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RWE Renewables UK Dogger Bank South (West) Limited

RWE Renewables UK Dogger Bank South (East) Limited

Dogger Bank South Offshore Wind Farms

Disposal Site Characterisation Report
Volume 8

June 2024

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Glossary

Term	Definition
Accommodation Platform	An offshore platform (situated within either the DBS East or DBS West Array Area) that would provide accommodation and mess facilities for staff when carrying out activities for the Projects.
Array Areas	The DBS East and DBS West offshore Array Areas, where the wind turbines, offshore platforms and array cables would be located. The Array Areas do not include the Offshore Export Cable Corridor or the Inter-Platform Cable Corridor within which no wind turbines are proposed. Each area is referred to separately as an Array Area.
Array cables	Offshore cables which link the wind turbines to the Offshore Converter Platform(s).
Concurrent Scenario	A potential construction scenario for the Projects where DBS East and DBS West are both constructed at the same time.
Construction Buffer Zone	1km zone around the Array Areas and Offshore Export Cable Corridor, and 500m zone around the Inter-Platform Cabling Corridor. Construction vessels may occupy this zone but no permanent infrastructure would be installed within these areas.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for one or more Nationally Significant Infrastructure Project (NSIP).
Development Scenario	Description of how the DBS East and / or DBS West Projects would be constructed either in isolation, sequentially or concurrently.
Electrical Switching Platform (ESP)	The Electrical Switching Platform (ESP), if required would be located either within one of the Array Areas (alongside an Offshore Converter Platform (OCP)) or the Export Cable Platform Search Area.
Environmental Impact Assessment (EIA)	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can

Term	Definition
	be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Directive and EIA Regulations, including the publication of an Environmental Statement (ES).
Horizontal Directional Drill (HDD)	HDD is a trenchless technique to bring the offshore cables ashore at the landfall and can be used for crossing other obstacles such as roads, railways and watercourses onshore.
In Isolation Scenario	A potential construction scenario for one Project which includes either the DBS East or DBS West array, associated offshore and onshore cabling and only the eastern Onshore Converter Station within the Onshore Substation Zone and only the northern route of the onward cable route to the proposed Birkhill Wood National Grid Substation.
Inter-Platform Cables	Buried offshore cables which link offshore platforms.
Landfall	The point on the coastline at which the Offshore Export Cables are brought onshore, connecting to the onshore cables at the Transition Joint Bay (TJB) above mean high water
Nationally Significant Infrastructure Project (NSIP)	Large scale development including power generating stations which requires development consent under the Planning Act 2008. An offshore wind farm project with a capacity of more than 100 MW constitutes an NSIP.
Offshore Converter Platforms (OCPs)	The OCPs are fixed structures located within the Array Areas that collect the AC power generated by the wind turbines and convert the power to DC, before transmission through the Offshore Export Cables to the Project's Onshore Grid Connection Points.
Offshore Development Area	The Offshore Development Area for ES encompasses both the DBS East and West Array Areas, the Inter-Platform Cable Corridor, the Offshore Export Cable Corridor, plus the associated Construction Buffer Zones.
Offshore Export Cable Corridor	This is the area which will contain the Offshore Export Cables (and potentially the ESP) between the Offshore

Term	Definition
	Converter Platforms and Transition Joint Bays at the landfall.
Offshore Export Cables	The cables which would bring electricity from the offshore platforms to the Transition Joint Bays (TJBs).
Onshore Converter Stations	A compound containing electrical equipment required to transform HVDC and stabilise electricity generated by the Projects so that it can be connected to the electricity transmission network as HVAC. There will be one Onshore Converter Station for each Project.
Onshore Export Cable Corridor	This is the area which includes cable trenches, haul roads, spoil storage areas, and limits of deviation for micro-siting. For assessment purposes, the cable corridor does not include the Onshore Converter Stations, Transition Joint Bays or temporary access routes; but includes Temporary Construction Compounds (purely for the cable route).
Project Team	A multi-disciplinary team consisting of individuals from RWE who are ultimately responsible for the construction, operation and maintenance and decommissioning phases of DBS East and DBS West, who are supported by a wider group of contractors and sub-contractors.
Projects Design (or Rochdale) Envelope	A concept that ensures the EIA is based on assessing the realistic worst-case scenario where flexibility or a range of options is sought as part of the consent application.
Scour Protection	Protective materials placed on the seabed to avoid sediment erosion from the base of the wind turbine foundations and offshore platform foundations due to water flow.
Sequential Scenario	A potential construction scenario for the Projects where DBS East and DBS West are constructed with a lag between the commencement of construction activities. Either Project could be built first.
The Applicants	The Applicants for the Projects are RWE Renewables UK Dogger Bank South (East) Limited and RWE Renewables UK Dogger Bank South (West) Limited. The Applicants are themselves jointly owned by the RWE Group of companies (51% stake) and Masdar (49% stake).

Term	Definition
The Projects	DBS East and DBS West (collectively referred to as the Dogger Bank South Offshore Wind Farms).
Transition Joint Bay (TJB)	The Transition Joint Bay (TJB) is an underground structure at the landfall that houses the joints between the Offshore Export Cables and the Onshore Export Cables.
Wind turbine	Power generating device that is driven by the kinetic energy of the wind.

Acronyms

Term	Definition
AL1	Action Level 1
BAC	Background Assessment Concentrations
CCME	Council of Ministers of the Environment
Cefas	Cefas Centre for Environment, Fisheries and Aquaculture Science
CEMP	Coordinated environmental monitoring programme
CSQG	Canadian Sediment Quality Guidelines
DBS	Dogger Bank South
DCO	Development Consent Order
DML	Deemed Marine Licence
EAC	Environmental Assessment Criteria
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
EPS	European Protected Species
EQS	Environmental Quality Standards
ERL	Effects Range-Low
ES	Environmental Statement
ESO	Electricity System Operator
ESP	Electrical Switching Platform
FFC	Flamborough and Filey Coast
FLO	Fisheries Liaison Officer

Term	Definition
HRA	Habitats Risk Regulations Assessment
HVDC	Offshore High Voltage Direct Current
IPMP	In -Principle Monitoring Plan
ISQGs	Interim Marine Sediment Quality Guidelines
LAT	Lowest Astronomical Tide
MBES	Multibeam Echosounder
MCA	Maritime and Coastguard Agency
MCAA	Marine and Coastal Access Act
MCZ	Marine Conservation Zone
MEEB	Measures of Equivalent Environmental Benefit
MHWS	Mean High Water Springs
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation
NSIP	Nationally Significant Infrastructure Project
OCP	Offshore Converter Platform
PAHs	Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PEL	Probable Effect Levels
QSRs	Quality Status Reports
ROV	Remotely Operated Vehicle

Term	Definition
SAC	Special Area of Conservation
SBBP	Sub-bottom profiler
SIP	Site Integrity Plan
SNCB	Statutory Nature Conservation Bodies
SNS	Southern North Sea
SPA	Special Protected Area
SSC	Suspended Sediment Concentrations
SSS	Side-scan Sonar
TEL	Threshold Effect Levels
THC	Total hydrocarbon Content
TJB	Transition Joint Bay
TWT	The Wildlife Trusts
UK	United Kingdom
UXO	Unexploded Ordnance
WFD	Water Framework Directive
WSI	Written Scheme of Investigation

1 Introduction

1. This document provides the necessary information to characterise the disposal requirements for the Dogger Bank South (DBS) East and DBS West Offshore Wind Farm (hereafter referred to as 'the Projects'). The DBS East Array Area would cover 349km^2 and would lie approximately 122km from the coast. The DSB West Array Area would cover 355km^2 and would be located approximately 100km from the coast. The Projects would make landfall on the East Riding of Yorkshire coastline near Skipsea, with onward cabling running to (up to) two newly constructed Onshore Converter Stations before further onward onshore cable routing to the proposed Birkhill Wood National Grid Substation, to the south of Beverley.

2. As the owners of the Projects, RWE Renewables UK Dogger Bank South (East) Limited and RWE Renewables UK Dogger Bank South (West) Limited are the Applicants within this document.

2 Key Relevant Parameters

3. Between 113 and 200 wind turbines would be installed across both Projects. For assessment purposes, it is assumed that between 57 and 100 wind turbines may be installed for DBS East or DBS West in isolation [1].

4. Depending on the Development Scenario (section 2.1), the Array Areas could be connected to one another via Inter-Platform Cables, with a maximum of six Offshore Converter / Collector Platforms (OCP / CPs) combined between the Projects. The Offshore Export Cable Corridor would connect the Array Areas with the landfall near Skipsea. The Offshore Export Cable Corridor would support the installation of up to four electrical cables along an integrated corridor running from landfall to a distance of approximately 80km from shore, where the cable corridors serving each Project would diverge into two branches, with one serving each individual Project. Two electrical cables would be located within each branch. In the worst case scenario, these cables would be installed within individual separate trenches.

[1] In situations where a number does not divide equally between DBS East and DBS West (e.g. 113 large turbines), they are rounded up to a higher number (e.g. 57 large turbines as opposed to 56.5) for the purposes of assessing the worst case scenario.

5. Water depths across DBS East Array Area, DBS West Array Area, and the Inter-Platform Cabling Corridor range from approximately 12 - 40m below Lowest Astronomical Tide (LAT). The seabed along the Offshore Export Cable Corridor gently slopes from landfall where water depths are shallow, to a maximum of 60m below LAT about 8km offshore. Water depths then shallow to a minimum of 15m below LAT as the Offshore Export Cable Corridor approaches the Array Areas.

6. The key offshore components comprise:

- Wind turbines;
- Offshore platforms - OCPs, an Electrical Switching Platform (ESP) and an Accommodation Platform (hereafter collectively referred to as 'offshore platforms' unless specified);
- Foundation structures for wind turbines and offshore platforms;
- Array cables;
- Inter-Platform Cables;
- Offshore High Voltage Direct Current (HVDC) export cables from the Array Areas to landfall; and
- Scour / cable protection (where required).

7. The detailed design of the Projects (e.g. numbers of wind turbines, layout configuration, foundation type and requirement for scour protection) will be determined post-consent. Therefore, the key parameters presented in **Table 2-1** are indicative based on current information and assumptions.

Table 2-1 Offshore Scheme Summary

Parameter	Details		
	DBS East	DBS West	Combined
Indicative construction duration (years) (excluding landfall works)	5	5	5 (7 years if sequential build)
Anticipated design life (years)	30	30	30 (32 if sequential build)
Number of wind turbines[1]	57-100	57-100	113-200
Total Array Area agreed in Agreement for Lease (km^2)	494.5	494.5	989

Parameter	Details		
	DBS East	DBS West	Combined
Total Array Area assessed for ES (km^2)	349	355	874[2]
Closest point from Array Area to coast (km)	122	100	100
Length of export cable to landfall (per cable) (km)	188 per cable	153 per cable	N/A
Maximum Offshore Export Cable length (km) for all cables	376	306	682
Maximum number of export cables and trenches	2	2	4
Maximum total length of all array cables (km)	325	325	650
Maximum Inter-Platform Cable length (km)	115	129	342
Wind turbine foundation type options	Steel monopile, piled jacket		
Maximum number of offshore platforms	4 (ESP may be located in the Offshore Export Cable Corridor or Array Area)	4 (ESP may be located in the Offshore Export Cable Corridor or Array Area)	8 (ESP may be located in the Offshore Export Cable Corridor or a single Array Area)
Offshore platform foundation type options (Array Areas)	Steel monopile, piled jacket		

[2] Total Array Area assessed for ES for the Projects combined includes 170km^2 for Inter Platform Cabling Corridor located between DBS East and DBS West.

Parameter	Details		
	DBS East	DBS West	Combined
Offshore platform foundation type options (Offshore Export Cable Corridor)	Steel monopile, piled jacket, suction bucket jacket, gravity based foundation		

2.1 Project Development Scenarios

8. As set out in **Volume 7, ES Chapter 1 Introduction (application ref: 7.1)**, whilst the Projects are each Nationally Significant Infrastructure Projects (NSIPs) in their own right, a single application for development consent has been made to address both wind farms, and the associated transmission infrastructure. A single planning process and Development Consent Order (DCO) application provides consistency in the approach to the assessment, consultation and examination. While a single DCO application has been made for both Projects, five separate Deemed Marine Licences (DMLs) are included as schedules to the DCO to cover each Array Area, the associated transmission infrastructure and the inter-project cabling required for the Projects. This approach allows for separate ownership of each asset should their ownership change over time.

9. The Applicants would develop DBS East and DBS West transmission infrastructure as co-ordinated projects in accordance with the high-level intentions of the Holistic Network Design as presented by National Grid Electricity System Operator (ESO). Where practicable the two Projects will co-locate infrastructure to reduce the overall environmental impact and disruption.

10. Whilst the Projects are the subject of a single DCO application (with a combined Environmental Impact Assessment (EIA) process and associated submissions), each Project is assessed individually, so that mitigation is Project specific (where appropriate). As such, the assessment within this report cover the following three Development Scenarios:

- DBS East or DBS West are developed in isolation (the In Isolation Scenario);
- Both DBS East and DBS West are developed concurrently (the Concurrent Scenario); or
- Both DBS East and DBS West are developed sequentially (the Sequential Scenario).

11. Both Projects would use HVDC to transmit electricity generated offshore to the landfall and onward to the Onshore Converter Stations.

12. This report considers the appropriate realistic worst case associated with the different Development Scenarios and presents the results accordingly. The information provided in this report is designed to clearly show how the Projects' Design Envelope would differ depending on which scenario may be taken forward.

13. In summary, the following principles set out the framework for how the Projects may be developed, as detailed in **Table 2-2**:

- DBS West and DBS East may be constructed at the same time, or at different times;
- If built in isolation, either Project could be constructed in five years;
- If built concurrently, both Projects could be constructed in five years;
- If built sequentially, either Project could be constructed first; and
- If built sequentially, the first Project would require a five year period of construction with the second project taking up to seven years to construct.

Table 2-2 Development Scenarios and Construction Durations

Development scenario	Description	Overall Construction Duration (Years)	Maximum construction Duration Offshore (Years)	Maximum construction Duration Onshore (Years)
In Isolation	Either DBS East or DBS West is built in isolation	Five	Five	Four

Development scenario	Description	Overall Construction Duration (Years)	Maximum construction Duration Offshore (Years)	Maximum construction Duration Onshore (Years)
Sequential	DBS East and DBS West are both built sequentially, either Project could commence construction first with staggered / overlapping construction	Seven	A five year period of construction for each project with a lag of up to two years in the start of construction of the second project (excluding landfall duct installation) – reflecting the maximum duration of effects of seven years.	Construction works (i.e. onshore cable civil works, including duct installation) to be completed for both Projects simultaneously in the first four years, with additional works at the landfall, substation zone and cable joint bays in the following two years. Maximum duration of effects of six years.
Concurrent	DBS East and DBS West are both built concurrently reflecting the maximum peak effects	Five	Five	Four

14. The impact assessments consider the development and build out scenarios presented above.

15. It is unlikely that an In Isolation Development Scenario would be taken forwards. However, it has been considered to ensure a robust assessment has been undertaken.

16. If a Concurrent Scenario is taken forwards then both Projects construction activities would be undertaken simultaneously throughout the construction duration for offshore and onshore.

17. The In Isolation, Concurrent and Sequential Development Scenarios allow for flexibility to build out the Projects using a phased approach. This will allow the Projects to adapt to National Grid Electricity Transmission Operator's development plans for the onshore grid connection points.

2.2 Design Options

18. The Projects' Design Envelope described in this Disposal Site Characterisation Report provides for a reasoned minimum and maximum extent for each parameter. The detailed design of the Projects will be developed and refined within this consented envelope prior to construction, with the final design lying between the minimum and the maximum extent of the consent. This approach to the EIA, also known as the 'Rochdale Envelope' approach, is further described in **Volume 7, Chapter 6 EIA Methodology (application ref: 7.6)**. The consent will therefore be granted on the basis of a range of parameters to allow flexibility in the final detailed design of the Projects.

19. The information presented in **Volume 7, Chapter 6 EIA Methodology (application ref: 7.6)** outlines the options and flexibility required along with the range of potential design and activity parameters upon which the subsequent impact assessment chapters are based.

20. The need for flexibility in the consent is a key aspect of any large development but is particularly significant for offshore wind projects where technology continues to evolve quickly. The Projects' Design Envelope must therefore provide sufficient flexibility to enable the Applicants and their contractors to use the most up to date, efficient and cost-effective technology and techniques in the construction, operation, maintenance and decommissioning of the Projects.

21. Key aspects of the Projects for which flexibility in the Projects' Design Envelope is required include:

- Wind turbine capacity, including parameters such as maximum tip height and foundation type, to benefit from improvements in technology prior to offshore construction;
- Construction and maintenance methodologies, as above, to enable competitive procurement and the most cost-effective option to be adopted post-consent; and
- The Development Scenarios detailed in section namely that either DBS East or DBS West are developed in isolation, or DBS East and DBS West are both developed, either concurrently or sequentially.

22. For the purposes of this Disposal Site Characterisation Report where specific magnitudes of impact or significance of effect are stated, these are based on a worst case assuming both the Projects are built, since this would result in the greatest volume of sediment being disposed and thus result in the greatest potential for impacts on physical characteristics, water and sediment quality, and benthic receptors.

2.3 Programme

23. The earliest any offshore construction works would start is assumed to be 2026.

24. Offshore construction works would require up to five years per Project (excluding pre-construction activities such as surveys), assuming DBS East and DBS West were built at different times. If built concurrently, offshore construction could be completed in five years. If the Projects were built sequentially, construction of the first project would be completed within five years, with the second project taking up to seven years to construct. Therefore. the maximum duration over which the construction of both Projects could take place is seven years.

3 Purpose of this Document

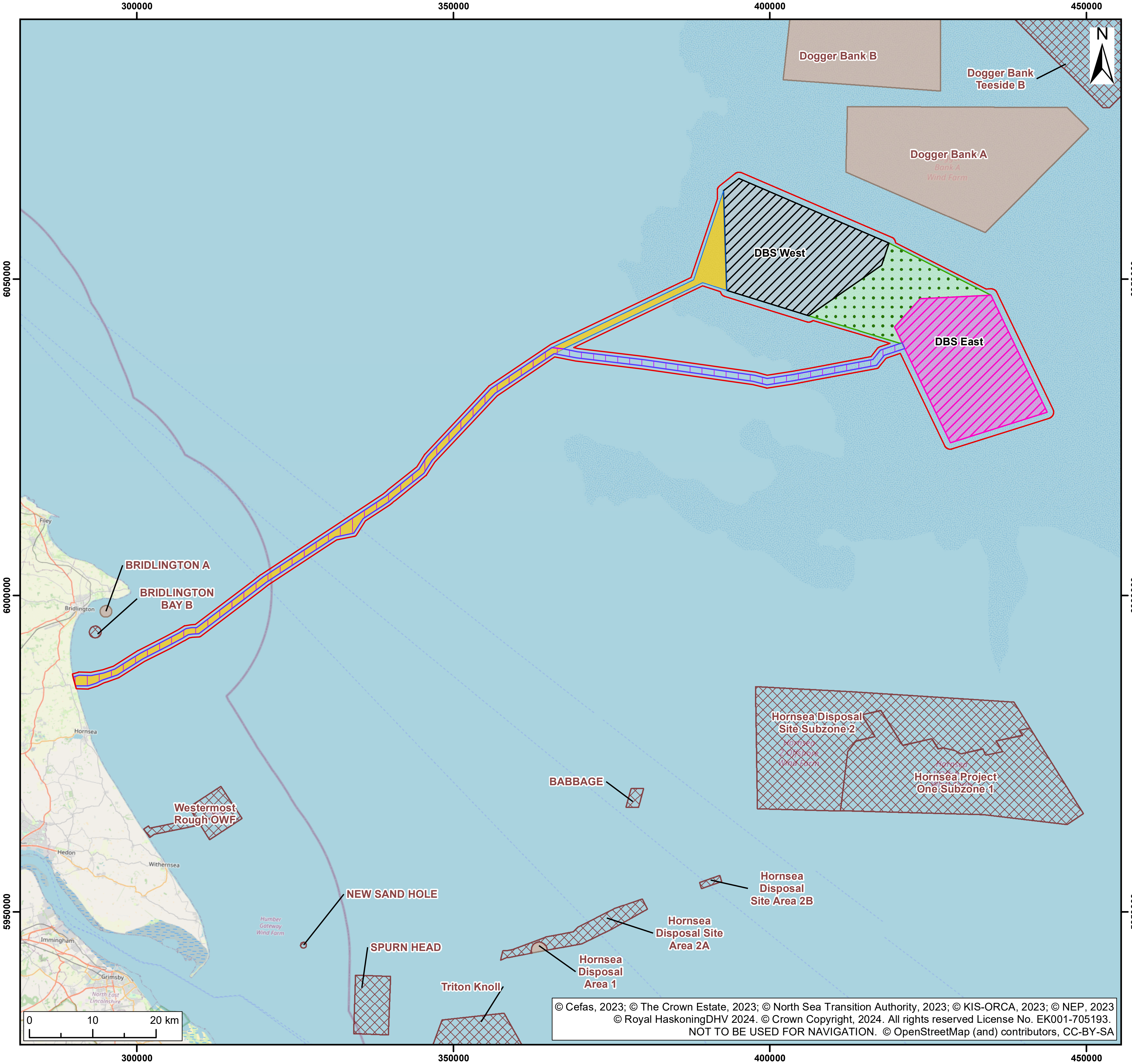
25. The Applicants are applying to designate the following areas for the disposal of material arising as a result of construction activities (i.e. seabed preparation (dredging) or drilling for wind turbine foundations and sand wave levelling (pre-sweeping)). The proposed disposal areas (**Figure 3-1**) are:

- The DBS East Array Area;
- The DBS West Array Area;
- The Inter-Platform Cable Corridor;
- The Offshore Export Cable Corridor (including landfall).

26. This document provides the necessary information to characterise the disposal requirements for the Projects. The proposed disposal site locations are shown on **Figure 3-1** (and the coordinates to delineate them are provided in **Annex 1**). As detailed above, Either DBS East or DBS West may be built in isolation and therefore the requirement for disposal at either Array Area will not be known until detailed design at the post-consent stage. Similarly, the requirement to build out the Projects' Inter-Platform Cable Corridor between the two Array Areas, will not be known until detailed design at the post-consent stage. In order to streamline the disposal site characterisation and licensing process, this document provides the necessary information for all areas to be licensed as disposal sites. It is proposed that these areas are included within the DMLs, however if any of these areas are not required following detailed design then the Applicants can agree with the Marine Management Organisation (MMO) and the Centre for Environment, Fisheries and Aquaculture Science (Cefas) that the licensed activities will not be undertaken in these areas.

27. The purpose of this document is to provide the information required to enable disposal site designation. Accordingly, this document sets out:

- The location of the proposed disposal sites;
- The need for disposal of material;
- Alternative options for disposal;
- The types of material to be disposed of;
- The quantity of the material to be disposed; and
- Potential impacts of disposal.



Legend:

- Offshore Development Area
- Offshore Export Cable Corridor
- DBS East Array Area
- DBS West Array Area
- Inter-Platform Cable Corridor

Marine Disposal Sites

- Closed
- Open

Proposed Disposal Sites

- East Array Offshore Export Cable Corridor Disposal Site
- West Array Offshore Export Cable Corridor Disposal Site
- DBS East Array Area Disposal Site
- DBS West Array Area Disposal Site
- Inter-Platform Cable Corridor Disposal Site

SUI	REV	DATE	DESCRIPTION	DRW	CHK	APR
S2	P01	23/01/2024	Suitable for Information	JH	SB	RF

Title:

Proposed Projects' Disposal Sites

Figure: 3-1 Drawing No: PC2340-RHD-OF-ZZ-DR-Z-0699

Co-ordinate system: WGS 1984 UTM Zone 31N | Page Size: A3 | Scale: 1:600,000

Project: Dogger Bank South Offshore Wind Farms

Report: Disposal Site Characterisation

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4 The Need for Disposal of Material

28. The type of foundation(s) and installation method(s) required for the DBS wind turbines and offshore platforms are yet to be determined. However, installation will result in the generation of spoil material and therefore, practicable options for the disposal of "capital" dredged or drilled material must be assessed.

29. The Marine and Coastal Access Act 2009 (MCAA) Section 66 states that it is a licensable marine activity to carry out any form of dredging within the UK marine licensing area. For the purposes of this document, "disposal" means the deposit of dredged sediment at the sea surface or at the seabed using a fall pipe; or the deposit of subsurface sediment at the seabed released during any drilling required for wind turbine foundation installation.

30. Offshore disposal of dredged sediment will take place in the vicinity of the disposal location where it would be dispersed by natural processes as described in the **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. Sediment would, where possible, be redeposited within areas of similar sediment type (see **Volume 7, Chapter 9 Benthic and Intertidal Ecology (application ref: 7.9)**). The worst case scenario assumes that, where required, sediment would be dredged and returned to the water column at the sea surface as overflow from a dredger vessel.

31. In addition, sediments below the seabed within the Offshore Development Area would become disturbed during any drilling activities that may be needed at the location of piled foundations. The disposal of any sediment that would be disturbed or removed during drilling for foundation installation would occur in close proximity to each foundation.

4.1 Foundation Installation

32. Foundation types currently under consideration are:

- Monopiles and pin pile jackets fixed vertically into the seabed by either driving (use of a piledriving hammer) or drilling techniques, or a combination of both;
- Suction bucket jackets (in the Offshore Export Cable Corridor only); and
- Gravity based foundation, which rely on the weight of the structure to anchor it to the seabed (in the Offshore Export Cable Corridor only);

33. The offshore platform foundation types that may be used are monopiles, pin pile jackets, suction bucket jackets or gravity based foundations (see **Volume 7, Chapter 5 Project Description (application ref: 7.5**). The pin pile, suction bucket jackets and gravity based foundations will have up to a maximum of eight legs per platform and will be secured to the seabed with either one pile at each leg, one suction bucket at each leg, or in the case of gravity based foundations, by its own weight.

34. Monopiles and jacket foundations for wind turbines and offshore platforms would be positioned in such a way to avoid the need for seabed preparation and therefore no sediment disposal is required for these foundation types. However, drilling may be required for monopile or pin pile foundations.

35. Each of the different wind turbine foundation types would require varying levels of seabed preparation to provide a more level formation for installation.

36. **Table 4-1** presents a summary of the physical properties of each foundation option to enable a direct comparison between them, to assist with defining the worst case scenario.

Table 4-1 Comparison of Physical Parameters for Different Foundation Types

Foundation Type	Maximum Foundation Dimensions (m/foundation)	Maximum Volume of Surface Sediment Release from Seabed Preparation (m^3/foundation)	Maximum Volume of Sub-surface Sediment Release from Foundation Drilling (m^3/foundation)
Wind Turbine Monopile (single steel pile)	11 (diameter)	0	4,524
	15 (diameter)	0	12,064
Offshore Platform Monopile (single steel pile)	15 (diameter)	0	14,074
Wind Turbine Pin pile jacket	3 (diameter per pin pile)	0	503
	4 (diameter per pin	0	1,178

Foundation Type	Maximum Foundation Dimensions (m/foundation)	Maximum Volume of Surface Sediment Release from Seabed Preparation (m^3/foundation)	Maximum Volume of Sub-surface Sediment Release from Foundation Drilling (m^3/foundation)
	pile)		
Offshore Platform Pin pile jacket	3.8 (diameter per pin pile)	0	1,267
Offshore Platform Gravity based foundation	65 (base plate diameter at seabed)	16,592	N/A

4.2 Cable Installation

37. Sandwave levelling (pre-sweeping) to a stable reference seabed level may be undertaken in areas with large ripples and sand waves to reduce the potential that cables become unburied over the life of the Projects. Locations where sand wave levelling (pre-sweeping) is anticipated to be required will be decided during further detailed design.

38. The Offshore Development Area comprises of sand and muddy sand with varying proportions of gravel and shell fragments. The Projects' Array Areas predominantly consist of sands and fine material, with some areas having a higher proportion of gravel. Sediment within the Offshore Export Cable Corridor is predominantly sand, with greater proportions of mud and / or gravel near the coast (see section 8.5.3 in the **Volume 7 Chapter, 8 Marine Physical Environment (application ref: 7.8)**). Therefore, it is expected that the majority of the offshore cables will be buried using a cable ploughing, jetting or mechanical cutting method (see section 5.4.7.5 of **Volume 7, Chapter 5 Project Description (application ref: 7.5)**). This means that for the majority of the cable corridors, no excavation and subsequent disposal of sediment would be required.

39. Anticipated sediment volumes for the levelling (pre-sweeping) of sand waves are provided in section 7.1.

4.3 Mitigation and Best Practice

40. The Applicants have committed to a number of areas of mitigation and best practice in order to minimise the potential impacts from disposal of sediment at the Projects (see **Volume 8, Commitments Register (application ref: 8.6)**). The following examples of embedded mitigation are of relevance to sediment disposal:

- Where necessary, foundations will include scour protection which will minimise the amount of scour and sediment released / transported due to scour;
- For piled foundation types, such as monopiles and jackets with pin piles, pile driving is the most likely installation method and will be used in preference to drilling where it is practicable to do so (i.e. where ground conditions allow). This would minimise the quantity of sub-surface sediment that is released into the water column and deposited from the installation process;
- Monopiles, jacket foundations and suction buckets for wind turbines and offshore platforms would be positioned in such a way to avoid the need for seabed preparation;
- Cables will be buried where possible, minimising the requirement for external cable protection measures and thus effects on sediment transport; and
- Route selection and micro-siting of the cables will be used to avoid areas of seabed that pose a significant challenge to their installation, including for example areas of sand waves and megaripples. This will minimise the requirement for seabed preparation (levelling) and the associated seabed disturbance.

5 Alternative Options for Disposal

41. Once drilled or dredged material has been produced, it is classified as a waste material. Once material has entered the waste stream it is strictly controlled.

42. Disposal of dredged and drilled material is controlled under the London Convention 1972, the Oslo-Paris Commission (OSPAR) Convention 1992, and the European Union Waste Framework Directive 2008/98/EC, as well as the national marine plans that contain policy aims for dredging and disposal activities.

43. The Waste Hierarchy is at the core of the Waste Framework Directive (Defra, 2011) which comprises:

- Prevention;
- Re-use;
- Recycle;
- Other recovery; and
- Disposal.

44. Where prevention is not possible, and waste has been minimised, management options for dealing with material must consider the alternative options in the order of priority indicated above (i.e. re-use, recycle, other recovery and then disposal).

45. The following sections of this document present information on potential alternative to the disposal of drilled and dredged material from the Projects.

5.1 Prevention

46. The Waste Hierarchy places a strong emphasis on waste prevention and the minimisation of waste. However, consent is being sought for the Projects for the use of a range of foundation options and cable installation methodologies and these different options have different potential requirements in terms of waste creation.

47. For piled foundations, if percussive piling alone does not achieve full pile penetration due to the presence of hard ground conditions, the material inside the monopile / pin piles may need to be drilled out before the pile can be driven to the required depth. If drilling is required, the generation of spoil arising from the drilling will be unavoidable. For piled foundations, the worse case is that up to 5% of the foundations may require drilling.

48. If non-piled foundations are chosen, seabed preparation works including dredging and disposal will be unavoidable in order to achieve the flat and stable seabed that is required to seat these particular foundation types, although the volumes of spoil generated will depend on the size of foundations needed and the seabed conditions at each installation location.

49. As described in section 4.2, sandwave clearance is expected to be required in areas with large ripples and sand waves to reduce the potential that cables become unburied over the life of the Projects. Sandwaves are generally mobile in nature therefore the cable must be buried beneath the level where natural sandwave movement would uncover it. Sometimes this can only be done by removing the mobile sediments before installation takes place. Therefore, to install the cables for the Projects, sandwave clearance and the associated dredging and disposal works will in some cases be unavoidable.

50. As a result, the safe and effective installation of the Projects infrastructure may involve installation techniques that give rise to spoil. Whilst volumes of spoil will be minimised to that necessary for safe and effective installation, it is not possible to prevent spoil generation.

5.2 Reuse, Recycle and Other Recovery

51. As the Projects' Array Areas and part of the Offshore Export Cable Corridor are within the Dogger Bank Special Area of Conservation (SAC), any sediment removed from within the Dogger Bank SAC during construction activities will be disposed of within the Offshore Development Area located within the SAC boundary, ensuring no sediment is lost from the sandbank habitat. Therefore, with respect to the Array Areas and the part of the Offshore Export Cable Corridor within the Dogger Bank SAC, reuse, recycling or other recovery is not appropriate. The following options would only be appropriate for the part of the Offshore Export Cable Corridor out with the Dogger Bank SAC.

52. Where prevention is not possible, the re-use of dredged and drilled material is the preferred option. Potential options for the re-use of dredged and drilled material can include:

- Beach nourishment / replenishment schemes;
- Land reclamation schemes; and
- Habitat enhancement schemes.

53. Collection of drill arisings from the Projects would be costly and technically difficult due to the need for suction dredging vessels in addition to drilling vessels. The limited material produced at each foundation site means collection would not be viable.

54. Dredger movements would lead to additional environmental impacts due to increased vessel emissions that could be avoided if dredged material were disposed of *in situ* (i.e. close to the source of production).

55. In conclusion, the assessments undertaken have not identified any significant adverse (in EIA terms) impacts on receptors as a result of the proposed disposal activity. Whilst potential options for re-use of spoil material may exist in theory and at some point in the future, disposal *in situ* remains the most viable option. *In situ* disposal also has the advantage of retaining sediment within the local sedimentary system

5.3 Disposal

56. Disposal sites are generally licensed to enable the disposal of material from specific locations and activities. It is not considered desirable to use an existing disposal site since they are not generally designated for additional volumes beyond those necessary for the specific purpose for which they were licensed.

57. As discussed above the Projects' Array Areas and part of the Offshore Export Cable Corridor are within the Dogger Bank Special SAC, any sediment removed from within the Dogger Bank SAC during construction activities will be disposed of within the Offshore Development Area located within the SAC boundary, ensuring no sediment is lost from the sandbank habitat.

58. In relation to the part of the Offshore Export Cable Corridor outwith the Dogger Bank SAC this area has been proposed as the disposal site.

59. The proposed disposal sites for the Projects are shown in **Figure 3-1**.

6 Type of Material to be Disposed

6.1 Seabed Sediment Type

60. Grab samples collected in August 2022 from within the Offshore Development Area (see **Volume 7, Chapter 9 Benthic and Intertidal Ecology (application ref: 7.9)**) show that the seabed consists of predominantly sand and to a lesser extent gravel, with small percentages of fines. In general, the variation of gravel content was higher at stations along the Offshore Export Cable Corridor than that at stations in the Array Areas and Inter-Platform Cabling Corridor. Conversely, in general the variation of fines content was higher at stations in the Array Areas than that of stations along the Offshore Export Cable Corridor.

61. Based on the geotechnical survey (see section 8.5.2 in the **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**), the lowermost deposits recovered in boreholes from the Array Areas are silty sands that may have been deposited in a range of settings, including marine, terrestrial, periglacial and intertidal environments. The uppermost deposits recovered in the boreholes are slightly gravelly sands with shell fragments that represent deposition in the modern marine environment.

62. The shallow Quaternary stratigraphy of the Offshore Export Cable Corridor is dominated by seabed sediments and shallow marine sands (overlying glacial clays interbedded with glacial sands. Interpretation of sub-bottom profiler data indicates bedrock is shallow in the nearshore part of the Offshore Export Cable Corridor and can be present within 1.5m of the seabed.

63. There is potential for spoil material generated by drilling to be different from surface material generated by other sources of seabed preparation, with finer near-surface sediments having the potential to disperse more widely.

6.2 Sediment Contamination Analysis

64. Grab samples collected in August 2022 from within the Offshore Development Area were analysed for contaminants (see **Volume 7, Appendix 9-3 Benthic Ecology Monitoring Report (application ref: 7.9.9.3)**) and subsequent interpretation provided in **Volume 7, Chapter 9 Benthic and Intertidal Ecology (application ref: 7.9)**. Levels of contaminants across the Offshore Development Area are generally low and typical of the region.

65. The locations of the grab sample stations are shown on Figure 9-2 and Figure 9-3 of **Volume 7, Chapter 9 Benthic and Intertidal Ecology (application ref: 7.9)** and contaminant data summarised in **Table 6-2** and **Table 6-3**. Twenty-eight samples were taken for contaminants analysis during the benthic ecology monitoring survey.

66. The context of the contaminants found within sediments is established through the use of recognised guidelines and action levels, in this case the Cefas Action Levels have been applied as a first stage because they provide good coverage of contaminants, across a broad range of contaminant types (MMO, 2018).

67. The majority of the material assessed against these standards arises from dredging and disposal activities as part of the MMO's marine licensing process for disposal of material to sea and are also considered a good way of undertaking an initial risk assessment with respect to determining risks to water quality from other marine activities as part of the EIA and associated Water Framework Directive (WFD) compliance assessment process.

68. If, overall, levels do not generally exceed the lower threshold values of these guideline standards (i.e. Action Level 1 (AL1)), then contamination levels are considered to be low risk in terms of the potential for impacts on water quality. Where concentrations fall close to, or above the upper threshold values, then more quantitative assessment regarding water quality effects might be required, which would consider the risk of breaching water quality Environmental Quality Standards (EQS). This approach is recommended by the Environment Agency in their WFD compliance assessment guidance 'Clearing the Waters for All', for example (Environment Agency, 2017). Relevant values are presented in **Table 6-1**.

Table 6-1 Selected OSPAR Sediment Guidelines and Cefas Action Levels

Contaminant	Units	OSPAR BAC	OSPAR ERL	Cefas AL1	Cefas AL2
Arsenic	mg/kg	25	8.2[3]	20	100
Cadmium		0.31	1.2	0.4	5

[3] The Effect Range-Low (ERL) values for arsenic and nickel are below the OSPAR Background Assessment Concentrations (BAC) therefore arsenic and nickel concentrations are only assessed against the BAC.

Contaminant	Units	OSPAR BAC	OSPAR ERL	Cefas AL1	Cefas AL2
Chromium		81	81	40	400
Copper		27	34	40	400
Mercury		0.07	0.15	0.3	3
Nickel		36	21[3]	20	200
Lead		38	47	50	500
Zinc		122	150	130	800
Polyaromatic Hydrocarbons (PAHS) – individual PAHs	µg/kg	-	-	100	-
Anthracene		5	85	100	-
Benz(a)anthracene		16	261	100	-
Benzo(a)pyrene		30	430	100	-
Chrysene		20	384	100	-
Dibenzo(a,h)anthracene		-	-	10	-
Fluoranthene		39	600	100	-
Naphthalene		8	160	100	-
Phenanthrene		32	240	100	-
Pyrene		24	665	100	-
Benzo(ghi)perylene		80	85	100	-
Indeno[1,2,3-cd]pyrene		103	240	100	-

Contaminant	Units	OSPAR BAC	OSPAR ERL	Cefas AL1	Cefas AL2
Polychlorinated biphenyls (PCBs) International Council for the Exploration of the Sea (ICES) 7 (PCB28, 52, 101, 118, 138, 153, and 180)	mg/kg	-	-	0.01	-

69. Analysis was undertaken by the MMO accredited laboratory, Socotec, for the following contaminants:

- Metals - arsenic, cadmium, chromium, copper, mercury, nickel, lead and zinc;
- Polychlorinated Biphenyls (PCBs);
- Aromatic compounds naphthalenes (2 ring aromatics), 3 to 6 ring Polycyclic Aromatic Hydrocarbons (PAHs) and the dibenzothiophenes (sulphur containing heteroaromatics) including the United States Environmental Protection Agency's (US EPA) 16 PAHs – these are 16 priority PAHs designated as high priority pollutants based on their potential human and ecological health effects. Individual aromatic hydrocarbon concentrations and their alkyl homologue concentrations were also recorded for naphthalene, phenanthrene/anthracene, dibenzothiophene, fluoranthene/pyrene, benzphenanthrenes/benzanthracenes;
- Total hydrocarbon Content (THC); and
- Organotins (dibutyltin (DBT) and tributyltin (TBT)).

70. The data for parameters which correlate with the MMO's list of contaminants of concern is presented in **Table 6-2** and **Table 6-3**. In summary:

- Metal concentrations were lower than the Cefas ALs for all metals except arsenic. Arsenic exceeded AL1 at three stations – two within the Offshore Export Cable Corridor and one within DBS West Array Area;
- The sum of the seven congeners of PCBs at all stations were below the Cefas AL1;
- No samples analysed for PAHs exceeded Cefas AL1;

- One station (ST161) in the Offshore Export Cable Corridor exceeded Cefas AL1 for THC, but was below Cefas AL2; and
- All concentrations of Organotins analysed were below Cefas AL1.

71. Therefore, all the sediment contaminant concentrations are deemed to be low risk from a sediment disposal perspective. In addition, at the Marine Physical Environment and Benthic and Intertidal Ecology Expert Topic Group (ETG) held on the 29th January 2024, Cefas were unconcerned regarding levels of contaminants as levels were as expected in the North Sea (see **Appendix 9-1 Consultation Responses (application ref: 7.9.9.1)**).

Table 6-2 Site Specific Data Collected in 2022 for Metals (Fugro, 2022) (coloured dots against each sediment quality guideline are used to indicate where there is an exceedance). All data in mg/kg

Site reference	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
AL1 ●	20	0.4	40	40	50	0.3	20	130
AL2 ●	100	5	400	400	500	3	200	800
BAC ●	25	0.31	81	27	38	0.07	36	122
ERL ●	-	1.2	81	34	47	0.15	-	150
Array Areas								
ST012	14	0.24	12.7	8.8	9.4	0.02	12.6	39.1
ST017	3.0	<0.04	5.8	4.7	2.8	<0.01	4.7	14.4
ST044	2.5	<0.04	4.5	3.6	1.9	<0.01	3.0	8.1
ST046	2.7	<0.04	5.2	4.1	2.3	0.02	3.2	8.3
ST063	16.4	0.13	11.5	8.3	4.5	0.01	15.0	32.9
ST085	2.8	<0.04	3.6	3.0	1.4	<0.01	2.3	15.0
ST098	9.9	<0.04	5.2	4.2	2.5	0.02	4.0	12.5

Site reference	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
ST103	2.2	<0.04	3.4	3.3	1.4	<0.01	2.1	10.1
ST113	3.7	<0.04	4.3	3.2	1.6	<0.01	2.5	14.5
ST121	3.2	<0.04	4.3	3.8	1.7	<0.01	2.7	10.2
ST125	**24.4** ●	0.14	15.2	7.4	5.9	0.02	14.9	35.0
Inter-Platform Cabling Corridor								
ST038*	3.0	<0.04	4.4	3.3	2.0	<0.01	3.3	9.8
ST040	2.5	0.07	4.5	3.8	1.9	<0.01	3.0	9.0
ST069	2.6	<0.04	4.7	3.2	2.2	<0.01	3.3	9.2
ST071	3.2	<0.04	5.8	3.5	2.4	<0.01	3.8	12.1
ST074	2.9	<0.04	5.0	3.0	2.1	<0.01	2.5	9.6
ST105*	2.7	<0.04	5.2	3.3	2.2	<0.01	2.4	13.9
Offshore Export Cable Corridor								
ST031	3.1	0.13	5.8	3.9	2.5	<0.01	3.6	13.6

Site reference	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
ST078*	10.0	<0.04	6.1	4.1	3.2	<0.01	4.7	12.3
ST107	8.5	<0.04	5.4	3.7	3.2	<0.01	3.6	14.8
ST134	7.0	<0.04	10.5	7.3	6.4	0.03	6.8	18.9
ST141	18.4	0.07	6.9	2.8	5.3	0.01	3.4	15.4
ST146	6.5	<0.04	4.4	3.5	3.8	<0.01	2.7	12.0
ST161	**32.2** ●●	0.12	12.3	7.1	17.8	0.02	12.2	37.0
ST164	**73.4** ●●	0.17	12.8	8.2	31.5	0.03	16.3	59.2
ST168	14.6	<0.04	11.2	8.0	24.6	0.03	9.0	45.5
ST172	13.4	<0.04	7.8	4.5	7.1	<0.01	4.4	16.8
ST178	5.8	<0.04	6.8	3.4	8.2	<0.01	3.5	16.3

* Stations are located within the Construction Buffer Zone of the relevant area.

Table 6-3 Site Specific Data collected in 2022 for PAHs and THC (Fugro, 2022) (coloured dots against each sediment quality guideline are used to indicate where there is an exceedance). All data in µg/kg except for THC which is in mg/kg

Site Reference	Acenaphthene	Acenaphthylene	Anthracene	Benzo[a]anthracene	Benzo[a]pyrene	Benzo[b]fluoranthene	Benzo[g,h,i]perylene	Benzo[e]pyrene	Benzo[k]fluoranthene	C1-naphthalenes	C1-phenanthrenes	C2-naphthalenes	C3-naphthalenes	Chrysene	Dibenzo[a,h]anthracene	Fluoranthene	Fluorene	Indeno[1,2,3-cd]pyrene	Naphthalene	Perylene	Phenanthrene	Pyrene	THC (mg/kg)
AL1 ●	100	100	100	100	100	100	100	100	100	100	100	100	100	100	10	100	100	100	100	100	100	100	100
AL2 ●	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BAC ●	-	-	5	16	30	-	80	-	-	-	-	-	-	-	-	39	-	103	8	-	-	24	-
ERL ●	-	-	85	261	430	-	85	-	-	-	-	-	-	-	-	600	-	240	160	-	-	665	-
Array Areas																							
ST012	<1	<1	<1	<1	1.49	2.63	2.82	2.06	1.65	3.74	3.22	3.45	3.54	1.68	<1	2.04	<1	2.06	1.22	1.78	2.67	1.92	22.0
ST017	<1	<1	1.08	2.19	2.50	2.66	3.23	2.66	2.04	4.76	10.5	12.0	12.0	3.24	<1	5.20	<1	1.99	1.09	1.57	6.24	8.82	2.02
ST044	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2.10	1.25	1.64	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
ST046	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.14	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
ST063	<1	<1	<1	<1	<1	1.01	<1	<1	<1	1.66	1.03	1.19	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
ST085	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
ST098	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
ST103	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2.17	1.58	1.47	<1	<1	<1	<1	<1	<1	<1	1.31	<1	<1
ST113	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.75	1.88	2.23	3.16	<1	<1	<1	<1	<1	1.70	<1	1.33	<1	<1
ST121	<1	<1	<1	<1	<1	<1	<1	<1	<1	3.66	2.04	1.91	1.82	<1	<1	<1	<1	<1	1.82	<1	<1	<1	<1
ST125	1.23	1.65	2.74	6.07	5.45	7.37	6.26	7.00	3.77	65.0	46.2	65.5	38.0	9.39	<1	12.1	6.93	2.57	7.83	3.38	34.7	15.3	8.98
Inter-Platform Cabling Corridor																							
ST038*	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Site Reference	Acenaphthene	Acenaphthylene	Anthracene	Benzo[a]anthracene	Benzo[a]pyrene	Benzo[b]fluoranthene	Benzo[g,h,i]perylene	Benzo[e]pyrene	Benzo[k]fluoranthene	C1-naphthalenes	C1-phenanthrenes	C2-naphthalenes	C3-naphthalenes	Chrysene	Dibenzo[a,h]anthracene	Fluoranthene	Fluorene	Indeno[1,2,3-cd]pyrene	Naphthalene	Perylene	Phenanthrene	Pyrene	THC (mg/kg)
ST040	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
ST069	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
ST071	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.10	1.06	1.15	1.26	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
ST074	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
ST105*	<1	<1	<1	<1	<1	<1	<1	<1	<1	5.04	2.90	5.62	3.06	<1	<1	<1	<1	<1	1.10	<1	3.49	<1	2.02
Offshore Export Cable Corridor																							
ST031	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
ST078*	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
ST107	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.18	1.59	1.20	1.05	<1	<1	<1	<1	<1	<1	<1	<1	1.05	<1
ST134	<1	<1	1.11	4.32	4.08	5.66	5.80	5.23	4.65	21.7	13.9	21.2	17.9	6.16	<1	9.75	<1	4.04	5.45	1.88	8.33	10.5	39.4
ST141	<1	<1	<1	<1	<1	<1	<1	<1	<1	3.78	2.32	2.32	2.69	<1	<1	<1	<1	<1	2.27	<1	1.01	<1	<1
ST146	<1	<1	<1	<1	<1	1.39	1.12	<1	1.34	4.18	2.40	3.22	2.63	1.15	<1	1.27	<1	1.10	2.35	<1	1.57	1.29	<1
ST161	2.18	1.62	3.47	8.67	9.76	9.31	13.2	11.9	10.5	57.7	33.7	46.1	40.4	14.5	1.59	18.7	3.65	7.15	**18.8**	2.32	24.6	18.1	**109**
ST164	2.56	1.81	4.01	8.24	6.85	10.1	11.1	10.6	9.68	77.1	34.1	68.7	51.0	12.9	1.53	17.4	4.36	5.72	**26.8**	1.68	26.8	18.0	45.6
ST168	5.60	2.59	**7.94**	15.3	15.1	17.7	18.7	20.9	15.3	135	80.4	117	122	26.0	2.56	34.5	8.50	8.19	**46.0**	3.65	58.5	**34.0**	70.2
ST172	<1	<1	<1	<1	<1	1.06	<1	1.05	1.16	3.80	1.80	2.85	2.00	<1	<1	1.01	<1	<1	1.68	<1	1.12	1.23	2.00
ST178	<1	<1	<1	1.06	1.07	2.82	2.30	2.24	2.12	7.28	4.12	4.77	4.25	2.12	<1	3.69	<1	1.45	3.09	<1	2.58	3.07	4.40

* Stations are located within the Construction Buffer Zone of the relevant area.

Table 6-4 Site Specific Data Collected in 2022 for PCBs (Fugro, 2022 All data in mg/kg

Site Reference	PCB 28	PCB 52	PCB 101	PCB 118	PCB 138	PCB 153	PCB 180	∑7 PCBs[4]
Array Areas								
ST012	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST017	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST044	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST046	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST063	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST085	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST098	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056

[4] The concentrations of the majority of individual PCB congeners analysed were below the Limit of Detection (LOD) (< 0.00008 mg/kg), therefore PCB concentrations less than LOD have been treated as being equal to their respective LODs. Consequently, the sum of PCB concentrations where one or more analytes were < LOD resulted in a less than value.

Site Reference	PCB 28	PCB 52	PCB 101	PCB 118	PCB 138	PCB 153	PCB 180	∑7 PCBs[4]
ST103	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST113	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST121	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST125	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
Inter-Platform Cabling Corridor								
ST038*	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST040	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST069	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST071	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST074	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST105*	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
Offshore Export Cable Corridor								

Site Reference	PCB 28	PCB 52	PCB 101	PCB 118	PCB 138	PCB 153	PCB 180	∑7 PCBs[4]
ST031	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST078*	< 0.00008	0.00016	0.00015	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00215
ST107	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST134	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST141	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST146	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST161	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST164	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST168	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST172	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056
ST178	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	<0.00056

* Stations are located within the Construction Buffer Zone of the relevant area.

6.2.1 Comparison With Canadian Sediment Quality Guidelines

72. The data analysed for PAHs and metals has also been compared to the Canadian Sediment Quality Guidelines (CSQG) for the Protection of Aquatic Life (Canadian Council of Ministers of the Environment (CCME), 2022)). These guidelines involved the derivation of Interim Marine Sediment Quality Guidelines (ISQGs) or Threshold Effect Levels (TEL) and Probable Effect Levels (PEL) from an extensive database containing direct measurements of toxicity of contaminated sediments to a range of aquatic organisms exposed in laboratory tests and under field conditions (CCME, 2022). It should be noted that these guidelines were designed specifically for Canada and are based on the protection of pristine environments. The findings of the comparison should therefore be treated with caution and are indicative only.

73. Selected Canadian guidelines correlating with the contaminants included in the site specific survey are presented in **Volume 7, Appendix 9-3 Benthic Ecology Monitoring Report (application ref: 7.9.9.3)** (Table 4-8 for PCBs and Table 4-9 for Metals). The lower level is referred to as the TEL and represents a concentration below which adverse biological effects are expected to occur only rarely (in some sensitive species for example). The higher level, the PEL, defines a concentration above which adverse effects may be expected in a wider range of organisms.

74. The PAH concentrations were below all CSQGs at all stations with the exception of naphthalene at one station along the Offshore Export Cable Corridor (ST168; 46.0μg/kg) which was above the Canadian SQG TEL of 34.6μg/kg.

75. Metals concentrations across the Offshore Development Area were below the marine CSQGs for all metals analysed, with the exception of arsenic and lead at some stations. Arsenic concentrations were above the TEL at 11 stations, with station ST164 along the Offshore Export Cable Corridor also above the PEL. The lead concentration at station ST164 was 31.5mg/kg which was above the Canadian SQG TEL (30.2mg/kg).

76. Sediment contamination data for metals (Table 4-9) in **Volume 7, Appendix 9-3 Benthic Ecology Monitoring Report (application ref: 7.9.9.3)**) shows that only marginal exceedances of TEL (and PEL at one station (ST164)) for arsenic concentrations are present but all other parameters are below their respective lower TEL concentration. This confirms the conclusions in section 6.2 that sediments are relatively low risk in terms of potential risks to water quality. Additionally, it can also be concluded that the sediments present relatively low risks to marine organisms. Whilst arsenic is indicated as being elevated, the TEL and PEL concentrations of 7.24 mg/kg and 41.6 mg/kg respectively, are lower than those for Cefas ALs which are considered by Cefas to be suitably protective to the UK marine environment in making offshore disposal to sea licensing decisions (Cefas, 2020).

6.2.2 Comparison with Other Sediment Quality Guidelines

77. Under the Convention for the Protection of the Marine Environment of the North-East Atlantic (the 'OSPAR Convention'), assessments are produced by the OSPAR commission on the quality status of the marine environment for the maritime area, or for regions or sub-regions, thereof. These are presented in Quality Status Reports (QSRs). An element contributing to these assessments considers sediment quality data and uses Background Assessment Concentrations (BAC) and the US Environmental Protection Agency's (EPA) Effects Range-Low (ERL) to determine levels of contamination and trends over time. BACs are statistical tools, defined in relation to the background concentrations, which enable statistical testing of whether observed concentrations can be considered to be near background concentrations. The ERL value is defined as the lower tenth percentile of the data set of concentrations in sediments which were associated with biological effects. Adverse effects on organisms are rarely observed when concentrations fall below the ERL value. Relevant BACs and ERLs are provided in **Table 6-1**.

78. The OSPAR Hazardous Substances Strategy aims to achieve concentrations in the marine environment to near natural background values for naturally occurring substances and close to zero for man-made synthetic substances. Due to their persistence in the marine environment, their potential to bioaccumulate and their toxicity, analyses of PAH concentrations in sediment are reported in the OSPAR coordinated environmental monitoring programme (CEMP) (see **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**).

79. PAHs are hydrocarbons composed of two or more fused aromatic rings, encompassing both parent (non-alkylated) compounds and alkylated homologues. Most datasets contain analysis for parent compounds only, with the exception of the MMO contaminant list for disposal to sea which requires analysis of three alkylated homologues of naphthalene (C1 to C3) and one of phenanthrene (C1).

80. CEMP compare selected metal and PAH concentrations against two assessment criteria: the OSPAR Background Assessment Concentration (BAC) and the US EPA's Effects Range-Low (ERL). The ERL value is defined as the lower tenth percentile of the data set of concentrations in sediments which were associated with biological effects. Adverse effects on organisms are rarely observed when concentrations fall below the ERL value. The ERL developed by the US EPA is used in the CEMP assessments because there are no OSPAR Environmental Assessment Criteria (EAC) currently available.

81. The metal and PAH parameters for which ERLs and BACs are available are presented in **Table 6-2** and **Table 6-3**, respectively.

82. It can be seen that analyses for all metals are below the BAC, the lower of the guideline values, apart from arsenic at two stations (ST161 & ST164) within the Offshore Export Cable Corridor. Natural sources of arsenic in the marine environment include mineral erosion, (Neff, 1997), whereas anthropogenic sources include mining, burning of fossil fuels and surface run-off (Neff, 1997; Nriagu, 1990). The arsenic concentrations recorded were within the range of < 0.15mg/kg to 135mg/kg reported for the wider Southern North Sea area (Whalley *et al*., 1999).

83. Of the 22 PAHs analysed, three stations exceeded the BAC but were below the ERL:

- ST168 (7.94ug/kg) exceeded the Anthracene BAC of 5ug/kg, but was below the ERL of 85ug/kg
- ST161 (18.8ug/kg), ST164 (26.8ug/kg) and ST168 (46.0ug/kg) exceeded the Naphthalene BAC of 8ug/kg, but were below the ERL of 160ug/kg

84. ST168 (34.0ug/kg) exceeded the Pyrene BAC of 24ug/kg, but was below the ERL of 665ug/kg. The total concentrations of 22 PAHs analysed were generally lower than, or within the range of 360mg/kg to 549mg/kg reported for CSEMP station 345 (Cefas, 2012), located near the current survey area, with the exception of station ST168. Station ST168 was the closest to the shore, with a higher likelihood of the sediment here being influenced by terrestrial run-off. In addition, PAH concentrations in stations offshore in the Array Areas were generally lower than PAH concentrations closer to the shore along the Offshore Export Cable Corridor.

6.2.3 Contaminants Baseline Summary

85. From the information and data presented above it can be concluded that the baseline water and sediment quality for the offshore and coastal waters surrounding the Offshore Development Area is good. Site-specific information relating to sediment contaminant concentrations do indicate that elevated levels of contaminants are likely to present a risk to water or sediment quality if disturbed.

7 Quantity of Material to be Disposed

86. Material to be disposed of may arise from the following sources:

- Sand wave levelling (pre-sweeping) for offshore cable installation;
- Seabed preparation and levelling for gravity based structure (GBS) foundations in the Offshore Export Cable Corridor; and
- Drill arisings associated with installing piled foundations.

7.1 Seabed Preparation

7.1.1 Wind Turbines

87. Foundations for wind turbines would be positioned in such a way to avoid the need for seabed preparation. Potential drilling volumes for wind turbine foundations are detailed in section 7.3.1.

7.1.2 Offshore Platforms

88. The greatest volumes of near-surface sediment disturbance due to seabed preparation activities during construction of offshore platforms is associated with GBS foundations. The worst case seabed preparation volume for a single GBS foundation with a 65m base plate diameter = 16,592m^3 (see **Table 4-1**).

89. As only the ESP located within the Offshore Export Cable Corridor would use GBS foundation (other platforms use foundations requiring no seabed preparation), therefore the overall worst case disposal volume for seabed preparation activities for offshore platforms would be 16,592m^3. Potential drilling volumes for other offshore platforms are detailed in section 7.3.2.

7.1.3 Sand Wave Levelling (Pre-Sweeping)

90. The seabed footprint and volume of sediment affected due to pre-sweeping is described in the worst case sandwave levelling scenarios detailed in **Table 7-1** (Table 5-17 of **Volume 7, Chapter 5 Project Description (application ref: 7.5)**). The total volume of sediment that could be required to be disposed of within the Array Areas and Offshore Export Cable Corridor is up to 1,003,944m^3 and 62,424,700m^3, respectively.

91. Areas of mobile seabed (typically either in sandwaves or megaripples) may present a risk to the cable burial process either by preventing the cable burial tools from operating efficiently or by resulting in exposure and scouring of the cable once installed. In some cases, this could result over time in the cable being left 'free-spanning' over the seabed. Free spanning cables present a risk to other marine users and result in a large amount of strain being placed on the cables, significantly increasing the chance of their failure and the subsequent need for repair works.

92. To prevent this, cables will be placed in the troughs of sandwaves where possible to the reference seabed level to minimise the potential for cables becoming exposed. However, where this is not possible, the alternative is to dredge the top of the sandwaves prior to installation down to the seabed reference level. This process is termed sandwave levelling. If this was required, it would be completed before the cable is laid on the seabed.

Table 7-1 Cable Corridor Pre-Sweeping Worst Case Scenarios (Table 5-17 of ***Volume 7, Chapter 5 Project Description (application ref:7.5****)*

Parameter	DBS East in isolation	DBS West in isolation	DBS West and DBS East sequentially or concurrently
Maximum seabed footprint disturbed by sandwave levelling within the Array Areas (m^2)	1,100,000	1,134,500	2,478,875
Maximum seabed footprint disturbed by sandwave levelling within the Offshore Export Cable Corridor (m^2)	12,282,010	10,833,835	23,115,845
Maximum volume of sandwave material to be dredged/relocated within the Array Areas (m^3)	445,500	459,473	1,003,944
Maximum volume of sandwave material to be dredged/relocated within the Offshore Export Cable Corridor (m^3)	33,121,800	29,302,899	62,424,700

7.2 Seabed Disturbance/Displacement Volumes from Offshore Cable Installation

93. Offshore electrical cables are required to transmit electricity from the wind turbines to OCPs and then onwards to the National Grid. The electrical cables that make up the offshore transmission system include:

- Offshore Export Cables (linking the OCP/s to the landfall); and
- Inter-Platform Cables (linking two separate wind farm areas).

94. Additionally, array cables link the wind turbine generators to the OCP/s.

95. Burial of the offshore cables will be through any combination of ploughing, jetting or mechanical cutting; however, infield cable burial is more likely to be undertaken by jetting or mechanical cutting.

96. The Offshore Export Cables will then be installed at a suitable time, as part of the main export cable installation campaign.

97. The total temporary area disturbed for export cable installation in the Offshore Export Cable Corridor is 19,824,219m^2**.** The maximum area temporarily disturbed due to Array and Inter-Platform Cable installation is 9,900,000m^2 (see Table 9-1 in **Volume 7, Chapter 9 Benthic Ecology (application ref: 7.9)**).

98. Section 5.4.7.4 of **Volume 7, Chapter 5 Project Description (Application ref: 7.5)** provides further details on each possible offshore cable installation technique.

7.2.1 Intertidal Exit Pit

99. The Offshore Export Cables make landfall near Skipsea. The Offshore Export Cables will be connected to the onshore export cables in the TJBs, which will be constructed prior to the installation of the Offshore Export Cables. The landfall location near Skipsea is shown on **Volume 7, Figure 5-4 (application ref: 7.5.1)**.

100. The TJBs would be located beyond any areas at risk of natural coastal erosion, and to provide space for temporary construction logistics and access requirements.

101. The total volume of sediment that may be disturbed by exit pits is 1,800m^3 (see Table 9-1 in **Volume 7, Chapter 9 Benthic Ecology (application ref: 7.9)**).

102. The landfall location near Skipsea was chosen as the result of a site selection process, considering environmental and technical constraints. The site selection process is described in **Volume 7, Chapter 4 Site Selection and Assessment of Alternatives (application ref: 7.4)**.

103. Installation of up to six ducts which would be installed using a trenchless technique such as Horizontal Directional Drilling (HDD). This consists of up to three ducts per Project (two power cable ducts plus a smaller duct for a fibre optic communications cable).

104. A trenchless solution is to be used to install ducts that would house the cables under the beach. The ducts would run from the TJBs, located landward of landfall, to an exit location which would be located within the intertidal. TJBs are permanent infrastructure where the offshore and onshore export cables are joined. The Offshore Export Cables would be pulled ashore through these pre-installed ducts and would interface with the onshore cables at the TJBs. No permanent infrastructure would be installed within the intertidal area above LAT.

105. The worst-case volumes of sediment disturbed with intertidal construction activities are detailed in **Table 7-2** below.

Table 7-2 Worst-Case Parameters for Intertidal Construction Activities

DBS East in isolation	DBS West in isolation	DBS West and DBS East concurrently and / or in sequence	Notes and rationale
Total volume of sediment disturbed by exit pits – 1,800m³ No. of exit pits – 3 Size of each exit pit – 20m length x 10m width x 3m depth Volume of displaced sediment per exit pit – 600m³ **Total volume of sediment disturbed by trenching in the intertidal - 990m³** Maximum temporary disturbance area for cable installation (based on 110m distance x 6m width) – 660m² Depth of cable – 1.5m	**Total volume of sediment disturbed by exit pits - 1,800m³** No. of exit pits – 3 Size of each cofferdam – 20m length x 10m width x 3m depth Volume of displaced sediment per exit pit – 600m³ **Total volume of sediment disturbed by trenching in the intertidal - 990m³** Maximum temporary disturbance area for cable installation (based on 110m distance x 6m width) – 660m² Depth of cable – 1.5m	**Total volume of sediment disturbed by exit pits – 3,600m³** No. of exit pits – 6 Size of each cofferdam – 20m length x 10m width x 3m depth Volume of displaced sediment per exit pit – 600m³ **Total volume of sediment disturbed by trenching in the intertidal - 990m³** Maximum temporary disturbance area for cable installation (based on 110m distance x 6m width) – 660m² Depth of cable – 1.5m	Technique for trenchless cable installation is not yet decided, however HDD is preferred. Number of exit pits assumes ducts for two power cables, one communications cable for each Project In Isolation Exit pits may be located within the intertidal area or subtidal Length of trench assumes 160m based on the distance between MHWS and MLWS minus mitigation to place exit pits at least 50m from the toe of the cliff.

7.3 Drilling

7.3.1 Wind Turbine Foundations

106. Whilst pile driving is the most likely installation method, in the event that ground conditions are not suited to piling, monopiles may be drilled, or both drilled and driven, into the seabed. For this purpose, it is estimated that up to 5% of the wind turbine locations could need drilling. Potential volumes of drill arisings for the Projects are detailed in **Table 4-1** and **Table 7-1** (and on section 5.4.3.2.1 of **Volume 7, Chapter 5 Project Description (application ref: 7.5)**.

107. Therefore, as a worst case scenario up to 73,790m^3 of drill arisings could occur at DBS East and West together, or 37,197m^3 for DBS East or DBS West in isolation.

108. The drill arisings (spoil) would be disposed of adjacent to the foundation location, above or slightly below the sea surface, from where they would be expected to settle onto the seabed in the immediate vicinity of each foundation (see **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** for further details).

7.3.2 Offshore Platform Foundations

109. As with the other piled foundation solutions and whilst considered unlikely, in the event of drilling being required, as a worse case, offshore platforms monopiles may be drilled or driven into the seabed. For this purpose, it is assumed that 5% of the offshore platforms will require drilling. In this manner, the amount of drill arisings would be 5,630m^3 for either DBS East and West together or 2, 815m^3 for DBS East or DBS West in isolation.

110. Drill arisings would be disposed of adjacent to the foundation location, above or slightly below the sea surface, from where they would be expected to settle onto the seabed in the immediate vicinity of each foundation (see **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** for further details). The key parameters (worst case) for platform piling are described in Table 5-12 in **Volume 7, Chapter 5 Project Description (application ref: 7.5)** and summarised in **Table 4-1**.

7.4 Summary of Sediment Disposal Quantities

111. **Table 7-3** provides a summary of the worst case sediment disposal quantities for DBS East and West.

Table 7-3 Summary of Worst Case Sediment Disposal Quantities at DBS East and DBS West

Activity	Worst case scenario description	Volume – DBS East	Volume – DBS West	Volume – DBS East and DBS West together
Seabed preparation – Offshore platforms (m^3)	One ESP along the Offshore Export Cable Corridor may use GBS foundation	16,592	16,592	16,592
Maximum volume of drill arisings for turbines – large turbines (m^3)	5% of turbine locations requiring drilling	34,382	34,382	68,160
Maximum volume of drill arisings for offshore platforms (m^3)	5% of offshore platforms requiring drilling	2,815	2,815	5,630
Maximum volume of sandwave material to be dredged/relocated within the Array Areas (m^3)	Max volumes were calculated by estimating the profile area of a trenched sandwave (separately for small, medium and large or very large) and multiplying by the estimated worst case length of each cable route where bedforms of each classification may be encountered. For the Offshore Export Cable Corridor, the sum was then multiplied by the max number of cables for	445,500	459,473	1,003,944
Maximum volume of sandwave material to be dredged/relocated within the Offshore Export Cable Corridor (m^3)		33,121,800	29,302,899	62,424,700

Activity	Worst case scenario description	Volume – DBS East	Volume – DBS West	Volume – DBS East and DBS West together
	that particular scenario.			
Total (m^3)		33,621,089	29,816,161	63,519,026

8 Potential Impacts of Disposal

112. The potential impact from the disposal of dredged or drilled material within the Offshore Development Area has been assessed within the DBS ES; specifically, within **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8),** and **Volume 7, Chapter 9 Benthic Ecology (application ref: 7.9)**. It should be noted however that the impacts assessed within the ES consider effects from the total volume of sediment potentially disturbed (i.e. not dredged - see Paragraph 29) from offshore cable installation alongside that potentially required to be dredged or drilled i.e. from sand wave levelling / pre-sweeping, piled foundations and seabed preparation for gravity based foundations, offshore platforms and trenchless working activities. Therefore, the parts of the assessments that relate specifically to disposal of dredged or drilled sediment have been drawn out and are presented below.

113. **Volume 7, Chapter 6 EIA Methodology (application ref: 7.6)** presents an overarching method for enabling assessments of the potential impacts arising from DBS on the receptors under consideration. The assessments presented in this report use the assessment methodologies presented in **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** (for potential impacts assessed in section 8.1) and **Volume 7, Chapter 9 Benthic Ecology (application ref: 7.9)**(for potential impacts assessed in section 8.3).

114. **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** incorporates the potential effects of disposal on marine physical processes. The impacts which contain relevant information for this assessment are as follows:

- Changes in suspended sediment concentrations (SSC) due to seabed preparation for foundation installation (wind farm site) (section 8.1.2.1);
- Changes in SSC due to drill arisings for installation of piled foundations for wind turbines and OSPs (section 8.1.2.2);
- Changes in seabed level due to seabed preparation for foundation installation (section 8.1.3.1);
- Changes in seabed level due to drill arisings for installation of piled foundations for wind turbines and OSPs (8.1.3.2);
- Change in SSC due to export cable installation (section 8.1.2.3);

- Change in seabed level due to deposition from the suspended sediment plume during export cable installation within the offshore cable corridor (section 8.1.3.3);
- Change in SSC due to offshore cables installation (array and inter platform cables) (section 8.1.2.5);
- Change in seabed level due to offshore cable installation (array and inter platform cables) (section 8.1.3.4); and
- Change in bedload sediment transport level due to landfall HDD works (section 8.1.4.1).

115. **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** incorporates the potential effects of disposal on water and sediment quality. The impacts which contain relevant information for this assessment are as follows:

- Deterioration in water quality due to an increase in SSCs (section 8.2.1);
- Deterioration in water quality due to an increase in suspended sediment associated with drill arisings for foundation installation of piled foundations (section 8.2.1); and
- Deterioration in water quality due to the release of contaminated sediment (section 8.2.1).

116. **Volume 7, Chapter 9 Benthic and Intertidal Ecology (application ref: 7.9)** incorporates the potential effects of disposal on the biological characteristics of habitats within the Offshore Development Area. The impacts which contain relevant information for this assessment are as follows:

- Temporary increases in SSCs and deposition (section 8.3.1); and
- Remobilisation of contaminated sediments (section 8.3.2).

8.1 Potential Impacts of Sediment Disposal on Physical Characteristics

117. The assessment provided in **Volume 7, Chapter 8 Marine Physical Environment (application Ref: 7.8)** is supported by an evidence-base obtained from research into the physical impacts of marine aggregate dredging on sediment plumes and seabed deposits (Whiteside *et al*., 1995; John *et al*., 2000; Hiscock & Bell, 2004; Newell *et al*., 2004; Tillin *et al*., 2011; Cooper & Brew, 2013).

8.1.1 Identified Receptors for the Marine Physical Environment Assessment

118. The principal receptors with respect to the marine physical environment are coastal or marine features with an inherent geological or geomorphological value or function which may be affected by the Projects. For water quality, the receptor is generally the marine environment given that water quality EQS are applied regardless of designation status. However, it is acknowledged within this assessment that specific areas of marine waters are classified according to their water quality status or water quality contributes to their classification status, such as bathing waters and WFD water bodies for example therefore an additional value assessment is provided where activities could impact these designations.

119. The Offshore Development Area consists mostly of sands, some gravel is present and very little fine material, with shallow geology along the Offshore Export Cable Corridor being expected to comprise glacial deposits of the Botney Cut Formation (see Table 8-14 of **Volume 7, Chapter 8 Marine Physical Environment (application Ref: 7.8)**.

120. The specific features defined within these three receptors as requiring further assessment at the EIA stage for the Projects are listed in **Table 8-1**.

Table 8-1 Marine Physical Environment Receptors Relevant to the Projects

Receptor group	Receptor	Description of features	Closest distance from the Projects
Designated sites and features	Dimlington Cliff SSSI	Geological Interest (Quaternary of East England)	36km south of the landfall
	Flamborough Head SSSI	Geological interest (Chalk cliffs) and coastal geomorphology	9km north of the Offshore Export Cable Corridor

Receptor group	Receptor	Description of features	Closest distance from the Projects
	Withow Gap Skipsea SSSI	Geological Interest (Quaternary of North-East England)	Part of the Offshore Export Cable Corridor and landfall located within SSSI
	Holderness Inshore MCZ	Geological features (Spurn Head)	Nearshore Offshore Export Cable Corridor and landfall located directly north of the MCZ
	Holderness Offshore MCZ	Geological features - North Sea glacial tunnel valleys	1km south of the Offshore Export Cable Corridor, 12km from the coast
	Marine waters (offshore)	No specific features	Both DBS Array Areas and part of the Offshore Export Cable Corridor
	Marine waters (inshore)	Marine waters within which the following designations are located: WFD water bodies: Yorkshire South coastal WFD water body, Yorkshire North coastal WFD water body Bathing waters: Bridlington North, Bridlington South Danes Dyke, Flamborough, Flamborough South Landing, Fraisthorpe, Hornsea, Skipsea Wilsthorpe.	Offshore Export Cable Corridor passes through the Yorkshire South coastal WFD water body and within 8.5km of the Yorkshire North coastal WFD water body as shown on **Volume 7 Figure 8-9 (application ref: 7.8.1)**. Closest bathing water – Skipsea is on the border of the Offshore Export Cable Corridor boundary. All others are located at least 5km from the Offshore Export Cable Corridor boundary (see **Volume 7 Figure 8-9 (application ref: 7.8.1)**)
Non-designated sites and features	Holderness Cliffs	Soft, rapidly eroding coastal cliffs and beach platform	HDD exit points at the landfall
	Smithic Bank	Offshore sand bank	Offshore Export Cable Corridor buffer partially

Receptor group	Receptor	Description of features	Closest distance from the Projects
			crosses southern part of Smithic Bank
	Flamborough Front	Seasonal tidal mixing front	Potentially present within Array Areas
	Humber Estuary	Geomorphological features of the coastal plain including the estuary, mud flats, sand flats, lagoons, saltmarsh and wetlands, coastal dunes and beaches	40km from the landfall
	Dogger Bank	Glacial and marine geological and geomorphological features	DBS Array Areas and part of the Offshore Export Cable Corridor are located within the Dogger Bank

8.1.2 Changes in Suspended Sediment Concentrations and Transport

121. Cefas (2016) published average suspended sediment concentrations between 1998 and 2015 for the seas around the UK (Figure 6-10 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**). Surface average suspended sediment concentrations are found to be relatively low across the DBS Array Areas, with concentrations typically less than 3mg/l in DBS East reducing to below 2mg/l in DBS West (Cefas, 2016). The relatively low concentrations are due to both a low content of fine material in the seabed sediments and the area being distant from any terrestrial sources, such as the Humber Estuary and the Holderness cliffs.

122. Along the Offshore Export Cable Corridor for both Projects, surface average suspended sediment concentrations are highest for around the first 10km from the coastline and around Flamborough Head where they may reach concentrations of 15mg/l. These concentrations may increase up to 300 mg/l during storm events (Pye & Blott, 2015). Further offshore the concentrations reduce to approximately 5mg/l.

123. Higher concentrations found in the nearshore region are likely driven by input of fine sediments from cliff erosion, shallower water depths, disturbance by waves and locally stronger wave-induced flows which keep sediment in suspension, inhibiting deposition locally.

8.1.2.1 Changes in SSCs and Transport due to Seabed Preparation for Foundation Installation

8.1.2.1.1 DBS East and DBS West Together

124. No seabed preparation is expected for the installation of wind turbine foundations. However, there is the potential for the offshore platform along the Offshore Export Cable Corridor to use gravity based foundations which require seabed preparation and therefore has the potential to disturb sediments from the seabed (near-surface sediments). The worst case scenario involves the dredge and disposal of a maximum volume of up to 16,592m^3 of near-surface sediment at the sea surface as overflow from a dredger vessel in the vicinity of the disposal location (section 7.1)

125. The volume of sediment disturbed will depend on the depth of dredging / clearance for seabed preparation. The disturbance effects at each foundation location are only likely to last for a few hours of construction activity within the overall construction programme lasting up to 60 months in total if DBS East and DBS West are constructed concurrently, and 84 months if they are constructed sequentially.

126. Seabed sediment across the Array Areas is dominated by sand with relatively low mud and gravel content. It is expected that any medium to coarse sand and coarse-grained mixed sediment across the Array Areas, and at the location of the offshore platforms in the Offshore Export Cable Corridor disturbed by the drag head of the dredger at the seabed would remain close to the seabed and settle rapidly. Most of the coarse sediment released at the water surface from the dredge vessel would fall rapidly (minutes or tens of minutes) to the seabed within a few tens of metres along the axis of tidal flow.

127. Any released fine sand, silt or clay will likely stay in suspension for longer and form a plume which would become advected by tidal currents. Sediment would eventually settle to the seabed in proximity to its release within a short period of time (hours). Smaller amounts of suspended sediment would extend further from the dredged area, along the axis of predominant tidal flows as shown in the model outputs, but the concentrations would be indistinguishable from background levels within 5km of the area of disturbance.

128. The effect on suspended sediment concentrations due to foundation installation is considered to have low to negligible magnitude of impact and the relevant receptors are of negligible sensitivity, resulting in a **negligible adverse** significance of effect upon the identified receptor groups for marine physical environment for DBS East or DBS West together (see section 8.1.1). Any changes in suspended sediment concentrations will be short-lived and, considering the low mud content in seabed sediments, any disturbed sediment would settle back to the seabed in close proximity to the area of disturbance.

8.1.2.1.2 DBS East or DBS West In Isolation

129. For either DBS East or DBS West in isolation, the same worst case disposal volume up to 16,592m³ of near-surface sediment at the sea surface applies, due to the potential for a single offshore platform to be located along the Offshore Export Cable Corridor for either Project.

130. As such, the effect on suspended sediment concentrations due to foundation installation is considered to have low to negligible magnitude of impact and the relevant receptors are of negligible sensitivity, resulting in a **negligible adverse** significance of effect upon the identified receptor groups for marine physical environment for DBS East or DBS West in isolation (see section 8.1.1). Any changes in suspended sediment concentrations will be short-lived and, considering the low mud content in seabed sediments, any disturbed sediment would settle back to the seabed in close proximity to the area of disturbance.

8.1.2.2 Changes in SSCs and Transport due to Drill Arisings from Foundations

8.1.2.2.1 DBS East and DBS West Together

131. Up to 73,790m³ (68,160m³ for wind turbines and 5,630m³ for offshore platforms) of deeper sub-surface sediments within the Array Areas would become disturbed during any drilling activities that may be needed at the location of each piled foundation (section 7.3).

132. The worst case scenario for a release from an individual wind turbine assumes a monopile foundation for a large wind turbine. In this case, an 15m pile diameter would be used, drilled to a depth of 70m, releasing a maximum of 12,064m³ of sediment per foundation into the water column. The maximum volume of arisings assumes 5% of monopile foundation locations are drilled as a worst case scenario across both Projects. The worst case for offshore platform foundations assumes monopiles with the same diameter as for a large wind turbine and the maximum drill arisings assumes each foundation requires drilling to a depth of 70m.

133. If required, the drilling process would cause localised and short-term increases in suspended sediment concentrations at the point of discharge of the drill arisings only. Sediments below the seabed within the Array Areas would become disturbed during any drilling activities that may be needed at the location of piled foundations. This released sediment may even then be transported by tidal currents in suspension in the water column. Any fine sediment released is likely to be widely and rapidly dispersed. Given seabed sediments are dominated by sand and mixed sediment, this would result in only low suspended sediment concentrations and low changes in seabed level when the sediments ultimately come to deposit. The disturbance effects at each wind turbine location are only likely to last for a few days of construction activity within the overall construction programme lasting up to 60 months in total if DBS East and DBS West are constructed together, and 84 months if they are constructed separately.

134. The modelling indicates net movement of fine-grained sediment retained within a plume would be to the north-west or south-east, depending on state of the tide at the time of release. Sediment concentrations arising from one foundation installation do not persist for a sufficiently long for them to interact with subsequent operations, and therefore, no cumulative effect is anticipated from multiple installations. Furthermore, only 5% of foundations are expected to be drilled.

135. Changes in SSCs (magnitudes, geographical extents and durations of effect) that are anticipated above, would move across the DBS Array Areas with progression of the construction sequence at the point of sediment release (and hence geographic location of the zone of effect). The effect on SSCs due to drill arisings from foundation installation is considered to have a negligible to low magnitude of impact and the relevant receptors are of negligible sensitivity, resulting in a likely **negligible adverse** effect upon the identified receptors groups for marine physical environment for DBS East and DBS West together (see section 8.1.1). This is because the receptors are dominated by processes that are active along the seabed and are not affected by sediment suspended in the water column.

8.1.2.2.2 DBS or DBS West In Isolation

136. Up to 37,197m^3 (34,382m^3 for wind turbines and 2,815m^3 for offshore platforms) of deeper sub-surface sediments within the Array Areas would become disturbed during any drilling activities that may be needed at the location of each piled foundation (section 7.3).

137. Given the reduced volumes of drill arisings for either Project in isolation when compared to those of both Projects together and the resulting negligible adverse effect conclusion reached for that assessment, the effect on SSCs due to drill arisings from foundation installation is considered to have a **negligible adverse** effect upon the identified receptors groups for marine physical environment for DBS East or DBS West in isolation (see section 8.1.1).

8.1.2.3 Changes in SSCs and Transport due to Offshore Cable Installation (Array, Inter Platform and Export)

8.1.2.3.1 DBS East and DBS West Together

138. The installation parameters of the array, inter-platform and Offshore Export Cables are dependent upon the final project design. The worst case cable laying technique is considered to be jetting which is not relevant this report. However, as a worst case scenario, it is also assumed seabed clearance and levelling (pre-sweeping) may be required prior to cable installation. The worst case scenario assumes that sediment would be dredged and returned to the water column at the sea surface as overflow from a dredge vessel. This process would cause localised and short-term increases in suspended sediment both at the point of dredging at the seabed and, more importantly, at the point of its discharge back into the water column.

139. Sediments across the Offshore Development Area are predominantly sand and to a lesser extent gravel, with a small percentage of fines. It is expected that any medium to coarse sand and coarse-grained mixed sediment disturbed would remain close to the seabed and settle rapidly. Most of the coarse sediment released at the water surface from the dredge vessel would fall rapidly (minutes or tens of minutes) to the seabed within a few tens of metres along the axis of tidal flow. Smaller amounts of suspended sediment would extend further from the dredged area, along the axis of predominant tidal flows. However, SSCs in the water column are predicted to return to baseline conditions within hours of the disturbance due to dispersion and dilution. Therefore, any effects will be temporary.

140. These effects on SSC due to seabed preparation for cable installation are considered to have a negligible to low magnitude of impact and the relevant receptors are of negligible sensitivity, resulting in a likely **negligible adverse** significance of effect upon the identified receptor groups for marine physical environment for DBS East and DBS West together. This is because the receptors are dominated by processes that are active along the seabed and are not affected by sediment suspended in the water column.

8.1.2.3.2 DBS East and DBS West In Isolation

141. As with the changes in SSCs and transport due to offshore cable installation for both Projects together, installation activities would cause localised and short-term increases in suspended sediment both at the point of dredging at the seabed and, more importantly, at the point of its discharge back into the water column. However, SSCs in the water column are predicted to return to baseline conditions within hours of the disturbance due to dispersion and dilution. Therefore, any effects will be temporary.

142. These effects on SSC due to seabed preparation for cable installation are considered to have a negligible to low magnitude of impact and the relevant receptors are of negligible sensitivity, resulting in a likely **negligible adverse** significance of effect upon the identified receptor groups for marine physical environment for DBS East or DBS West isolation.

8.1.2.4 Changes in SSCs and Transport due to Cable Installation at the Landfall

8.1.2.4.1 DBS East and DBS West Together

143. The Offshore Export Cable will be connected to the Onshore Export Cable using trenchless techniques below the cliffs. The worst case scenario is a 'short trenchless' option which sees the bore pits exits on the beach in the intertidal zone at the MHWS water level which is located at the base of the cliffs. The bore exit pits will be excavated to a maximum depth of 3m in order to provide access to connect the onshore export cable to the offshore export cable. A maximum of six exit pits may be required and each pit will 20m by 10m, separated by a distance of 50m, running in a line parallel to the shoreline. Installation of the exit pits will occur over a duration of 18 months but each individual pit will be open for a maximum of four months within this period.

144. The excavated material will be disposed of directly adjacent to the location of the excavation and will comprise a mix of gravelly sandy beach sediments and glacial till from the underlying shore platform. The maximum volume of sediment excavated for six exit pits will be 3,600m^3 and the volume of sediment excavated from the trench between the exit pits and MLWS will be 990m^3.

145. Excavation will be undertaken at low tide but the excavated sediment stored on the beach will become submerged at high tide, where seabed currents (predominantly wave-driven) will mobilise and redistribute it as a combination of suspended sediment and bedload.

146. SSCs will be elevated above prevailing conditions but are likely to remain within the range of background nearshore levels (which are high close to the coast because of increased wave activity) and lower than those concentrations that would develop during storm conditions when sediment yields are higher due to cliff erosion. Once mobilised, the suspended sediment will dissipate rapidly (i.e. over a period of a few hours) in the water and be transported alongshore and offshore. Complete removal of the excavated material would be expected within weeks to months of excavation, at which point prevailing conditions will resume and there will be no changes to SSCs.

147. The trench will be backfilled on completion of cable installation activities. Depending on the duration of this processes, there is potential for SSCs to become elevated when the area becomes submerged during high tide, either during or immediately after the activity ceases as the backfilled material settles.

148. These effects on SSC and transport due to landfall installation activities are considered to have a negligible to low magnitude of impact and the relevant receptors are of negligible sensitivity, resulting in a likely **negligible adverse** significance of effect upon the identified receptor groups for marine physical environment for DBS East and DBS West together.

8.1.2.4.2 DBS East or DBS West In Isolation

149. Up to a maximum of three exit pits would be required for either Project in isolation. As such the maximum volume of sediment excavated for three exit pits will be 1,800m^3 and the volume of sediment excavated from the trench between the exit pits and MLWS will be 990m^3.

150. Given the reduction in volumes when compared to the assessment detailed in section 8.1.2.4.1, the effects on SSC and transport due to landfall installation activities are considered to have a negligible to low magnitude of impact and the relevant receptors are of negligible sensitivity, resulting in a likely **negligible adverse** significance of effect upon the identified receptor groups for marine physical environment for DBS East or DBS West in isolation.

8.1.2.5 Magnitude of Impact and Significance of Effect for Changes in SSCs

151. The likely magnitudes of effect of worst case changes in suspended sediment concentrations due to seabed preparation for foundation and cable installation and drill arisings from foundation installation are summarised in **Table 8-2**.

Table 8-2 Magnitude of Effect on Suspended Sediment Concentrations and Transport Under the Worst Case Scenarios for DBS East and DBS West Together or In Isolation

Location	Scale	Duration	Frequency	Reversibility	Magnitude of Impact
Seabed Preparation for Foundation Installation					
Near-field*	High	Negligible	Negligible	Negligible	Medium
Far-field	Low	Negligible	Negligible	Negligible	Low
Drill Arisings for Installation of Piled Foundations					
Near-field*	Medium	Negligible	Negligible	Negligible	Negligible
Far-field	Negligible	Negligible	Negligible	Negligible	Negligible
Offshore Cable Installation					
Near-field*	Low	Negligible	Negligible	Negligible	Negligible
Far-field	Negligible	Negligible	Negligible	Negligible	Negligible
Cable Installation at Landfall					
Near-field*	Low	Negligible	Negligible	Negligible	Negligible
Far-field	Negligible	Negligible	Negligible	Negligible	Negligible

*The near-field impacts are confined to a small area, likely to be up to 1km from each foundation location.

152. The effects on SSCs due to seabed preparation for foundation and cable installation and drill arisings from foundation installation are considered to have a negligible to low magnitude of impact and the relevant receptors are of negligible sensitivity, resulting in a likely **negligible adverse** effect on the identified receptor groups for marine physical environment for DBS East and DBS West Together or In Isolation. This is because the receptors are dominated by processes that are active along the seabed and are not affected by sediment suspended in the water column. However, the effects do have the potential to impact upon other receptors, discussed in section 8.2 and section 8.3.

8.1.2.6 Cumulative Impacts

153. The receptors that have been identified in relation to marine physical environment are the geological features of the Holderness Inshore MCZ, Smithic Bank, Dogger Bank, and marine waters (inshore and offshore). The potential changes in SSCs and transport that have been assessed for the Projects in isolation or together are all anticipated to result in a **negligible adverse** effect to the above-mentioned receptors.

154. Due to the effects of changes in SSCs and transport due to seabed preparation for foundation installation and drill arisings from foundations occurring at discrete locations for a time-limited duration there is no potential for cumulative impacts with other projects or activities. However, depending on the construction timetable from nearby schemes there is potential for temporal overlap in construction periods which could have a cumulative effect from changes in SSCs and transport due to array, inter-platform and Offshore Export Cable installation, and cable installation at the landfall.

155. Section 8.8 of **Volume 7, Chapter 8 Marine Physical Environment (application Ref: 7.8)** provides the cumulative impact assessment. Potential cumulative construction and operation impacts for both the Projects, Hornsea Project Four offshore wind farm and Eastern Green Link 2 (EGL2) interconnector cable are assessed, however the assessment concludes that these would not be significant.

8.1.3 Changes in Seabed Level

8.1.3.1 Changes in Seabed Level Due to Seabed Preparation for Foundation Installation

8.1.3.1.1 DBS East and DBS West Together

156. Seabed preparation for the installation of wind turbine foundations has the potential to deposit sediment from the plume and change the elevation of the seabed. The worst case scenario for a release from an individual wind turbine assumes the installation of 200 large monopile wind turbines and one gravity based offshore platform.

157. It is predicted that coarser sediment disturbed during seabed preparation would fall rapidly to the seabed as a highly turbid dynamic plume immediately after it is discharged. The resulting change would be a measurable protrusion above the existing seabed, but one which would remain local to the release point. Depending on the prevailing physical conditions, the geometry of the change would vary across the Array Areas, but in all cases the deposited sediment would be similar.

158. The impacts on seabed level due to seabed preparation for foundation installation are considered to have a negligible magnitude of impact and the relevant receptors are of negligible sensitivity, resulting in a likely **negligible** significance of effect for DBS East and DBS West together. The installation of turbines and offshore platform will increase the volume of sediment disturbed overall but deposition from individual plumes will be very small and undetectable.

8.1.3.1.2 DBS East or DBS West In Isolation

159. The worst case scenario for a release from an individual wind turbine assumes the installation of 100 large monopile wind turbines and one gravity based offshore platform for either Project in isolation.

160. As with the Projects together, the impacts on seabed level due to seabed preparation for foundation installation are considered to have a negligible magnitude of impact and the relevant receptors are of negligible sensitivity, resulting in a likely **negligible adverse** significance of effect for DBS East or DBS West in isolation.

8.1.3.2 Changes to Seabed Level Due to Drill Arisings from Foundations

8.1.3.2.1 DBS East and DBS West Together

161. The installation of foundations has the potential to increase suspended sediment concentration. Combined with the disposal of any sediment that would be disturbed or removed whilst drilling monopile, the foundations have the potential to deposit sediment and change the seabed elevation. The drilling of piles could occur through 13 geological units, and if the drilling penetrates through the till, the worst case scenario is considered whereby the sediment released from the drilling is assumed to be wholly in the form of larger aggregated 'clasts' which would settle rapidly. These clasts would remain on the seabed (at least initially), rather than being disaggregated into individual fine-grained sediment components immediately upon release. The coarser sediment fractions (medium and coarse sands and gravels) would also settle out of suspension in close proximity to each foundation location. Under this scenario, the worst case scenario assumes that a 'mound' would reside on the seabed near the site of its release.

162. Drilling process would cause localised and short-term increases in suspended sediment concentrations at the point of discharge of the drill arisings only. Released sediment may then be transported by tidal currents in suspension in the water column. Any fine sediment released will be widely and rapidly dispersed.

163. Changes in seabed level due to deposition of suspended sediment released from drill arising from foundation installation was modelled and results show no observable change greater than 5mm. Any changes are therefore considered to be within the range of natural background variability and would also be undetectable using standard bathymetric survey techniques. The worst case for drill arisings is for the maximum number of the largest wind turbines (diameter) and the maximum number of offshore platforms and assumes only 5% of locations will be drilled (maximum five locations).

164. The magnitude of impact is negligible and the relevant receptors are of negligible sensitivity, and therefore, there be a **negligible adverse** effect upon the identified receptors groups for marine physical environment for DBS East and DBS West together. This is because changes are predicted to be undetectable and short-lived.

8.1.3.2.2 DBS East or DBS West In Isolation

165. As with the Projects together, changes in seabed level due to deposition of suspended sediment released from drill arising from foundation installation were modelled with results showing no observable change greater than 5mm. Any changes are therefore considered to be within the range of natural background variability and would also be undetectable using standard bathymetric survey techniques.

166. The magnitude of impact is negligible and the relevant receptors are of negligible sensitivity, and therefore, there be a **negligible adverse** effect upon the identified receptors groups for marine physical environment for DBS East or DBS West in isolation.

8.1.3.3 Changes in Seabed Level Due to Cable Installation (Array, Inter-array and Export)

8.1.3.3.1 DBS East and DBS West Together

167. Cable installation has the potential to change the seabed level during the seabed levelling phase within the export cable corridor and Array Areas. An increase of up to 0.05m is predicted within and immediately adjacent to the area of levelling. Changes in seabed level within the Array Areas are much larger, reaching 0.5m where multiple cable corridors merge. This is likely due to an accumulation of sediment as the model simulation trenches over the same area of seabed. In practice, there will not be repeat phases of trenching within the same area and the inter-array cable layout will be designed to avoid this. During the levelling phase, changes in seabed level are spatially restricted to within the cable corridors and are typically <0.03m.

168. Modelling results suggests changes due to deposition of the finer-grained fraction during cable installation. However, coarser sediment is predicted to fall rapidly to the seabed (minutes or tens of minutes) as a highly turbid dynamic plume immediately after it is discharged. Given the sand-dominated nature of seabed sediments, this coarser material will be restricted to the area of disturbance and after deposition, this sediment will likely be transported as bedload by prevailing tidal currents and with time (less than a year), the seabed will return to previous levels.

169. The worst case assumes 100% of the cables will be buried. However, geotechnical surveys along the Offshore Export Cable Corridor show high strength clays (till) may be present at seabed. If cable installation disturbs the till, then a worst case scenario is considered whereby the sediment released from the jetting is assumed to be in the form of larger aggregated 'clasts' which would settle rapidly. These clasts would remain on the seabed (at least initially), rather than being disaggregated into individual fine-grained sediment components immediately upon release.

170. The magnitude of impact is negligible and the relevant receptors are of negligible sensitivity, and therefore, there would be a **negligible adverse** effect upon the identified receptors groups for marine physical environment for DBS East and DBS West together. This is because any changes will be short lived with the seabed returning to baseline conditions.

8.1.3.3.2 DBS East or DBS West In Isolation

171. As with both Projects being built together, an increase in seabed level of up to 0.05m is predicted within and immediately adjacent to the area of levelling. Changes in seabed level within either Array Area are much larger, reaching 0.5m where multiple cable corridors merge. This is likely due to an accumulation of sediment as the model simulation trenches over the same area of seabed. In practice, there will not be repeat phases of trenching within the same area and the inter-array cable layout will be designed to avoid this. During the levelling phase, changes in seabed level are spatially restricted to within the cable corridors and are typically <0.03m.

172. The magnitude of impact is negligible and the relevant receptors are of negligible sensitivity, and therefore, there would be a **negligible adverse** effect upon the identified receptors groups for marine physical environment for DBS East or DBS West in isolation.

8.1.3.4 Magnitude of Impact and Significance of Effect for Changes in Seabed Level

173. The likely magnitudes of effect of worst case changes in seabed levels due to foundation installation, offshore export, array and Inter-Platform Cable installation are summarised in **Table 8-3.**

Table 8-3 Magnitude of Impact on Seabed Level Under the Worst Case Scenarios for DBS East and DBS West Together or In Isolation

Location	Scale	Duration	Frequency	Reversibility	Magnitude of Impact
Seabed Preparation for Foundation Installation					
Near-field	Negligible	Negligible	Negligible	Negligible	Negligible
Far-field	Negligible	Negligible	Negligible	Negligible	Negligible
Drill Arisings for Installation of Piled Foundations					
Near-field	Negligible	Negligible	Negligible	Negligible	Negligible
Far-field	Negligible	Negligible	Negligible	Negligible	Negligible
Cable Installation					
Near-field	Low	Negligible	Negligible	Negligible	Negligible
Far-field	Negligible	Negligible	Negligible	Negligible	Negligible

174. The magnitude of the effects on seabed level due to seabed preparation for foundation installation, drill arisings from foundation installation, and cable installation are negligible, and the relevant receptors are of negligible sensitivity. Therefore, there would be a **negligible adverse** effect upon the identified receptors groups for marine physical environment for DBS East and DBS West together or in isolation. This is because any changes will be short lived with the seabed returning to baseline conditions. However, the effects do have the potential to impact upon other receptors, discussed in section 8.2 and section 8.3.

8.1.3.5 Cumulative Impacts

175. The receptors that have been identified in relation to marine physical environment are the geological features of the Holderness Inshore MCZ, Smithic Bank and Dogger Bank. The potential changes in seabed level that have been assessed for the Projects in isolation or together are all anticipated to result in **negligible adverse** effects to the above-mentioned receptors.

176. Depending on the construction timetable, there is the potential for cumulative effects associated with seabed level due to array, inter platform and offshore export cable installation, due to the possibility of temporal overlap in construction periods. However, cumulative effects associated with changes in seabed levels associated with drill arisings and preparation for foundation installation, its predicted that there will be no cumulative effects due to the time-limited activities within discrete locations.

177. Section 8.8 of **Volume 7, Chapter 8 Marine Physical Environment (application Ref: 7.8)** provides the cumulative impact assessment. Potential cumulative construction and operation impacts for both the Projects, Hornsea Project Four offshore wind farm and EGL2 interconnector cable are assessed, however the assessment concludes that these would not be significant.

8.1.4 Changes to Bedload Sediment Transport

8.1.4.1 Changes to Bedload Sediment Transport Due to Cable Installation Activities at the Landfall

8.1.4.1.1 DBS East and DBS West Together

178. The Offshore Export Cable will be connected to the Onshore Export Cable using trenchless installation techniques below the cliffs. The worst case scenario is a 'short trenchless' option which sees the bore pits exit on the beach in the intertidal zone at the MHWS water level which is located at the base of the cliffs. A full description of these activities is outlined in section 8.1.2.4.

179. Considering beach sediments are relatively thin along the Holderness coast, significant accumulations of sediment with the exit pits are not expected and as the construction activities require the pits to remain open for up to four months, if sediment begins to accumulate in the pits, it will be excavated and returned to the beach where it can be transported alongshore to the south, as per the prevailing sediment transport regime. Upon completion of trenchless duct installation and following export cable installation within the trench between the exit pits and MLWS, the trenches will be backfilled to reinstate the intertidal zone close to its original morphology. This activity would result in some localised and short-term disturbance of sediment on the beach, but there would be no long-term effect on sediment transport processes.

180. The volume of excavated material is small (at 600m^3) per exit pit and the volume of sediment excavated from the trench between the exit pits and MLWS will be 990m^3. The exit pits will be located at least 50m from the toe of the cliff line at the time of construction, reducing the potential for the destabilisation of the nearby cliffs. Upon completion of trenchless duct installation and following export cable installation within the trench between the exit pits and MLWS, the trenches will be backfilled to reinstate the intertidal zone close to its original morphology. This activity would result in some localised and short-term disturbance of sediment on the beach, but there would be no long-term effect on sediment transport processes.

181. The effects on bedload sediment transport due to landfall installation activities are considered to have a negligible magnitude of impact and the relevant receptors are of high sensitivity, resulting in a likely **minor adverse** significance of effect upon the identified receptor groups for marine physical environment for DBS East and DBS West together.

8.1.4.1.2 DBS East or DBS West In Isolation

182. If the Projects are built in isolation, a maximum of three exits pits will be required during a single construction phase of 18 months, with each pit open for a period of up to four months. The duration of the construction phase will not decrease but the footprint and volume of sediment disturbed will halve when compared with the Projects together. Due to the reduced number of exit pits, a smaller length of cliff coastline will be affected. Therefore, the impact on bedload sediment transport will be small and localised, resulting in a negligible magnitude of effect. The sensitivity of the marine physical environment receptors at the landfall are considered to be high.

183. The effects on bedload sediment transport due to landfall installation activities are considered to have a negligible magnitude of impact and the relevant receptors are of high sensitivity, resulting in a likely **minor adverse** significance of effect upon the identified receptor groups for marine physical environment for DBS East or DBS West in isolation.

8.1.4.2 Magnitude of Impact and Significance of Effect for Changes in Bedload Sediment Transport Due to Cable Installation Activities at the Landfall

184. The magnitude of impact for the worst case scenario due to cable installation activities within the intertidal zone is given in **Table 8-4.**

Table 8-4 Magnitude of Impact on Bedload Sediment Transport Under the Worst Case Scenario for HDD Exit Cable Installation DBS East and DBS West Together or In Isolation

Location	Scale	Duration	Frequency	Reversibility	Magnitude of Impact
Near-field	Medium	Low	Low	High	Medium
Far-field	Low	Low	Low	High	Medium

*The near-field effects are confined to a small area of seabed likely to be up to 1km from each foundation location and would not cover the whole of DBS.

185. The overall effect of changes to bedload sediment transport due to cable installation activities at landfall is considered to be major adverse due to a medium magnitude of impact and high sensitivity. The impact can be mitigated by locating the exit pits a suitable distance from the base of the cliffs to ensure coastal erosion is not enhanced. This would reduce the magnitude of impact to negligible but the sensitivity of the Holderness Cliffs and Withow Gap Skipsea SSSI would remain high, resulting in a residual **minor adverse** significance of effect for DBS East and DBS West together or in isolation.

186. Construction of the Projects together would result in a greater scale and frequency of impact than the Projects in isolation but the magnitude of impact would remain the same as the potential increase in sediment yield due to cliff erosion would be small in comparison and difficult to distinguish from background coastal erosion.

8.1.4.3 Cumulative Impacts

187. The relevant receptors that have been identified in relation to marine physical environment is the Holderness Cliffs and Withow Gap Skipsea SSSI. The potential changes to bedload sediment transport that have been assessed for DBS East or DBS West together are anticipated to result in a **minor adverse** significance of effect, due to a negligible magnitude of impact and high sensitivity.

188. Depending on the construction timetable from nearby schemes there is also the potential for temporal overlap in construction periods which could have a cumulative effect.

189. Section 8.8 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** provides the cumulative impact assessment. Potential cumulative construction and operation impacts for both the DBS Projects, Hornsea Project Four offshore wind farm and EGL2 interconnector cable are assessed, however the assessment concludes that these would not be significant.

8.1.5 Summary of Impacts of Sediment Disposal on Physical Characteristics

190. The assessment conclusions for all relevant impacts on physical characteristics was that there would be no greater than a **negligible adverse** effect from changes in SSCs and transport, and seabed level for DBS East and DBS West together or in isolation. The effect from bedload sediment transport is **minor adverse** for DBS East and DBS West together or in isolation but the effect would be small and difficult to distinguish from background coastal erosion. Therefore, there would be no discernible effect on the physical characteristics of the proposed DBS disposal sites (see **Figure 1**), should they be designated.

8.2 Potential Impacts of Sediment Disposal on Water and Sediment Quality

8.2.1 Deterioration in Water Quality Associated with Release of Sediment Bound Contaminants

191. Any sediment that is disturbed and released during construction, could give rise to impacts on water quality via the release of contaminants bound to the sediment particles.

192. Sediment data in section 6.2 show that for all parameters, sediment contaminant concentrations are low. Where exceedance of sediment guidelines occur, these are marginal (i.e. only just above lower guideline values) and no samples exceeded the Cefas AL2 (where available) which indicates that there is minimal risk to the water column if suspended.

193. Regional information available indicates that these levels are below the range identified as being typical for the area.

194. Additionally, as mentioned in section 8.1.2, sediments are not predicted to remain in suspension for long periods of time (days) given that the seabed material is predominantly coarse gravel and sand with low levels of fines, thus reducing the risk of exposure to the water column for partitioning to occur.

195. The magnitude of impact is therefore considered to be negligible. Since the receptor is considered to be of low sensitivity, an increase in suspended sediment from dredging and disposal activities is expected to have a **negligible adverse** effect on water quality for DBS East and DBS West together or in isolation.

8.2.2 Cumulative Impacts

196. The receptor for this impact is marine waters (both offshore and inshore). The potential increases in SSCs that could result in the deterioration of water quality have been assessed for DBS East and DBS West together or in isolation are anticipated to result in **negligible adverse** effect. Neither of the above impacts are considered to have potential to interact cumulatively with other schemes as the effect occurs at discrete locations for a time-limited duration and levels of contaminants are low, therefore there would be no potential for cumulative impacts with regard to this assessment.

8.3 Potential Impacts of Sediment Disposal on Benthic Ecology

8.3.1 Increased SSCs (Including Sediment Deposition and Smothering)

197. As discussed in section 8.1.2, seabed preparation for foundation and cable installation, and drill arisings from foundations have the potential to increase SSCs within the water column. This increase has the potential to affect the benthic ecology receptors through blockage to the sensitive filter feeding apparatus of certain species and / or smothering of sessile species upon redeposition of the sediment (see section 9.6.2.2 in **Volume 7, Chapter 9 Benthic and Intertidal Ecology (application Ref: 7.9**).

198. As described in section 8.1.2.1, due to the predominance of sand with relatively low mud and gravel content across the Offshore Development Area, the coarse sediment disturbed by the drag head of the dredger at the seabed would remain close to the bed and settle back to the bed rapidly.

199. The finer sand fraction from this release and the very small proportion of mud that is present are likely to stay in suspension for longer, and form a passive plume which would become advected by tidal currents. It is expected that the coarser sediment will settle rapidly to the seabed following disturbance, in close proximity of the disturbance event. Finer sediments may stay in suspension within the water column for a longer period of time.

200. During foundation installation and seabed preparation SSCs may increase up to 5mg/l within 1km of disturbance, although values of up to 50mg/l may occur in localised hot spots. Levels will return to background levels within 5-7km from the area of disturbance. The maximum predicted deposition will be <0.5cm in localised areas immediately adjacent to the foundation installation area or <3cm spatially restricted to within the cable corridors.

201. The sensitivity of benthic receptors in the Offshore Development Area to increases in suspended sediments and smothering are shown below in **Table 8-5**.

Table 8-5 The Sensitivity of Biotopes to Increased Suspended Sediment Concentrations

Receptor	MarESA Sensitivity	
	Changes in suspended solids (water clarity)	Smothering and siltation rate changes (light)
Nephtys cirrosa and *Bathyporeia* spp. in Atlantic infralittoral sand (MB523)	Low	Not Sensitive

Receptor	MarESA Sensitivity	
	Changes in suspended solids (water clarity)	**Smothering and siltation rate changes (light)**
Circalittoral coarse sediment (MC3) *Proxy used - Pomatoceros triqueter with barnacles and bryozoan crusts on Atlantic circalittoral unstable cobbles and pebbles (MC3211)*	Not Sensitive	Not Sensitive
Branchiostoma lanceolatum in Atlantic circalittoral coarse sand with shell gravel (MC3215)	Not Sensitive	Low
Mediomastus fragilis, *Lumbrineris* spp. and venerid bivalves in Atlantic circalittoral coarse sand or gravel (MC3212)	Low	Low
Abra prismatica, *Bathyporeia elegans* and polychaetes in circalittoral fine sand (MC5212)	Low	Low
Abra alba and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment (MC5214)	Low	Low
Piddocks with a sparse associated fauna in Atlantic circalittoral very soft chalk or clay (MC1251)	Not Sensitive	Medium

202. The majority of the identified biotopes have a none-to-low sensitivity to the pressures described above. Therefore, these biotopes will not be affected by, or will recover rapidly from an increase in SSC and subsequent deposition.

203. The exception to this is the biotope 'Piddocks with a sparse associated fauna in Atlantic circalittoral very soft chalk or clay', which has a medium sensitivity to light smothering and siltation rate changes. This is due to the short length of the siphons (utilised by the characteristic piddock species to maintain contact with the surface of the seabed) being susceptible to smothering (Tillin & Hill, 2016). The piddock species *Pholas dactylus* has been found to be tolerant of deposition depths of 1-5cm (Knight, 1984). This biotope is not widespread in the Offshore Development Area and it is likely that construction activities will be a sufficient distance from this receptor such that the pathway for an effect is limited. However, as a worst case scenario a sensitivity of medium has been determined in relation to temporary increases in SSC and deposition from sediment disposal activities.

204. Given the localised and short-term increases in SSCs around the point of discharge due to seabed preparation drill arisings, and negligible changes in seabed level expected due to deposition, the magnitude of impact is considered to be negligible.

205. Based on the worst case medium sensitivity of one biotope (MC1251) and the negligible magnitude of temporary increases in SSCs and deposition during the construction phase, the impact is assessed as **minor adverse** significance for DBS East and DBS West together or in isolation.

8.3.2 Remobilisation of Contaminated Sediments

206. As described in section 8.2.1, sediment disturbance could lead to the mobilisation of contaminants within sediment and which could be harmful to the benthos. Sediment contamination levels in the surveyed area are not considered to be of significant concern and are low risk in terms of potential effects on the marine environment.

207. The sensitivity of the identified biotopes within the Offshore Development Area to chemical pressures have not been assessed by MarESA. It should be noted that the contaminant pressures assessment criteria are currently under review (Tyler-Walters *et al*, 2022). However, the majority of instances of elevated contaminants were located in the vicinity of ST164, where lead and arsenic levels were identified as being above the Canadian SQG TEL. ST164 was characterised by the biotope '*Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in Atlantic circalittoral coarse sand or gravel'.

208. Overall, the evidence for species typical of this biotope indicates a tolerance of low-levels of heavy metal contamination. *Mediomastus fragilis*, a key indicator species for the biotope present at ST164, is considered to be tolerant of contaminated sediments (Dean, 2008).

209. Given the tolerance of species characteristic of the biotope to low levels of heavy metal contamination, the sensitivity has been assessed as negligible.

210. Overall levels of contaminants were very low across the majority of the Offshore Development Area. This is likely because sediment contaminants are typically associated with mud and silt particles, which have limited distribution within the Offshore Development Area. Section 8.3.1 explains that due to installation and seabed preparation SSCs return to background levels within 5-7km from the area of disturbance, therefore any contaminants disturbed will not remain in the water column for a significant length of time. Any contaminant dispersal will occur at very low levels, given the minimal contaminants identified across the Offshore Development Area, with any dispersal remaining under the significant contaminant level thresholds. Therefore, the magnitude of effect is considered to be negligible.

211. Due to the negligible magnitude and low sensitivity to the presence of existing contamination, the overall worst case effect is considered to be **negligible adverse.**

8.3.3 Cumulative Impacts

212. There is the potential for cumulative increases is SSCs and associated deposition as a result of construction activities associated with the Projects and other developments, in particular Hornsea Project Four and EGL2. Should construction of the Projects occur concurrently and overlap with other sediment disposal activities nearby, there is likely to be a corresponding increase in SSCs at that location over and above what would be expected should the activity be undertaken alone.

213. Increase in SSCs are expected to be localised at the point of discharge and short-term. Small quantities of fine sediment present may be transported up to approximately 7km however these will be widely and rapidly dispersed. In most cases, the elevation of SSC is expected to be lower than concentrations that would develop in the water column during storm conditions.

214. The cumulative impacts of increased SSC are expected to be of local spatial extent, temporary duration, intermittent and reversible. Fine suspended sediment may be transported a further distance than coarse sediments, however this is likely to be widely and rapidly dispersed and within the range of natural variability within the region. The magnitude of impacts is therefore considered to be low.

215. Section 8.8 of **Volume 7, Benthic and Intertidal Ecology (application ref: 7.9)** provides the cumulative impact assessment. Potential cumulative construction and operation impacts for both the Projects, Hornsea Four offshore wind farm and EGL2 interconnector are assessed, however the assessment concludes that these would not be significant.

216. Remobilistaion of contaminated sediments was not screened into the benthic ecology cumulative assessment due to the very low levels of contaminants identified during surveys, and a negligible significance of effect for the Projects. No cumulative effects are predicted for the remobilisation of contaminated sediments.

9 Summary

217. As part of the DCO application for the Projects, the Applicants are applying for a disposal licence for the areas identified on **Figure 3-1**. Whilst the Projects are the subject of a single DCO application (with a combined EIA process and associated submissions), each Project is assessed individually, so that mitigation is Project specific. To streamline the disposal site characterisation and licensing process, this document was produced to provide the necessary information for all areas to be licensed as disposal sites and included on the face of the DMLs. If any of these areas are not required following detailed design, then the Applicants can agree with the MMO and Cefas that the licensed activities will not be undertaken in these areas.

218. Licensing of the proposed disposal sites would allow the Applicants to dispose of material arising from construction activities (including seabed preparation (dredging) and drilling). Licensing of the proposed areas would allow the Applicants, as far as possible, to dispose of sediment in the vicinity of the locations from which it was extracted, ensuring sediment is disposed of within areas of similar sediment type and subject to the same sedimentary processes.

219. The seabed sediments across the Offshore Development Area are predominantly sand and to a lesser extent gravel, with a small percentage of fines. Maximum quantities of material which would need to be excavated for foundations are provided along with maximum quantities of material released from drilling should piled foundations be utilised.

220. Most of the material released from seabed preparation, drilling and seabed preparation would be deposited in the near vicinity of the point of release forming a mound which would reside on the seabed near the site of its release. The geometry of each of these mounds would vary across the Offshore Development Area, depending on the prevailing physical conditions, but in all cases the sediment within the mound would be similar (but not exactly the same as) the seabed that it is deposited on and the surrounding seabed.

221. Some of the finer sand fraction from this release and the very small proportion of fines that is present are likely to stay in suspension for longer and form a passive plume which would become advected by tidal currents. Due to the sediment sizes present, most of the coarse sediment released at the water surface from the dredge vessel would fall rapidly (minutes or tens of minutes) to the seabed within a few tens of metres along the axis of tidal flow.

222. Any released fine sand, silt or clay will likely stay in suspension for longer and form a plume which would become advected by tidal currents. Sediment would eventually settle to the seabed in proximity to its release within a short period of time (hours). Smaller amounts of suspended sediment would extend further from the dredged area, along the axis of predominant tidal flows as shown in the model outputs, but the concentrations would be indistinguishable from background levels within 5-7km of the area of disturbance.

223. The disposal of dredged material has the potential to release sediment-bound contaminants, such as heavy metals and hydrocarbons into the water column. However, levels of contaminants throughout the Offshore Development Area are generally very low. Elevated levels of arsenic, which are typical of the region, have been recorded at some locations however regional information available indicates that these levels are below the range identified as being typical for the area and they are not at concentrations considered to pose an unacceptable risk to the marine environment.

224. Results of the benthic ecology assessment show that the majority of identified receptors across the Offshore Development Area are not sensitive to increased SSCs (including deposition and smothering). Adverse impacts could occur within a few metres of the disposal locations where heavy smothering would be expected, but overall, the impact from disposal site activities is predicted to result in no impact with the exception of temporary increases in SSC and deposition impacts which would be of **minor adverse** significance for DBS East and DBS West together or in isolation.

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Annex 1

225. This annex and **Table A 1** to **Table A 5** provides coordinates to delineate the proposed disposal sites for DBS East and DBS West.

Table A 1: Coordinates Delineating the Proposed DBS East Array Area Disposal Sites

Point	Latitude (Degrees, Decimal, Minutes)	Longitude (Degrees, Decimal, Minutes)
1	54° 31.397' N	1° 45.545' E
2	54° 33.825' N	1° 49.262' E
3	54° 34.234' N	1° 59.64' E
4	54° 24.331' N	2° 8.094' E
5	54° 21.597' N	1° 53.993' E

Table A 2: Coordinates Delineating the Proposed DBS West Array Area Disposal Sites

Point	Latitude (Degrees, Decimal, Minutes)	Longitude (Degrees, Decimal, Minutes)
1	54° 42.687' N	1° 20.051' E
2	54° 43.762' N	1° 22.289' E
3	54° 38.535' N	1° 44.555' E
4	54° 36.637' N	1° 43.492' E
5	54° 32.203' N	1° 32.945' E
6	54° 34.215' N	1° 20.841' E

Table A 3: Coordinates Delineating the Proposed DBS Inter-platform Cabling Area Disposal Sites

Point	Latitude (Degrees, Decimal, Minutes)	Longitude (Degrees, Decimal, Minutes)
1	54° 30.054' N	1° 46.707' E
2	54° 30.004' N	1° 46.465' E

3	54° 31.017' N	1° 40.376' E
4	54° 32.203' N	1° 32.945' E
5	54° 36.637' N	1° 43.492' E
6	54° 38.535' N	1° 44.555' E
7	54° 34.234' N	1° 59.64' E
8	54° 33.825' N	1° 49.262' E

Table A 4: Coordinates Delineating the Proposed DBS East Offshore Export Cable Corridor Disposal Site

Point	Latitude (Degrees, Decimal, Minutes)	Longitude (Degrees, Decimal, Minutes)
1	53° 58.656' N	0° 11.916' W
2	53° 58.694' N	0° 11.932' W
3	53° 58.782' N	0° 11.99' W
4	53° 58.793' N	0° 11.985' W
5	53° 59.03' N	0° 12.114' W
6	53° 59.37' N	0° 12.31' W
7	53° 59.56' N	0° 11.454' W
8	53° 59.571' N	0° 9.727' W
9	53° 59.847' N	0° 7.915' W
10	54° 0.217' N	0° 6.361' W
11	54° 1.656' N	0° 2.81' W
12	54° 2.908' N	0° 0.939' E
13	54° 3.549' N	0° 2.777' E
14	54° 3.911' N	0° 3.684' E

Point	Latitude (Degrees, Decimal, Minutes)	Longitude (Degrees, Decimal, Minutes)
15	54° 4.011' N	0° 4.5' E
16	54° 4.05' N	0° 5.229' E
17	54° 8.562' N	0° 14.539' E
18	54° 15.827' N	0° 31.895' E
19	54° 15.982' N	0° 32.188' E
20	54° 16.131' N	0° 32.456' E
21	54° 18.256' N	0° 36.672' E
22	54° 19.354' N	0° 37.773' E
23	54° 25.313' N	0° 46.761' E
24	54° 28.948' N	0° 55.454' E
25	54° 28.856' N	0° 57.171' E
26	54° 28.667' N	0° 59.245' E
27	54° 28.134' N	1° 9.118' E
28	54° 27.049' N	1° 25.2' E
29	54° 26.798' N	1° 27.071' E
30	54° 27.173' N	1° 30.781' E
31	54° 28.59' N	1° 42.482' E
32	54° 29.407' N	1° 43.551' E
33	54° 30.054' N	1° 46.707' E
34	54° 29.568' N	1° 47.127' E
35	54° 28.952' N	1° 44.12' E
36	54° 28.102' N	1° 43.009' E

Point	Latitude (Degrees, Decimal, Minutes)	Longitude (Degrees, Decimal, Minutes)
37	54° 26.644' N	1° 30.954' E
38	54° 26.248' N	1° 27.045' E
39	54° 26.517' N	1° 25.042' E
40	54° 27.598' N	1° 9.022' E
41	54° 28.132' N	0° 59.131' E
42	54° 28.434' N	0° 55.811' E
43	54° 24.911' N	0° 47.385' E
44	54° 19.037' N	0° 38.524' E
45	54° 17.906' N	0° 37.39' E
46	54° 15.731' N	0° 33.074' E
47	54° 15.455' N	0° 32.57' E
48	54° 15.403' N	0° 32.465' E
49	54° 13.863' N	0° 28.769' E
50	54° 12.594' N	0° 27.492' E
51	54° 12.224' N	0° 24.843' E
52	54° 8.134' N	0° 15.099' E
53	54° 3.528' N	0° 5.594' E
54	54° 3.477' N	0° 4.635' E
55	54° 3.405' N	0° 4.048' E
56	54° 3.093' N	0° 3.268' E
57	54° 2.441' N	0° 1.399' E
58	54° 1.198' N	0° 2.324' W

Point	Latitude (Degrees, Decimal, Minutes)	Longitude (Degrees, Decimal, Minutes)
59	53° 59.739' N	0° 5.925' W
60	53° 59.233' N	0° 8.05' W
61	53° 58.948' N	0° 8.966' W
62	53° 58.696' N	0° 10.099' W

Table A 5: Coordinates Delineating the Proposed DBS West Offshore Export Cable Corridor Disposal Site

Point	Latitude (Degrees, Decimal, Minutes)	Longitude (Degrees, Decimal, Minutes)
1	53° 58.656' N	0° 11.916' W
2	53° 58.694' N	0° 11.932' W
3	53° 58.782' N	0° 11.99' W
4	53° 58.793' N	0° 11.985' W
5	53° 59.03' N	0° 12.114' W
6	53° 59.37' N	0° 12.31' W
7	53° 59.56' N	0° 11.454' W
8	53° 59.571' N	0° 9.727' W
9	53° 59.847' N	0° 7.915' W
10	54° 0.217' N	0° 6.361' W
11	54° 1.656' N	0° 2.81' W
12	54° 2.908' N	0° 0.939' E
13	54° 3.549' N	0° 2.777' E
14	54° 3.911' N	0° 3.684' E

Point	Latitude (Degrees, Decimal, Minutes)	Longitude (Degrees, Decimal, Minutes)
15	54° 4.011' N	0° 4.5' E
16	54° 4.05' N	0° 5.229' E
17	54° 8.562' N	0° 14.539' E
18	54° 15.827' N	0° 31.895' E
19	54° 15.982' N	0° 32.188' E
20	54° 16.131' N	0° 32.456' E
21	54° 18.256' N	0° 36.672' E
22	54° 19.354' N	0° 37.773' E
23	54° 25.313' N	0° 46.761' E
24	54° 28.948' N	0° 55.454' E
25	54° 35.055' N	1° 15.981' E
26	54° 42.687' N	1° 20.051' E
27	54° 34.215' N	1° 20.841' E
28	54° 34.832' N	1° 17.277' E
29	54° 28.856' N	0° 57.171' E
30	54° 28.434' N	0° 55.811' E
31	54° 24.911' N	0° 47.385' E
32	54° 19.037' N	0° 38.524' E
33	54° 17.906' N	0° 37.39' E
34	54° 15.731' N	0° 33.074' E
35	54° 15.455' N	0° 32.57' E
36	54° 15.403' N	0° 32.465' E

Point	Latitude (Degrees, Decimal, Minutes)	Longitude (Degrees, Decimal, Minutes)
37	54° 13.863' N	0° 28.769' E
38	54° 12.594' N	0° 27.492' E
39	54° 12.224' N	0° 24.843' E
40	54° 8.134' N	0° 15.099' E
41	54° 3.528' N	0° 5.594' E
42	54° 3.477' N	0° 4.635' E
43	54° 3.405' N	0° 4.048' E
44	54° 3.093' N	0° 3.268' E
45	54° 2.441' N	0° 1.399' E
46	54° 1.198' N	0° 2.324' W
47	53° 59.739' N	0° 5.925' W
48	53° 59.233' N	0° 8.05' W
49	53° 58.948' N	0° 8.966' W
50	53° 58.696' N	0° 10.099' W

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