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# **Dogger Bank South Offshore Wind Farms**

**Environmental Statement**

**Volume 7**

**Appendix 9-2 Intertidal Survey Report**

**June 2024**

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# REPORT

## **Dogger Bank South Offshore Wind Farms**

### Intertidal Survey Report

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## Acronyms

<b>DBS</b>	Dogger Bank South
<b>GPS</b>	Global Positioning System
<b>MNCR</b>	Marine Nature Conservation Review
<b>SACFOR</b>	Super abundant, Abundant, Common, Frequent, Occasional and Rare Scale
<b>SSSI</b>	Site of Special Scientific Interest

## 1 Introduction

### 1.1 Purpose of the Report

This document has been prepared by Royal HaskoningDHV on behalf of RWE Renewables. It details the results of the Phase I Qualitative intertidal ecology survey that was undertaken on the 28<sup>th</sup> of September, 2022 for the possible landfall locations for Dogger Bank South (DBS) East and DBS West, collectively known as Dogger Bank South (DBS) offshore wind farms (hereafter referred to as ‘the Projects’).

## 2 Survey Location and Method

### 2.1 Location

The survey was conducted along five transects selected prior to the survey commencing within the possible landfall locations, known as Landfalls 8 and 9 (see **Figure 2-1**). These two landfalls were (at the time of writing) the only remaining landfall options being considered for the Projects. The landfalls are located along the Holderness Coast, with the area typically being characterised by long sandy beaches backed by the priority habitat Maritime Cliff and Slope, as listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006. This habitat is comprised of sloping to vertical faces on the coastline where a break in slope is formed by slippage and/or coastal erosion (JNCC 2008). Located within Landfall 9 is Withow Gap Site of Special Scientific Interest (SSSI), a site designated for its geological interest features (see **Figure 2-2**). Three transects were surveyed within Landfall 8 and two in Landfall 9. Their locations are detailed in **Figure 2-2** below.

The survey was undertaken on the 28<sup>th</sup> of September 2022, beginning at 11:02 and ending at 13:45. The survey was undertaken during spring tides, with high tide occurring at approximately 06:28 at a height of 6.16m and low tide occurring at approximately 13:00 at a height of 0.84m. The weather for the survey was mixed with sunny spells, occasional light showers and rare heavier downpours all occurring.

Figure 2-1 Location of Landfall 8 and 9 along the Holderness Coast

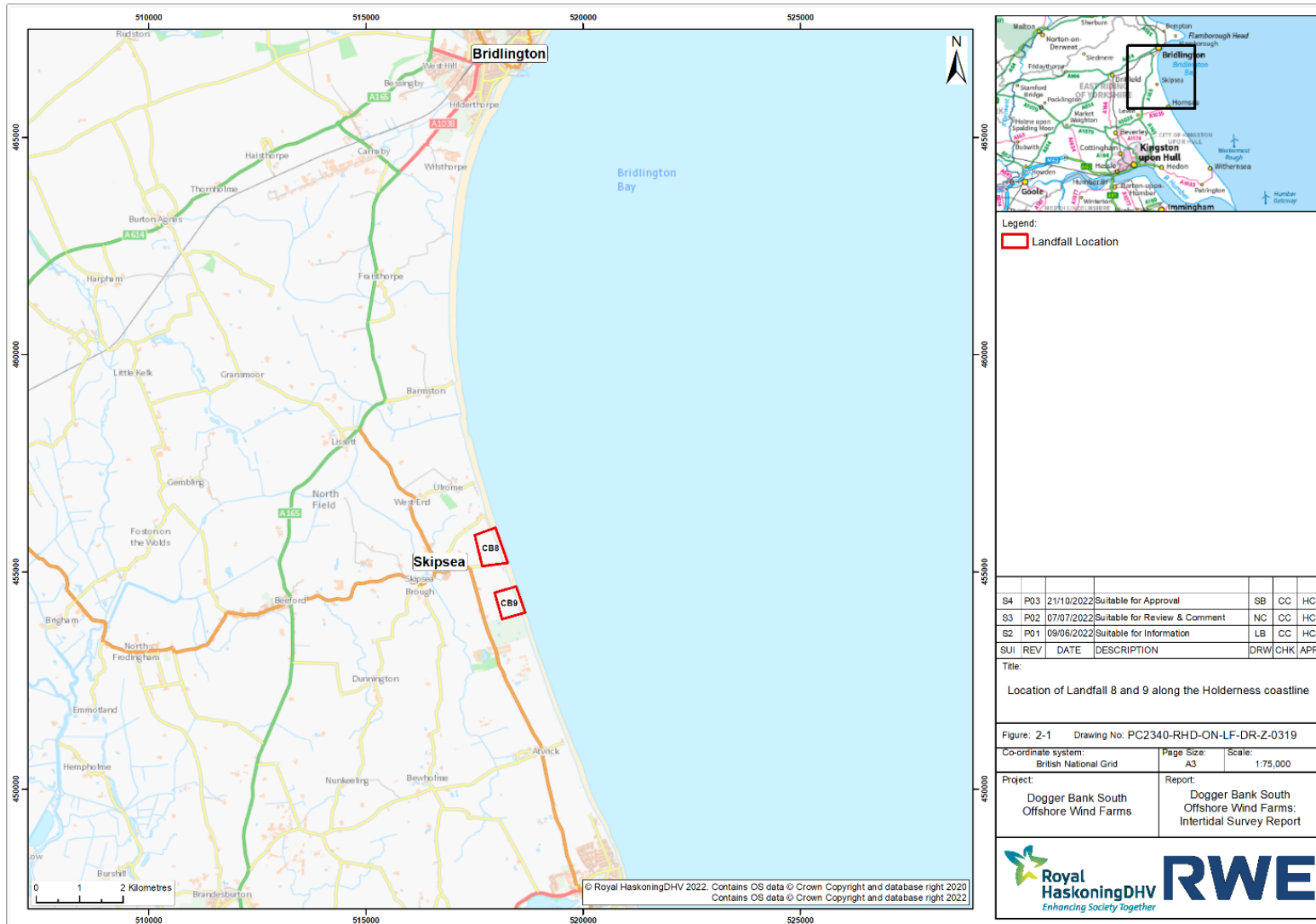
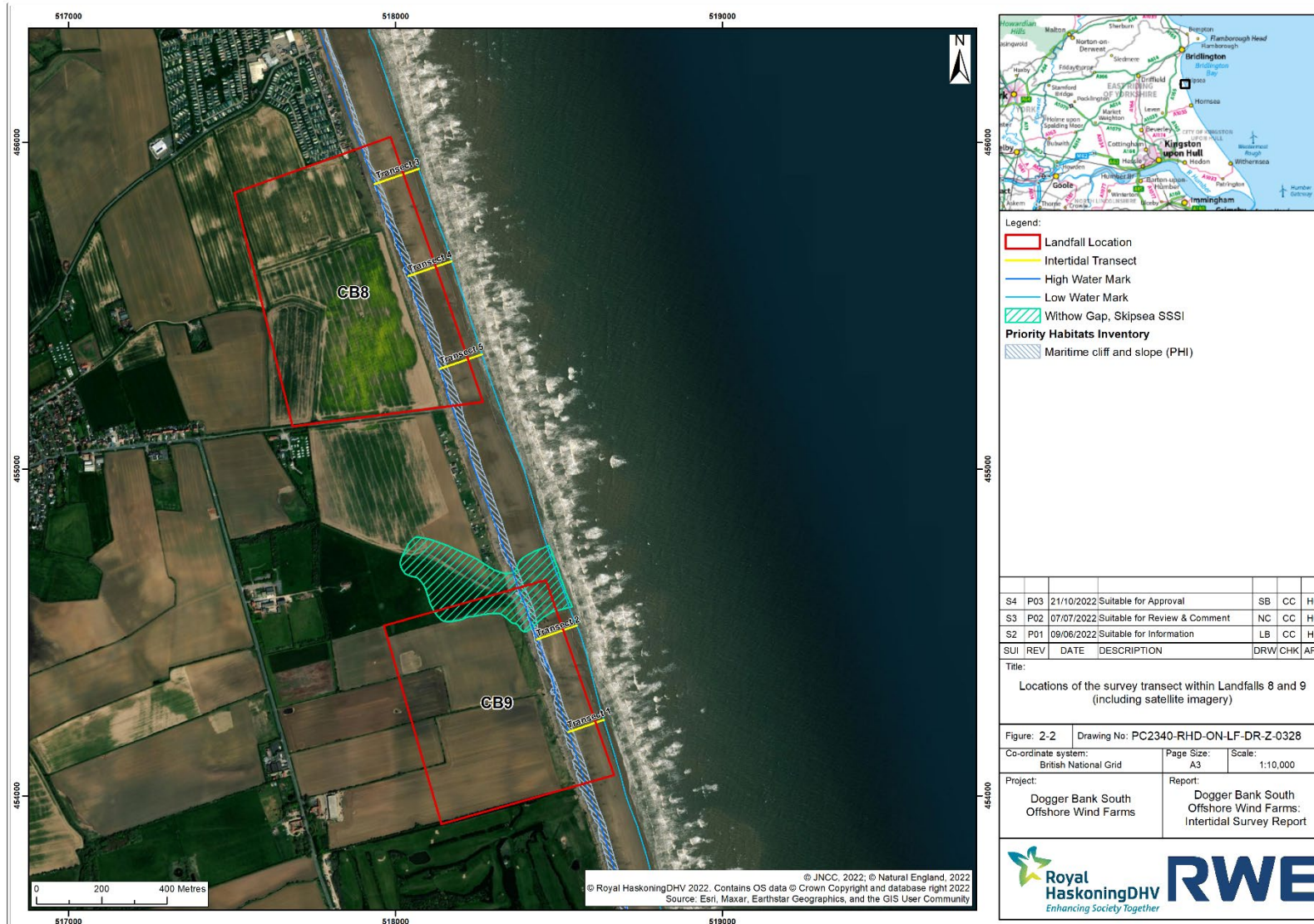




Figure 2-2 Locations of the survey transect within Landfalls 8 and 9



## 2.2 Methodology

Guidance set out in the Handbook for Marine Intertidal Phase I surveys (Wyn et al., 2006) was used to produce the Benthic Site Characterisation Survey Method Statement (Ref: PC2340-RHD-OF-ZZ-MS-Z-0005, 004177105-03) for this survey, as recommended in Section 7.3.3.1 of Natural England's Phase I Best Practice Advice for Evidence and Data Standards (Natural England, 2022).

To provide adequate coverage of the intertidal zone at each landfall location, transects were spaced approximately 300m apart. This led to three transects being recorded at Landfall 8, and two transects being recorded at Landfall 9 (see **Figure 2-2** above which details the locations of each transect).

Along each transect, boundaries were identified where there were changes in habitat types and/or associated ecology from the lower littoral zone to the high intertidal (splash) zone. In addition, a visual inspection of the cliff areas above each transect was undertaken, with the cliff profile and any conspicuous vegetation being noted. Photographs of the cliff habitat were taken for further inspection where applicable. Areas of different habitats were identified on the basis of visual features along the length of the transect. All positional data were recorded with Global Positional System (GPS). Field notes recorded during the survey have been included in Appendix A to this report.

Within each observed habitat, a sampling station was identified at the approximate centre of each zone. The following information was recorded at each sampling station:

- Sediment type (identified visually on the basis of the Tyler-Walters and Tillin (2014) scale, Appendix B);
- Surface features (e.g. of conspicuous casts, mounds or burrows, indicative of a species presence);
- Reduction–oxidation (redox) layer depth; and
- Presence/absence or estimate of abundance of fauna identified on site.

At each sampling station three dig-overs were undertaken of a 0.25m x 0.25m sediment area to a depth of around 20cm. At locations where the substrate was fine, a sample was sieved through a 1mm mesh sieve and visual observations made of any species remaining on the sieve. No species were retained for further analysis and no physical samples were removed from site.

Photographs were taken at each of the sampling stations to record the habitat, context and location. Percentage cover or counts were made of conspicuous species and casts, mounds or burrows indicative of species presence (e.g. *Lanice conchilega* tubes). Any identified species (or genus/class depending on identification potential) recorded was assigned an abundance measure according to the Marine Nature Conservation Review (MNCR) SACFOR<sup>1</sup> scale (Appendix C). The nature of the habitat and substrate sampling station was also recorded. Where there were additional points of interest, or conspicuous features such as changes in substrate or the presence of strandlines, these were marked with GPS waypoints with target notes recorded.

An overall profile of the shore within each landfall is detailed in **Figure 3-1** and **Figure 3-2** below, outlining the intertidal boundaries identified and sampling station locations. Based upon the substrata and abundance of species present along each transect, biotope(s) have been assigned to areas of shore within each transect according to Connor et al. (2004).

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<sup>1</sup> Super Abundant, Abundant, Common, Frequent, Occasional and Rare

## 3 Results

### 3.1 Overview

At the beginning of the intertidal survey, the surveyors walked along the top of the shoreline to visually characterise the stretch of coast based on physical and ecological characteristics such as habitat structure and complexity, and obvious intertidal zonation.

This initial walkover, and subsequent surveys conducted along the five selected transects, identified three distinct habitats within Landfall 8 and four within Landfall 9 (**Figure 3-1** and **Figure 3-2** respectively). Predominantly the beach comprised sand and shingle habitat interspersed with occasional hard anthropogenic structures.

The presence of fauna and flora was very limited, most likely due to high levels of substrate mobility and the coarse abrasive nature of the littoral sediments. There were rare to occasional observations of worm casts and tubes close to mean low water springs (MLWS). Hard substrates, where present, were encrusted with barnacles, limpets and algae, fauna typically associated with such habitats. As such, the entirety of the survey area has been classified as the biotope barren littoral coarse sand (EUNIS biotope A2.221).

The cliff face was largely characterised as soft sediment cliff comprising clay with coarser cliff habitat above the clay layer. The cliff face was partly vegetated (mostly where it had slumped and cliff top vegetation had fallen with the cliff top), but with large areas of recently eroded bare slopes. It should be noted that the Maritime Cliff And Slopes data layer (part of the Priority Habitat Inventory (England) dataset from Natural England and last updated in August 2022), appears to be outdated, with the GPS co-ordinates recorded at the base of the cliff being found further inland than the extent of the current publicly available dataset. For example, the initial GPS point for Transect 1 is set approximately 30m back from the currently recorded cliff location in the Natural England dataset.

Concrete structures, likely remnants of war-time anti-tank beach defences (UrbanRim 2022), were found within the northern extent of Landfall 9 (see **Plate 3-2** and **Figure 3-2**). The larger concrete structures had been colonised by barnacles and green and red algae (*Ulva* sp and *Porphyra*), with low abundances of limpets also present (see **Plate 3-3** below). **Plate 3-2** shows a typical example of one of these structures and the associated flora and fauna found along the shoreline. **Plate 3-3** provides a close-up illustration of the biota associated with the relict concrete structures. In addition there were occasional concrete and metal structures heading seawards at a 90 degree angle from these concrete structures (see Plate below).

Also located within Landfall 9 (but outside of the transects undertaken for the survey) is the Withow Gap, Skipsea SSSI (see **Figure 3-2** above). The site is designated for its geological features, namely the evidence of an ancient mere (lake) being located here (WildNatureBlog 2019). The site has no ecological relevance to this survey, however, with the overlying sediments found within the site boundary characterised by the same medium/coarse sand as the other sample points recorded along the upper shore of this landfall area.

**Table 3-1** & **Table 3-2** below provides a summary of the physical and biological characteristics of each sample point recorded in the survey, and presents indicative images of each identified zone captured during the survey.

*Figure 3-1 Zonation of the shoreline within Landfall 8*

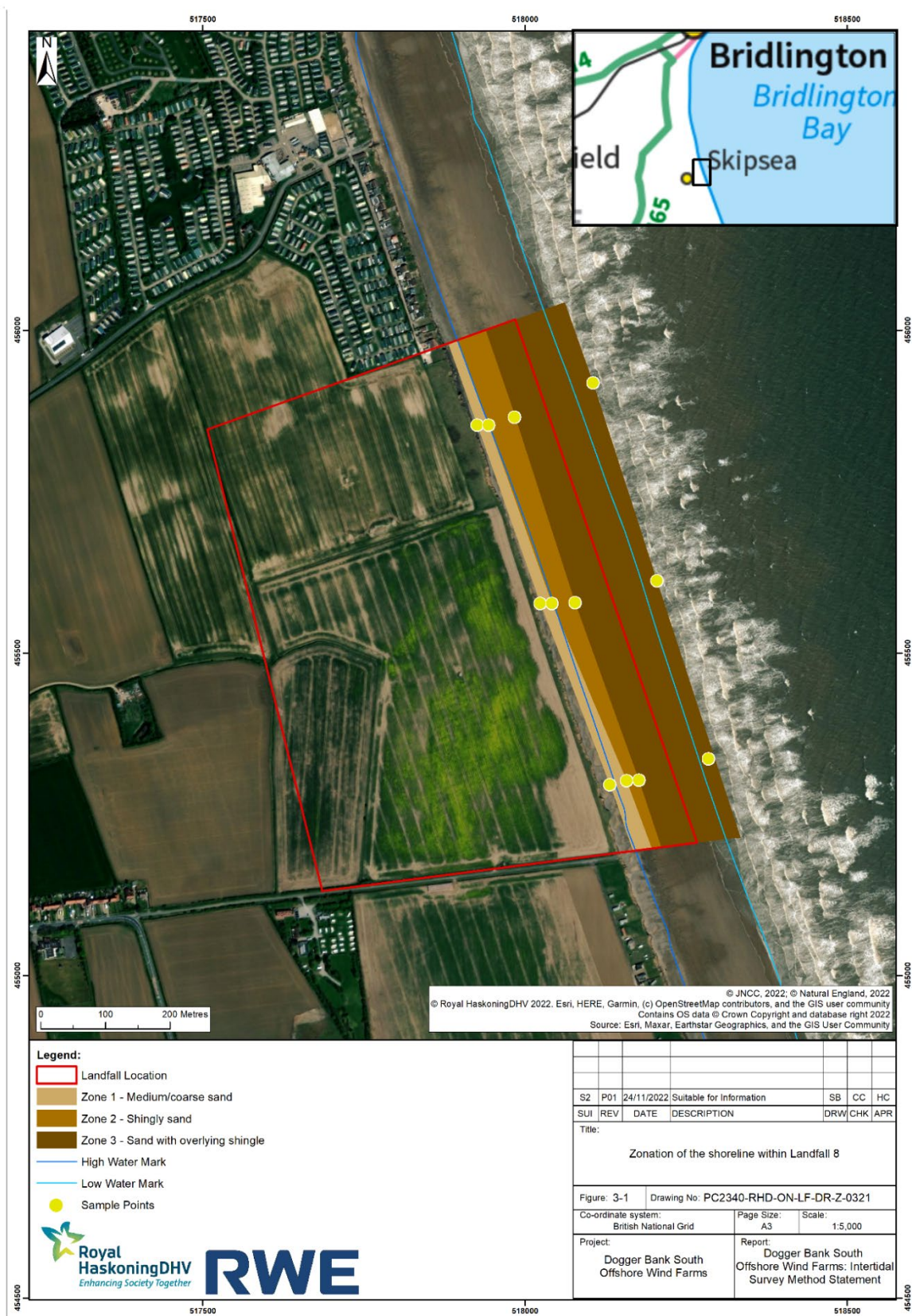


Figure 3-2 Zonation of the shoreline within Landfall 9



Plate 3-1 Example of the concrete structures found within Landfall 9



Plate 3-2 Close-up of the concrete structure and the species inhabiting its surface, and an example of the metal / concrete structures found seaward from the existing line of concrete blocks

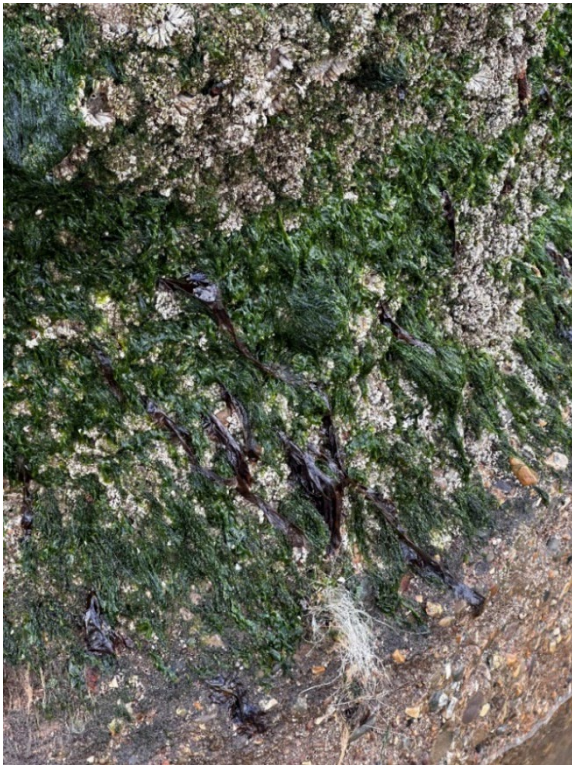


Table 3-1 Detailed description of sample points recorded within Landfall 9

	GPS Co-ordinates (Decimal Degrees)	Estimated Tidal Height at Zone Sampling Station (m)	Sample Point Description
<b>Transect 1</b>			
Zone 1 – Medium / Coarse Sand	53° 58' 12 N 0° 11' 41 W	6.16	Medium / coarse sand with no visible signs of biota present. Adjacent cliff comprised of clay, with scattered stones within the clay. Signs of recent slumping of a consolidated clay layer leaving the lower cliff at an approximate 45 degree angle. No obvious vegetation visible on the cliff face.
Zone 2 – Shingly Sand	53° 58' 12 N 0° 11' 40 W	5.56	Sand and shingle mix, with smaller clay boulders present along the shore. No biota evident on the shore or identified in the dig-overs conducted.
Zone 3 – Sand with Overlying Shingle	53° 58' 13 N 0° 11' 38 W	4.36	Habitat consisted of finer sand overlain with a patchy veneer of shingly sand. No evidence of biota was identified on the beach surface or within the dig-overs.
Zone 4 – Fine Sand with Rarely Distributed Stones	53° 58' 13 N 0° 11' 36 W	3.12	Comprised almost exclusively of fine sand, with a narrow band of rippled sand present in the middle of the zone. No apparent anoxic layer in the sediment at any location along the transect, due to there being very limited organic material associated with the sediments. Low water recorded at 53° 58' 13 N 0° 11' 35 W, tidal height of 2.52m.
<b>Transect 2</b>			
Zone 1 – Medium / Coarse Sand	53° 58' 21 N 0° 11' 46 W	6.06	Zone consisted of a 1cm layer of fine sand overlaying shingly sand. No evidence of fauna noted on the beach surface or within the dig-over locations. The adjacent cliff consisted of dark clay with stones to a height of approximately 2m, which transitioned to lighter clay with coarser substrates present near the top of the cliff. The profile of the cliff at this location was very steep, with no slumping at an approximate 90 degree angle.
Zone 2 – Shingly Sand	53° 58' 22 N 0° 11' 45 W	5.11	Zone consisted of a mix of fine sand and shingle, with no redox layer identified at a dig-over depth of approximately 20cm. No evidence of fauna was noted on the beach surface or within the dig-over locations.
Zone 3 – Sand with Overlying Shingle	53° 58' 22 N 0° 11' 42 W	3.36	Characterised by an approximately 4m wide strip of rippled sand with overlying shingle, that appeared to be formed by small run-off streams mobilising the sediment. No evidence of fauna was identified on the surface of the beach or in any of the dig-overs conducted.
Zone 4 – Fine Sand with Rarely Distributed Stones	53° 58' 22 N 0° 11' 42 W	2.76	Lower shore zone consisted of fine sand with stones distributed rarely on the surface. While no evidence of fauna was identified on the surface of the beach, the occasional small worm tube was found within sieved residue from the dig-overs. No living specimens were found, however. The redox layer of the sediment was estimated to begin at approximately 20cm depth. Low water recorded at 53° 58' 23 N 0° 11' 40 W, tidal height of 1.8m.

Table 3-2 Detailed description of sample points recorded within Landfall 8

	GPS Co-ordinates (Decimal Degrees)	Tidal Height	Sample Point Description
<b>Transect 3</b>			
Zone 1 – Medium / Coarse Sand	53° 59' 07N 0° 12' 11 W	6.16	Upper shore consisted of coarse sand overlaying shingly sand. There was no evidence of fauna on the beach surface or within the dig-overs samples. Cliff face adjacent to the upper shore comprised of clay with stones to a height of approximately 3m above the beach. This graded into a lighter layer of clay with coarser sediment above this.
Zone 2 – Shingly Sand	53° 59' 07 N 0° 12' 10 W	5.67	Characterised by a high coverage of shingle overlaying sand. There was no evidence of fauna on the beach surface or within the dig-overs samples.
Zone 3 – Sand with Overlying Shingle	53° 59' 08 N 0° 12' 08 W	4.53	Habitat comprised an area of finer sand with minimal shingle present. There was evidence of fauna living within the sediment in the form of infrequently distributed worm casts ( <i>Arenicola marina</i> ) and tubes ( <i>Lanice conchilega</i> ). No live individuals were identified within the dig-over samples conducted. Towards the edge of the lower shore worm casts and tubes became more abundant. Low water recorded at 53° 59' 09 N 0° 12' 01 W, tidal height of 1.02m.
<b>Transect 4</b>			
Zone 1 – Medium / Coarse Sand	53° 58' 58 N 0° 12' 06 W	6.16	Upper shore characterised by medium to fine sand to a depth of 2cm, overlaying a mixture of sandy shingle beneath. No anoxic layer or evidence of life were found within this zone. Cliff-face comprised a layer of darker clay to a height above the beach of approximately 4m. The cliff face transitioned to a 2m high section of lighter clay interspersed with coarse substrates.
Zone 2 – Shingly Sand	53° 58' 58 N 0° 12' 05 W	5.64	Zone characterised by a level of overlying shingle, with the underlying sediment consisting of shingly sand. No anoxic layer or evidence of life was found within this zone.
Zone 3 – Sand with Overlying Shingle	53° 58' 58 N 0° 12' 03 W	4.59	Lower shore zone consisted of fine sand with pebbles scattered infrequently across the surface. Along the very edge of the lower shore, worm casts and tubes were occasionally observed. The dig-overs conducted in this zone contained no apparent anoxic layer or live species. Low water recorded at 53° 58' 59 N 0° 11' 56W, tidal height of 0.97m.
<b>Transect 5</b>			
Zone 1 – Medium / Coarse Sand	53° 58' 48' N 0° 12' 00 W	6.16	Upper shore consisted of a surface of coarse sand overlaying the shingly sand below. No anoxic layer or evidence of life were found within this zone. Adjacent cliff-face comprised dark clay to a height of approximately 4m, with the face then transitioning to a 4m high section of lighter clay interspersed with coarse substrates.
Zone 2 – Shingly Sand	53° 58' 49 N 0° 11' 59 W	5.36	Zone consisted of a sand and shingle mix which continued deeper below the beach surface. The dig-overs conducted in this zone contained no apparent anoxic layer or live species.



## Project related



Zone 3 – Sand with Overlying Shingle	53° 58' 49 N 0° 11' 58 W	4.79	Zone characterised by finer sand with very little shingle present. There were observable signs biota in the form of rarely distributed worm casts and tubes. The dig-overs conducted in this zone contained no apparent anoxic layer, but one live <i>Arenicola marina</i> individual was recorded. Low water recorded at 53° 58' 50 N 0° 11' 52 W, tidal height of 1.23m.
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*Plate 3-3 Example of the slumped clay cliff-face present along the shoreline*



*Plate 3-4 Example of the medium / coarse sand zone found in Landfall 8 & 9 and representative dig-over*



*Plate 3-5 Example of shingly sand zone found in Landfall 8 & 9 and representative dig-over*



*Plate 3-6 Example of the sand with overlying shingle zone found in Landfall 8 & 9 and representative dig-over*



*Plate 3-7 Example of the fine sand with rarely distributed stones zone found in Landfall 9 and representative dig-over*



## 4 Summary

A Phase I Qualitative intertidal ecology survey that was undertaken on the 28<sup>th</sup> of September, 2022 for the possible two landfall locations for the DBS East and DBS West offshore wind farms. Five transects across the two landfalls were surveyed to determine the habitat present within each landfall area and the presence/absence of any fauna. Three distinct habitats were identified within Landfall 8 and four within Landfall 9. Instances of worm casts (*Arenicola marina*) and tubes (*Lanice conchilega*) were found along the lower shore, with only one live *Arenicola marina* individual in Landfall 8 being recorded across all the transects surveyed.

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## Appendix A – Recorded Field Notes

Field Notes from survey on the 28<sup>th</sup> September 2022 Skipsea beach area

Weather: Cloudy sunny spells and showers

Low tide: 13:00hrs spring tide

Results of survey: Five transects completed between 11:00 and 14:30. Each transect is recorded below. General notes for the survey area are also included below.

**General Notes:** The beach was backed by a cliff area (which is recorded as priority maritime cliff slope). The cliff is made up of clay with stones in the clay. The lower level of the cliff face is dark clay overlain with a lighter layer that seems to have coarser sediment within it (although it was not possible to closely observe this layer). It was largely unvegetated cliff face although vegetation was present where the cliff had slumped and cliff top vegetation was still present. Part way along the beach is a historic feature comprising the remains of a mire which shows as a peaty layer with wooded remains. This feature is located between transects 2 and 5.

There were a series of concrete structures along the beach in front of the mire location. These were marked as occurring between the following locations (53° 58' 22N 0° 11' 42W and 53° 58' 28N 0° 11' 45W). The larger concrete structures had been colonised by barnacles, green and red algae (*Ulva* sp and *Porphyra*) and rare distribution of limpets. The concrete structures appeared to be a war-time feature. There were some concrete and metal structures going out from this line at 90 degrees.

**Transect 1:** GPS co-ordinates 53° 58' 12 N 0° 11' 41W (upper shore) Transect started at 11:03  
Upper shore habitat (53°58'12 N 0°11'40 W) : Medium/coarse sand with no visible signs of life (no worm casts, worm tubes or bivalve holes). There are scattered clay outcrops with stones in the clay. There were signs of recent slumping of a consolidated clay layer leaving the cliff at about a 45 degree angle. There was no obvious vegetation on the cliff face.

At the following GPS location (53° 58' 12 N 0° 11' 40 W) the shore changed to sand and shingle habitat with smaller clay boulders on the shore. Sand was the dominant habitat. No signs of life on the shore or evidence in the areas that were dug and sieved.

At the following GPS location (53° 58' 13 N 0° 11' 38 W) the habitat changed to a finer sand layer overlying shingly sand. No evidence of life on the surface or in the areas that were dug and sieved.

At the following GPS location (53° 58' 13 N 0° 11' 36 W) the habitat changed to finer sand. There was a narrow band of rippled sand (approximately 5m wide) but otherwise it was comprised of fine sand habitat. The transect finished at the following GPS location (53° 58' 13 N 0° 11' 35) at the seaward end.

**Transect 2:** Start Point (seaward end) GPS location 53° 58' 23 N 0° 11' 40 W started at 11.45  
Lower shore: Fine sand with rarely distributed stones. No signs of life visible (no worm casts or tubes). A local dog walker communicated that there used to be a lot of life in the sand, including worms that local fishermen used to dig for bait and crabs. He said that in recent years there have been no worms observed and fishermen have to buy bait in order to fish. The holes dug showed no life and no redox layer to about 20cm. Small worm tubes were observed in the sieved residue but no signs of life.

At the following GPS location (53° 58' 22 N 0° 11' 42 W) the habitat changed to rippled sand with no signs of life observed on the surface or at depth through the dug areas. This strip was approximately 4m wide and seemed to be caused by run-off mobilising the sediment.

At the following GPS location (53° 58' 22 N 0° 11' 42 W) the habitat changed to shingly sand with no redox layer when dug to approximately 20cm. A mix of fine sand and shingle.

At the following GPS location (53° 58' 22 N 0° 11' 45 W) the habitat changed to sand on the upper shore with about 1cm of sand overlaying shingly sand habitat.

At the base of the cliff (53° 58' 21 N 0° 11' 46W) the cliff face was clay with stones at the lower cliff face for about 2m height changing to lighter clay with coarser substrate above this. The cliff face profile was steep (approximately 90 degree angle).

**Transect 3 (furthest north)** Start Point (53° 59' 07N 0° 12' 11) at base of cliff. Transect started at 12:48. The cliff face comprised of clay with stones up to approximately 3m grading into a lighter layer of clay with coarser sediment above this with the cliff at approximately 4m high. The upper beach consisted of sand (coarse sand) overlaying shingly sand below.

At the following GPS location (53° 59' 07N 0° 12' 10W) the habitat changed to a higher proportion of shingle in the surface layer. There were no signs of life in the sediment on the surface or in the dug and sieved samples.

At the following GPS location (53° 59' 08N 0° 12' 08W) the habitat changed to finer sand with very little shingle. There were observable signs of life but only rarely distributed worm casts and tubes. The dug samples did not reveal any life. Although the worms were not observed directly, it is predicted that the worms were *Arenicola marina* and *Lanice conchilega*.

The water's edge was measured at 53° 59' 09N 0° 12' 01W at low tide. Walking along the lower shore towards transect 4 there was an observable area that had a higher abundance (albeit still only rare or occasionally distributed) of worm casts and tubes, expected to be the same species identified above.

**Transect 4** Start Point (53° 58' 59 N 0° 11' 56W) at the lower shore. Transect started at 13:10. Lower shore comprised of fine sand with rare scattered pebbles. A narrow strip near the waters edge contained worm casts and tubes (the same species expected as above). The dug sample locations had no anoxic layer and no obvious species.

At the following location (53° 58' 58N 0° 12' 03W) the habitat changed to one with a higher proportion of shingle on the surface and at depth to shingly sand. There were no longer any signs of life on the seabed. There were occasional clay boulders scattered on the shore.

At the following location (53° 58' 58N 0° 12' 05W) the habitat changed the layer of upper beach of medium to fine sand layer of approximately 2cm overlaying sandy shingle underneath. There were no signs of life in the surface layer or at depth. Every sample showed no anoxic layer.

The base of the cliff was at 53° 58' 58N 0° 12' 06W and the cliff face comprised approximately 4m height of dark clay with a 2m layer of lighter clay with coarse substrate. An ammonite was found in a stone in the cliff.

**Transect 5** Start Point (53° 58' 48'N 0° 12' 00W) at base of cliff. Transect started at 13:29.



The cliff face comprised of clay with stones up to approximately 4m grading into a lighter layer of clay with coarser sediment above this with the cliff at approximately 5m high. The upper beach consisted of sand (coarse sand) overlaying shingly sand below.

At the following GPS location (53° 58' 49N 0° 11' 59W) the habitat changed to a higher proportion of shingle in the surface layer. There were no signs of life in the sediment on the surface or in the dug and sieved samples.

At the following GPS location (53° 58' 49N 0° 11' 58W) the habitat changed to finer sand with very little shingle. There were observable signs of life but only rarely distributed worm casts and tubes. The dug samples did not reveal any life. Although the worms were not observed directly, it is predicted that the worms were *Arenicola marina* and *Lanice conchilega*.

The water's edge was measured at 53° 58' 50N 0° 11' 52W. The lower shore comprised of fine sand with rare scattered pebbles. A narrow strip near the water's edge contained worm casts and tubes (the same species expected as above). The dug sample locations had no anoxic layer and no obvious species.

## Appendix B – Sediment Characteristics Scale

Term	Definition
Bedrock	Any stable hard substratum not separated into boulders or smaller sediment units. Includes soft rock-types such as chalk, peat and clay.
Large to very large boulders	>512mm. Likely to be stable.
Small boulders	256-512mm. May be unstable.
Cobbles	64-256mm. May be rounded to flat. Substrata that are predominantly cobbles.
Pebbles	16-64mm. May be rounded to flat. Substrata which are predominantly pebbles.
Gravel / shingle	4-16mm. Clean stone or shell gravel
Muddy gravel	10-80% gravel, 20-90% mud.
Coarse clean sand	0.5-4mm. >90% sand.
Fine clean sand	0.063-0.5mm. >90% sand.
Sandy mud	50-90% sand, 10-50% mud.
Muddy sand	50-90% mud, 10-50% sand.
Mud	<0.063mm (silt/clay fraction).

(Source: Tyler-Walters & Tillin, 2014)

## Appendix C – MNCR SACFOR Scale

Growth form		Size of individuals/colonies						
% cover	Crust/meadow	Massive/Turf	<1cm	1-3 cm	3-15 cm	>15 cm	Density	
>80%	S		S				>1/0.001 m <sup>2</sup> (1x1 cm)	>10,000 / m <sup>2</sup>
40-79%	A	S	A	S			1-9/0.001 m <sup>2</sup>	1000-9999 / m <sup>2</sup>
20-39%	C	A	C	A	S		1-9 / 0.01 m <sup>2</sup> (10 x 10 cm)	100-999 / m <sup>2</sup>
10-19%	F	C	F	C	A	S	1-9 / 0.1 m <sup>2</sup>	10-99 / m <sup>2</sup>
5-9%	O	F	O	F	C	A	1-9 / m <sup>2</sup>	
1-5% or density	R	O	R	O	F	C	1-9 / 10m <sup>2</sup> (3.16 x 3.16 m)	

<1% or density		R		R	O	F	1-9 / 100 m <sup>2</sup> (10 x 10 m)	
					R	O	1-9 / 1000 m <sup>2</sup> (31.6 x 31.6 m)	
						R	<1/1000 m <sup>2</sup>	

#### Use of the MNCR SACFOR abundance scales

The MNCR cover/density scales adopted from 1990 provide a unified system for recording the abundance of marine benthic flora and fauna in biological surveys. The following notes should be read before their use:

1. Whenever an attached species covers the substratum and percentage cover can be estimated, that scale should be used in preference to the density scale.
2. Use the massive/turf percentage cover scale for all species, excepting those given under crust/meadow.
3. Where two or more layers exist, for instance foliose algae overgrowing crustose algae, total percentage cover can be over 100% and abundance grade will reflect this.
4. Percentage cover of littoral species, particularly the fucoïd algae, must be estimated when the tide is out.
5. Use quadrats as reference frames for counting, particularly when density is borderline between two of the scale.
6. Some extrapolation of the scales may be necessary to estimate abundance for restricted habitats such as rockpools.
7. The species (as listed above) take precedence over their actual size in deciding which scale to use.
8. When species (such as those associated with algae, hydroid and bryozoan turf or on rocks and shells) are incidentally collected (i.e. collected with other species that were superficially collected for identification) and no meaningful abundance can be assigned to them, they should be noted as present (P).

(Source: JNCC, 1990)