Low Water Neap Tides	+2.7	+1.3
Mean Low Water Spring Tides	+0.7	+0.6
Lowest Astronomical Tide	0.0	0.0

Wave Regime

On the east coast, as in many other parts of the UK, westerly and south-westerly winds are the most frequent. However, during the winter and spring, winds from the northeast and east sectors are common. Winds blow from the quadrant north around to east only about 20% of the time and it is from this direction that the wind farm is capable of exerting an influence upon the nearshore wind-wave climate. The dominant wind regime interacts with HS2, from directions that can affect the inshore wave climate, relatively infrequently. Approximately 80% of the time, the winds are directed away from, or parallel to, the coastline, see Figure 3.5.

Figure 3.5: Hornsea Two Wind Rose (UK Met Office data)



Data from the UK Met Office ("**UKMO**") European Wave Model were obtained from a point likely to be representative of the winds and waves in the approaches to HS2. From the wave and wind roses for this location, it was seen that the dominant winds blow from sector 202.5ºN to 270ºN (south-southwest through to west), whereas the dominant wave sector is from 315ºN to 0ºN (northeast to north). Waves associated with this latter sector represent long period swell waves.

Since wind-waves originate from meteorological forcing, the wave regime is highly episodic and exhibits strong seasonal variation. In deep water, waves will move across the sea surface without major modification, but as they move into shallower water, refraction, shoaling (wave steepening) and eventually wave breaking will occur. Across the many shallow banks of the southern North Sea, maximum wave heights are also likely to become 'depth limited' with shoaling and wave breaking occurring, especially around low tide.

A review of the metocean data collected within the Hornsea Zone in relation to waves is presented in Annex 5.1.3: Metocean Data Review of the EIA. To summarise, wave peak periods were found to vary between 2 seconds and 20 seconds, indicating that the waves recorded are both locally generated wind waves and remotely generated swell waves. The dominant wave direction was found to be north westerly to northerly.

3.4.3 **Biological Environment:** Subtidal and Intertidal Benthic Ecology

Designated Areas

A Habitats Regulations Assessment ("**HRA**") was undertaken as part of the DCO application. The HRA considers the potential impacts upon European protected sites, primarily these include Special Areas of Conservation ("**SAC**") and Special Protection Areas ("**SPA**"). Included within the assessment are the sites/ features listed below.

Table 3.2: Likely Significantly Effected Areas

Species	Site Name	Potential Impact
Annex I Habitats	Humber Estuary SAC and Ramsar (UK)	Temporary reduction in extent of a number of SAC habitat features. Effects on water quality, including resuspension of contaminated sediments and increases in suspended sediment concentrations.
Annex II Species – River and Sea Lamprey	Humber Estuary SAC and Ramsar (UK)	Disruption of lamprey migration during cable installation. Indirect effects on water quality.
Annex II Species – Grey seal	Humber Estuary SAC and Ramsar (UK) Berwickshire and North Northumberland Coast SAC (UK) Doggersbank pSCI (Netherlands) Klaverbank pSCI (Netherlands)	Physical injury and/or behavioural disturbance from underwater noise impacts during construction piling of foundations and other construction activities. Behavioural disturbance from underwater noise from vessel noise and other activities. Physical injury from increased risk of collision with vessels. Change in prey availability distribution / abundance.
Annex II Species – Harbour seal	The Wash and North Norfolk Coast SAC (UK) Doggerbank SCI (Germany) Doggersbank pSCI (Netherlands) Klaverbank pSCI (Netherlands)	
Annex II Species – Harbour porpoise	Vlakte van de Raan pSCI (Belgium) NTP S-H Wattenmeer und angrenzende Küstengebiete SCI (Germany) Doggerbank SCI (Germany) Östliche Deutsche SCI (Germany) Sylter Außenriff SCI (Germany) Steingrund SCI (Germany) Helgoland mit Helgoländer Felssockel SCI (Germany) Hamburgisches Wattenmeer SCI (Germany) Unterelbe SCI (Germany) Borkum-Riffgrund SAC (Germany)	

	Nationalpark Niedersächsisches Wattenmeer SCI (Germany) Gule Rev SAC (Denmark) Sydlige Nordsø SAC (Denmark) Falaises du Cran aux oeufs et du cap gris-nez, dunes du chatelet, marais de tardinghen et dunes de wissant pSCI (France) Bancs des Flandres pSCI (France) Recifs Gris-nez Blanc-nez pSCI (France) Ridens et dunes hydrauliques du detroit du pas-de-calais pSCI (France) Baie de canche et couloir des trois estuaries pSCI (France) Doggersbank pSCI (Netherlands) Klaverbank pSCI (Netherlands) Vlakte van de Raan SAC (Netherlands) Noordzeekustzone SAC (Netherlands) Noordzeekustzone II pSCI (Netherlands)	
SPA Qualifying Features Wader and Wildfowl	Humber Estuary SPA and Ramsar (UK)	Disturbance during construction and decommissioning (intertidal birds).
SPA qualifying features – Gannet, Kittiwake, Fulmar, Guillemot, Razorbill, Puffin	Flamborough Head and Filey Coast pSPA (UK)	Collision and displacement of birds during the operational phase.
SPA qualifying features – Gannet	Forth Islands SPA (UK)	Additional mortality due to collisions with operational turbines. Displacement from foraging and loafing areas due to operational turbines and other infrastructure.
SPA qualifying features – Fulmar	Fowlsheugh SPA	Collision and displacement of birds during the operational phase

Benthic Ecology

The benthic subtidal and intertidal habitats and species present within the HS2 benthic ecology study area were typical of the southern North Sea. Differences in the benthic communities recorded generally reflected the differences in the sediment types present. Sandy sediments supported communities of typically low infaunal diversity (characterized by infaunal polyachaetes, burrowing bivalves and amphipods) with sparse to non-existent epifaunal communities. The communities associated with coarse sediments were generally more infaunally diverse (characterized by polyachaetes, molluscs, crustaceans and echinoderms) with, in places, such as along the export cable corridor, more diverse epifaunal communities (characterized by hydroids, bryozoans, sponges and soft corals) associated with cobbles and pebbles. The mixed sediment biotopes supported the most diverse communities characterized by rich communities of epifaunal species including the tube building polchaete *S. spinulosa,* ascidians, crustaceans, hydroids and bryozoans.

Annex I cobble reef and *S. spinulosa* reef assessments did not indicate the presence of Annex I reefs within the HS2 benthic ecology study area. An area of potential Annex I *S. spinulosa* reef identified in the northeast end of the export cable corridor, one year previously during surveys for Project One ("**HOW01**"), was not subsequently identified during the HOW02 surveys. This supports the assertion that was made in the HOW01 Assessment (SMart Wind, 2013b) that *S. spinulosa* reefs in the area are ephemeral.

The only benthic species of conservation interest within the HOW02 benthic ecology study area was the ocean quahog *A. islandica*, but this was recorded in low abundances.

The majority of the intertidal site was classified as Annex I 'mudflats and sandflats not covered by seawater at low tide' or Annex I '*Salicornia* and other annuals colonizing mud and sand'. Annex I 'mudflats and sandflats not covered by seawater at low tide' are the primary reason for site selection for the Humber Estuary SAC. The Annex I 'Salicornia and other annuals colonizing mud and sand' habitat is a qualifying feature, but not the primary reason for site selection, of the Humber Estuary SAC.

Fish and Shellfish Ecology

Both site-specific surveys and desk-based study found the species assemblage of the HOW02 fish and shellfish study area to be typical for this region of the southern North Sea. The key characterizing fish species consisted of a mix of both pelagic and demersal species: flounder, plaice, dab, common sole, lemon sole, cod, whiting, sprat, herring and sandeels. Many of these species are fished commercially within the southern North Sea, as are shellfish species as brown crab, European lobster and *Nephrops*.

Many of the characterizing fish and shellfish species have important nursery and spawning grounds within and in close proximity to the HOW02 fish and shellfish study area. The Humber Estuary is also known to be a key nursery habitat for many species and is known as a migratory route for several diadromous fish species, which migrate to freshwater habitats to spawn. These include sea and river lamprey, both of which are listed as qualifying features of the Humber Estuary SAC.

Marine Mammals

Site-specific and historical data have shown that for HOW01 and HOW02, the five key marine mammal species identified as important receptors within the regional marine mammal study area were: harbor porpoise, white-beaked dolphin, minke whale, harbor seal and grey seal. Harbour porpoise is the most common cetacean in the North Sea with densities highest in central North Sea (SCANS-II, 2006).

The Greater Wash is also a key area for both minke whale and white-beaked dolphin, although both species tend to have higher densities in more northerly, cooler offshore areas (Evans *et al*., 2003; Reid *et al*., 2003; Hammond *et al*., 2001; SCANS-II, 2006). Harbour grey seals are also common throughout the Greater Wash, with large breeding colonies situated along the coastlines, although the majority (approximately 80%) of their breeding population occurs in Scottish waters (SCOS, 2012).

The foregoing historical findings are supported by the site-specific boat-based visual and acoustic surveys within the wider HOW02 marine mammal study area which recorded harbor porpoise, minke whale, white beaked dolphin, harbor seal and grey seal frequently over three years of surveys.

Offshore Ornithology (Birds)

The characterization of the baseline environment within Subzone 2 and the Hornsea Zone in addition to the contextual southern North Sea has been obtained from a number of sources. For site-specific data, this was gathered during boat-based baseline surveys. A detailed description of the seabird patterns and abundance in the wider North Sea is provided in Annex 5.5.1: Ornithology Technical Report of the EIA and this information has provided a context for determining the relative importance of populations recorded within the Hornsea Zone. This report cites ornithological surveys and monitoring reports which have shown that the southern North Sea, extending roughly between the Humber and the Strait of Dover and incorporating the Hornsea Zone and HOW02, is an important area for seabirds. This is particularly the case during passage and in winter months when British breeding birds are joined by birds that have migrated from continental Europe and Fennoscandia. Because of the mix of birds present, it is probable that the Hornsea site is used by birds which are:

(i) overwintering in the area;

(ii) foraging from nearby breeding coastal colonies; and

(iii) on post-breeding dispersal, migration and pre-breeding return at different times of the year.

As well as true pelagic seabirds (e.g. gannet, fulmars and auks), other species that spend part of their annual life cycle at sea (e.g. divers, gulls and seaducks) may also be present in particular months, with periodic numbers of non-seabird migrants also present (e.g. wildfowl, waders and passerines).

In Subzone 2, during boat-based surveys, a total of 33 seabird species were identified in Year 1 (March 2011 to February 2012) and 29 species recorded during Year 2 surveys (March 2012 to February 2013). A number of records were of species groups (e.g. divers, skuas, small gulls, large gulls, auks). In both survey years, guillemot was the most abundant species representing 27.3% and 32.0% of all birds recorded in Year 1 and Year 2, respectively. Kittiwake was the second most abundant species in both years with razorbill the third most abundant species in Year 1 and fulmar in Year 2.

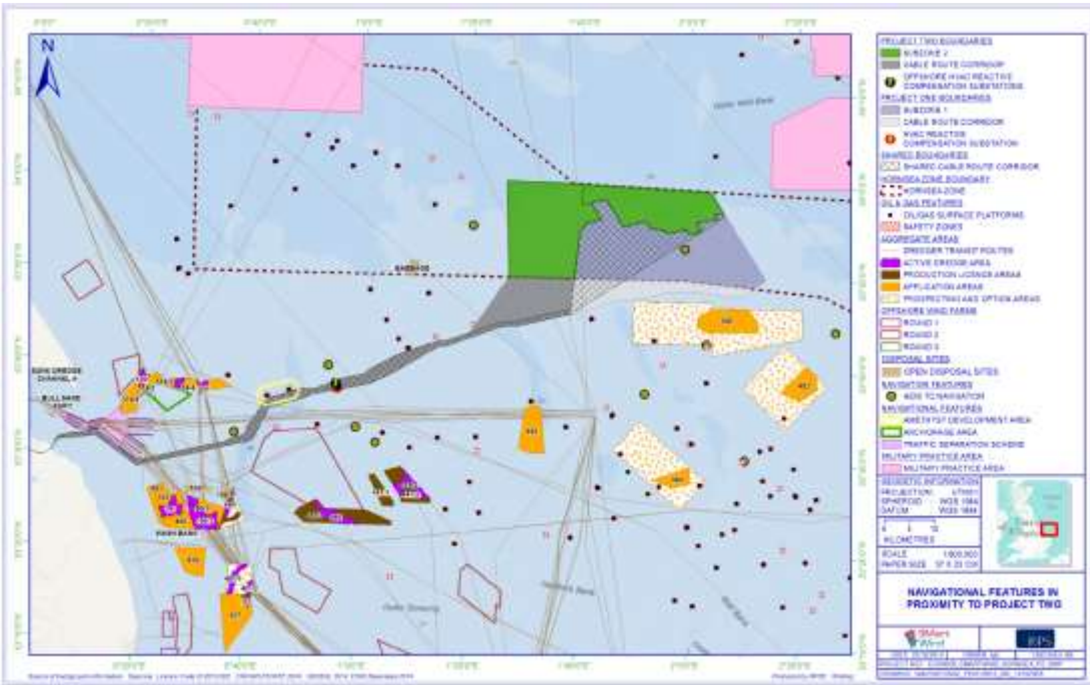
3.5 Offshore Human Environment

Navigation features

A Navigational Risk Assessment ("**NRA**") was undertaken for each site within the project. Further detail can be found in the NRAs (Volume 5, Annex 5.7.1: Subzone 2 and Offshore Cable Route NRA and Volume 5, Annex 5.7.2: Offshore HVAC Reactive Compensation Substations NRA). Subzone 2 is located in the southern North Sea where some of the busiest shipping routes presently operate and safely co-exist alongside a number of notable marine activities including: oil and gas (including a large number of operational gas platforms with pipelines running to and from offshore fields); Telecommunications cables; Disposal sites; and Marine aggregate and extraction areas. The following navigational features have been identified in proximity to the offshore aspects of HS2:

- IMO routing measures: There are no IMO routing measures in close proximity to Subzone 2 although the offshore cable route enters the Humber near the existing Humber Traffic Separation Scheme ("**TSS**"). This overlaps the edge of the cable route corridor but at its closest point, passes approximately 390m from the route centerline;
- MOD Practice and Exercise Areas ("**PEXAs**") – Subzone 2 does not intersect any MOD PEXAs.
- Oil and gas surface platforms: There are no oil or gas surface platforms located within Subzone 2. The nearest platforms are the Schooner A platform located approximately 7.34km/3.96NM to the northeast of Subzone 2 and the Mimas platform located 8.86km/4.78NM to the south of Subzone 2;
- Marine Environmental High Risk Area ("**MEHRA**"): There is no MEHRA in Subzone 2. The nearest MEHRA is the Spurn Point MEHRA, which is located 5.25 km/2.83 NM north of the proposed export cable route corridor; and
- Radar Early Warning Systems ("**REWS**"): Some oil and gas platforms operate REWS, which identify vessels on a Closest Point of Approach ("**CPA**") with the platform and alerts the standby vessel to respond. The nearest platform with REWS is the Saturn platform at a distance of 20.38km/11.00NM from Subzone 2.

Figure 3.6: Navigational Features within the Southern North Sea and in Proximity to HS2



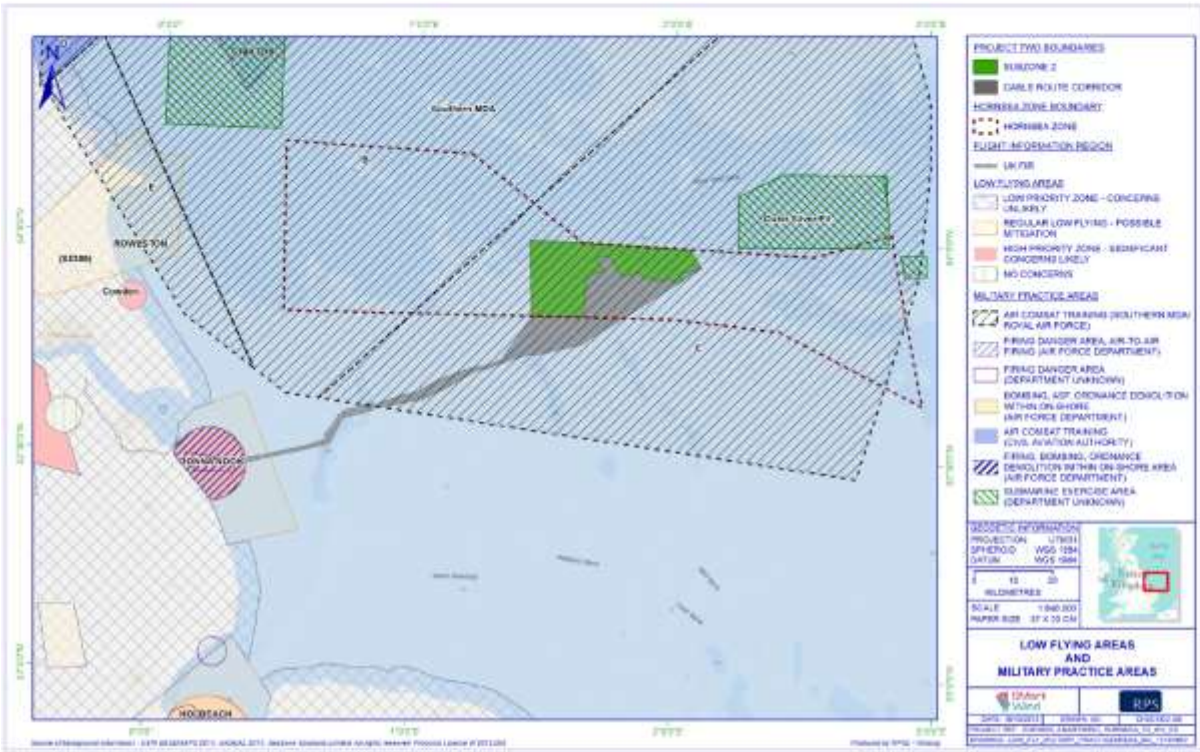
Aviation, Military and Communications

There are a number of aviation, military and communications related interests in the vicinity of the array area and the ECR. This includes MOD Managed Danger Areas, Military Low Flying Areas and Donna Nook Danger Area (D307). In addition, three Helicopter Main Routes cross the array area. Donna Nook Danger

Area is located within the ECR near the landfall point. Live firing, bombing and demolition activities occur in this area with the Defence Infrastructure Organisation ("**DIO**") requiring briefing of the nature and timing of any cable laying operations occurring within the area.

The array area is located within the operational range of the National Air Traffic Service ("**NATS**") Claxby and Cromer Primary Surveillance Radars ("**PSRs**"). In addition, the area is also within operational range of the MOD's Air Surveillance and Control Systems Air Defence PSRs located at Staxton Wold and Trimingham, see figure 3.7.

Figure 3.7: Overview of Low Flying and Military Practice Areas



Commercial vessels

This section provides findings of vessel tracks recorded on Automatic Identification System ("**AIS**") and radar during a marine traffic survey for the baseline navigation review. AIS is now fitted on all commercial ships operating in UK waters over 300 Gross Register Tonnage ("**GRT**") engaged on international voyages, over 500 GRT on domestic voyages, passenger vessels carrying 12 or more persons and fishing vessels over 24m (at the time of surveying). Small vessels not carrying AIS have been captured by radar and visual observations, where possible. A 10NM buffer was used as the study area around Subzone 2 to provide a sample area to undertake data analysis relative to the wind farm.

For the 14 days analysed in June 2012, there were an average of 35 unique vessels per day passing within 10NM of Subzone 2, recorded on AIS and radar (excluding temporary traffic). There was an average of 12 unique vessels per day actually intersecting Subzone 2. The majority of tracks were cargo vessels (53% within Subzone 2) and tankers (25% within Subzone 2), see figure 3.8 for ship tracks in summer.

For the 28 days analysed in October and November 2012, there were an average of 35 unique vessels per day passing within 10NM of Subzone 2, recorded on AIS and radar (excluding temporary traffic). There were an average of 12 unique vessels per day actually intersecting Subzone 2. The majority tracks were cargo vessels (49% within Subzone 2) and tankers (23% within Subzone 2). See figure 3.9 for ship tracks in winter.

Ten main commercial routes have been identified as transiting through or in close proximity to Subzone 2.

Figure 3.8: Ship Tracks Relative to Subzone 2 Site (14 days in summer 2012)

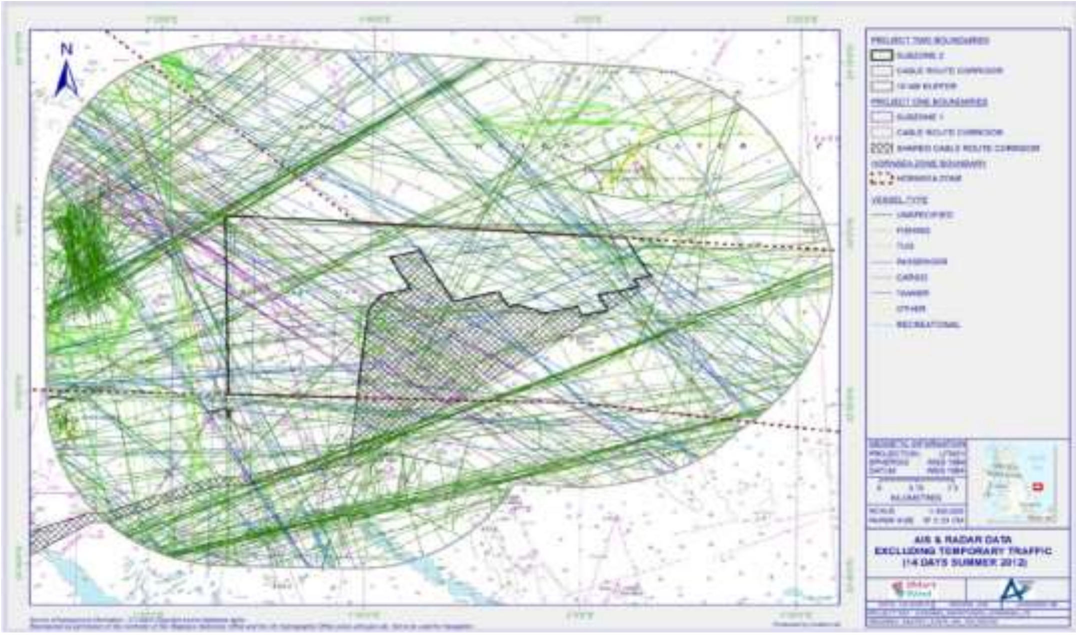
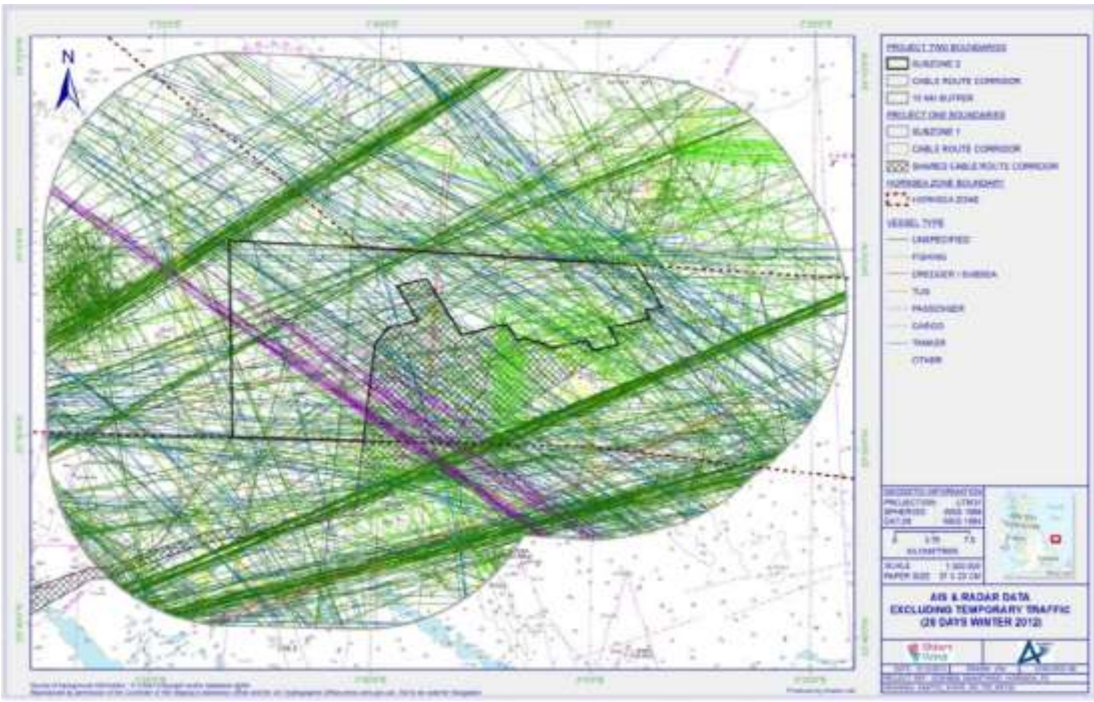


Figure 3.9: Ship Tracks Relative to Subzone 2 Site (28 days in winter 2012)



Commercial Fisheries

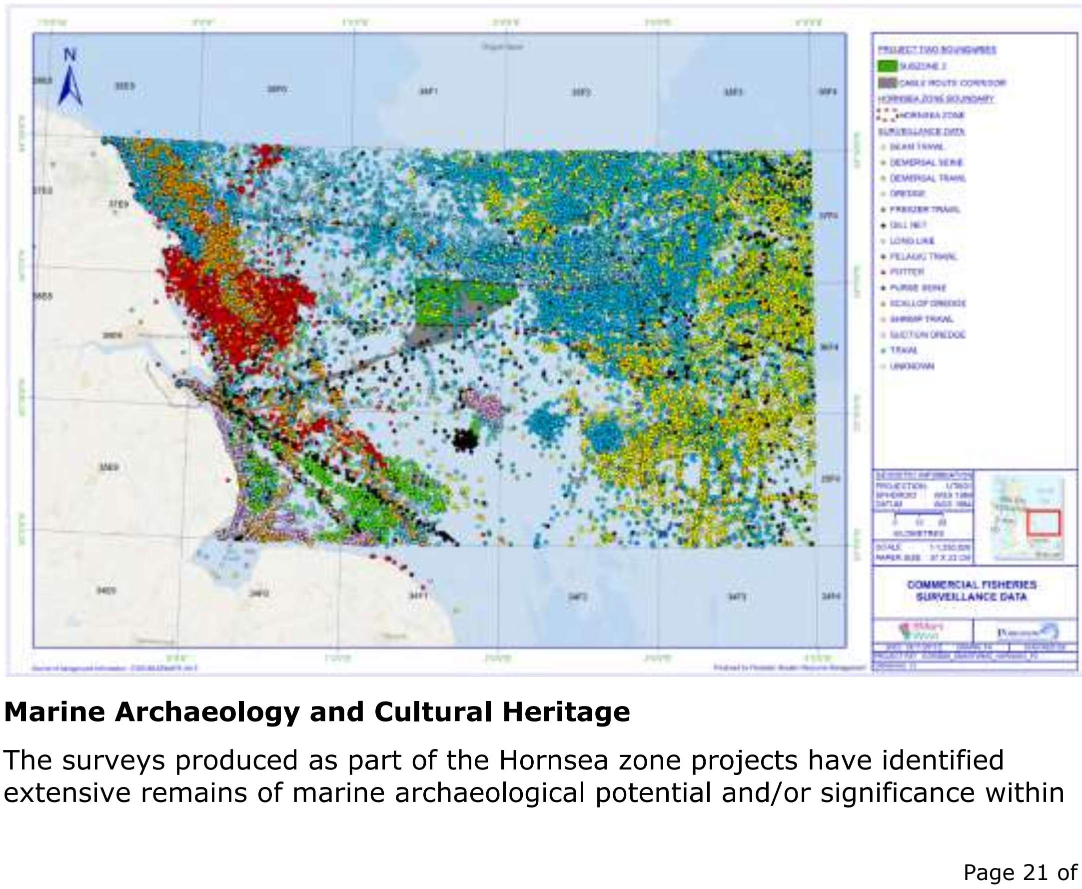
The Subzone 2 study area is dominated by landings of sole and plaice targeted principally by the Dutch fleet, but also UK registered vessels, including UK registered, Dutch owned vessels. In 2012 the combined sole, plaice and turbot *Scopthalmus maximus* fishery from the Subzone 2 study area worth £10 million for UK, Dutch and Norwegian vessels.

The industrial fisheries for sandeel *Ammodytes spp*. and sprat are undertaken by Danish vessels. Herring Clupea harengus were landed from the Subzone 2 study area at the end of 2006 by UK and German fleets, but have not appeared within statistics in notable volumes since then. This is to be expected as herring is a highly mobile pelagic species that, when at commercial sizes, is not associated with particular habitat (with exception of spawning periods).

In summary, the key commercial fishing fleets operating within the regional Commercial Fisheries study are include (in no particular order):

- Danish demersal/semi-pelagic trawlers targeting sandeel, sprat and herring;
- Dutch beam trawlers targeting sole and plaice;
- UK beam trawlers targeting sole and plaice;
- UK potters targeting lobster and crab;
- UK shrimpers targeting brown shrimp;
- UK dredgers targeting scallops;
- German beam trawlers targeting sole and plaice;
- German demersal/semi-pelagic trawlers targeting sandeel and herring;
- French demersal and pelagic trawlers targeting sandeel;
- Belgian beam trawlers targeting sole and plaice; and
- Swedish demersal and pelagic trawlers targeting sandeel.

Figure 3.10: Surveillance Data for UK and Non-UK Vessels Actively Fishing within the Study Area, Amalgamated for 2008 to 2012 (Source: MMO, 2010, 2013)



Marine Archaeology and Cultural Heritage

The surveys produced as part of the Hornsea zone projects have identified extensive remains of marine archaeological potential and/or significance within the marine archaeology study area. These comprise largely buried remains of palaeolandscapes and wrecks and possible aviation losses. The palaeondscapes are discretely grouped within the marine archaeology study area.

The western part of Subzone 2 is situated on Well Bank Flats, while the north-eastern part is located almost entirely on the Well Bank. The geology of Subzone 2 comprises a complex of Jurassic and Triassic bedrock overlain by glacial till known as Elbow Formation. Subzone 2 lies on the southern side of the Outer Silver Pit. In the Early Holocene, this was a major lake, and subsequently a marine estuary, forming the focus of drainage from the surrounding landscape, including a series of 'Botney Cut' palaeochannels, running across both Subzone 2 and the offshore cable route corridor. The channels are likely to contain preserved ancient land surfaces, covered and protected by fluvial alluvium deposited in the Early Holocene period.

A total of 36 of the SeaZone records in the marine archaeology study area are identified as wrecks: 21 in Subzone 2 and 15 in the cable route corridor. The remainder are classified as obstructions. A total of 11 of these records are considered by the UKHO to be 'dead' (not seen in repeated surveys). The remainder are designated 'live' and should be assumed to be present in or on the seabed at or near the positions given. The National Record of the Historic Environment ("**NRHE**") lists three recorded positions in the offshore cable route, two of which refer to the Ravonia, a WWII casualty. All but one is within the 12NM of the coast, and there are no NHRE records within Subzone 2.

Existing Infrastructure

A range of other activities are carried out in the area around the offshore site including a number of oil and gas interests (licence blocks, operational or in development fields, and various oil and gas infrastructure); offshore cables; other offshore wind farms; marine sand and gravel dredging; maintenance dredging and marine disposal. The potential effects of the project on these other activities have been assessed in consultation with relevant operators and statutory bodies.

4 Description of Items to be Decommissioned

As part of the HS2 construction the OFTO assets are constructed in a way that it is possible to decommission them at the end of its operational life (approximately 24 years[3]), in order to fulfil regulatory requirements at construction consenting stage.

The items covered in this section for decommissioning by DTPHT are:

- one Offshore Substation Platform ("**OSP**") (including jacket and ALL components on the platform);
- one Reactive Compensation Station ("**RCS**") (including jacket and ALL components on the platform); and
- three offshore export cables.

4.1 Offshore Substation Platform

The project has an installed capacity of 1,386MW. The offshore element of the project consists of one 66/220kV OSP. The purpose of the OSP is to transform the voltages of the electricity generated by the turbines from 66kV up to 220kV for transmission of generated power to the onshore transmission grid system.

[3] Note Ofgem OFTO regime requires the OFTO to be prepared to decommission the transmission assets after 24 years.

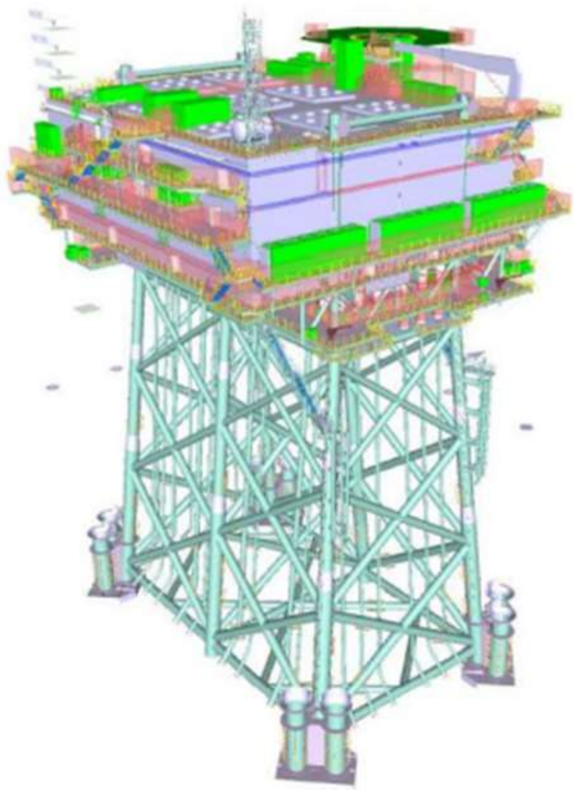
The dimensions of the OSP is as follows:

- topside lift weight of approximately 7,652 Metric Tonnes ("**Mt**");
- foundation and support structure weight (excluding piles) of approximately 4,712Mt (lift weight);
- piles: diameter 2.438m, pile length of approximately 73.15m;
- area of topside: 57m x 51m x 21.6m (L x W x H):

Located on the OSP is:

- six main transformers including coolers;
- three Shunt Reactors;
- 220kV Gas Insulated Switchgear ("**GIS**") bays;
- 66kV GIS switchgear bays;
- six auxiliary transformers and six earthing resistors;
- control and communication room;
- LV & utility room;
- public room accommodation (emergency) laydown areas;
- cable deck.

Figure 4.1: General View of OSP



4.2 Offshore Reactive Compensation Substation Platform

The offshore element of the project consists of one RCS. The purpose of the RCS is to house mid-point shunt reactors used for absorption of reactive power from the export cables that would otherwise have to be absorbed by the offshore reactor/WTGs or be exported to the onshore system.

The dimensions of the RCS are as follows:

- topside lift weight of approximately 2,097Mt;
- foundation and support structure weight (excluding piles) approximately 1,449Mt;
- piles: diameter 2.438m, pile length of approximately 63m; and
- area of topside: 35m x 25m x 15m (L x W x H).

Located on the RCS are:

- three Shunt Reactors including coolers;
- 220kV GIS bays;
- auxiliary transformers and earthing resistors;
- control and communication room;
- LV & utility room;
- public room accommodation (emergency) laydown areas; and
- cable deck.

Figure 4.2: General View of RCS

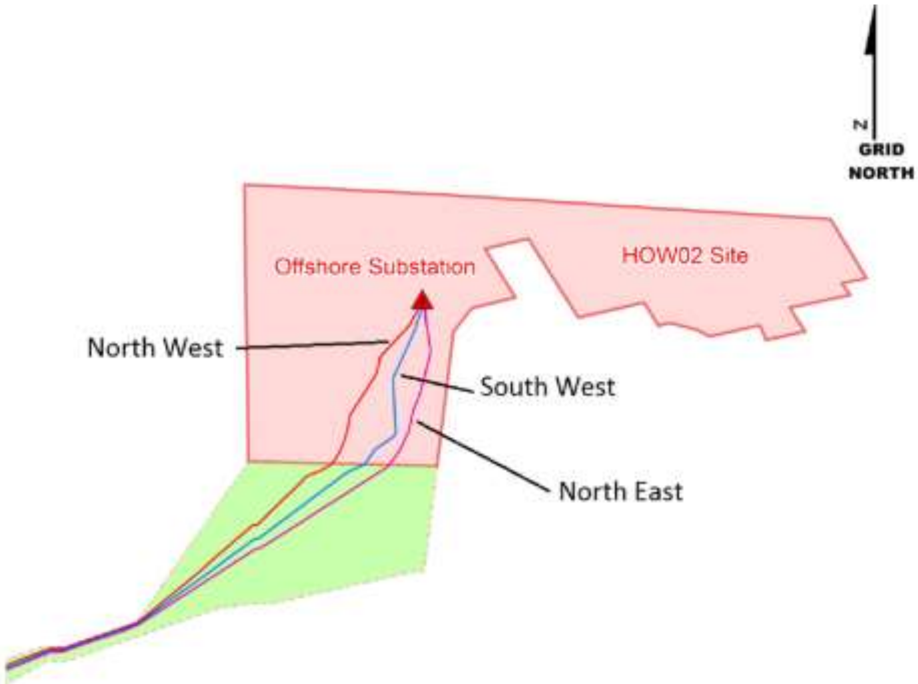
4.3 Offshore Export Cable

The total lengths of the offshore export cables from the OSP to landfall where the transition bay is located at North Coates field, Lincolnshire are as follows:

- North-West export cable – 128km (RCS at KP 65.9);
- South-West export cable – 128km (RCS at KP 65.9); and

- North-East export cable – 128km (RCS at KP 65.9).

Figure 4.3 HS2 Cable Identification



Subsea cables are required to connect the wind farm to the onshore electricity transmission system. As part of their design, each of the cables will also have an internal fibre optic for data transfer and control purposes.

The subsea export cables are buried to a minimum Depth of Lowering ("**DoL**") of 0.49m and a maximum DoL of 2.73m. The cable route has crossings in the following approximate locations:

1. Viking Link HVDC Cables (UK-Denmark Interconnector): KP38.959;
2. 2.4" AMYP4 power cable/10" Amethyst Chemical Line: KP56.075;
3. 4" MEOH Line Theddlethorpe to Murdoch/24" Gas pipeline Murdoch to Thedddlethorpe: KP89.320; and
4. 34" Gas Pipeline Shearwater to Bacton: KP105.895.

At crossings 1 and 2 above, the design is similar and consists of pre-lay mattressing measuring 3m x 6m x 0.3m. On each of crossings 3 and 4, a pre-lay rock layer, which is approximately 0.5m in height, is installed over the crossed asset. The HS2 cables are then surface laid over the mattressing/rock with no cable burial allowed within the defined areas around the crossing. The surface laid cable is then protected by a post-lay rock berm. The rock berm lengths across each of the 12 cable crossings on the three circuits range in length between 175m and 780m.

Other than the crossings, rock berms have been installed at the location of a planned joint at approximately KP38 and at several locations where the minimum DoL has not been met. In summary, the following total length of rock berm and mattressing was installed on each circuit:

- NW circuit – 7.506km;
- SW circuit – 6.762km; and
- NE circuit – 6.618km.

5 Description of Proposed Decommissioning Measures

This section gives an overview of legislation and guidance relevant to decommissioning activities and further outlines in more detail how decommissioning of individual parts of the development will be carried out i.e. the OSP, RCS and the export cables.

At the time of writing this document, the decommissioning phase is expected to commence after 24 years. Therefore, it is not possible to describe the precise technology and methods of decommissioning works. These will develop over the operational lifetime of the wind farm, and should therefore be reviewed and a detailed decommissioning works schedule finalised before the decommissioning phase starts. DTPHT will also review the DP upon request by BEIS.

In decommissioning HS2 DTPHT will apply the principles in Table 5.1.

Table 5.1: Guiding Principles

Guiding Principles	Comments
Minimise environmental impact	In considering decommissioning measures, the Best Practical Environmental Option ("**BPEO**") will be chosen in order to minimise impact on the environment at an acceptable cost.
Safety at all times for all	The highest levels of health and safety will be followed throughout the project lifecycle. Safe practices will be followed in implementing decommissioning solutions.
Maximise reuse of materials	DTPHT will aim to maximise the reuse of waste material from the decommissioning phase and will pay full regard to the 'waste hierarchy', see Table 5.8.
Consideration of the rights and needs of legitimate users of the sea	The rights and needs of other users are respected by DTPHT. Decommissioning activities will seek to minimise the impact on stakeholders and emphasis will be placed on clear and open communication.
Follow Polluter Pays Principle	DTPHT decommissioning and waste management provisions acknowledge our responsibility to incur the costs associated with our impact on the environment.

The BEIS guidance (BEIS, 2019) recommends considering the application of the 'Comparative Assessment Framework' developed for the oil and gas industry and detailed within the Decommissioning of Offshore Oil and Gas Installations and Pipelines Guidance Notes (BEIS, 2018) to determine the best approach for decommissioning infrastructure where complete removal may not be the most appropriate option. Building on these core principles and the UK's commitment to international legislation detailed above, Table 5.2 describes the key objectives that will be considered in developing the final decommissioning strategy for the Project. Where an alternative to complete removal is being considered, this adapted comparative assessment approach will be undertaken with reference to the objectives detailed in Table 5.2.

In accordance with the BEIS guidance, the choice of BPEO should be informed by environmental surveys and assessment prior to decommissioning. Towards the end of the project's operational life, new surveys and assessments would be expected to inform the process of approving the final version of the approved DP and the developer/owner conducting the decommissioning activity. The final programme will ensure compliance with the relevant legislation and take into account best practice, technological capabilities and costs at that time.

Table 5.2: Assessment criteria for developing the proposed decommissioning programme for the OFTO components using Comparative Assessment of options

Assessment Criteria	Guiding Principle	DTPHT's Objective
Safety	**No harm to people**	DTPHT is committed to adhering to the highest standards of health and safety throughout the lifecycle of the project. DTPHT will seek to promote safe practices and minimise risk in the development and implementation of decommissioning solutions.
	Consider the risks, rights and needs of legitimate users of the sea	DTPHT respects the rights and needs of other users of the sea. Decommissioning activities will seek to minimise the impact on stakeholders and emphasis will be placed on clear, open communication.
Environmental	**Minimise environmental impact**	At the time of considering the precise decommissioning procedure, BPEO will be chosen in order to minimise impact on the environment at an acceptable cost.
	Maximise re-use of materials	DTPHT is committed to maximising the re-use of waste materials and has full regard for the 'waste hierarchy'.
	Adhere to the "Polluter Pays" principle	DTPHT's decommissioning and waste management provisions acknowledge our responsibility to incur the costs associated with our impact on the environment.

Assessment Criteria	Guiding Principle	DTPHT's Objective
Technical	**Ensure practical feasibility**	Solutions that are necessary to achieve these objectives must be practicable.
Societal	**Promote sustainable development**	In decommissioning, DTPHT will seek to ensure that future generations do not suffer from a diminished environment or from a compromised ability to make use of marine resources.
Economic	**Ensure commercial viability**	In order that commercial viability is maintained, the Best Available Technique not Entailing Excessive Cost ("**BATNEEC**") decommissioning solutions will be sought.

DTPHT's assumption in establishing the decommissioning requirements is for removal of all the offshore components, with the exception of rock berms and mattressing, to shore for re-use, recycling or energy recovery through incineration at a licensed site. For all the components making up the HS2 OFTO system, this assumption is assessed against the key principles presented above. As such, in some instances, this option is not considered appropriate and alternative options are considered. These alternatives are also assessed according to the above principles and the optimum solution selected.

Drawing on IMO standards, the BEIS Guidance (2019) will consider some exceptions from complete removal of offshore installations in line with those standards. Arguments for exceptions to full decommissioning include the following:

1. **unacceptable risks to personnel** during full removal;
2. **unacceptable risks to the marine environment** during full removal;
3. where full removal would be **technically unfeasible**; and
4. where full removal would involve **extreme costs.**

All work will also follow the recommendations and requirements of the CDM Regulations 2015 (or applicable regulations at the time the work starts).

5.1 Adherence to relevant legislation and guidance

The decommissioning measures are based on known techniques of today and have been proposed taking into consideration the following key UK and international legislation and guidance notes:

- BEIS Decommissioning of offshore renewable energy installations under the Energy Act 2004: Guidance notes for industry (England and Wales) March 2019 (the "**2019 Guidance**");

- The BPEO, the option that provides the most benefits or the least damage to the environment, as a whole, at an acceptable cost, in the long term as well as short term;
- Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone, International Maritime Organisation ("**IMO**"), 19 October 1989;
- Assessment of the Developer's pre-construction DP produced and submitted to the Secretary of State for approval;
- Assessment of The Crown Estate ("**TCE**") lease, the Energy Act 2013 and onshore lease requirements for decommissioning;
- Guidance Notes for Industry: Decommissioning of Offshore Oil and Gas Installations and Pipelines under the Petroleum Act 1998, BEIS, updated in November 2018;
- United Nations Convention on the Law of the Sea ("**UNCLOS**"), 1982 ("**OSPAR**");
- Health and safety regulations including CDM Regulations 2015;
- Environmental Liability Directive;
- Guidelines for Environmental Risk Assessment and Management, Defra, September 2002;
- The Conservation of Habitats and Species Regulations 2017; and
- Other users of the sea.

Other relevant legislation includes:

- Hazardous Waste Regulations 2005;
- Marine and Coastal Access Act 2009;
- The Water Resources Act 1991;
- Directive 2008/98/EC on waste (Waste Framework Directive);
- The Conservation of Habitats and Species Regulations 2017;
- The Conservation of Habitats and Species (Amendment)(EU Exit) Regulations 2019;
- The disposal or recovery of waste on land, principally under Part II of the Environmental Protection Act 1990, other legislation relating to the carriage and transfer of waste and, where appropriate, the Hazardous Waste Regulations 2005; and relevant health and safety legislation;
- London Convention 1972 and the 1996 Protocol, relating to the prevention of marine pollution by dumping of wastes;
- CDM 2015; and
- Appropriate H&S Regulations.

5.2 Phasing and Co-ordination of Decommissioning

At the time of writing, the following wind farms are situated in close proximity to Hornsea Project Two Offshore Wind Farm:

- Hornsea One;
- Triton Knoll;
- Race Bank;
- Humber Gateway;

- Dudgeon East;
- Lincs;
- Sheringham Shoal; and
- Westermost Rough.

Due to the different installation dates across the different windfarms, it's unlikely that decommissioning will coincide in a large number of the cases. However, on recent projects such as Hornsea One and Triton Knoll, it is conceivable that decommissioning could take place around the same time. In such cases, DTPHT will endeavour to liaise with the owners of installations in close proximity, to phase the decommissioning process and take advantage of potential partnerships, where possible. This may result in reduction of environmental impact, costs for vessel transport (through economies of scale), staff and equipment as well as enabling optimal use of onshore handling facilities.

The phasing and detailed programme for decommissioning will be defined closer to the time and submitted to BEIS in advance of decommissioning.

5.3 Plan of Works and Integration

A detailed final DP will be prepared two years ahead of the proposed decommissioning date and will incorporate the results of a detailed recent EIA, thus allowing sufficient time to implement any measures arising into the final DP. The process supporting the EIA will include pre-decommissioning surveys. The plan of work will include detailed method statement together with project specific hazard and risk assessments. DTPHT will also liaise with other developers in the region to ensure potential synergies for decommissioning facilities are investigated.

5.4 Decommissioning of OSP and RCS

It is planned that the structures of the OSP and RCS will be removed in their entirety including the foundations. There are some structures that may be left under the seabed i.e. foundation bottom pieces whereby removal may result in greater impact on the environment than leaving them in situ.

The items to be decommissioned are:

- all of the topside equipment and transformers/reactors;

  (As the transformers/reactors are oil filled, they and the various other components including generators and fuel storage, will be transported to an onshore facility for dismantling, with constituent parts processed for reuse, recycling and disposal. This will be performed in conjunction with the generator, if possible);
- the topside's support structure;
- the jacket structure, including all appurtenances such as J-Tubes and boat access system;
- the piles will be cut at an appropriate height to allow the jacket to be separated from the foundation;

  (Following the cutting operation, the jacket structure will be removed as a single structure after the removal of the topside. The piles still in the seabed will then be removed, where possible, using the most appropriate extraction tools available at the time. Table 5.3 for an outline on current technology and future technology still undergoing research and development ("**R&D**"). However, if removal of piles is not possible, the piles will be cut at such a depth below the surface of the seabed that the remaining parts do not pose a danger for shipping or fishing vessels, even if sediment should become relocated. The jacket and the piles will then be lifted by a heavy lift vessel and taken ashore for either re-use or recycling); and

- the turbine interconnecting cables adjacent to the substructure will be cut at a point below the surface of the seabed with the generator responsible for there decommissioning (cut sections will be removed with minimal disruption to the seabed).

It is expected that each of the OSP and RCS will be decommissioned in three main stages, comprising the complete removal firstly of the topside, followed by removal of the jacket foundation and lastly, the piles, if possible.

Prior to removal of the topside, a number of preparatory activities will be conducted including:

- de-energisation and isolation of electrical control and power cables from National Grid and SCADA system;
- reduction of transformer/reactor oil levels in conservator tank and cooler fans to manage liquid load and bracing of the transformers and reactors for sea transportation;
- dismantling of terminations for export and array cables;
- removal of all cables back to cable deck, or seabed;
- removal of all unsecured loose items from the topside;
- containment and/or removal of potentially hazardous/polluting fluids;

  (A special agreement will be made with the GIS supplier to ensure the safe removal of the SF_6 Gas); and
- cutting of welded stab-in connections between topside and foundation.

A Heavy Lift Barge Vessel ("**HLBV**") will be used to dismantle the topside and transport the structure ashore for further dismantling.

The process of decommissioning of the OSP and RCS is likely to involve the following first stage sequence:

- A HLBV takes the weight of the topside;
- the welded stab-in connections between topside and jacket structure are cut;
- the HLBV lifts the topside module onto an adjacent barge; and

the topside is transported back to port where it is transferred to the quayside for dismantling, with electrical equipment and oil from transformers and reactors being removed and parts processed for reuse, recycling and disposal.

The process of decommissioning of the OSP and RCS is likely to involve the following second stage sequence:

- a HLBV takes the weight of the jacket structure;
- the piles are cut at an appropriate height to allow the jacket to be separated from the foundation;
- the HLBV lifts the jacket structure onto an adjacent badge: and
- the jacket structure is transported back to port where it is transferred to the quayside for dismantling and recycling.

The process of decommissioning of the piles is likely to involve the following third stage sequence:

- the piles still in the seabed will be removed using the most applicable technology at the time, it is anticipated that this method will be one of the technologies in Table 5.3;
- the HLBV lifts the piles onto an adjacent badge: and
- the piles are transported back to port where they are transferred to the quayside for dismantling and recycling.

If complete removal of the pile below the seabed is considered neither practical nor environmentally desirable, the appropriate depth for removal would depend upon the sea-bed conditions and site characteristics at the time of decommissioning. If this decision is taken, it will be in line with the IMO standards as complete removal of the foundations may involve an unacceptable risk to the marine environment and/or extreme cost, based on current knowledge. The general target for cutting of the jacket piles will be at such a depth below the surface of the seabed that the remaining parts do not pose a danger for shipping or fishing vessels, even if sediments should become relocated. When assessing the possibility of cutting below the seabed, it is important to consider the need to overcome frictional forces acting on the pile. Considerable excavation will have to take place, approximately two meters in diameter for every meter in depth below the seabed.

If an obstruction exists above the sea bed or an obstruction appears following decommissioning which is attributable to HS2, this obstruction will be marked by the owner so as not to present a hazard to other sea users. The marking will remain in place until such time as the obstruction is removed or is no longer considered to be a hazard to other sea users. The monitoring of this obstruction will be built into the decommissioning monitoring and maintenance programme.

Environmental issues and hazards to working practice will be assessed prior to decommissioning operation with particular attention to the following risks:

- oil and chemical discharge to sea;
- seabed contamination due to excavation debris and drill cuttings from pile removal;
- physical disturbance to the seabed;
- potential damage to substructure and subsea cables due to dropped objects; and
- underwater noise generated by decommissioning activities.

In decommissioning the OSP and RCS, it is considered that the greatest environmental impact is likely to arise from removal of the foundation pile. The next section provides an assessment of the options for removal of the foundation piles, taking into account current technology and scientific knowledge as well as the anticipated impact of each considered option.

Partial Removal of Piles

If assessment at the time of decommissioning makes complete removal unviable, the proposed approach to the decommissioning of the OSP and RCS foundation piles would be to cut off the piles at such a depth below the surface of the seabed that the remaining parts do not pose a danger for shipping or fishing vessels, even if sediments should become relocated. Currently, either abrasive Diamond Wire Cutting ("**DWC**"), water jet cutting or remotely controlled underwater thermal cutting would be considered for the cutting of the piles, but other methods may be preferred at the time of decommissioning. With the foregoing methods, excavation around the pile will be needed to complete the pile cutting below the seabed. The material cut off from the piles will be recovered and taken ashore for scrap recycling. Any subsea holes left after piles removal will be backfilled by natural tidal action, see Figure 5.1.

Figure 5.1: Cut Below Seabed with Accretion above Remaining Pile Section.

Complete Removal of Piles

Depending on the ground conditions, industry experience, and current and predicted technological maturity, the currently available and future techniques (currently at R&D stage) have been considered from across the offshore wind sector and associated sectors including oil and gas, as detailed below. It is noted that the piles for HS2 are buried at down to about 73m below seabed, therefore, irrespective of the method used, full removal would cause damage to the surrounding seabed and marine environment. As indicated in the preceding section, the second stage of full removal would involve cutting the piles above seabed level to separate the jacket from the foundation. DWC would be the preferred means of cutting where there is good access around the pile. This would be followed by application of any of the methods in Table 5.3, depending on maturity at the time of decommissioning.

Table 5.3: Summary of Techniques Reviewed

Technique	Sector (origin, other uses)	Currently Available Techniques	Future Possible Techniques
Vibration	Offshore Wind	✓ (Requires more applications to be a proven technique)	
Jetting	Oil & Gas	✓ (Proven outside of offshore sector. Would need to be combined with other techniques.)	
Buoyancy	Offshore Wind		✓ (R&D)
Pull-out via Jacking	Offshore research		✓ (R&D)

Technique	Sector (origin, other uses)	Currently Available Techniques	Future Possible Techniques
Pile Pressurisation	Offshore research		✓ (R&D)

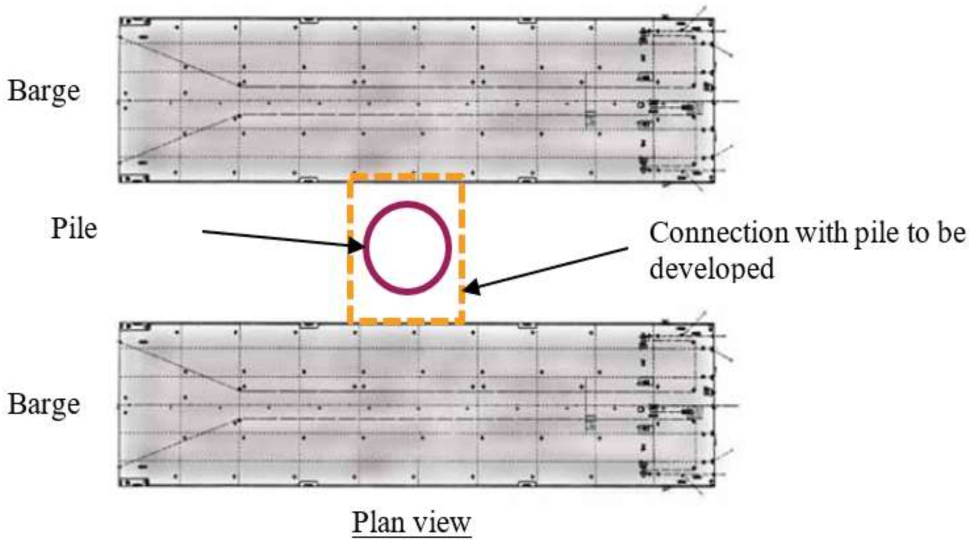
The methods and readiness of the technology in Table 5.3 is discussed further below:

- **<u>Vibration</u>**: Removal via vibration is practically feasible using the current available technology. Consultation from a specialist piling contractor suggested it should be possible to attach an underwater hammer to cut in-situ pile head. Due to the vibration, short-term noise or wave disturbance to the local environment is likely to occur when using this technique. To date, there are no examples of full-scale removal of piles using vibration and further research is required to quantify the effect of different levels of vibration on the extraction force required for a pile. This is particularly a key risk for clays, with no data currently identified from which to draw conclusions. Therefore, the lack of evidence available to confirm the effect of vibration on piles in clay remains a key risk.

- **<u>Jetting</u>**: Jetting is commonly used for both onshore and offshore piles to break up the soil below the pile as it is installed. It is not expected that this method would be able to remove the piles by itself, as the piles are very deep below the seabed. This method is only likely to be used to ease extraction with another methodology by reducing the strength of the soil.

- **<u>Buoyancy (not proven technique yet)</u>**: Buoyancy is considered the most technically feasible option for full removal, as it utilises existing technology to the greatest extent. The technique would use external tanks that are ballasted, attached to the pile and then de-ballasted, exerting upwards force in a controlled manner. Modifications to existing solutions would be required, including a structure to enable connection to the pile. A symmetrical arrangement would be required to enable vertical lift without rotation. This could be achieved with two barges acting on either side of the pile, as shown in Figure 5.2, a support beam, or truss, spanning across the width of the barges may be required to prevent them rolling. It should be noted that several cycles of ballasting and de-ballasting may be required to ensure complete removal of the pile. However, this technique has never been done or proven. This technique may also take significantly longer than others and is not commercially available.

Figure 5.2: Schematic of Dual Barge Buoyancy Removal Option



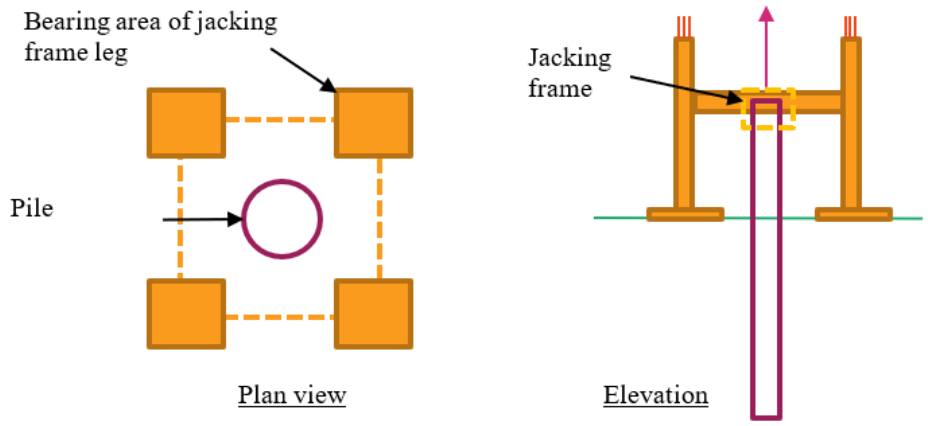
An alternative option to using barges would be to develop a bespoke ballast tank assembly, such as those used in the Frigg field (9000te Frigg DP2 jacket) decommissioning Figure 5.3. These tanks could be designed to fit and connect to the piles and could potentially incorporate higher ballast pumping rates to speed up the removal process. It should be noted that buoyancy was only used to re-float the jacket after the jacket's pile foundations were cut and was not used to pull the piles from the seabed. Currently, there are no examples of buoyancy being used to remove piles.

Figure 5.3: Buoyancy Tank Assemblies (BTA) used to Float the Frigg DP2 Jacket

- **Pull-out via Jacking (not proven technique yet)**: Use of jacks supported on a buoyant platform seem unlikely to be economically viable compared to the use of buoyancy directly. Solutions have therefore considered jacking from the seabed. This would require the engineering development of a bespoke jacking frame, which could be reused at each pile location.

  Although the bedrock at seabed level provides competent bearing, significant bearing area is still required to overcome extraction forces. An example of the jacking frame leg proportions is shown in Figure 5.4.

Figure 5.4: Schematic of Seabed Jacking Frame

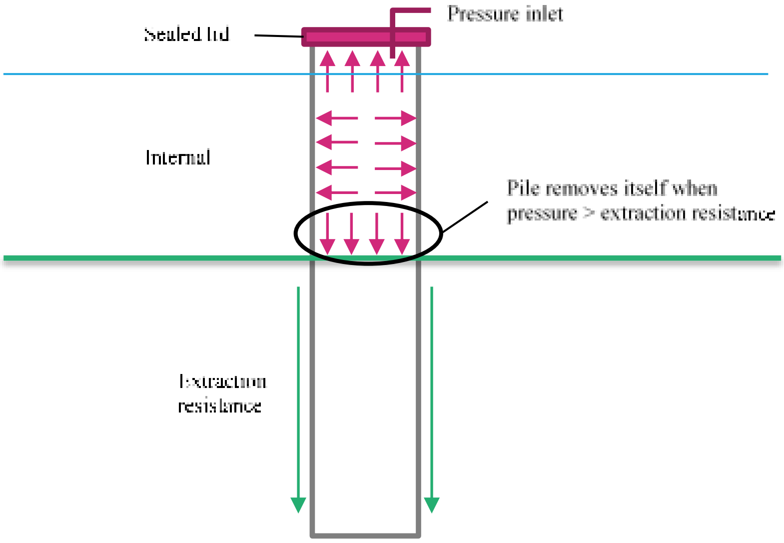


The seabed frame would require a strand jack system, similar to that used on jack-up rigs Figure 5.5.

Figure 5.5: A Jack-up Rig with Strand Jack System

- **<u>Pile pressurisation (not proven technique yet)</u>**: This technique is based on applying a pressure to the inside of the pile by sealing the top of pile and pressurising the inside with a fluid such seawater or air Figure 5.6. For the foundations considered here, seawater would be used for the pressurised fluid. Once the internal pressure exceeds the extraction force, the pile would remove itself from the seabed and can be lifted out. The pile pressurisation technique is relatively immature, with more research required to both develop a method to attach the equipment to the cut in-situ pile and confirm sufficient capacity for all the piles. With future R&D, it is considered possible that this technique could be applicable to the DTPHT site.

Figure 5.6: Schematic of Pile Removal by Pressurisation



An assessment of the OSP topside decommissioning process against the guiding principles is outlined in Table 5.4.

Table 5.4: Assessment of Piled Foundation Decommissioning Options against Guiding Principles

Assessment Criteria	Guiding Principle	Complete Removal of Piled Foundations	Cutting of Piled Foundations at a Depth That Does Not Pose a Danger to Other Sea Users
Safety	**No harm to people**	Significant excavation required to remove seabed material prior to pile recovery. There may be a requirement for diver support associated with subsea cutting, excavation and lifting operations. Any diving operations could result in significant risk to dive teams.	Fewer activities to be undertaken over a shorter time period offshore, minimising risk to personnel. Post decommissioning site monitoring will identify any unlikely exposure with the result that safety risk is insignificant.
	Consider the risks, rights and needs of legitimate users of the sea	Disadvantages to other users of the marine environment include disruption over a longer time period whilst the works are undertaken, and remaining scour holes associated with excavation.	Negligible risk presented providing adequate consultation and notification, cutting is to a sufficient depth, site is monitored post decommissioning and any unlikely exposure identified.
Environmental	**Minimize environmental impact**	Excavation pits over a wide area causing potentially significant impact to marine environment, considering excavation will be approximately 2m for every 1m in depth. Associated dumping of excessive volume of excavated waste material may be required. Disturbance would take place over long time period.	Piles cut off at such a depth below the surface of the seabed that the remaining parts do not pose a danger for shipping or fishing vessels. However, depth of cutting will be dependent on local ground conditions. The final depth of cutting will be determined prior to completing the final DP and take into consideration all available information at the time. Considerable excavation is required to cut below the seabed. Therefore, the depth of cutting should be informed by an assessment of impacts from the excavation diameter versus of foundations becoming exposed due to shifting sediments. By cutting below the seabed works would take place over reduced time period and involve less equipment, than complete removal.

Assessment Criteria	Guiding Principle	Complete Removal of Piled Foundations	Cutting of Piled Foundations at a Depth That Does Not Pose a Danger to Other Sea Users
			Seabed recovery shorter than complete removal scenario. No excavation required in comparison to complete removal scenario.
	(Sediment disturbance)	Significant negative disruption of the sediment caused by pulling out the piles.	Some disruption of the seabed surrounding the piles.
	(Benthic ecology disruption)	Potential for extreme benthic ecology disturbance as pile pulled out and if remaining hole collapses inwards.	Some benthic ecology disturbance due to excavations for pulling out the pile.
	(Physical presence and avoidance of marine mammals)	Impact to physical presence and avoidance of marine mammals significant due to increased number of vessels and increased operational time.	Impact to physical presence and avoidance of marine mammals moderate due to moderate vessel time.
	(Water quality impact)	Potential disturbance of potentially contaminated sediments and increased water turbidity.	Potential disturbance of contaminated sediment, increased water turbidity due to excavations. Not expected to be long term impact.
	(Permeant obstruction/changes to seabed morphology)	Potential for unstable seabed, potential geo-technical risks.	No significant impact. Cut made below sea level, hole expected to be back filled.
	(Carbon emissions related to vessel time)	Significant operational time to complete removal, higher number of vessels with more equipment required. Enhanced fuel used and therefore emissions.	Moderate vessel time related to dredging and cutting.
	(Fuel spills from decommissioning vessels)	Significant due to increased number of vessels and increased operational time.	Moderate due to moderate vessel time.
	(Toxic chemical release from vessels and	Significant due to increased number of vessels and increased operational time.	Moderate due to moderate vessel time.

Assessment Criteria	Guiding Principle	Complete Removal of Piled Foundations	Cutting of Piled Foundations at a Depth That Does Not Pose a Danger to Other Sea Users
	equipment e.g. paints, coatings, lubricants)		
	Maximise re-use of materials	Maximum amount of piled foundations potentially available for recycling.	Less foundation material available for recycling relative to complete removal.
	Adhere to the "Polluter Pays" Principle	Consistent in principle, assuming a suitable disposal solution can be found for the excavated waste material and that the seabed can be restored.	Consistent, as remaining elements of piles remain in the seabed and therefore do not affect other sea users.
Technical	**Ensure practical Feasibility**	Not a practical solution: Extreme risk associated if heavy lift is required, would require considerable excavation with associated storage or disposal of large volumes of waste. Complete pile removal methods are not currently available (Oil & Gas tend to cut and leave them in place) and so unfamiliar activities and methodologies increase risk to accidents and errors during operations.	Standard and well-established procedures and equipment.
Societal	**Promote sustainable development**	In the long-term complete removal affords maximum flexibility over use of seabed, though considerable impacts are likely over the whole site in short to medium term.	Providing remaining structures do not become exposed, most future activities will not be affected. Seabed recovery is considered highly likely.
Economic	**Ensure Commercial Viability**	Not considered commercially viable: excavation and extreme lifting is estimated to involve major equipment requirements over longer periods of time. There is no proven methodology available for complete removal of piled foundations.	Considerably less expensive alternative to complete removal, involving minimal excavation and minimising environmental impacts.

Scientific Evidence

Total pile removal is still unheard of in the offshore industry; cutting and backfilling is generally accepted as the best option.

Fowler et al (2018) carried out a recent study on the environmental benefits of leaving offshore infrastructure in the ocean. The study surveyed 200 experts around the world (spanning academic, government and private organisations) and concluded, "in contrast to current regulations, 94.7% of experts (36 out of 38) agreed that a more flexible case-by-case approach to decommissioning could benefit the North Sea environment. Partial removal options were considered to deliver better environmental outcomes than complete removal for platforms, but both approaches were equally supported for wind turbines. Key considerations identified for decommissioning were biodiversity enhancement, provision of reef habitat, and protection from bottom trawling, all of which are negatively affected by complete removal.".

5.5 Decommissioning of Export Cables

In accordance with the March 2019 Guidance, the default position is for full removal of the cables from the seabed, with the exception of cables located under mattresses or rock berms. In those sections, the ends will be weighted down and buried at the current depth to ensure that no navigational risk arises in the sense that fishing gear or anchor would interface with the as left cables.

The sequence for removal of cables is anticipated to be:

- identify the location of the cables that need to be removed;
- seabed material may need to be removed to locate the cable, likely to be carried out using a water jetting tool similar to that used during cable installation e.g. mass flow excavator.
- buried cables will be located using a grapnel to lift them from the seabed, alternatively, or in addition, it may be necessary to use an Remote Operated Vehicle ("**ROV**") to cut and/or attach a lifting attachment to the cable so that it can be recovered to the vessel;
- the recovery vessel will either 'peel out' the cable as it moves backwards along the cable route whilst picking it up on the winch or cable engines, or, if the seabed is very stiff/hard it may first under-run the cable with a suspended sheave block to lift the cable from the seabed, the use of a suspended sheave block could be carried out before by a separate vessel such as a tug prior to the recovery vessel 'peeling out' the cable;
- the recovery vessel will either spool the recovered cable into a carousel or chop it into lengths as it is brought on-board before transport to shore; and
- parts will be processed for reuse, recycle or disposal.

Complete Cable removal vs Partial Cable Removal

Table 5.5 compares and contrasts the options of complete removal of the export cables with the alternative of leaving some sections of the cable in situ (e.g. under rock berms and mattresses) to mitigate risks associated with removal.

Table 5.5: Assessment of Subsea Export Cabling Decommissioning Options against Guiding Principles

Assessment Criteria	Guiding Principle	Complete Removal of Subsea Cable	Complete Removal of Subsea Cable wit the Exception of Cable under Mattresses and Rock Berms
Safety	**No harm to people**	There would be greater risk to personnel, being offshore for longer, compared to leaving the cable in situ due to increased offshore operations, however the risk is not considered excessive. There is also potentially increased need for divers during cable and/or mattress/rock berm removal, which is a high-risk operation. Cable removal operations are not very common currently (oil and gas tend to leave them in place along with pipelines) and so unfamiliar activities and methodologies increase risk to personnel.	Cable buried within stable seabed or under rock berms / mattresses does not pose safety risks to marine users
		Any potential risk to mariners, fishermen and navigation routes is unlikely using existing decommissioning methods.	Left in situ under rock berms and mattresses would marginally result in reduced temporary fishing exclusion during the removal works.
	Consider the risks, rights and needs of legitimate users of the sea	Removal affords maximum flexibility over use of seabed.	Cable buried under rock berms or mattresses do not pose safety risks to marine users.
		Increased risk for potential damage of third party assets crossing the export cable or in the proximity during decommissioning works.	Leaving the cable in situ at cable crossings avoids the risk for potential damage to third party infrastructure, such as subsea oil/gas pipelines and cables.
		Where it might be required to carry out work within third-party safety/ exclusion zones, vessel operation may not be authorised and/or cause safety risk to third-party assets.	Leaving the cable in situ under rock berms or mattresses will have no impact associated with exclusion and/ or safety zones around third party infrastructure in the proximity.

Assessment Criteria	Guiding Principle	Complete Removal of Subsea Cable	Complete Removal of Subsea Cable wit the Exception of Cable under Mattresses and Rock Berms
Environmental	**Minimize environmental impact**	Given the considerable length of cable and the need for jetting techniques, removal would cause considerable damage and disruption to the seabed and established communities. These impacts could be considered large relative to the environmental gains from removal. The seabed will have recovered over time following burial of the cables; removal would result in new disturbance and destruction of marine habitats.	Benign: no environmental impact associated with long term disintegration of buried cables, based on experience from the Oil & Gas industry. There is high potential for reefs to have formed in the area, especially on rock berms and mattresses that then attract and create enhanced habitat opportunities for all kinds of other species.
	(Rock berm / mattressing related to cable)	Where there has been rock berms or mattresses, these will likely have been colonised, thus removal of the cable and associated rock berm / mattresses would disturb these new habitats and species.	The rock berms / mattresses will have been colonised by marine life. Therefore, leaving the cable and associated rock berms in situ creates enhanced habitat opportunities for marine species.
	(Sediment disturbance)	Significant negative disruption of the sediment caused by pulling out the cable.	Marginally reduced as no disruption of the seabed surrounding the cable remaining in situ under rock berms and mattresses.
	(Benthic ecology disruption)	Potential for extreme benthic ecology disturbance as cable pulled out.	Marginally reduced due to no operations for cable left in situ under rock berms and mattresses.
	(Physical presence and avoidance of marine mammals)	Impact to physical presence and avoidance of marine mammals significant due to increased number of vessels and increased operational time.	Impact to physical presence and avoidance of marine mammals reduced marginally due to slightly reduced vessel time at rock berm and mattress locations.
	(Water quality impact)	Potential disturbance of potentially contaminated sediments.	Potential disturbance of contaminated sediment due to operations. Not expected to be long term impact.

Assessment Criteria	Guiding Principle	Complete Removal of Subsea Cable	Complete Removal of Subsea Cable wit the Exception of Cable under Mattresses and Rock Berms
	(Carbon emissions related to vessel time)	Increased Greenhouse Gas (“**GHG**”) emissions associated with the vessels performing cable removal operations and waste disposal once onshore.	Marginally reduced GHG emissions associated with vessels, as vessels would not be needed and for rock berm and mattress locations. Marginally reduced emissions associated with waste disposal of reduced cable length.
	(Fuel spills from decommissioning vessels)	Significant due to increased number of vessels and increased operational time	Marginally reduced due to no vessel time at rock berm and mattress locations.
	(Toxic chemical release from vessels and equipment e.g. paints, coatings, lubricants)	Significant due to increased number of vessels and increased operational time.	Marginally reduced due to no vessel time at rock berm and mattress locations.
	Maximise re-use of materials	Maximum material, e.g. copper, potentially available for reuse.	Removing of cable other than under rock berms and mattresses still allows for some considerable amount of material re-use.
	Adhere to the “Polluter Pays” principle	Consistent, assuming suitable disposal option is found for surplus cable components.	Although marginally reduced pollution risk for leaving cable in situ under rock berms and mattresses there is still a considerable amount of cable and components from HS2.
Technical	**Ensure practical feasibility**	Not practical to remove rock berms / mattresses and likely to cause damage to marine environment. Cable removal operations are not common currently (Oil & Gas tend to leave them in place along with pipelines) and so unfamiliar activities and methodologies increase risk of accidents and errors during operations.	Marginally easier to undertake, as there is no need for rock berm and mattress removal.

Assessment Criteria	Guiding Principle	Complete Removal of Subsea Cable	Complete Removal of Subsea Cable wit the Exception of Cable under Mattresses and Rock Berms
Societal	**Promote sustainable development**	Though considerable 'troughs' would remain on the seabed in the short-medium term, complete removal affords maximum flexibility over use of seabed in the long term.	Some future activities may be limited, e.g. extraction at rock berm and mattress locations.
Economic	**Ensure commercial viability**	Expensive operation, offset to an extent by copper resale value. Vessel rates, fuel costs and metal price are volatile and may change over time and further drive up the total decommissioning costs, altering the economic balance. Increased vessel days associated with decommissioning of the cables, and staff rates having people offshore for longer.	Reduced cost involved with leaving cable under rock berm and mattresses.
	Commercial opportunities	Cable, rock berm and mattress removal would destroy any habitats and species which would have colonised in the area and enhanced fisheries resources. This could either reverse commercial opportunities or delay them for a long time.	The area will have been colonised by marine life at rock berms and mattress locations. This may include commercially important species (such as mussels, lobster, crab and finfish) in the UK, thus enhancing fisheries resources.

Scientific Evidence

Full removal of the subsea export cable, except where covered with rock berms / mattresses is our default, however it is noted that partial removal of the subsea cable provides less risk to personnel and the marine environment, which is underpinned by a number of scientific and research sources including Fowler et al (2018) and Macreadie et al (2011).

Full removal will result in a significantly greater impact to the seabed environment than installation. It is considered that the seabed will have recovered since installation, and since installation features such as rock berms may now support additional habitats.

Where there has been rock dump, these will likely have been colonised (Lacey et al., 2018) (Fowler et al, 2018.), thus, removal would destroy these new habitats and species. There are numerous articles showing the ecological growth on oil and gas subsea infrastructure. For example, Macreadie et al (2011) reference Love and York's 2005 study, which compared fish assemblages associated with an oil and gas pipeline and the adjacent sea floor in the Santa Barbara Channel, southern California. This noted that oil and pipelines might act as nurseries for bocaccio rockfish, based on observed size frequencies of fish and an apparent lack of predation in the vicinity. In the UK, BMT Cordah undertook a study on the management of marine growth during decommissioning in 2011, this noted that in the North Sea, marine growth comprises a variety of organisms that occur naturally on hard substrata, including seaweeds such as kelp, anemones, hydroids, mussels, barnacles, tube worms, soft and hard corals. This can include reefs listed under Annex I of the Habitats Directive, particularly cold-water coral *Lophelia pertusa* and *Sabellaria spinulosa* reefs. Although not all of these particular species may be present within the HS2 site, the infrastructure could create habitats for other marine features, which colonise on hard substrata.

It is noted that there is no discussion of the presence of species on infrastructure within the BEIS guidance and whether the presence of protected species would affect the DP.

5.6 Summary of Proposed Decommissioning Measures

A summary of the proposed decommissioning measures for the offshore components of the DTPHT are outlined in Tables 5.6 and 5.7.

Table 5.6: Summary of Proposed Decommissioning Measures for HS2

Component		Proposed decommissioning measures
OSP and RCS	Topside	Complete removal
	Jacket & Foundation	Complete removal, including piles, technology permitting. If not feasible or deemed environmentally unacceptable, piles will be cut off at such a depth below the surface of the seabed that the remaining parts do not pose a danger for shipping or fishing vessels.
Offshore export cable		Removed in all sections other than those under rock berms and mattresses, which will be weighted down and buried at such a depth below the surface of the

Component	Proposed decommissioning measures
	seabed that the remaining parts do not pose a danger for shipping or fishing vessels.

Table 5.7: Decommissioning Programme Technical and Environmental Summary

Activity	Description	Approach
Dis-connection	Transmission assets disconnected from NGET and wind turbine generators, isolated and earthed.	Undertaken in accordance with the safety rules in place at the time.
OSP and RCS Topside Structure	Houses transmission assets: oil-filled transformers, switchgear, and termination of the OFTO export cables and OSP wind farm array cables. Gross lift weight OSP topside is circa 7,652 metric tonnes ("**Mt**"). Gross lift weight of the RCS topside is circa 2,097Mt.	Oil filled transformers braced for sea transportation, transformer oil levels reduced in the conservator tank and cooler fins to deal with a liquid load. Cables will be removed or cut at the hang-off. Any loose items will be removed. The topside is then cut from the jacket and removed in one piece. Parts will be processed for reuse, recycling and disposal in line with the waste hierarchy and GIP.
OSP and RCS Jacket Structure and Piles	Gross lift weight of the OSP jacket structure and supporting foundations and skirt piles is circa 4,712Mt. Gross lift weight of the RCS jacket structure and supporting foundations and skirt piles is circa 1,449Mt.	Critical joints and members of the structure will be inspected using a remote operate vehicle. Post topside removal and cutting operation, the jacket structure will be removed. The piles will be removed, where possible, using extraction tools such as heavy vibratory hammers, depending on the most applicable technology at the time. If removal of jacket piles is not possible, the piles will be cut off at such a depth below the surface of the seabed that the remaining parts do not pose a danger for shipping or fishing

Activity	Description	Approach
		vessels, even if sediments should become relocated.
Offshore Export Cables	The OSP is connected to the RCS by three export cables each of circa 62km length buried to a target DoL of between 0.6 and 2.63 metres. The RCS is connected to land via three export cables of circa 66km in length buried to a target DoL of between 0.49 and 2.73 metres. The subsea export cable consists of three XLPE insulated; three core 1000mm^2, 1200mm^2 and 1600mm^2 copper conductor cables.	The cable will be fully removed where mattresses and rock berms are not installed. At mattress locations, the cable ends will be weighted down and buried to a secure depth below seabed level, such that there is no danger for shipping or fishing vessels. Recovered cable will be stripped and recycled.

5.7 Proposed Waste Management Solutions

DTPHT is committed to maximising the reuse of waste materials and pays full regard to the 'waste hierarchy' which suggests that reuse should be considered first, followed by recycling, incineration with energy recovery and lastly, disposal. In any event, waste management will be carried out in accordance with all relevant legislation and it would be intended that any disposal takes place on land.

At the time of decommissioning, where assets have remaining technical asset life and a second hand market exists DTPHT will look to sell assets. If this is not possible, a waste management plan will be drawn up prior to the commencement of decommissioning to ensure that adequate time remains for the proper provisions to be made.

An overview of expected types of wastes and their expected re-use, recycling or disposal is provided in Table 5.8. In any event, waste management will be carried out in accordance with all relevant legislation at the time of decommissioning and it is intended that any disposal will take place on land.

Table 5.8: Re-use, Recycle and Disposal Options

Asset	Waste Type	Re-Use	Recycle	Disposal
Jacket and foundations from OSP and RCS	Steel from topside and Foundations		X	
Main power transformers	Steel, iron laminate, copper, transformer oil	X	X	
Gas insulated switchgear	Copper, electronics	X	X	

Asset	Waste Type	Re-Use	Recycle	Disposal
OSP and RCS power cables	Copper and aluminium		X	
Diesel generators	Steel, copper and electronics	X	X	
Reactors	Steel, iron laminate, copper and reactor oil	X	X	
Auxiliary transformers	Steel, iron laminate, copper, transformer oil	X	X	
SCADA, protection panels	Steel, electronics		X	
Neutral earthing resistor	Steel, copper	X	X	
LV switchboard	Steel, electronics	X	X	
Subsea cables	Copper, lead and steel		X	
Onshore cables	Aluminium, lead, copper and steel		X	
Other	Non-recyclable materials and fluids			X

5.8 Details of Any Item Left in-situ Offshore Following Decommissioning

It is anticipated that the cable protection installed along the ECR on the seabed (mattresses, rock berm and associated cable) will remain in situ.

Leaving cable protection on the seabed is associated with certain positive effects (leaving the exposed rock habitat and benthic community that will have likely colonised it in place, and avoiding the increased vessel disturbance/damage and sediment effects associated with removing the material). However, leaving cable protection in place is also associated with certain adverse effects (the enduring loss of the original biotopes and potential scouring of surrounding natural seabed sediments). On balance, avoiding impacts arising from removal and the positive impacts of colonisation outweigh the negligible to minor adverse impacts of continued seabed loss and potential scour. A similar rationale applies in relation to cable and pipeline crossings where mattresses and rock armour cover the exposed cable, and where removal is undesirable owing to the risk of damaging the other cable or pipeline.

Leaving the cable protection system in-situ is in line with the March 2019 Guidance, which states in:

- Section 7.1.2 "Decommissioning programmes……….should include a base case of all infrastructure being removed"
- Section 7.2.3 goes on to state "Exceptions will be considered on a case by case basis prior to decommissioning, taking on board environmental conditions, the balance of risk, cost and technological capabilities at the time"; and finally

- Section 7.2.6 states "Where less than full decommissioning is proposed, developers/owners will need to engage with other regulators (such as the Marine Management Organisation and Natural Resources Wales in respect of Marine Licences and Maritime and Coastguard Agency and the General Lighthouse Authority in connection with navigational risk) and their landlord on the acceptability of the proposals."

In line with the March 2019 Guidance Section 7.2.2 the basis of the cable protection is that one of the four IMO standards where non-removal or partial removal may be considered is met, being:

1. the installation or structure will serve a new use, whether for renewable energy generation or for another purpose, such as enhancement of a living resource (provided it would not be detrimental to other aims, such as conservation);
2. entire removal would involve an unacceptable risk to personnel;
3. entire removal would involve an unacceptable risk to the marine environment; and
4. entire removal would involve extreme costs.

The primary reason for leaving cable protection in situ is:

IMO Standard 2:

1. Decommissioning of the cable protection will require the involvement of divers in significant and dangerous operations e.g. in preparatory work for installation/recovery/snagging works of the lifting operation required during removal to maintain stability etc.;

IMO Standard 3:

1. **Cable Protection:** Leaving cable protection on the seabed is associated with certain positive effects (leaving the exposed habitat and the benthic community that will have colonised it in place, and avoiding the increased vessel disturbance/damage and sediment effects associated with removing the material). However, leaving cable protection in place is also associated with certain adverse effects (the enduring loss of the original biotopes and potential scouring of surrounding natural seabed sediments). On balance, avoiding impacts arising from removal and the positive impacts of colonisation outweigh the negligible to minor impacts of continues seabed loss and potential scour.

   In addition, cable protection will also trap sand migration on the seabed. It is assumed that some form of localised dredging, or more likely the use of a remotely operated under water excavator tool as used in cable re-burial would be used to pre-blast or clear the sand away from the cable protection with associated disturbance / damage and sediment effects associated with removing the material.
2. **Jacket Piles:** Complete removal of the pile below the seabed with currently proven technology is considered neither practical, nor environmentally desirable due to the considerable excavation that will have to take place, approximately two metres diameter for every metre in depth below the seabed, with piles buried to a depth pf approximately 87.44 (OSP) and 61.4 metres (RCS) resulting in disturbance of 175 metres (OSP) and 123 metres (RCS).

IMO Standard 2 and 3:

1. **Cable protection**: Removal at crossing locations is undesirable owing to the risk of damaging the third party infrastructure that the rock berm / mattress

is protecting, which includes other power cables and a major gas pipeline. Damaging third party assets may lead to a major pollution incident and may involve divers in the significant and dangerous repair work operations.

Table 5.5 also provides an assessment of removal of rock berms and mattresses against leaving in situ against guiding principles and assessment criteria for developing the proposed DP using comparative assessment of options.

An updated EIA will be produced in year 22 to review and confirm assumptions based on environmental conditions at the time. DTPHT will enter into discussions with BEIS and TCE regarding long term monitoring and residual liability of any infrastructure left in-situ.

5.9 Lighting and marking

During the decommissioning of the HOW02 Offshore Wind Farm, appropriate aviation and nautical marking and illumination will be applied.

In accordance with the HOW02 consent under Section 36 of the Electricity Act 1989, DTPHT is committed to exhibiting the appropriate marks and lights during the decommissioning of the project.

In relation to aviation safety, the shape, colour and character of the lighting will be compliant with the Air Navigation Order 2005, or as otherwise directed by the Civil Aviation Authority or the relevant legislation at the time.

In relation to navigational safety, lights and marks will be agreed with Trinity House, in consultation with the Maritime and Coastguard Agency prior to decommissioning to specify any obstruction marking that may be required during the removal operations. In the event that any obstruction is left on site, which may be considered to present a hazard to navigation, the necessary and specified marking will be provided.

6 Environmental Impact Assessment

An EIA was completed by the Developer for HOW02 Offshore Wind Farm in January 2015. Table 6.1 summarises the impacts from the decommissioning phase.

Table 6.1: Summary of Decommissioning Impact Assessment

Topic	Impact Description	Decommissioning Impact
MetOcean	Impacts during construction and decommissioning of the Project are likely to include short term increases in suspended sediment concentrations, localised changes to the seabed and construction vessels leaving small indentations on the seabed. These impacts were considered likely to be localised and short in duration (hours to days). The effects will be localised (to within a few hundred metres) and short term and temporary in duration and as such are not considered to be significant.	Negligible
Morphology and coastal processes	Effects during the construction (and decommissioning) phase could occur as a result of foundation or cable installation (or removal) as well as from accidental spills from construction vessels or plant or the use of chemicals. In all cases increases in	Negligible

Topic	Impact Description	Decommissioning Impact
	suspended sediment were predicted to be localised and temporary and as such were not considered significant. With regard to accidental spills a pollution control plan will be implemented as part of a wider environmental management plan in order to manage such events and mitigate against such eventualities. As a result, such effects are not considered likely to be significant.	
Bottom fauna	During construction (and decommissioning), the installation of the inter-array, export cables and OSP will cause temporary disturbance of the seabed habitats but these are predicted to recover relatively quickly and as such these effects are not considered significant.	Negligible
Fish and Shellfish	The fish and shellfish species found in and around the Project area have been described using data from surveys conducted at the site (using a variety of fishing techniques). The potential effects on fish and shellfish species resulting from decommissioning (including noise effects as described above) were considered including effects as a result of the loss of habitat and increases in suspended sediment. In all cases these were predicted to be localised and/or short term in nature and as such were not considered to be significant.	Minor/Negligible
Birds	Noisy and disruptive activities during the construction phase will be of short-term and intermittent nature and as such are not generally considered likely to lead to significant longer term effects although some species may be temporarily displaced from the area affected. Effects from decommissioning are expected to be similar to those from construction.	Minor/Negligible
Marine mammals	Overall, it is predicted that the impact will be intermittent and of medium term duration (throughout the decommissioning phase).	Negligible
Shipping and navigation	The EIA finds that the Project will have no significant effect on ship routeing and radar. A NRA was undertaken as part of the EIA, which found the main hazards identified were the potential for construction vessel collusion with other vessels and project structures. The increase in risk associated with the wind farm to shipping activities was considered moderate.	Negligible

Topic	Impact Description	Decommissioning Impact
Commercial fishery	In order to comply with statutory safety policies, temporary safety zones will be required during decommissioning, the extent of which would be dependent upon the final decommissioning strategy adopted, and would be designed to ensure the safety of all vessels including those not directly associated with the development work. In view of the numbers of vessels that might be affected, the relatively short periods of any such displacement, and the scope for relocating to adjacent areas without risks of conflicting with other vessels, the expected residual loss of area impact is expected to be localised, of minor significance and confined to a small number of vessels. Provided all vessels comply with safety zones and standard safety policy, impacts on safety should be negligible. Interference with fishing vessels by construction vessels would be minimised by decommissioning vessels using existing shipping lanes and prescribed transit corridors. Ongoing liaison would also keep fishermen informed of proposed works.	Moderate/ Negligible
Cultural heritage	Mitigation for marine archaeology and cultural heritage includes implementation of archaeological exclusion zones (areas of avoidance) around areas of medium and high archaeological potential, and implementation of an archaeological discoveries protocol, to ensure that any potentially important finds during construction works are treated appropriately. A significant hazards associated with the decommissioning phase is the draw-down of sediment into voids left by removed turbine foundations leading to loss of sediment, destabilising archaeological sites and contexts, and exposing such material to natural, chemical or biological processes. Another significant hazard is the penetration and compression effects of jack-up barges and anchoring of decommissioning vessels leading to total or partial loss of archaeological receptors (material or contexts).	Negligible

Consistent with the commitment to undertake reviews of the decommissioning provisions contained within this document, DTPHT will review and update the existing EIA throughout the lifetime of the project. A final review will be undertaken towards the end of the asset life when final details of the decommissioning measures are known in order to address the impacts at the time. At this point a decision will be made as to whether a more detailed assessment is required. Key criteria that will inform the decision will include:

- An updated review, identification and assessment of potential impacts on both the physical, biological and human environment. Planned surveys in and around the transmission assets which could inform this process could include:
  - Geophysical surveys Side Scan Sonar ("**SSS**") and Multiband Echo Sounder ("**MBES**"));
  - geotechnical surveys;
  - benthic grab/camera surveys;
  - ornithological surveys;
  - marine mammal monitoring; and
  - fish surveys.
- An updated review, identification and assessment of activities of other legitimate users of the sea with the potential to be affected by decommissioning. This is because the nature and/or intensity of human activities taking place on/around the transmission assets, such as navigation in and out of the Mersey Estuary, could have changed over the lifetime of the project.
- An updated review, identification and assessment of the potential impacts of decommissioning on the local community, e.g. potential socio-economic impacts.
- An updated review, identification and assessment of potential impacts on historic environment interests, in particular marine archaeological features.

If upon these additional reviews it is concluded that gaps exist in any of the topics above, a specific EIA covering the decommissioning process will be prepared in consultation with the relevant authorities. The EIA will list measures to avoid or otherwise reduce or remedy adverse impacts where possible.

7 Consultations with Interested Parties

DTPHT regards open and effective communication and consultation as an essential element of owning and operating the asset. Carrying on with the good work and relationships established by the Developer during the development and construction phase, we will ensure that this is applied during the operational life of the asset through to decommissioning.

DTPHT proposes to seek the advice and opinions on the DP prior to decommissioning from a range of stakeholders including but not limited to:

- The Crown Estate;
- BEIS;
- local and national government;
- port authorities (Associated British Ports ("**ABP**"));
- UK Hydrographic Office;
- Ministry of Defence;
- Maritime and Coast Guard Agency;
- Marine and Fisheries Agency;
- Centre for Environment;

- Health and Safety Executive ("**HSE**")
- Fisheries and Aquaculture Science;
- Marine Management Organisation ("**MMO**");
- local businesses;
- National Grid Electricity System Operator ("**NGESO**")
- National Grid Electric Transmission ("**NGET**");
- British Gas;
- National Federation of Fishermen's Organisation;
- local land and marine community;
- Inshore fisheries and conservation Authority;
- The Chamber of Shipping;
- Joint Nature Conservation Committee;
- National British Marine Aggregate Producers Association ("**BMAPA**");
- Historic England;
- The Royal Yachting Associations; and
- Trinity House.

All advice and opinions received through the consultation will be reviewed and where applicable incorporated into the DP.

DTPHT will apply for a separate decommissioning marine licence from Marine Management Organisation at the time of decommissioning.

In accordance with the relevant clauses under Section 36 of the Energy Act 1989 and relevant conditions of the Marine Licence, DTPHT will issue timely and efficient Notice to Mariners and other navigational warnings of the position and nature of the decommissioning activities that will be taking place. Efforts will be made to ensure that this information reaches mariners of the shipping and fishing industry as well as recreational mariners. The UK Hydrographic Office will be notified as appropriate on the progress and completion of works.

8 Costs and Financial Security

Cost and financial security information is confidential and therefore not included in DP. Cost and financial security information is provided separately to BEIS.

9 Proposed Decommissioning Schedule

It is proposed that decommissioning commences after year 24, coinciding with the end of life of the asset based on its design life and the mid-life of The Crown Estate lease.

As no offshore windfarm has been decommissioned to date worldwide, it is difficult to anticipate the operational challenges, costs and precise timings of works. Once other farms start to be decommissioned, it will provide valuable information to DTPHT on timings, costs and operational challenges to be faced. Currently we anticipate HS2 will be decommissioned between 2047 and 2050 and will take 24 months to complete.

In line with project management guidelines and DTPHT experience, we acknowledge that the most important step in the decommissioning process is advanced planning and having an option of decommissioning methods. Applying the principles mentioned in earlier parts of this document, DTPHT will carry out regular reviews throughout the project lifecycle to take account of:

- information gathered during the course of construction and operation;
- changes in market conditions, international standards, the regulatory regime;
- knowledge of environmental impacts, including any sediment shift since construction, or new species entering the area;
- new technology assessed against developmental status (e.g. prototype or proven), efficiency both in terms of time and cost and health and safety and environmental impacts;
- new methods assessed against developmental status (e.g. prototype or proven), efficiency both in terms of time and cost and heath safety and environmental impacts;
- any relevant changes in nearby infrastructure or navigational routes; and
- the latest cost estimates and the robustness of the financial security arrangements.

DTPHT intends to undertake internal reviews of the DP throughout the life of the project with an internal review of the DP before the commencement of the formal review in year 12 to ensure the DP and financial security estimates are up to date. Formal review exercises will be undertaken with BEIS at the following times:

- 12-18 month before the first security provision is due; and
- 22 years following commencement of the transmission licence.

During the formal reviews DTPHT will undertake a review of any items proposed to be left in-situ following decommissioning.

In addition, a formal review will be undertaken following any major work or when a material change has occurred with the relevant authorities notified.

The final review will provide an opportunity to scrutinise the detail of the decommissioning provisions in consultation with BEIS and key stakeholders (including Marine Management Organisation), ensuring the impacts of the decommissioning works have been adequately assessed and the schedule of works and the costs associated are fully understood and agreed.

10 Project Management and Verification

The final DP will provide information on how DTPHT will manage the implementation of the decommissioning works and also provide assurance to the BEIS concerning progress and compliance. The final review of this document and the proposed schedule of decommissioning works will be undertaken towards the end of the operational lifetime (depending on repowering taking place or not). This review will produce a DP of Works, including current knowledge of decommissioning methods, measures and timing. The DP will be made available to the public for comment.

The project management of the decommissioning works will be undertaken with the right level of rigor expected of such a project. DTPHT envisages a single main contractor for the decommissioning work and will also appoint an experienced and highly qualified project management team to ensure the decommissioning work proceeds on schedule and in accordance with the requirements of the DP.

A Decommissioning Report will be issued for the approval from the appropriate regulatory authorities after the decommissioning phase is finished, in compliance with the BEIS Guidance, summarising how the Programme has been carried out.

As a minimum, this report will include:

- confirmation that the approved DP has been adhered to during the decommissioning works; otherwise, an explanation of any major variances from the programme; this includes information of actual costs of the works and an explanation of any major variances from the forecast costs;
- information on the outcome of the decommissioning phase, including sea-bed clearance;
- confirmation that relevant authorities have been notified, in case any elements of the development remain protruding from the seabed, of existence of such remains; and
- information of any appropriate aids to navigation have been installed, where required, to overcome risks posed by such remains.

Upon completion, not more than four months after the decommissioning works, the report will be provided to BEIS.

11 Sea-bed Clearance

In accordance with the Polluter Pays Principle ("**PPP**"), DTPHT proposes to clear the seabed in accordance with the provisions made in this DP and to collect and provide evidence of this.

Following the completion of decommissioning works, surveys will be carried out to show that the site has been cleared. These surveys will enable identification and subsequent recovery of any debris located on the sea-bed which may have arisen from activities related to the project and which may pose a risk to navigation, other users of the sea or the marine environment. It is currently intended that side scan sonar will be used to identify debris, with an ROV deployed to investigate and recover any potential identified.

The area to be covered will be determined prior to decommissioning but DTPHT is aware of the guidance for oil and gas installations, which specifies a 500m radius around any installation.

References will be made to 'Archaeological No Build Areas' in order that these are not inadvertently cleared in the process of removing any debris. Analysis of the survey data will also ensure that items for removal and disposal relate only to the project. The appropriate competent authority will be approached regarding the identification of other anomalies that may be of archaeological interest.

It is important that this process of collecting and presenting evidence that the site is cleared is independent. DTPHT proposes that an independent survey company complete the surveys and that they report in parallel to both DTPHT and BEIS.

12 Restoration of the Site

Following the successful completion of the decommissioning works, the DTPHT site will be restored, as far as reasonably practicable, to the condition it was in pre-construction.

The key restoration works will include the following:

- securing and adequately covering all cut foundations; and
- ensuring that cable ends are adequately buried at rock berm and mattress locations.

Active restoration relying on intervention with equipment is not proposed as it is considered that such works present unnecessary and unacceptable risk to personnel.

13 Post-decommissioning Monitoring, Maintenance and Management of the Site

DTPHT proposes to use an independent contractor to carry out surveys post decommissioning. The scope will include identification and mitigation of any unexpected risks to navigation and other users of the sea caused by materials left on the seabed.

DTPHT proposes to undertake magnetometer and geophysical surveys at the completion of decommissioning, and subsequently in Year 1 and 2 post decommissioning with a scope to survey in Year 4 and 6 based on findings from the previous surveys. The area covered by the magnetometer and geophysical surveys will be determined prior to decommissioning, but we are aware of oil and gas installation guidance which specifies a 500 metres radius around any installation.

Should these surveys identify any residual elements from the project protruding above the sea bed, DTPHT will ensure that notification is given to the UK Hydrographic Office so that suitable notation of a potential anchoring hazard can be marked on relevant charts and mariners informed accordingly. Appropriate measures will then be taken to remove or re-bury in order to avoid posing a risk to mariners potentially using the area. The removal or reburial technique and machinery will be decided depending on the type, size and location of the elements, but will more likely mirror that used for the initial decommissioning works.

14 Supporting Studies

Any supporting studies or investigations which are undertaken in support of future DPs will be included as annexes to the DP.

The following documents inform and support the decommissioning provisions contained in this document:

- HOW02 Offshore Wind Farm Decommissioning Programme;
- Decommissioning of offshore renewable installations under the Energy Act 2004: Guidance notes for the industry, BEIS, March 2019 (revised);
- Marine and Coastal Access Act 2009;
- Deemed marine licence granted as part of the DCO awarded 16 August 2016 and correction dated November 2016 and amendment dated April 2018.
- Section 36 Licence;
- DCO granted August 2016;and
- HOW02 Offshore Wind Farm Environmental Statement 2015.