GREEN VOLT

Chapter 9
Benthic Ecology

Offshore EIA Report: Volume 1

Revision history

Revision	Date	Description	Prepared	Checked	Approved
1	16/08/2022	First draft	RL (Royal HaskoningDHV)	CM (Royal HaskoningDHV)	VC (Flotation Energy)
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3	22/11/2022	Final draft	RL (Royal HaskoningDHV)	CM (Royal HaskoningDHV)	VC (Flotation Energy)

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Acronyms

Acronym	Description
AC	Alternating Current
BAP	Biodiversity Action Plan
BEIS-OPRED	Business, Energy and Industrial Strategy – Offshore Petroleum Regulator for Environment and Decommissioning
BSI	British Standards Institute
BSL	Benthic Solutions Ltd
CaP	Cable Plan
CCS	Carbone Capture and Storage
CIA	Cumulative Impact Assessment
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CEMP	Construction Environmental Management Plan
CIEEM	Chartered Institute for Ecology and Environmental Management
CNOOC	China National Offshore Oil Corporation
COWRIE	Collaborative Offshore Wind Research into The Environment
CPA	Coast Protection Act
DC	Direct Current
EcIA	Ecological Impact Assessment
EEA	European Environment Agency
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMF	Electromagnetic Field
EMODnet	European Marine Observation and Data Network
ERL	Effect Range Low
EUNIS	European University Information Systems organisation
FeAST	Feature Activity Sensitivity Tool
GEN	General policy
HabMoS	NatureScot Habitat Map of Scotland

HDD	Horizontal Directional Drilling
HM	Her Majesty
HRA	Habitats Regulation Appraisal
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
INNS	Invasive Non-Native Species
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
MAGIC	Multi-Agency Geographic Information for the Countryside
MarESA	Marine Evidence-Based Sensitivity Assessments
MarLIN	Marine Life Information Network
MBES	Multi-Beam Echo Sounders
MDAC	Methane Derived Authigenic Carbonate
MHWS	Mean High Water Springs
MINNS	Marine Invasive Non-Native Species
MPA	Marine Protected Area
MRE	Marine Renewable Energy
MS-LOT	Marine Scotland - Licensing Operations Team
MSS	Marine Scotland Science
NBN	National Biodiversity Network
NC	Nature Conservation
NM	Nautical Miles
NMP	National Marine Plan
O&M	Operation and Maintenance
OSP	Offshore Substation Platform
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
PAC	Pre-Application Consultation
PAH	Polycyclic Aromatic Hydrocarbons
PCI	Project of Common Interest
PEMP	Project Environmental Monitoring Plan
PMF	Priority Marine Feature

PSA	Particle Size Analysis
RMP	Regional Marine Plan
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SACFOR	Superabundant, Abundant, Common, Frequent, Occasional, Rare, and Less than rare
SFF	Scottish Fisherman's Federation
SNH	Scottish Natural Heritage
SPA	Special Protection Area
SSC	Suspended Sediment Concentrations
SSS	Sidescan Sonar
THC	Total Hydrocarbon Content
TOC	Total Organic Carbon
TOM	Total Organic Matter
UKCS	UK Continental Shelf
UXO	Unexploded Ordnance
WTG	Wind Turbine Generator
ZoI	Zone of Influence

Glossary

Term	Description
Applicant	Green Volt Offshore Windfarm Ltd.
Buzzard	Buzzard Platform Complex.
Buzzard Export Cable Corridor	The area in which the export cables will be laid, from the perimeter of the Windfarm Site to Buzzard Platform Complex.
Green Volt Offshore Windfarm	Offshore windfarm including associated onshore and offshore infrastructure development (Combined On and Offshore Green Volt Projects).
Horizontal Directional Drilling	Mechanism for installation of export cable at landfall.
Inter-array cables	Cables which link the wind turbines to each other and the offshore substation platform.
Landfall Export Cable Corridor	The area in which the export cables will be laid, from the perimeter of the Windfarm Site to landfall.
Mean High Water Springs	At its highest and 'Neaps' or 'Neap tides' when the tidal range is at its lowest. The height of Mean High Water Springs (MHWS) is the average throughout the year, of two successive high waters, during a 24-hour period in each month when the range of the tide is at its greatest (Spring tides).
Moorings	Mechanism by which wind turbine generators are fixed to the seabed.
NorthConnect Parallel Export Cable Corridor Option	Landfall Export Cable Corridor between NorthConnect Parallel Landfall and point of separation from St Fergus South Export Cable Corridor Option.
NorthConnect Parallel Landfall	Southern landfall option where the offshore export cables come ashore.
Offshore Development Area	Encompasses i) Windfarm Site, including offshore substation platform ii) Offshore Export Cable Corridor to Landfall, iii) Export Cable Corridor to Buzzard Platform Complex.
Offshore export cables	The cables which would bring electricity from the offshore substation platform to the Landfall or to the Buzzard Platform Complex.
Offshore infrastructure	All of the offshore infrastructure, including wind turbine generators, offshore substation platform and all inter-array and export cables.
Offshore substation platform	A fixed structure located within the Windfarm Site, containing electrical equipment to aggregate the power from the wind turbine generators and convert it into a more suitable form for export to shore.
Onshore Export Cable Corridor	The proposed onshore area in which the export cables will be laid, from landfall to the onshore substation.
Project	Green Volt Offshore Windfarm project as a whole, including associated onshore and offshore infrastructure development.
Safety zones	An area around a structure or vessel which must be avoided.

St Fergus South Export Cable Corridor Option	Landfall Export Cable Corridor between St Fergus South Landfall and point of separation from NorthConnect Parallel Export Cable Corridor Option.
St Fergus South Landfall	Northern landfall option where the offshore export cables come ashore.
Windfarm Site	The area within which the wind turbine generators, offshore substation platform and inter-array cables will be present.

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CHAPTER 9: BENTHIC ECOLOGY

9.1 Introduction

1. This chapter of the **Offshore Environmental Impact Assessment (EIA) Report** describes the benthic ecology baseline environment ('existing environment') with respect to the Project (in this instance the Project refers to the offshore elements of the Green Volt Offshore Windfarm only, up to Mean High Water Springs (MHWS) and presents an assessment of potential impacts associated with the construction, operation and maintenance and decommissioning phases. Intertidal ecology is not included in this assessment as the Project has been designed to avoid any interaction with the intertidal zone.

2. The objectives of this chapter are to:

   - define legislation, guidance, and policy documents relevant to benthic ecology;
   - provide an overview of consultation activities and present the responses relevant to benthic ecology;
   - present the methodology and significance criteria used in the impact assessment and provide definitions of the scope of the Study Area;
   - define the benthic ecology existing environment;
   - assess the potential impacts that activities associated with any stage of the Project may have on benthic ecology from direct, indirect, and cumulative sources; and
   - describe any potential transboundary impacts and inter-relationships on benthic ecology.

3. This chapter has been written by Royal HaskoningDHV and incorporates site-specific survey results from between 2006 and 2022 (**Figure 9.2**). Appropriately qualified and experienced marine technical specialists from Royal HaskoningDHV have completed the ecological impact assessment (EcIA) with reference to the Chartered Institute for Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018), The Marine Works (Environmental Impact Assessment) Regulations 2007 and 2017 (as amended) and The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 as amended by The Environmental Impact Assessment (Miscellaneous Amendments) (Scotland) Regulations 2017.

4. The impacts assessed on benthic ecology have potential interactions with the following offshore environment chapters:

   - **Chapter 7: Marine Geology, Oceanography and Physical Processes**
   - **Chapter 8: Marine Sediment and Water Quality**
   - **Chapter 10: Fish and Shellfish Ecology**
   - **Chapter 11: Marine Mammal Ecology**
   - **Chapter 12: Offshore and Intertidal Ornithology**
   - **Chapter 13: Commercial Fisheries**

9.2 Legislation, Guidance and Policy

5. The following legislation, guidance and policy documents are relevant to benthic ecology and have been referred to in the characterisation of the existing environment and the impact assessment. Further information on the legal framework is presented in **Chapter 3: Policy and Legislative Context of this EIA**.

9.2.1 Relevant Legislation

6. The characterisation of the benthic ecology baseline and the assessment of potential impacts have been made with reference to the following legislation:

- The Conservation (Natural Habitats, &c.) Regulations 1994 (Habitats Regulations) and the Conservation of Offshore Marine Habitats and Species Regulations 2017 (Offshore Habitats Regulations).
- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)
- Nature Conservation (Scotland) Act 2004 (as amended).
- Marine (Scotland) Act 2010.
- Wildlife and Natural Environment (Scotland) Act 2011.
- The Conservation of Offshore Marine Habitats and Species Regulations 2017 (referred to as the "Offshore Marine Regulations 2017") (applies to Marine Licence and Section 36 consent applications within Scottish waters beyond 12 nautical miles (nm)).
- The Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention; 1979).
- Convention for the Protection of the Marine Environment of the North-East Atlantic (the 'OSPAR Convention') 1992.

9.2.2 Relevant Guidance

7. The characterisation of the benthic ecology baseline and the assessment of potential impacts have been made with specific reference to the following guidance and publications:

- Joint Nature Conservation Committee (JNCC), Marine Monitoring Handbook, (JNCC, 2001).
- Ware, S.J. & Kenny, A.J. (2011) Guidelines for the Conduct of Benthic Studies at Marine Aggregate Extraction Sites, 2nd edn. Marine Aggregate Levy Sustainability Fund (MALSF, 2011).
- Centre for Environment, Fisheries and Aquaculture (CEFAS), Guidelines for Data Acquisition to Support Marine Environmental Assessments for Offshore Renewable Energy Projects (CEFAS, 2012).
- A Review of Assessment Methodologies for Offshore Wind Farms (Collaborative Offshore Wind Research into The Environment (COWRIE) METH-08-08) (Maclean et al., 2009).
- Guidance and publications from Scottish Natural Heritage (SNH) and Marine Scotland on Priority Marine Features (PMF) and Marine Protected Area (MPA) search features (SNH, 2012).
- British Standards Institute (BSI), Environmental Impact Assessment for Offshore Renewable Energy Projects (BSI, 2015).
- Marine Scotland, Consenting and Licensing Guidance: For Offshore Wind, Wave and Tidal Energy Applications (Marine Scotland, 2018b).
- CIEEM, Guidelines for Ecological Impact Assessment in the UK and Ireland Terrestrial, Freshwater, Coastal and Marine. (CIEEM, 2018).
- Advice Note Seventeen: Cumulative Impacts Assessment Relevant to Nationally Significant Infrastructure Projects (The Planning Inspectorate, 2019).
- NatureScot guidance on marine invasive non-native species (NatureScot, 2022).
- Guidance on non-native species, approved by the Scottish Parliament (Scottish Government, 2012).

9.2.3 Relevant Policy

8. The UK Marine Policy Statement (Her Majesty's (HM) Government, 2011) represents a UK wide policy context within which Marine Plans will be developed. The Scottish Government has produced a National Marine Plan in accordance with these UK policies (Scottish Government, 2015). This plan provides a high-level approach to marine planning and general principles for decision making. The objective '*Living within environmental limits'* covers points relevant to benthic ecology, and requires that:

- biodiversity is protected, conserved and where appropriate recovered and loss has been halted;
- healthy marine and coastal habitats occur across their natural range and are able to support strong, biodiverse biological communities and the functioning of healthy, resilient and adaptable marine ecosystems; and
- our oceans support viable populations of representative, rare, vulnerable, and valued species.

9. Within Scotland's National Marine Plan are a range of strategic policies for which management decisions will be made across the main marine sectors. These policies include general overarching policies, and policies specific to offshore wind and marine renewable energy. The following general policies apply to this benthic ecology assessment:

- "General Policy (GEN) 9 Natural heritage: Development and use of the marine environment must:
  - (a) Comply with legal requirements for protected areas and protected species.
  - (b) Not result in significant impact on the national status of Priority Marine Features.
  - (c) Protect and, where appropriate, enhance the health of the marine area."
- GEN 10 Invasive non-native species: Opportunities to reduce the introduction of invasive non-native species to a minimum or proactively improve the practice of existing activity should be taken when decisions are being made; and
- "GEN 13 Noise: Development and use in the marine environment should avoid significant adverse effects of man-made noise and vibration*, especially on species sensitive to such effects."*

10. Scotland's National Marine Plan has identified a list of 81 PMFs. These PMFs are species and habitats considered to be of greatest marine nature conservation importance in Scottish territorial and offshore waters and are considered under threat. These PMFs include benthic habitats and species potentially present within the Study Area.

9.3 Consultation

11. Green Volt Offshore Windfarm Ltd. ('the Applicant') has sought opinion from key stakeholders through scoping and consultation regarding the **Offshore Scoping Report** (**Appendix 1.2**) (Royal HaskoningDHV, 2021) and the Habitats Regulations Appraisal (HRA) **Offshore HRA Screening Report** (**Appendix 3.1**) (Royal HaskoningDHV, 2021). The responses received from stakeholders relevant to benthic ecology are provided in **Table 9.1** below.

Table 9.1 Consultation Responses

Consultee	Date / Document	Consultee Comment	Response / where addressed in the EIA Report
Marine Scotland Licensing Operations Team (MS-LOT)	April 2022 Offshore Scoping Opinion	The Scottish Ministers also advise that the Developer must identify how habitats of conservation value can be avoided through micrositing of windfarm components, inclusive of all cabling, in the EIA Report.	Pre-construction surveys will be used to inform final survey design and where sensitive features cannot be avoided the Project will adopt micrositing to mitigate.
MS-LOT	April 2022 Offshore Scoping Opinion	**[Ref: 5.10.1] Benthic Ecology:** The Scottish Ministers draw the Developer's attention to the representation from the SFF which states that the Developer should define the baseline for benthic ecology with the Buzzard platform in situ. In addition, the Scottish Ministers ask the Developer to note the advice from NatureScot to make use of Marine Scotland's Feature Activity Sensitivity Tool.	Noted. The baseline for the EIA comprises historical data supported by recent surveys. The recent surveys, in particular, have been carried out with the Buzzard platform in situ, so in encompassed in the baseline characterisation of the benthic ecology. Furthermore, Feature Activity Sensitivity Tool (FeAST) has been used in the assessment where relevant.
MS-LOT	April 2022 Offshore Scoping Opinion	**[Ref: 5.10.2] Benthic Ecology:** Regarding key species, the Scottish Ministers advise that the Developer must fully implement the advice contained in both the NatureScot representation and the Marine Scotland Science (MSS) advice with regards to Priority Marine Features ("PMFs") and use the 2021 site-specific survey data in identifying their occurrence and distribution.	PMFs potentially present are described in **Section 9.6.2.1 and 9.6.3.1** and the findings of site surveys are provided in **Section 9.6.**
MS-LOT	April 2022 Offshore Scoping Opinion	**[Ref: 5.10.3] Benthic Ecology:** The Scottish Ministers broadly agree with the potential impacts scoped in for further assessment in the EIA Report as contained within Table 6.2 of the Scoping Report. However, in line with the MSS advice, the Scottish Ministers advise that impacts of scour on benthic communities arising from the mooring chains and anchors, impacts of open trenching for cable at the landfall site (if HDD [Horizontal Directional Drilling] is not possible) and impacts from the introduction of non-native species should also be scoped into the EIA Report for further assessment during all phases of the Proposed Development.	Noted. The impacts of scour on the benthic habitat are addressed in **Section 9.7.4.2**. The Applicant has committed to the use of HDD at either landfall location and are no longer considering open trenching.
MS-LOT	April 2022 Offshore Scoping Opinion	**[Ref: 5.10.4] Benthic Ecology:** The Scottish Minsters advise that the Developer must fully implement the advice included in the NatureScot representation regarding the Conservation and Management document for the Southern Trench Nature Conservation Marine Protected Area ("NC MPA").	Conservation Objectives of the Southern Trench Marine Protected Area (MPA) are summarised in **Section 9.6.4.** Implications for the potential effects of the Landfall Export Cable Corridor have been taken into account. Pre-application surveys, siting and installation techniques will be implemented to reduce or limit pressures, minimise the footprint of new cables within areas of burrowed mud habitat for sandeels.

Consultee	Date / Document	Consultee Comment	Response / where addressed in the EIA Report
MS-LOT	April 2022 Offshore Scoping Opinion	**[Ref: 5.10.5] Benthic Ecology:** With regards to key habitats, the Scottish Ministers advise that the EIA Report must identify how habitats of conservation value within the cable corridor can be avoided through micrositing. The Scottish Ministers also advise that the MSS advice in relation to introduction of hard substrates, the avoidance of areas of *Sabellaria spinulosa* reef habitat and recognition of stony reef habitats must all be fully addressed in the EIA Report.	Noted and added as part of mitigation in **Section 9.7.**
MS-LOT	April 2022 Offshore Scoping Opinion	**[Ref: 5.10.6] Benthic Ecology:** With regards to Electromagnetic Fields ("EMFs"), the Scottish Ministers advise, in line with the advice received from MSS, that all epifauna should be included in the assessment of EMF. In addition, inclusion of a quantitative assessment of EMF emissions in relation to type of cable burial depths and a qualitative assessment on species effects must be included in the EIA Report.	Noted. **Section 9.7** discusses embedded mitigation, including the development of a Cable Plan (CaP) which takes into consideration the EMF attenuation study, for both the export cable and inter-array cables. The presence of sensitive benthic habitats/species and species/habitats of conservation importance will be a key consideration in the detailed design of the final cable routes.
MS-LOT	April 2022 Offshore Scoping Opinion	**[Ref: 5.10.7] Benthic Ecology:** With regards to pockmark features, the Scottish Ministers advise that the Developer must fully consider and implement the MSS advice. The Scottish Ministers also advise the Developer to engage with Marine Scotland Science (MSS) via MS-LOT regarding benthic survey data prior to the submission of the EIA Report to identify whether or not they are sufficiently comprehensive to allow conclusions to be made around the presence of methane derived antigenic carbonate.	The presence of methane derived authigenic carbonate (MDAC) or submarine structures made by leaking gases in any pockmarks are considered in **Section 9.6.3.1**. These have been surveyed as part of the 2021 site survey and previously as part of the Ettrick and Blackbird oil field environmental surveys over the last 20 years. These reports can be provided directly to MSS as required.
MS-LOT	April 2022 Offshore Scoping Opinion	**[Ref: 5.10.8] Benthic Ecology:** In regards to the installation of the export cable, the Scottish Ministers direct the Developer's attention to the representation from NatureScot which advises that if Horizontal Directional Drilling (HDD) cannot be used, further consideration of the impacts on the Buchan Ness to Collieston Coast Special Area of Conservation ("SAC") and sensitivity of the impact pathways will require to be assessed within the EIA Report. The Scottish Ministers agree and advise that this must be fully addressed in the EIA Report.	The Applicant has committed to the use of HDD at either landfall location and are no longer considering open trenching. As such, following commitments to best practice and to HDD at landfall there is no potential impact pathway or impact on the Buchan Ness to Collieston Coast SAC.

Consultee	Date / Document	Consultee Comment	Response / where addressed in the EIA Report
NatureScot	27th January 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	We understand that there was an additional site-specific survey in 2021. The results from this should be used to update the known occurrence and distribution of any Priority Marine Features (PMFs) and confirm conclusions made to date.	PMFs noted as present during both the 2021 and 2022 habitat surveys are described in **Sections 9.6.2** and **9.6.3.**
NatureScot	27th January 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	At both the offshore windfarm development site and export cable routes, potential Annex I habitats and Priority Marine Features (PMFs) have been identified. In addition, the export cable passes through the Southern Trench MPA. In terms of scoping, the EIA should focus on the identification and distribution of PMFs and other habitats of importance. Notably, the Scoping report mentions: - Sea pen and burrowing megafauna communities' habitat as defined by OSPAR (2010), were observed at all stations within the windfarm Site (likely to include PMFs). *Sabellaria spinulosa* with a bryozoan turf and barnacles on silty turbid circalittoral rock; - *Sabellaria spinulosa* on stable circalittoral mixed sediment (although, at the time of survey, this was not classed as a reef). Note that Marine Scotland have published a guidance note on this species.) - *Urticina felina* and sand-tolerant fauna on sand-scoured or covered circalittoral rock (potential to support the Annex I habitat of bedrock reef or stony reef); - *Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (PMF);	Annex I habitats and PMFs noted as present during both the 2021 and 2022 habitat surveys are described in **Sections 9.6.2, 9.6.3** and **9.6.5.** Details of surveys undertaken at the Windfarm Site, including records of *S. spinulosa*, are described in **Section 9.6**.
NatureScot	27th January 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	We agree with the list of potential impacts that have been scoped in as per Section 6.1.3.	Noted
NatureScot	27th January 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	We note that the Marine Evidence-Based Sensitivity Assessments (MarESA) on the Marine Life Information Network (MarLin) website will be used to judge the sensitivities of the benthic and intertidal habitats and communities during the construction, operation and decommissioning phases. We would also advise the use of FeAST (Marine Scotland's Feature Activity Sensitivity Tool). The information in FeAST reflects our current understanding of the interactions between activities, pressures and features. It highlights that activities can give rise to a range of pressures which the protected features may be sensitive to.	Noted. FeAST has been used in the EIA to help assess the sensitivity of a receptor (see **Section 9.4.1,** Paragraph 13).

Consultee	Date / Document	Consultee Comment	Response / where addressed in the EIA Report
NatureScot	27th January 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	The NorthConnect EIA Report (2018) also identified various habitats of interest that correspond to the location of the proposed Green Volt export cable corridor. The Green Volt Scoping report states that the NorthConnect consenting corridor was designed to exclude habitats of conservation value. The EIA for the Green Volt development should also identify how these habitats can be avoided through micrositing, etc.	The Landfall Export Cable Corridor will follow the NorthConnect consented corridor as one of the two options. Pre-construction surveys will be used to inform final survey design and where sensitive features cannot be avoided the Project will adopt micrositing to mitigate.
NatureScot	27th January 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	**Southern Trench MPA** Section 5.2.2.1 of the Scoping document states that 'the Export Cable Route through the Marine Protected Area (MPA) predominantly passes through areas of gravelly sand, with some sections of slightly gravelly muddy sand and not the protected marine muds noted as the protected feature of the southern Trench Marine Protected Area (STMPA) which are more predominant in the northern section of the MPA'. We agree that this is the case for the burrowed muds, fronts and shelf deeps features. However, there may be areas of burrowed mud outwith the northern concentration and if possible the cable route should seek to avoid these. Advice contained within the Conservation and Management document for the Southern Trench MPA for cables and pipelines: • Reduce or limit pressures- Minimise the footprint of new cables and pipelines within areas of burrowed mud habitat. Early discussion of siting, design and construction is recommended to reduce the potential of impacts. Key details which should be discussed will include pre-application surveys, siting and installation techniques.	Noted, MPAs have been accounted for and assessed in line with the Marine and Coastal Access Act 2009 requirements. Pre-consent surveys of the seabed have been undertaken and Pre-Application Consultation (PAC) held to discuss and present the siting, design and construction of the Project. Pre-construction surveys, siting and installation techniques will also be implemented post-consent.
NatureScot	27th January 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	In addition, the entire MPA provides supporting habitats important for minke whale (e.g. supporting key prey species). The advice in the above document relating to habitats that support minke whales and cable and pipeline activities is: • Reduce or limit pressures - Early discussion of siting, design and construction is recommended to reduce the risks of disturbance… This is also recommended to reduce potential impact on the habitat of sandeels.	Pre-construction surveys will be carried out to check for the presence of any rare or protected habitats and species, including Annex I habitats which may be classified as reef features. Following these surveys, micrositing of the cable would be used to mitigate impacts to these receptors where possible. This would inform areas which should be avoided and areas which infrastructure should not be placed. By following this mitigation, it is predicted that the loss of habitat that will incur will allow for the minimal loss of important or protected habitats.

Consultee	Date / Document	Consultee Comment	Response / where addressed in the EIA Report
NatureScot	27th January 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	Buchan Ness to Collieston Coast SAC/ Special Protection Area (SPA). We confirm that if Horizontal Directional Drilling (HDD) is undertaken for the cable export option that passes through this site, then we agree there will be no significant impacts. However, if HDD cannot take place, further consideration of the impacts and sensitivity of impacts pathways will require addressing.	HDD will take place at landfall to avoid trenching through the Buchan Ness to Collieston Coast SAC/SPA.
NatureScot	Email 28th July 2022	"Thanks for following this up with us. In terms of the difference between the pre scoping advice and the scoping opinion - this is really a matter for you to agree a way forward with Marine Scotland. If you are unable to speak directly with Marine Scotland, one approach (at your risk) is within the EIAR to indicate the reasons why you have not followed the scoping opinion. You may also wish to consider whether eDNA sampling is something that could be undertaken as part of a post consent - pre construction / post construction monitoring technique, if the project is consented), and to discuss this in the EIAR. With regard to the proposed meeting to discuss Marine Invasive Non-Natives (MINNS), I suggest what may be useful is for you to share with us a draft proposal and we can provide advice and at that stage advise whether we consider a meeting to be necessary either solely with us or jointly with JNCC."	An eDNA survey is being considered, which is to be carried out post-consent (pre-construction and post-construction). See **Chapter 10: Fish and Shellfish Ecology, Section 10.3.1** for details.
NatureScot	Email dated 22nd August 2022	Thank you for sending through your proposed approach to marine invasive non-native species (MINNS). We are content with your proposed approach as outlined below.	Proposed approach referred to in comment is presented in **Sections 9.7.3.5, 9.7.4.4, 9.7.5.4** and **9.8**
Scottish Fishermen's Federation (SFF)	28th January 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	Best practice for the benthic ecology studies should discount the data from pre 2013, and use it only as a guide as to what is actually there. The SFF would expect that Ettrick/ Blackbird should be fully decommissioned prior to development of Green Volt. Only then can a true picture of the seabed become visible as well heads are removed, and safety zones are finished with. This should happen in order to get an accurate scoping of the area.	Site-specific baseline data has been gathered from between 2005 and 2022 (**Section 9.5.2**). Earlier relevant datasets for the whole region have also been consulted. This provides a historical context to help to highlight changes and variability within benthic community composition over time. The final offsets from historic oil and gas asset locations applied will be determined by collaboration with the oil and gas operator via a structured risk assessment approach, as discussed in **Section 9.6.2.3**.
Marine Scotland Science (MSS)	Marine Scotland Licensing Operations Team	MSS consider the most likely routes for the introduction of invasive non-native species (INNS) are through	Impacts from the introduction of non-native species are presented in **Section 9.7** and the embedded

Consultee	Date / Document	Consultee Comment	Response / where addressed in the EIA Report
	Green Volt Scoping Opinion Follow-Up 20 May 2022	vessel movements and ballast water exchange, but it is the 'stepping-stone effect' of newly introduced hard structures that is of most concern. MSS appreciate that a quantitative assessment of the risk of the introduction of INNS would be difficult. However, there are a number of existing developments in the area such as the Buzzard oil and gas facility. Surveys of the marine growth on the hard structures associated with such developments may provide evidence of the presence or absence of INNS. Given the sporadic nature of spawning and other reproductive behaviours of many benthic species (including INNS) and the fact that dispersal patterns may change in response to the effects of climate change (Cook et al., 2013), a biosecurity monitoring plan is important for detecting such species over time. Research shows that renewable energy devices can provide a habitat for marine species with a pelagic larval phase (Adams et al., 2014; Want et al., 2017). The Green Volt scoping report describes floating substructures, moorings, export cables and cable protection, anchors and scour protection. Such structures will provide hard substrate in an otherwise sedimentary habitat, which can create new dispersal pathways for benthic marine species. This stepping stone effect may, for example, provide a new pathway for the dispersal of INNS to adjacent protected sites, such as the Southern Trench MPA.	mitigation included to address this risk is outlined in **Section 9.7.1.**
MSS	4th February 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	MSS advise that *Sabellaria spinulosa* (Sabellaria) reef habitat (on the OSPAR List of Threatened and Declining Species and Habitats) is known to occur within the development area (Pearce and Kimber 2020). In particular, an extensive outcrop of *Sabellaria* reef has been found north of Rattray Head which fits the description of high reefiness with regard to the Gubbay (2007) criteria. Off the coast of Buchan, a variety of Sabellaria has been found growing in isolated clumps on otherwise soft sediment. It has a high ecological value in terms of biodiversity, but does not necessarily fit the Gubbay criteria (2007). MSS advise that the descriptions in Pearce and Kimber (2020) together with the broader habitat descriptions under OSPAR should be used to assess reefiness of this clumped variety. MSS	Details of surveys undertaken in the Offshore Development Area, including records of *S. spinulosa*, are described in **Section 9.6**. As advised by MSS, Pearce and Kimber (2020) has been used for consideration of any *Sabellaria* reef alongside Golding (2020) and Irving (2009) for stony reef recognition and other data sources to inform the benthic baseline within the Offshore Development Area, but no aggregations of *S. spinulosa* that qualify as reef-forming were identified (**Section 9.6.2.1**)

Consultee	Date / Document	Consultee Comment	Response / where addressed in the EIA Report
		recommend that all instances of Sabellaria reef are avoided (including low, medium and high grade reef). The habitat is rare in Scottish waters and all Sabellaria reef has a high ecological value. For recognition of Annex I stony reef habitats, MSS recommend that Golding (2020) should be used together with Irving (2009).	
MSS	4th February 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	In addition to those impacts already scoped in, MSS advise that the following are also scoped into the benthic and intertidal ecology assessment: • Impact of scour on benthic communities arising from the mooring chains and anchors should be scoped into the benthic ecology section. • Impact of open trenching for cable at the landfall site (if HDD is not possible). • Introduction of non-native species: this impact should be scoped in for during all phases.	Noted. These impacts have been addressed in **Sections 9.7.4.2** and **9.7.3.5.** Since scoping, the Applicant has committed to HDD, so there will be no open trenching at landfall.
MSS	4th February 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	Annex I reef. MSS are pleased to read that micrositing around sensitive PMFs is planned.	Noted. The Applicant confirms that micrositing around sensitive PMFs is planned.
MSS	4th February 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	With regard to pockmark features, MSS advise MS-LOT that evidence should provided that the pockmark features are not active, i.e. that features associated with methane derived authigenic carbonate (MDAC; an Annex I feature and PMF) are not present. As such, MSS recommends asking the developer to share relevant sections of the benthic surveys mentioned in the scoping report to ascertain whether they are sufficiently comprehensive to be certain that MDAC is not present. Additionally, MSS request that the developer provides a description of the geological feature in picture ENV18 Fix 413? Although it does not resemble the usual flat structures associated with MDAC, we query whether there is any possibility that it it have formed in this different form?	The Green Volt Windfarm habitat survey undertaken in 2021 and the inshore habitat survey undertaken in 2022 are provided in **Appendix 9.3** and **Appendix 8.1** respectively. **Section 9.6.2.1** presents findings on pock marks and **Table 9.13** presents details of station ENV18.
MSS	4th February 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	MPA assessment. MSS advise baseline data should be sufficient to inform the MPA assessments that will be required for the Turbot Bank Nature Conservation Marine Protected Area (MPA) with regard to the conservation objectives for sandeels and the Southern Trench MPA with regard to the burrowed mud and habitats within the shelf	Noted. Species and habitats of conservation interest are presented in **Section 9.6.2.1** and designated sites are presented in **Section 9.6.4**. Impacts are discussed in **Section 9.7.**

Consultee	Date / Document	Consultee Comment	Response / where addressed in the EIA Report
		deeps. We note that the highest concentration of the protected benthic features of the Southern Trench MPA do not occur in the vicinity of the proposed cable route, but this does not mean that these features do not occur in the vicinity of the cable route.	
MSS	4th February 2022 Representation to MS-LOT during consultation on Offshore Scoping Opinion	MSS also have the following comments. Cable and scour protection. MSS advise that permanent habitat loss should include the introduction of scour protection and cable protection. As in standard NS advice, introduction of hard substrates such as rock dump or concrete mattressing should be minimised to protect benthic habitats. Consideration to matching the type of cable protection with substrate type should be given, e.g. sand or grout bags on soft substrate.	Noted. The impact of scour has been addressed in **Sections 9.7.2 and 9.7.4.2.** The Applicant will consider matching type of cable protection with substrate type, where possible. However, there may be instances where other considerations take priority, such as ensuring the safety of other users of the sea or any installation engineering and technical constraints.

9.4 Assessment Methodology

9.4.1 Impact Assessment Methodology

12. This section describes the EIA assessment methodology for the Project. It outlines the methodology for identification and evaluation of potential likely significant environmental effects and presents methodology for the identification and evaluation of potential cumulative and inter-related impacts across different receptor groups. The approach to the assessment for benthic ecology follows the methodology set out in **Chapter 6: EIA Methodology**, and the sensitivity and value of the receptors and the magnitude of impact specific to benthic ecology are provided in the following sections. This assessment is also conducted with reference to Guidelines for EcIA in the UK and Ireland – Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018).

9.4.1.1 Sensitivity

13. The sensitivities of benthic species and habitats have been developed using a four-point scale (high, medium, low or negligible). This scale has been developed with reference to the MarLIN MarESA, (Tyler-Walters, 2018). In conjunction with MarESA, and the definitions of resistance and resilience used in the assessment are provided in **Table 9.2** and **Table 9.3**, and the matrix of sensitivity scores is provided in **Table 9.4**. Marine Scotland's FeAST has also been used in assessment of sensitivity of MPA protected features. FeAST has developed a sensitivity matrix of marine habitats and species to pressures taking place in the marine environment.

14. The sensitivity of a receptor is dependent upon its adaptability (the degree to which a receptor can avoid or adapt to an impact), tolerance (the ability of a receptor to absorb stress or disturbance without changing character) and recoverability (the temporal scale and extent to which a receptor will recover following an impact).

Table 9.2 Assessment scale for resistance (tolerance) to a defined intensity of pressure

Resistance	Definition
High	No significant effects on the physicochemical character of habitat and no effect on population viability of key/characterising species but may affect feeding, respiration and reproduction rates.
Medium	Some mortality of species (can be significant where these are not keystone structural/functional and characterising species) without change to habitats relates to the loss <25% of the species or habitat component.
Low	Significant mortality of key and characterising species with some impacts on the physicochemical character of habitat. A significant decline/reduction relates to the loss of 25-75% of the extent, density, or abundance of the selected species or habitat component e.g. loss of 25-75% of the substratum.
None	Key functional, structural, characterising species severely decline and/or physicochemical parameters are also affected e.g. removal of habitats causing a change in habitats type. A severe decline/reduction relates to the loss of 75% of the extent, density or abundance of the selected species or habitat component e.g. loss of 75% substratum (where this can be sensibly applied).

Table 9.3 Assessment scale for resilience (recovery)

Resistance	Definition
High	Full recovery within 2 years
Medium	Full recovery within 2-10 years
Low	Full recovery within 10-25 years
Very Low	Negligible or prolonged recovery possible; at least 25 years to recover structure and function

Table 9.4 Definitions of Sensitivity Levels for Benthic Ecology

	Resistance			
Resilience	**None**	**Low**	**Medium**	**High**
Very Low	High	High	Medium	Low
High	High	High	Medium	Low
Medium	Medium	Medium	Medium	Low
High	Medium	Medium	Low	Negligible

15. In sections where several sensitivity levels are given for receptors against a potential impact, professional judgement will be used for the assessment.

9.4.1.2 Value

16. In addition, for some assessments the 'value' of a receptor may also be an element to add to the assessment where relevant – for instance if a receptor is designated or has an economic value. The definitions of value levels have been developed using a four-point scale and example definitions of the value levels for a generic receptor are provided in **Table 9.5**.

Table 9.5 Definitions of Value Levels for Benthic Ecology

Value	Definition
High	Nationally important / rare with limited potential for offsetting / compensation. Habitats (and species) protected under international law (e.g. Annex I habitats within a Special Area of Conservation (SAC) boundary)
Medium	Regionally important / rare with limited potential for offsetting / compensation. Habitats protected under national law (e.g. Annex I habitats not within an SAC boundary; UK Biodiversity Action Plan (BAP) priority habitats and species) Species/habitat that may be rare or threatened in the UK.
Low	Locally important / rare. Regional UK BAP priority habitats. Habitats or species that provide prey items for other species of conservation value
Negligible	Habitats and species which are not protected under conservation legislation and are not considered to be particularly important or rare.

17. It should be noted that high value and high sensitivity are not necessarily linked within a particular impact. A receptor could be of high value (e.g. an Annex I habitat) but have a low or negligible physical/ecological sensitivity to an impact – it is important not to inflate effect significance just because a feature is 'valued'. This is where the narrative behind the assessment is important; the value can be used where relevant as a modifier for the sensitivity assigned to the receptor.

9.4.1.3 Magnitude of Impact

18. Example definitions of the magnitude levels for a generic receptor are given in **Table 9.6**.

Table 9.6 Definitions of Magnitude levels for Benthic Ecology

Magnitude	Definition
High	Fundamental, permanent / irreversible changes, over the whole receptor, and / or fundamental alteration to key characteristics or features of the particular receptors character or distinctiveness.
Medium	Considerable, permanent / irreversible changes, over the majority of the receptor, and / or discernible alteration to key characteristics or features of the particular receptors character or distinctiveness.
Low	Discernible, temporary (throughout project duration) change, over a minority of the receptor, and / or limited but discernible alteration to key characteristics or features of the particular receptors character or distinctiveness.
Negligible	Discernible, temporary (for part of the project duration) change, or barely discernible change for any length of time, over a small area of the receptor, and/or slight alteration to key characteristics or features of the particular receptors character or distinctiveness.

19. In sections where several magnitude values are given for receptors against a potential impact, professional judgement will be used for the assessment.

9.4.1.4 Effect Significance

20. Following the identification of receptor value and sensitivity and magnitude of the impact, it is possible to determine the significance of the impact. The matrix provided in **Table 9.7** (and the definitions of sensitivity, value and magnitude) is used as a framework to aid in determination of the impact assessment.

21. This chapter provides the criteria, including sources and justifications, for quantifying the different levels of impact on benthic ecology. Where possible, this is based upon quantitative and accepted criteria, together with the use of value judgement and expert interpretation to establish to what extent an impact is significant.

Table 9.7 Effect Significance Matrix

		Negative Magnitude				Beneficial Magnitude			
		High	Medium	Low	Negligible	Negligible	Low	Medium	High
Sensitivity	High	Major	Major	Moderate	Minor	Minor	Moderate	Major	Major
	Medium	Major	Moderate	Minor	Minor	Minor	Minor	Moderate	Major
	Low	Moderate	Minor	Minor	Negligible	Negligible	Minor	Minor	Moderate
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

22. The definitions of effect significance to be used with the effect significance matrix (and the definitions of sensitivity, value and magnitude) is provided in **Table 9.8**.

Table 9.8 Effect Significance Definitions

Effect Significance	Definition
Major	Very large or large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives or could result in exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate change in receptor condition, which are likely to be important considerations at a local level.
Minor	Small change in receptor condition, which may be raised as local issues but are unlikely to be important in the decision making process.
Negligible	No discernible change in receptor condition.
No Change	No impact; therefore, no change in receptor condition.

23. Note that for the purposes of the EIA, major and moderate effects are deemed to be significant. In addition, whilst minor effects are not significant in their own right, it is important to distinguish these from other non-significant effects as they may contribute to significant impacts cumulatively or through interactions.

24. Where relevant, embedded mitigation is referred to and included in the initial assessment of impact. If the impact does not require mitigation (or none is possible) the residual effect will remain the same. If, however, mitigation is required there is an assessment of the post-mitigation residual impact.

9.4.2 Cumulative Impact Assessment

25. The Cumulative Impact Assessment (CIA) will identify where the predicted impacts of the construction, operation and maintenance and decommissioning of the Project could interact with impacts from different plans or projects within the same region and impact benthic ecology. The methodology for the cumulative impact assessment to be followed in this **Offshore EIA Report** is provided in **Chapter 6: EIA Methodology**. The potential for projects to act cumulatively on benthic ecology is considered in the context of the likely spatial and temporal extent of impacts, as well as the combined impact on a sensitive or important habitat or species in the wider region. Further detail is provided in **Chapter 20: Transboundary and Cumulative Impacts**.

26. The following types of plans and projects are considered:

- Marine Renewable Energy (MRE) developments.
- Aggregate extraction and dredging.
- Licenced disposal sites.
- Planned installation and existing presence of telecom cables, sub-sea cables and pipelines.
- Oil and gas exploration, development and decommissioning.
- Carbon Storage activities.
- Unexploded Ordnance (UXO) clearance.

9.4.3 Transboundary Impact Assessment

27. The distribution of benthic species and habitats is independent of national geographical boundaries and the assessment has considered benthic ecology irrespective of national jurisdictions – no specific transboundary assessment is therefore required. For general methods, see **Chapter 6: EIA Methodology**.

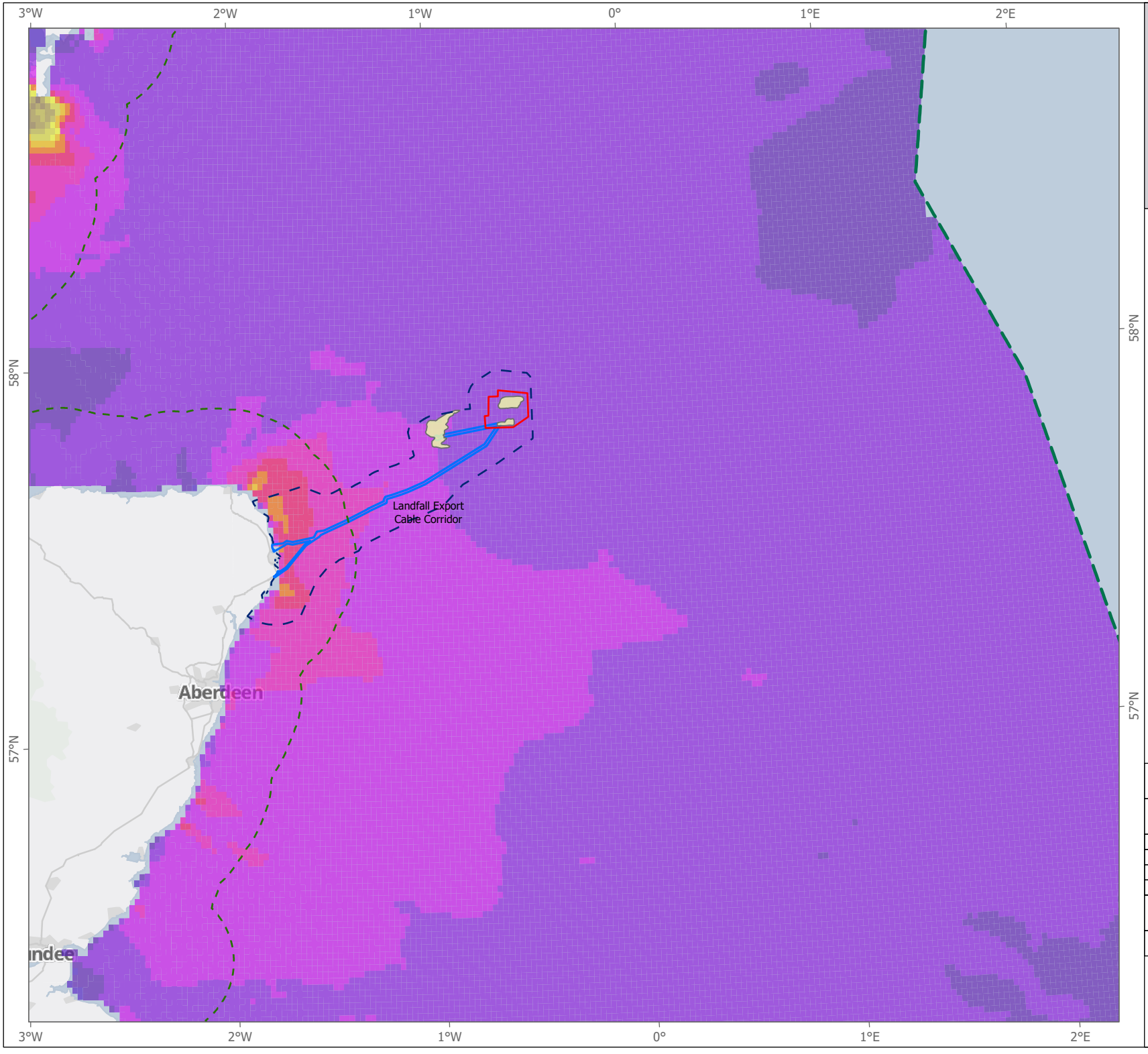
9.5 Scope

28. The scope of the assessment will cover the Study Area as described below (**Section 9.5.1**), and all associated benthic habitats, species and protected sites.

29. Potential impacts on the Buchan Ness to Collieston SAC and the Buchan Ness to Collieston Coast SPA have been scoped out of further assessment for benthic ecology in the **Offshore Scoping Report** (Royal HaskoningDHV (2021). Although the NorthConnect Landfall Option passes through the Buchan Ness to Collieston Coast SAC, which is designated for its vegetated sea cliffs, following commitments to best practice and to HDD at landfall there is no potential impact pathway or impact on the qualifying features of this SAC.

9.5.1 Study Area

30. The spatial scale of the Study Area for benthic ecology is defined as: the Windfarm Site, the Offshore Export Cable Corridors, and the intertidal zone at the landfall plus approximately one tidal ellipse. The Study Area is shown in **Figure 9.1**.



LEGEND

- Windfarm Site
- Offshore Export Cable Corridor
- Exclusive Economic Zone Limit
- Territorial Sea Limit
- Oil and Gas Fields
- Study Area

Mean Spring Peak Flow Tidal Current

- < 0.11
- 0.11 - 0.25
- 0.26 - 0.50
- 0.51 - 0.75
- 0.76 - 1.00
- 1.01 - 1.25
- 1.26 - 1.50
- 1.51 - 1.75
- 1.76 - 2.00
- 2.01 - 2.50
- 2.51 - 3.00
- 3.01 - 3.50
- 3.51 - 4.00
- > 4.00

0 20
Kilometres

PROJECT: GREEN VOLT

TITLE: Figure 9.1 Benthic Ecology Study Area

VER	DATE	COMMENTS	DRAWN	CHECKED
001	13/01/2023		GC	CM

ARCGIS REF: PC2483_RHD_EIA_Offshore_Chpt_BenthicIntertidalEcology
LAYOUT: PC2483-RHD-EI-OF-D-GS-0061

SCALE:	PAGE SIZE:	COORDINATE SYSTEM:
1:1,500,000	A4	WGS 1984 UTM Zone 30N

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9.5.2 Data Sources

31. Details of the baseline data used to inform the EIA is sources provided within this section and detailed in **Table 9.9**.

Table 9.9 Data Sources – Benthic Ecology

Data	Source	Year
Green Volt site-specific benthic data	Several site investigation survey reports commissioned by Nexen Petroleum UK Limited for the Ettrick and Blackbird sites. These surveys provide an indication of the likely potential habitat. A summary of the surveys conducted: • 2006 -Ettrick grab sampling, seabed photography and geophysical survey (Fugro 2006). • 2008 – Blackbird grab sampling, seabed photography and magnetometer surveys (Fugro 2008). • 2009 – Blackbird grab sampling, seabed photography and video as well as single beam and multi-beam echo sounders (MBES), sidescan sonar (SSS) (Gardline 2009). • 2010 – Blackbird geophysical survey. (Fugro 2010) • 2011 - Blackbird grab sampling, seabed photography and gravity core, MBES, SSS (Fugro 2011b) • 2011 – Ettrick Panda site grab sampling and seabed photography, MBES, SSS (Fugro 2011a). • 2012 – Ettrick grab sampling and seabed photography (Calesurvey and Benthic Solutions Ltd, 2013).	2006 – 2012
Blackbird site-specific benthic data	Blackbird Field Development Environmental Statement (Nexen).	2010
Benthic ecology data from cable route	NorthConnect EIA Report.	2018
Gardline Limited Green Volt Environmental Survey	Surveys commissioned by China National Offshore Oil Corporation (CNOOC) conducted by Gardline Limited in 2021, included a geophysical survey, habitat assessment and environmental baseline survey of the Green Volt windfarm site and the Export Cable Route up to 12 nautical miles (nm) from shore	2021
Green Marine UK Green Volt Inshore Environmental Survey	Surveys commissioned by CNOOC conducted by Green Marine UK in 2022, included a geophysical survey, habitat assessment and environmental baseline survey of the cabling route from 0 to 12 nm from shore	2022
Marine Protected Areas	Marine Protected Area reports from NatureScot.	Accessed 2022
Priority Marine Habitats	Priority marine habitats information from NatureScot and JNCC.	Accessed 2022
North Sea benthic data	National Biodiversity Network (NBN) Atlas (https://nbnatlas.org/; accessed 07/02/2022).	Accessed 2022
North Sea benthic data	UKSeamap 2010 Interactive Map (https://jncc.gov.uk/our-work/marine-habitat-data-product-ukseamap/; accessed 07/02/2022).	Accessed 2022
North Sea habitats	European Marine Observation and Data Network (EMODnet) Seabed Habitats, data ranging from 2004 – 2014 (https://emodnet.ec.europa.eu/en/seabed-habitats; accessed 07/02/2022).	Accessed 2022
North Sea benthic data	MarLIN (https://www.marlin.ac.uk/; accessed 07/02/2022).	Accessed 2022
North Sea habitats	NatureScot Habitat Map of Scotland (HabMoS) (https://www.environment.gov.scot/our-environment/habitats-and-species/habitat-map-of-scotland/; accessed 07/02/2022).	Accessed 2022

Data	Source	Year
North Sea benthic habitats	Multi-Agency Geographic Information for the Countryside (MAGIC) interactive map (https://magic.defra.gov.uk/; accessed 07/02/2022).	Accessed 2022

9.5.3 Assumptions and Limitations

32. Data on habitats and species referred to in the desk study from surveys conducted before 2013 is presented as an indicator to what the potential baseline conditions in these areas may be. This also provides historical data to show trends of how the benthic community has potentially changed over the years and, therefore, will give a good indication of the recoverability of the seabed habitat.

33. There are also limitations within the tools used in this assessment regarding sensitivity: MarESA and FeAST. Both tools assess the sensitivity of a hypothetical population or habitat and use data that is not site-specific, and the value may differ based on the specific habitat and species present within the site. The confidence of the assessment for both tools is divided into three categories: low medium, and high. For FeAST the confidence assessment categories for evidence are based on the definitions below:

- High - there is good information on the sensitivity of the feature to the relevant pressure. The assessment is well supported by the scientific literature.
- Medium - there is some specific evidence or good proxy information on the sensitivity of the feature to the relevant pressure.
- Low - there is limited or no specific or suitable proxy information on the sensitivity of the feature to the relevant pressure. The assessment is based largely on expert judgement.

34. The confidence assessment categories for MarESA uses the following definitions:

- High - based on peer reviewed papers or grey literature reports by established agencies on the feature.
- Medium - based on some peer reviewed papers but relies heavily on grey literature or expert judgement on feature (habitat, its component species, or species of interest) or similar features.
- Low - based on expert judgement.

35. Uncertainties exist in these assessment tools but as presented in **Section 9.6** there are a number of primary datasets on the benthic habitat in the area. The location of these sample sites is presented in **Figure 9.2**. The evidence base is sufficiently robust as the data acts to validate the assessment.

9.5.4 Data Gaps

36. There is limited benthic data available on the inshore and intertidal zone at each of the landfall sites. This is primarily due to restrictions to survey vessels in acquiring nearshore data from fishing activities (e.g., pots, creels etc). However, due to the nature of HDD proposed by the Applicant, the benthic environment within the inshore and intertidal zone is expected to remain unchanged.

9.6 Existing Environment

9.6.1 Methodology

9.6.1.1 Desk Study

37. The characterisation of the baseline environment is undertaken using data sources listed in **Table 9.9**, and with reference to survey data. A review of these sources has been used to characterise the existing environment, from historic benthic environment relevant to the Study Area to the results from site-specific surveys conducted in 2021 and 2022.

38. Site-specific survey data is available for the Ettrick and Blackbird site from surveys conducted by Nexen in between 2005 and 2013 and benthic ecology data was reviewed from the NorthConnect EIA Report (NorthConnect, 2018). The sample stations from previous surveys are presented in **Figure 9.2**.

9.6.1.2 Gardline Limited Surveys 2021

39. An environmental survey was carried out in September 2021 by Gardline Limited, which included, amongst others, sample collection for benthic habitat data. The survey covered the Windfarm Site and the two offshore export cable corridors (one from the Windfarm Site to the Buzzard Platform Complex ('Buzzard') and the other from the Windfarm Site to the 12 nautical mile (nm) limit). Sampling methods included taking 18 Day grab samples and 18 video transects using a remotely operated vehicle (ROV). The grab samples were analysed for physico-chemical properties and macrofaunal identification. Further detail on the methodology and the findings of the physico-chemical analysis is provided in **Chapter 8: Marine Sediment and Water Quality.**

40. The aims of the environmental aspect of the survey were as follows:

- acquire environmental camera and seabed sample data to establish baseline environmental conditions;
- identify any sensitive habitats and species;
- provide a characterisation of the physical, chemical, and biological conditions of the area; and
- establish seabed conditions.

41. Out of the 18 sample locations surveyed, several were situated at previous sample locations for surveys carried out for the Ettrick and Blackbird hydrocarbon fields. This provides a good comparison for changes in benthic habitat between 2006 – 2022 (**Figure 9.2)**. Initial survey results are presented in **Section 9.6**.

42. Benthic samples were recovered using a 0.1 m^2 day grab. Sediment samples were taken from the day grab for physico-chemical analysis and three separate grab samples from each station were collected for infaunal macrofaunal identification. Across the 14 sampling stations, 56 single grab samples were retained from 72 deployments.

43. Seabed images were taken by means of a digital stills camera system with a dedicated strobe and video lamp(s), mounted within a stainless-steel frame. Video footage was also acquired throughout transects and target investigations. Footage was fed back to the onboard surveyor via an umbilical to allow viewing of the seabed in real time. The umbilical was also used as a means of communication and control of the ROV during deployment. This allowed for shot selection to capture sediment changes or features at the seafloor. During acquisition, a minimum of 16 seabed photographs and ten minutes of footage were collected at each station and transect at appropriate intervals across 19 stations and four transects.

44. Due to the recorded presence of the tube-dwelling *S. spinulosa* in the Study Area NorthConnect (2018), upon acquisition of seabed imagery from the 2021 surveys (Gardline, 2021), where *S. spinulosa* was identified, the Hendrick and Foster- Smith (2006) scoring system was applied in an attempt to define the 'reefiness' of the areas or colonies identified within the surveyed area. The scoring criteria used are:

- Spatial Extent – Area (from the geophysical data) of interpreted extent of colonies
- Patchiness – Percentage cover (from video/stills footage)
- Elevation – Average height of tubes within colony(ies) (from video/stills footage) as well as elevation of overall reef-like features relative to surrounding seabed (from MBES data)

45. The scale used in this assessment is presented in **Table 9.10**. Further detail on the approach used in determining the 'reefiness' of *S. spinulosa* is in the Gardline 2021 survey report provided in **Appendix 9.3.**

Table 9.10 Scale Used as a Measure of 'Reefiness'

Measure of 'reefiness'	Not a Reef	Low	Medium	High
Elevation (cm) (average tube height)	<2	2-5	5-10	>10
Area (m^2)	<25	25-10,000	10,000-1,000,000	>1,000,000
Patchiness (% cover)	<10%	10-20%	20-30%	30%

46. As advised by MSS, Pearce and Kimber (2020) has also been used for consideration of any Sabellaria reef alongside Golding (2020) and Irving (2009) for stony reef recognition and other data sources to inform the benthic baseline.

47. Further detail of the methodology used on the Gardline surveys is provided in **Appendix 9.3.**

9.6.1.3 Green Marine UK Surveys 2022

48. Further surveys were conducted by Green Marine UK in May 2022, with analysis provided by APEM (2022). The survey focused on the Landfall Export Cable Corridor from the Windfarm Site to the landfall, between the landfall and to the 12 nm limit from shore. Sampling consisted of grab sampling taken at fixed interval sampling stations and drop-down video transects and stills.

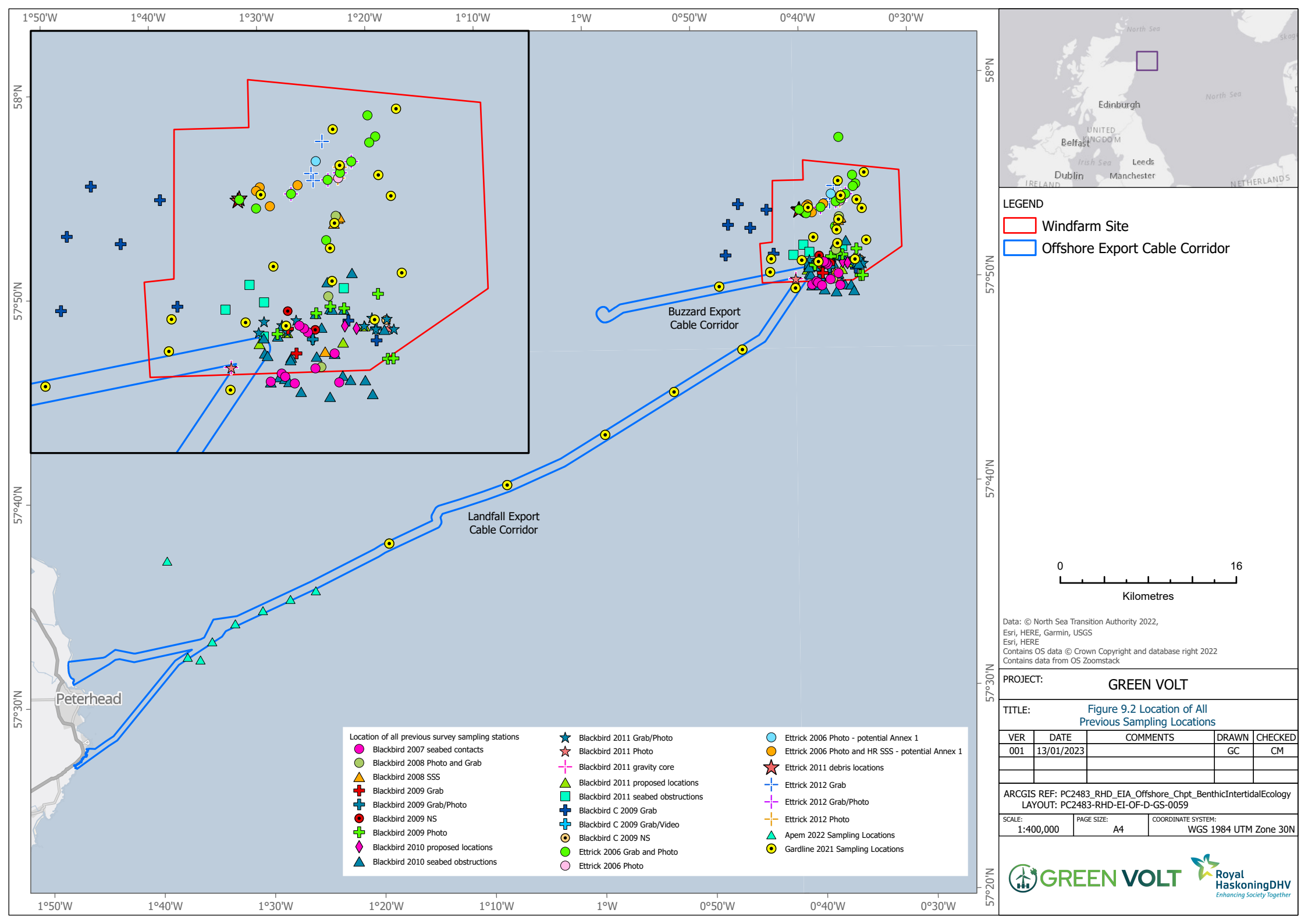
49. Eight 0.1m^2 day grab samples were collected at depths between 64 m and 89 m; 500 ml subsamples were taken from each for particle size analysis (PSA), Total Organic Carbon (TOC) content and sediment chemistry and grab samples were analysed for macrofaunal identification and biotope allocation.

50. Six video transects were taken across the surveyed area with still photographs taken along five of these transects.

51. The aims of the environmental aspect of the survey were as follows:

- acquire seabed sample data to establish baseline environmental conditions;
- identify any sensitive habitats and species; and
- provide a characterisation of the physical, chemical, and biological conditions of the area.

52. Further detail on the methodology for analysis of the data is provided in **Appendix 8.1.**



PROJECT: GREEN VOLT

TITLE: Figure 9.2 Location of All Previous Sampling Locations

VER	DATE	COMMENTS	DRAWN	CHECKED
001	13/01/2023		GC	CM

ARCGIS REF: PC2483_RHD_EIA_Offshore_Chpt_BenthicIntertidalEcology
LAYOUT: PC2483-RHD-EI-OF-D-GS-0059

SCALE:	PAGE SIZE:	COORDINATE SYSTEM:
1:400,000	A4	WGS 1984 UTM Zone 30N

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9.6.2 Windfarm Site and Buzzard Export Cable Corridor

53. The Windfarm Site is located within the North Sea (see **Figure 9.1**) on the brownfield site which previously accommodated the Blackbird and Ettrick oil and gas facility. The Ettrick and Blackbird Decommissioning Programmes (Nexen, 2017) states there are no drill cuttings piles in either field and no oil based mud discharge was reported at either site. Nexen (2017) also reports that there are no piles that exceed the OSPAR criteria, and they will be left in place to degrade naturally. From this it is determined that water-based muds will have been used and discharged with drill arisings under the appropriate permit from Department for Business, Energy and Industrial Strategy - Offshore Petroleum Regulator for Environment and Decommissioning (BEIS-OPRED) following a chemical risk assessment to confirm that there would be no significant environmental effects either at the time or in the future. The OSPAR Recommendation 2006/5 on the Management Regime for Offshore Cuttings Piles says that if water-based drilling fluids were used then no further investigation is necessary and the criteria/thresholds do not need to be applied, which would be the case for the Ettrick and Blackbird fields. Due to the nature of water-based mud drill arisings and their discharge being mostly within the water column rather than at the seabed it is more likely for the drill arisings to become widely dispersed as a thin veneer rather than forming piles, particularly when drilling is undertaken from a mobile offshore drilling unit rather than a fixed platform drilling package. A detailed presentation of sediment contamination and particle size analysis is presented in **Chapter 8: Marine Sediment and Water Quality** and **Appendix 9.3**.

54. Biodiversity is generally lower in central and southern areas of the North Sea than in the northern areas (Künitzer et al., 1992; Kröncke, 2011). The benthic species present within the area are largely correlated with the substrate type and associated hydrodynamic conditions and the following sections provide information on the benthic species and habitats within the Windfarm Site and the Buzzard Export Cable Corridor.

55. Camera observations and geophysical data from 2021 have characterised the Windfarm Site and the Buzzard Export Cable Corridor as fine silty sand with occasional shell fragments. The soft sediment habitats were dominant at every location across the Windfarm Site and the Buzzard Export Cable Corridor, with these areas overall appearing homogeneous. Seabed sediments across the Windfarm Site and the Buzzard Export Cable Corridor comprised a Holocene veneer (<0.5m) of silty sand with shell fragments, overlying Witch Ground, Swatchway and Coal Pit Formations.

56. Pockmarks and depressions were present throughout the site with pockmarks measuring up to 130m in diameter and with depths of up to 5m. The depressions measured up to 200m in length and up to 3m in depth. Abundant scars on the seabed were observed throughout the greater survey area. These were interpreted to be the result of anchoring, often associated with pull out pits. Silty sands were accumulated within the bathymetric lows associated with the megaripples, with possible gravelly sands from to the end of the route along the bathymetric ridges. Seabed sediments within the Windfarm Site and the Buzzard Export Cable Corridor comprised predominantly silty sand with shell fragments. Megaripples were intermittent to the end of the Corridor. Occasional areas of increased sidescan sonar reflectivity may represent local accumulations of coarser material or exposures of underlying clay. Anchoring scars and pullout pits were identified. Examples of sediment types from 2021 are shown in **Figure 9.3.**

57. This is consistent with previous survey data at least for the northern section of the Windfarm Site (Ettrick hydrocarbon field) where 2011 and 2013 surveys also consisted primarily of fine silty sand with shell fragments (Fugro, 2011a; RPS, 2013; Calesurvey and Benthic Solutions Ltd (BSL), 2013). In 2011 to the northwest of the Windfarm Site (within the Ettrick Panda Bear site in UK Continental Shelf (UKCS) Block 20/02), was dominated by megaripples and patches of shell debris (Fugro, 2011a) and in the southern half of the Windfarm Site (Blackbird hydrocarbon field), survey data

identified a homogenous slightly cohesive silty clay seabed with low proportions of sand observed in the grab samples.

58. Surveys carried out for the Ettrick Panda Bear site (Fugro, 2011a), adjacent and to the west of the Windfarm Site, identified two biotopes that covered the Ettrick Panda Bear survey site: Deep Circalittoral Sand (SS.SSa.Osa) and Deep Circalittoral Mixed Sediment (SS.SSa.OMx). This survey area is located to the north of the Buzzard Export Cable Corridor. The deep circalittoral sand biotope recorded across the majority of the Ettrick Panda Bear survey site was characterised by fine sands or non-cohesive muddy sands. Sea pens and burrowing megafauna communities were sparsely distributed across the biotope. Imagery from the Ettrick Panda Bear survey indicate that deep circalittoral mixed sediment was associated with boulders found within potential pockmarks or depressions (**Figure 9.4**). This corresponds with the findings of the Ettrick survey above (CaleSurvey & BSL, 2013) and is characterised by mixed sediments and poorly sorted mosaics of shell, cobbles, and pebbles on fine sand. Dominant species include the Devonshire cup coral *Caryophyllia smithii*, encrusting bryozoans and hydroids, along with hermit crabs and Norway lobster.

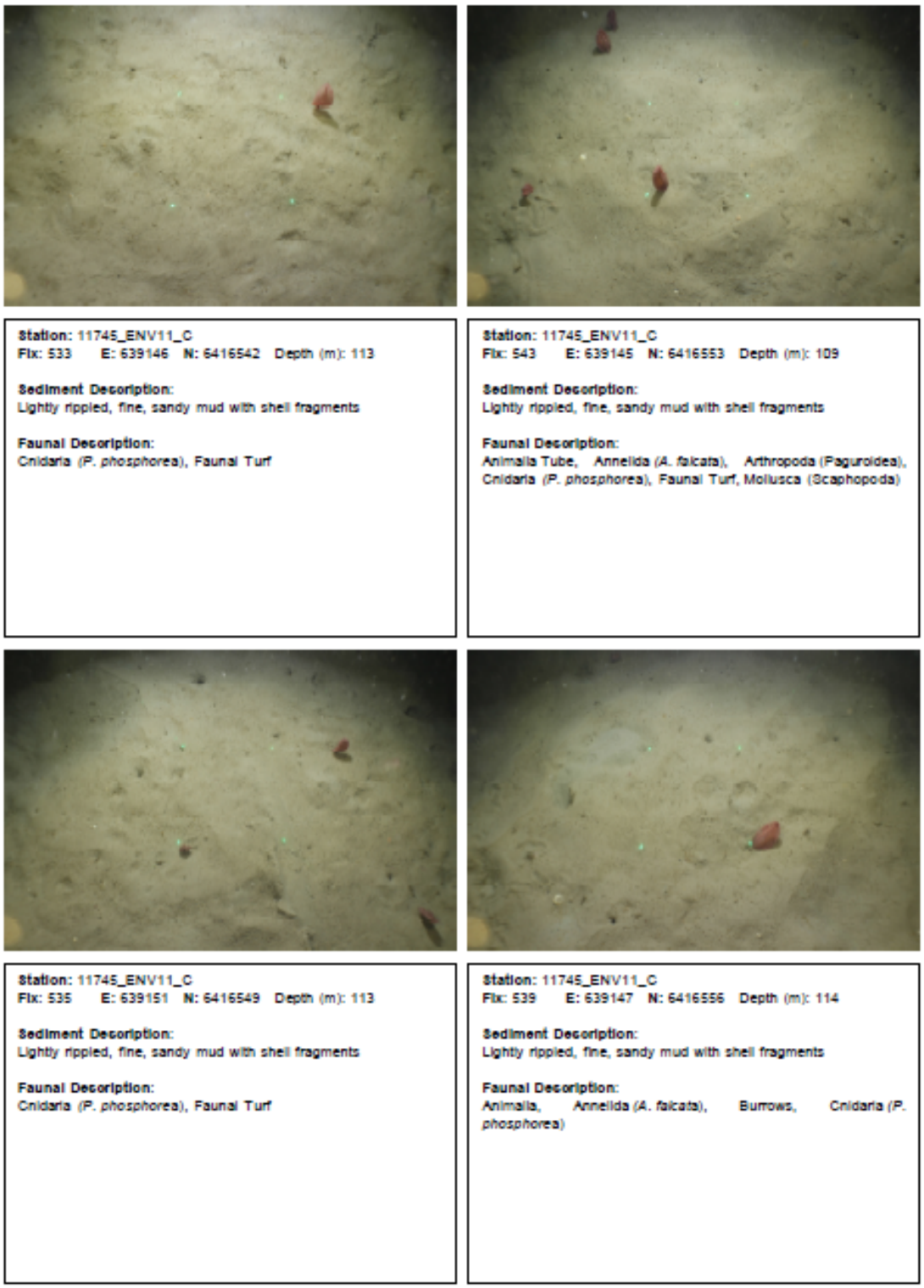


Figure 9.3 Examples of observed sediment types and habitats within the Windfarm Site from the 2021 survey results

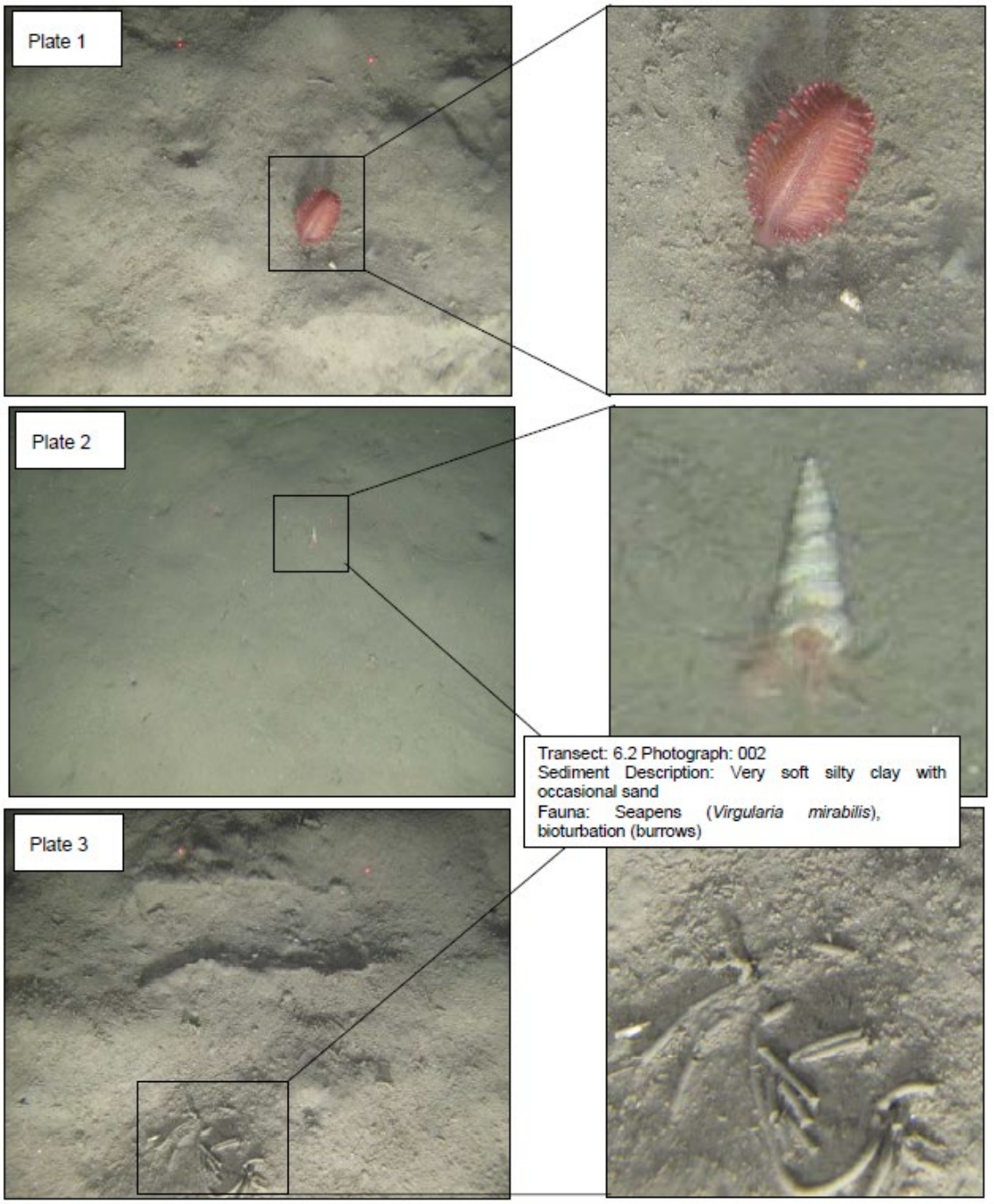


Figure 9.4 Sample survey pictures taken from the Blackbird survey showing the sediment and fauna present within the circalittoral muddy sand biotope (Fugro, 2011b).

59. In 2021 visible fauna identified to the lowest taxonomic level with confidence across the Windfarm Site included:

- Annelida (Ampharetefalcata, Echiura, Hyalinoeciatubicola, Oxydromusflexuosus, Serpulidae, Terebellidae)
- Arthropoda (*Cancer pagurus*, Caridea, Cirripedia, Decapoda, *Ebalia sp., Lithodes maja, N. norvegicus*, Paguroidea, *Pagurus prideaux*, Pycnogonida)
- Bryozoa (*Reteporella* sp.)
- Chordata (Actinopterygii, cf. *Ammodytes* sp., Eutriglagurnardus, *Gadus morhua*, Glyptocephaluscynoglossus, Gobiidae, Limandalimanda, Lotidae, *Melanogrammus aeglefinus*, *Molva molva*, *Myxine glutinosa*, Pleuronectiformes)
- Cnidaria (Actinaria, *Adamsia sp*., *Alcyonium digitatum*, *Cellaria sp*., Ceriantharia, Hormathiadigitata, Hydrozoa, *Nemertesia sp*., *Pennatula phosphorea*, *Tubularia indivisa*, *Virgularia sp*., Zoantharia)
- Echinodermata (*Asterias rubens*, Asteroidea, *Astropecten irregularis*, cf. *Echinus esculentus*, *Echinocardium cordatum*, *Hippasteria sp*., Luidiasarsi, *Ophiura sp*.)
- Mollusca (Anomiidae, Buccinidae, Fjordiabrowni, Naticidae, Octopoda, Pectinidae, Scaphopoda, Sepiida*)*
- Porifera.

60. Overall, the most observed taxa or features in 2021 were *Ampharete falcata* (present in 60% of stills), burrows (present in 56% of stills), Annelida tubes (53%), the cnidarian *P. phosphorea* (49%), faunal turf (27%), the arthropod Paguroidea (18%). The extent to which the seabed resembled a 'Sea Pen and Burrowing Megafauna Communities' habitat, which is listed as a threatened and/or declining habitat (OSPAR, 2008) was determined during the European University Information Systems organisation (EUNIS) assessment during the 2021 surveys.

61. These findings are consistent with observations in the Windfarm Site and the Buzzard Export Cable Corridor in previous surveys. Surveys conducted by Fugro in 2008 (Fugro, 2008) of the pipeline route between Ettrick and Blackbird, located within the Windfarm Site, identified low to moderate faunal diversity from analysis of seabed video footage and stills photography. Fauna in this habitat included hermit crabs (Paguroidea), cushion star *Hippasteria phrygiana*, sea pens *Pennatula phosphorea*, anemone *Adamsia carciniopados*, hagfish *Myxine glutinosa* and a flatfish *Pleuronectiforme spp.* Homogenous sediments were noted throughout the Blackbird area of the Windfarm Site (UKCS Block 20/02) during June – July 2011, and the whole of the Blackbird survey area was classified as Circalittoral Muddy Sand biotope (SS.SSa.CMu.Sa) (Fugro, 2011b). This biotope is characterised by non-cohesive muddy sands, fine to very fine sand with a fine silt fraction with sea pens and megafauna burrow communities sparsely distributed, but indicative of a muddy habitat in deep water (see **Figure 9.4** above). The dominant fauna were polychaete worms, in particular *Paramphinome jefferysii*, typical for this type of sediment (Nexen, 2010). *P. jefferysii* is an opportunistic colonising polychaete characteristic of deep, offshore, cohesive sandy muds. It is common throughout the North Sea in habitats similar to the Blackbird site. An increase in fauna was observed in the pockmarks/depressions, which was also associated with an increase in coarse substrate and anthropogenic debris such as boulders, anchors, and rope. Sessile fauna such as cup corals, coral worms *Filograna implexa*, anemones, and hydroids colonised the boulders. Mobile epifauna included edible crab *Cancer pagurus*, hermit crabs, and spider crabs.

62. The 2012 survey findings are consistent with those recorded during the 2021 survey. Benthic sampling stations and drop-down video transects undertaken during the October 2012 survey sampled a number of locations within the Ettrick area of the Windfarm Site (UKCS Block 20/2a and 20/3a) and two main habitats were noted: moderately bioturbated silty sand and isolated boulders with surrounding gravel, cobbles and shell fragments.

63. Supplementary to the seabed imagery, sediment sampling was conducted at seven stations on the Windfarm Site and two stations along the Buzzard Export Cable Corridor. Sediments predominantly comprised muddy sand. Visible fauna observed within the retrieved grab samples included:

- Annelida (Polychaeta);
- Arthropoda (Amphipoda, Brachyura, Gnathidae, Isopoda, Nephoropidae);
- Cnidaria (Anthozoa, Hydrozoa, Pennatulacea);
- Echinodermata (Echinoidea, Ophiuroidea); and
- Mollusca (Bivalvia, Gastropoda, Scaphopoda).

64. PSA results showed a variable muddy sand to sand sediment type and are presented in more detail in **Chapter 8: Marine Sediment and Water Quality**.

65. **Appendix 8.1 and Appendix 9.3** present the survey data collated and referred to from the Offshore Development Area.

9.6.2.1 Habitats and Species of Conservation Importance

Sea Pen and Burrowing Megafauna Communities

66. The 'Sea Pen and Burrowing Megafauna Communities' habitat is listed as a component biotope of habitat 'Burrowed Mud - Sea Pen and Burrowing Megafauna Communities' habitat, which itself is classified as a threatened and/or declining habitat (OSPAR, 2008). It is defined by OSPAR (2010) as plains of fine mud, extending over an area of at least 25 m^2 and at water depths ranging from 15 m to 200 m or more. These areas are defined as being heavily bioturbated by burrowing megafauna including *Nephrops norvegicus, Calocaris macandreae* or *Callianassa subterranea*, with burrows and mounds typically forming a prominent feature of the sediment surface, and which may include conspicuous populations of sea pens typically, *Virgularia mirabilis* and *Pennatula phosphorea*. Despite its classification as a threatened and/or declining habitat (OSPAR, 2008); this habitat is widespread throughout the North Sea, around the south and west coasts of Norway and around the north of the British Isles (OSPAR, 2010).

67. In the 2021 surveys, bioturbated sediment featured across the site, with both large *N. norvegicus* burrows and smaller pencil burrows and other faunal tracks identified. Analysis of the footage determined that 'Sea Pen and Burrowing Megafauna Communities' habitat as defined by OSPAR (2010) were observed at all stations within the Windfarm Site and the Buzzard Export Cable Corridor. Clarifications on the identification of OSPAR description of the habitat were summarised in a report by the JNCC (2014) to improve the definition and correct identification of this habitat. These clarifications suggest that burrowed areas of mud should be deemed to be a 'seapen and burrowing megafauna communities' habitat regardless of the presence of sea pens if multiple sightings of burrows and/or mounds attributable to the relevant species are observed. Furthermore, although the habitat occurs predominantly in fine mud sediments, examples of the habitat have been identified in areas of sandy muds where there is clear evidence of the relevant biological assemblages (burrowing megafauna and in some examples, sea pens). Consequently, habitats can be classed as 'Sea Pen and Burrowing Megafauna Communities' regardless of the grain size composition of the sediment (JNCC, 2014). The JNCC report (2014) also recommends that the definition should extend further than the habitat classification biotope 'sea-pens and burrowing megafauna in circalittoral fine mud' (Connor *et al*., 2004) since additional biotopes are also considered to be associated with the habitat (Hughes and Hughes, 1998).

68. Seabed imagery shows that sediment burrows and sea pens are present at all stations and transects across the Offshore Development Area and both stations along the Buzzard Export Cable Corridor. A total of 2,041 individuals were recorded. Of these, three were identified as *Virgularia* sp., with the remaining identified as *P. phosphorea.* Overall, the mean density of Pennatulacea, calculated from seabed imagery across the surveyed area, was 1.7 individuals per m^2. The resulting 'Superabundant,

Abundant, Common, Frequent, Occasional, Rare, and Less than rare' (SACFOR) [1] scores encompassed the 'frequent' classification at all stations and transects. The densities of burrows and sea pens were categorised using the SACFOR classification to assess the similarity of the locations to a 'Sea Pen and Burrowing Megafauna Communities' habitat.

69. Within the Windfarm Site burrow densities ranged from 0.3 burrows per m^2 at Station 11745_ENV8 to 2.6 burrows per m^2 at Station 11745_ENV11. Both sea pens and burrows were classified within a range that encompassed 'frequent' at all stations and transects across the Windfarm Site. Station 11745_ENV14 was classified as 'occasional' to 'frequent. Therefore, the Windfarm Site shows a similarity to the 'Sea Pen and Burrowing Megafauna Communities' as defined by OSPAR (2010). The habitat is also listed as a component biotope of the burrowed mud habitat which is a PMF (JNCC, 2012).

70. Furthermore, several individuals of the taxa *N. norvegicus* were observed at Transects 11745_ENV5, 11745_ENV7, 11745_ENV9, 11745_ENV13 and Stations 11745_ENV15 and 11746_ENV1. This species is considered as a 'megafauna' species within the 'sea pen and burrowing megafauna community' habitat classification.

Submarine Structures Made by Leaking Gas

71. The Habitats Directive includes 'submarine structures made by leaking gases' as a protected habitat or feature on Annex I of the Directive. These structures, often observed as MDAC structures within pockmarks, have been well documented in the North Sea; with sediments and biological communities studied in some detail (Hovland & Judd, 1988). Submarine structures made by leaking gases are also listed as a PMF in Scottish waters (JNCC, 2012) under the Marine and Coastal Access Act 2009.

72. There was no evidence of MDAC or active fluid escape (e.g. gas bubbles, bacterial mats) observed at Transect 11745_ENV13 (located northeast of the centre of the Windfarm Site), which was designated to traverse a potential pockmark. There was no evidence of any increase in faunal density or notable shift in faunal community associated with the pockmarks/depressions. No evidence of the presence of the Annex I feature was recorded in previous surveys (i.e. CaleSurvey & BSL (2013), Fugro (2011b)). Surveys carried out at the Panda Bear site (Fugro, 2011a), adjacent and to the west of the Windfarm Site, identified no carbonate mounds or Annex I 'submarine structures made by leaking gas', although pockmarks were identified.

Annex I Reefs

73. The definition of what constitutes a reef is not prescriptive, particularly for *Sabellaria spinulosa* reefs. The presence of individual *S. spinulosa* or a stony environment does not necessarily constitute an area as potential Annex I habitat. No stony reef was identified during surveys. MSS recommend that all instances of Sabellaria reef are avoided (including low, medium and high-grade reef). As proposed by Gubbay (2007), the presence of *S. spinulosa* and it's 'reefiness' has been assessed based on its physical, biological and spatial properties. The reefiness is weighted according to the perceived importance of each feature (**Table 9.11**).

Table 9.11 Criteria for determining the 'reefiness' of Sabellaria reef (Gubbay, 2007)

Characteristic	Not a reef	Reefiness		
		Low	Medium	High
Elevation (cm) (average tube height)	<2	2 - 5	5 - 10	>10
Extent (m^2)	<25	25 – 10,000	10,000 – 1,000,000	>1,000,000
Patchiness (% cover)	<10	10 – 20	20 – 30	>30

[1] *MNCR Abundance Scales - S = Superabundant, A = Abundant, C = Common, F = Frequent, O = Occasional, R = Rare*

74. As noted in Pearce and Kimber (2020), and the NorthConnect EIA (NorthConnect, 2018) a survey was undertaken along the NorthConnect export cable corridor in 2016 and 2017, in support of the Marine Licence application for NorthConnect. During this survey, the habitat *Sabellaria spinulosa* with a bryozoan turf and barnacles on silty turbid circalittoral rock (A4.2211) was recorded at one transect approximately 5 km offshore from the proposed landfall point (south of Peterhead) (**Figure 9.9**,). This site aligns with the NorthConnect Parallel Export Cable Corridor option for the Project. The tube formations were densely aggregated and accounted for a coverage of approximated 70-100%, covering a total area of approximately 12,200 m^2 with rich surrounding epifauna. This area of densely aggregated *S. spinulosa* met the criteria of a medium graded reef and qualifies as a potential Annex I Reef. Due in part to this finding, the NorthConnect cable corridor site selection process was designed to avoid these potential Annex I Reef areas and, therefore, avoid potential impacts on these features. The Project site-specific surveys undertaken in 2021 and 2022 (Gardline 2021 and APEM 2022) were designed to incorporate repeats of some stations sampled by the NorthConnect (2018) surveys.

75. In 2021 (Gardline) small aggregations of weathered *S. spinulosa* tubes (**Figure 9.10**) were observed at Station 11746_ENV5. The aggregations were eroded and encrusted with faunal turf. However due to the degraded nature and scattered presence of the tubes occurring, and the small amount of this species recorded (imagery analysis the maximum coverage in a single image of *S. spinulosa* was <1%) no further analysis was carried out at this station.

76. Grab sampling and imagery in 2022 recorded a total of 164 *S. spinulosa* individuals (APEM, 2022). Stations SFS7, SFS5, SFS6, NCP4 and NCP5 all recorded *S. spinulosa* and were assigned to the biotope *Sabellaria spinulosa* on Stable Circalittoral Mixed Sediment (SS.SBR.PoR.SspiMx, EUNIS MC2211). Stations SFS5, SFS6, NCP4 and NCP5 were the closest fit to the definitions of the biotope, but the abundance of *S. spinulosa* was not high enough to be considered a reef. Station SFS7 also recorded *S. spinulosa* but numbers were again not abundant enough to be considered a reef.

77. The recordings of *S. spinulosa* in the 2021 and 2022 surveys were determined to not meet the criteria to qualify as reef habitat, and these locations were also determined not to qualify as reef forming in the 2016 and 2017 NorthConnect surveys.

Other Features

78. Other than those habitats and species listed above, there was no further evidence of any Annex I habitats, any other species or habitats selected as PMF (Marine and Coastal Access Act, 2009) in the Windfarm Site or the Buzzard Export Cable Corridor. No species listed on the Scottish Biodiversity List (2020), species or habitats on the OSPAR (2008) list of threatened and/or declining species nor any species on the IUCN Red List (2022). No other surveys carried out between 2005 and 2013 yielded any evidence of Annex I habitats or biological communities of conservation significance (Gardline, 2009; Fugro, 2011a; Fugro, 2011b; CaleSurvey & BSL, 2013) at the Windfarm Site.

9.6.2.2 EUNIS Classification

79. The EUNIS classification hierarchy to biotopes (level 5) were mainly based on geophysical, PSA, depth and seabed imagery. All habitats observed were related to EUNIS level 1 environment marine habitats (EUNIS habitat type code A) and level 2 broad habitat sublittoral sediment (EUNIS habitat type code A5), corresponding to sediment habitats in the sublittoral near shore zone extending up to 200 m depth. A summary of the results is provided in **Table 9.12**, **Figure 9.6** and **Figure 9.7.**

80. EUNIS level 3 habitat classification was determined based on geophysical data, seabed imagery interpretation of the seabed composition and the results of the PSA where available. All stations and transects were classified as EUNIS habitat type code A5.3 sublittoral mud. One EUNIS level 4 category also encompassed all stations within the Windfarm Site and three of the stations on the Landfall Export Cable Corridor to the 12 nm limit: EUNIS habitat type code A5.36, circalittoral fine mud. This category is described by the European Environment Agency (EEA) (2019), as habitats with sublittoral muds, occurring below moderate depths of 15-20 m. The sea pens *V. mirabilis* and *P.*

phosphorea are characteristic of this habitat type together with the burrowing anemone *C. lloydii* and the ophiuroid *Amphiura* spp. The relatively stable conditions often lead to the establishment of communities of burrowing megafaunal species, such as *N. norvegicus*.

81. All stations within the Windfarm Site and the two stations along the Buzzard Export Cable Corridor were classified to EUNIS level 5 habitat type code A5.361 'Seapens and Burrowing Megafauna in Circalittoral Fine Mud'. This category is described by the EEA (2020), as plains of fine mud that may be heavily bioturbated by burrowing megafauna, burrows and mounds may form a prominent feature of the sediment surface with conspicuous populations of sea pens, typically *V. mirabilis* and *P. phosphorea*. The burrowing fauna present typically include *N. norvegicus* and *C. lloydii*.

82. Within the Ettrick area of the Windfarm Site during surveys by Calesurvey and BSL (2013), the findings were consistent, with moderately bioturbated silty sand (offshore circalittoral sand biotope SS.SSa.OSa predominant habitat across the survey area, with frequently observed species including the sea pen *P. phosphorea* and polychaete tubes. Apart from these species, fauna was relatively sparse and included the following: hermit crabs, common starfish *Asterias rubens*, Norway lobster *N. norvegicus*, spider crab, slender sea pen *Vigularia mirabilis*, polychaete casts, hydroid clusters, and tusk shells. These species were only occasionally recorded.

83. Transects 11745_ENV 7, 11745_ENV8 and 11745_ENV9 within the Windfarm Site were selected to assess the abandoned anchor mooring piles. Where the seabed imagery traversed the mooring piles the substrate was classified to EUNIS level 4 habitat type code A6.12 deep-sea artificial hard substrata. However, the sediment classification for the seabed surrounding the anchor mooring piles remained consistent with the surrounding Windfarm Site assessment.

84. The two remaining stations were classified as level 4 EUNIS habitat type code A5.35, circalittoral sandy mud. This category is described by the EEA (2020), as habitats with typically over 20% silt/clay, occurring below moderate depths of 10m. Sea pens such as *V. mirabilis* and brittlestars such as *Amphiura spp*. are characteristic of this habitat.

85. Calesurvey and BSL (2013) also recorded a number of boulders across the survey site, thought to be isolated features or associated with large pockmarks or depressions. It was unclear from the survey images whether the boulders were anthropogenic in nature or drop stones from the last glacial period. Visual analysis was limited due to poor visibility, making it difficult to identify any species; however, it was clear that, due to the size of some of the boulders, this was a cause of seabed turbulence as scoured gravels and shell material was recorded surrounding the feature to a distance of several metres (it is important to note that no scour has been observed around the existing subsea oil and gas installations, indicating that these features have been generated over a very long period of time). A high density of hydroids was associated with this habitat. The biotopes associated with this area were classified as being more closely associated with offshore circalittoral mixed sediment biotope (SS.SMx.OMx) or a low energy circalittoral rock biotope (CR.LCR).

86. Overall, seabed sediments across the Windfarm Site and the Buzzard Export Cable Corridor comprised muddy sand to sand, with sediments along the Landfall Export Cable Corridor to the 12 nm limit becoming coarser with a small gravel component. Pockmarks, depressions and buried ploughmarks were present throughout the Windfarm Site with the exception of the bathymetric shoal in the northwest. Burrows were present in approximately half of the seabed photographs, with SACFOR densities reaching 'frequent' or more at all stations and transects. All stations and transects were classified to the EUNIS (European Environment Agency, 2019), level 5 biotope A5.361 (sea pens and burrowing megafauna in circalittoral fine mud), with the exception of Stations 11746_ENV4 and 11746_ENV5 which were classified to level 4 biotope A5.35 (circalittoral sandy mud).

87. These results are largely consistent with previous surveys carried out for the oil and gas industry, where in 2008 (Fugro) of the pipeline route between Ettrick and Blackbird within the Windfarm Site identified low to moderate faunal diversity from analysis of seabed video footage and stills

photography (Figure 9.5). In general, the Windfarm Site was mainly characterised as being low in diversity, with epifauna sparsely distributed comprising mainly of sea pens, hydroids, bryozoans, hermit crabs and *Nephrops* (Nexen, 2010).

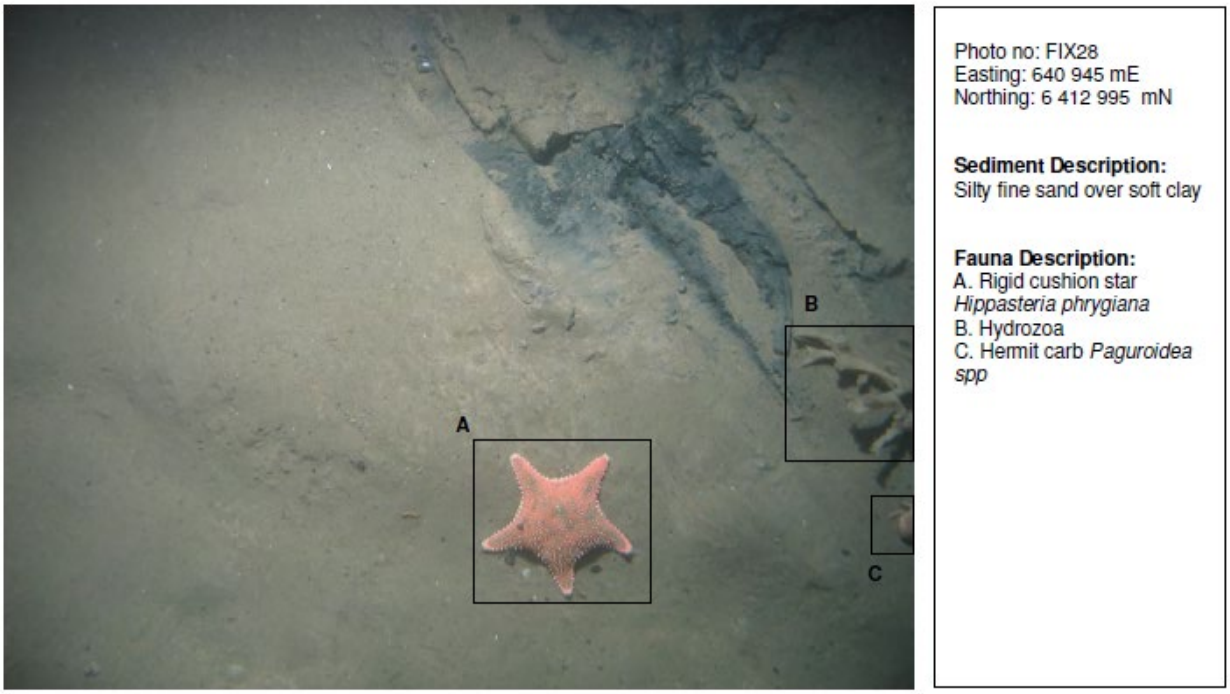


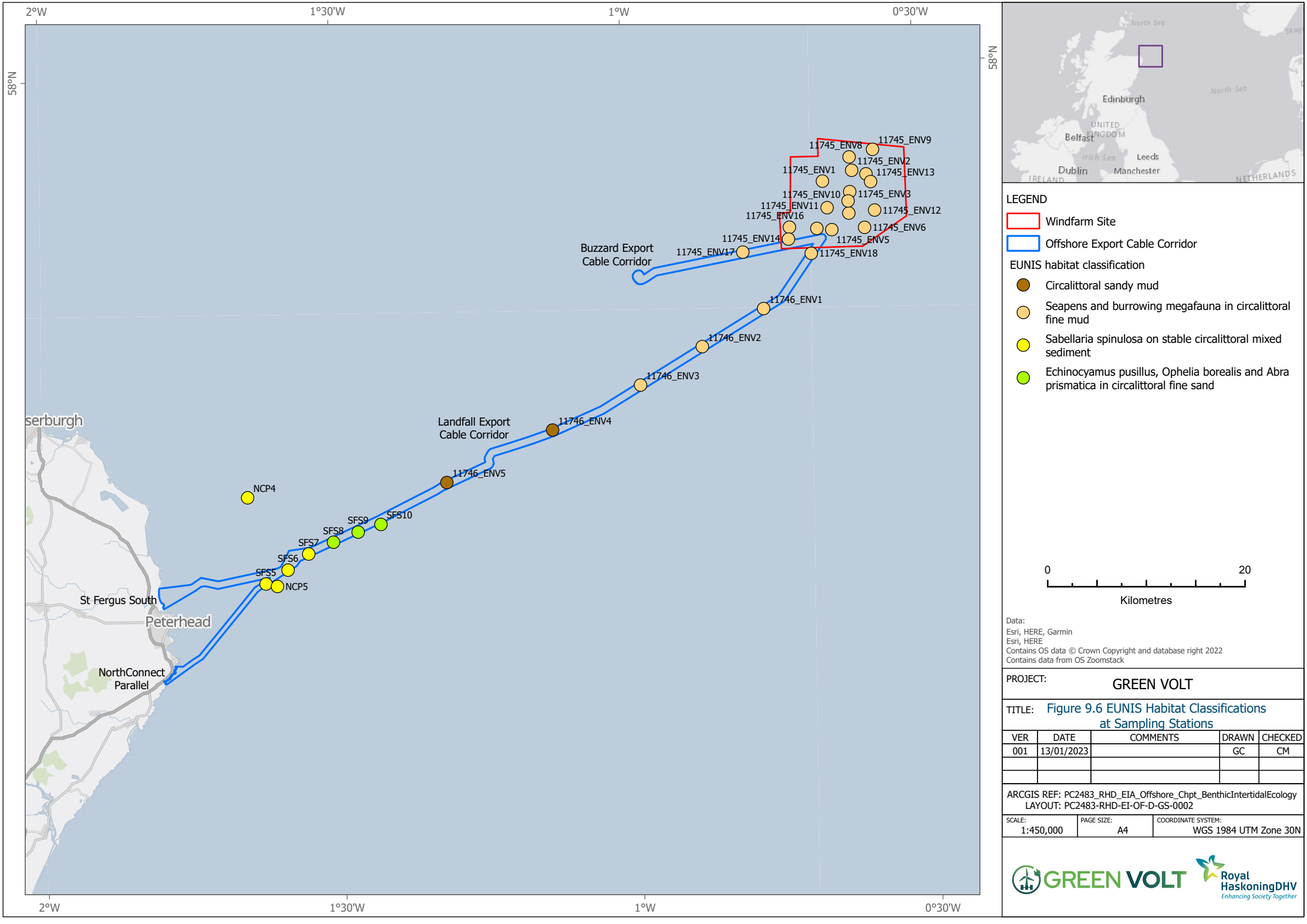
Figure 9.5 Photograph from the 2008 Fugro survey showing silty fine sediment and benthic species observed

Table 9.12 EUNIS Habitat Classification for the Windfarm Site and Buzzard Export Cable Corridor

Station	Easting	Northing	Observed Depth (m)	Modified Folk Classification[2] from PSA Analysis	EUNIS Habitat Classification Habitat Type	Code
11745_ENV1	638668	6419239	114	Mud and sandy mud	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	A5.361
11745_ENV2	641627	6420342	111	Mud and sandy mud	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	A5.361
11745_ENV3	641434	6418176	113	Sand and muddy sand	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	A5.361
11745_ENV4	641344	6416002	113	Mud and sandy mud	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	A5.361

[2] Sediment sampling was conducted at seven stations across the GVDA, two stations along the Green Volt to Buzzard export cable route and five stations along the export cable route to the 12 nm limit, with results in blue. Grey represents site where sediment sampling was not conducted.

Station	Easting	Northing	Observed Depth (m)	Modified Folk Classification[2] from PSA Analysis	EUNIS Habitat Classification Habitat Type	Code
11745_ENV5	639619	6414323	111	Mud and sandy mud	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	A5.361
11745_ENV6	642939	6414555	113	Mud and sandy mud	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	A5.361
11745_ENV7	643078	6419980	111		Seapens and Burrowing Megafauna in Circalittoral Fine Mud	A5.361
11745_ENV8	641367	6421694	111		Seapens and Burrowing Megafauna in Circalittoral Fine Mud	A5.361
11745_ENV9	643742	6422464	112		Seapens and Burrowing Megafauna in Circalittoral Fine Mud	A5.361
11745_ENV10	641267	6417235	114		Seapens and Burrowing Megafauna in Circalittoral Fine Mud	A5.361
11745_ENV11	639142	6416548	113		Seapens and Burrowing Megafauna in Circalittoral Fine Mud	A5.361
11745_ENV12	643958	6416312	116		Seapens and Burrowing Megafauna in Circalittoral Fine Mud	A5.361
11745_ENV13	643549	6419197	114		Seapens and Burrowing Megafauna in Circalittoral Fine Mud	A5.361
11745_ENV15	638101	6414447	111		Seapens and Burrowing Megafauna in Circalittoral Fine Mud	A5.361
11745_ENV16	635323	6414567	115	Mud and sandy mud	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	A5.361
11745_ENV14	635226	6413364	118	Mud and sandy mud	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	A5.361
11745_ENV17	630597	6412044	98	Sand and muddy sand	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	A5.361



Data:
Esri, HERE, Garmin
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PROJECT: GREEN VOLT

TITLE: Figure 9.6 EUNIS Habitat Classifications at Sampling Stations

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LAYOUT: PC2483-RHD-EI-OF-D-GS-0002

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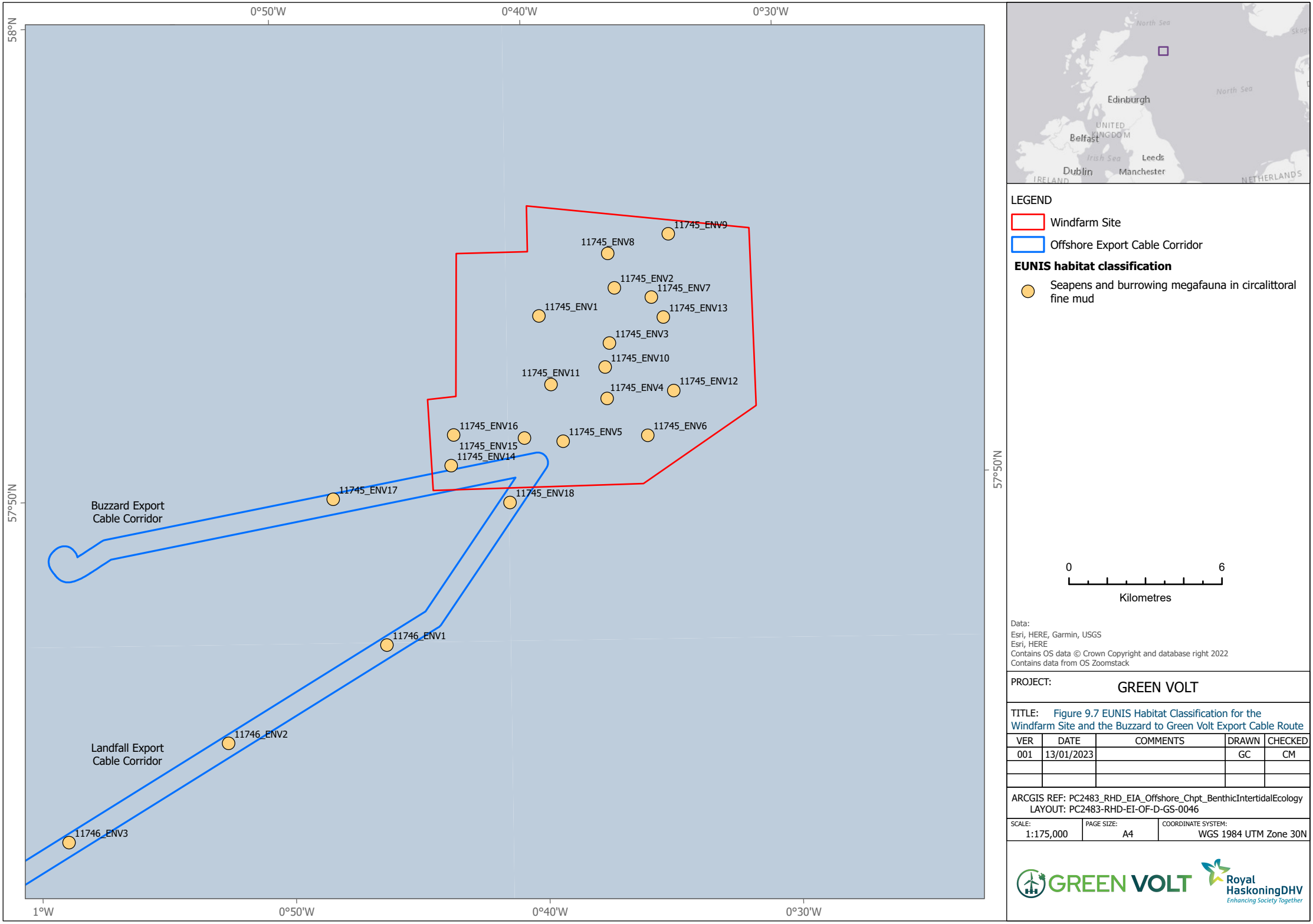

LEGEND

Windfarm Site

Offshore Export Cable Corridor

EUNIS habitat classification

Seapens and burrowing megafauna in circalittoral fine mud

0 6

Kilometres

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PROJECT: GREEN VOLT

TITLE: Figure 9.7 EUNIS Habitat Classification for the Windfarm Site and the Buzzard to Green Volt Export Cable Route

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9.6.2.3 Sediment Contamination

88. As discussed in **Chapter 8: Marine Sediment and Water Quality**, the Windfarm Site is located within the Blackbird and Ettrick Oil and Gas fields (i.e. on brownfield site), and specific contaminants and groups of contaminants have been analysed to identify the potential impact the activities in the area have had on the seabed sediments.

89. Overall, chemical analysis on sediment samples from the Blackbird location show values to generally be within typical background levels for the North Sea. However, the levels of barium, alkanes, mercury, iron, lead and zinc were found to be above background levels in the sample taken close to the PB1 well, these elevated levels being attributed to historical drilling contaminants (Genesis 2016).

90. The sediments data for the Ettrick area show that concentrations of the majority of the heavy metals are within published mean concentrations for the North Sea. The exceptions, barium, iron and lead, were moderately above these published values. THC and concentrations of n-alkanes and PAHs were considered to represent background levels for the North Sea (Genesis, 2016).

91. Data acquired from sediment sampling at the windfarm Site in 2021 concluded that the sediments contain concentrations of contaminants in line with background concentrations within the wider area.

92. There is no agreed legal or regulator position regarding the need to apply defined exclusion zones between decommissioned oil and gas assets and newly installed wind farm assets. It is likely this stems from the fact the principles applied to oil and gas decommissioning requirements places primacy on returning the seabed to its original state for future marine users.

93. It is also of note that considerable responsibility remains with the oil and gas operator after decommissioning with respect to any interaction with abandoned equipment left in-situ. Therefore, there should be provision to allow ongoing monitoring for potential for hazards to other users of the sea and to ensure there is recovery of the environment after decommissioning.

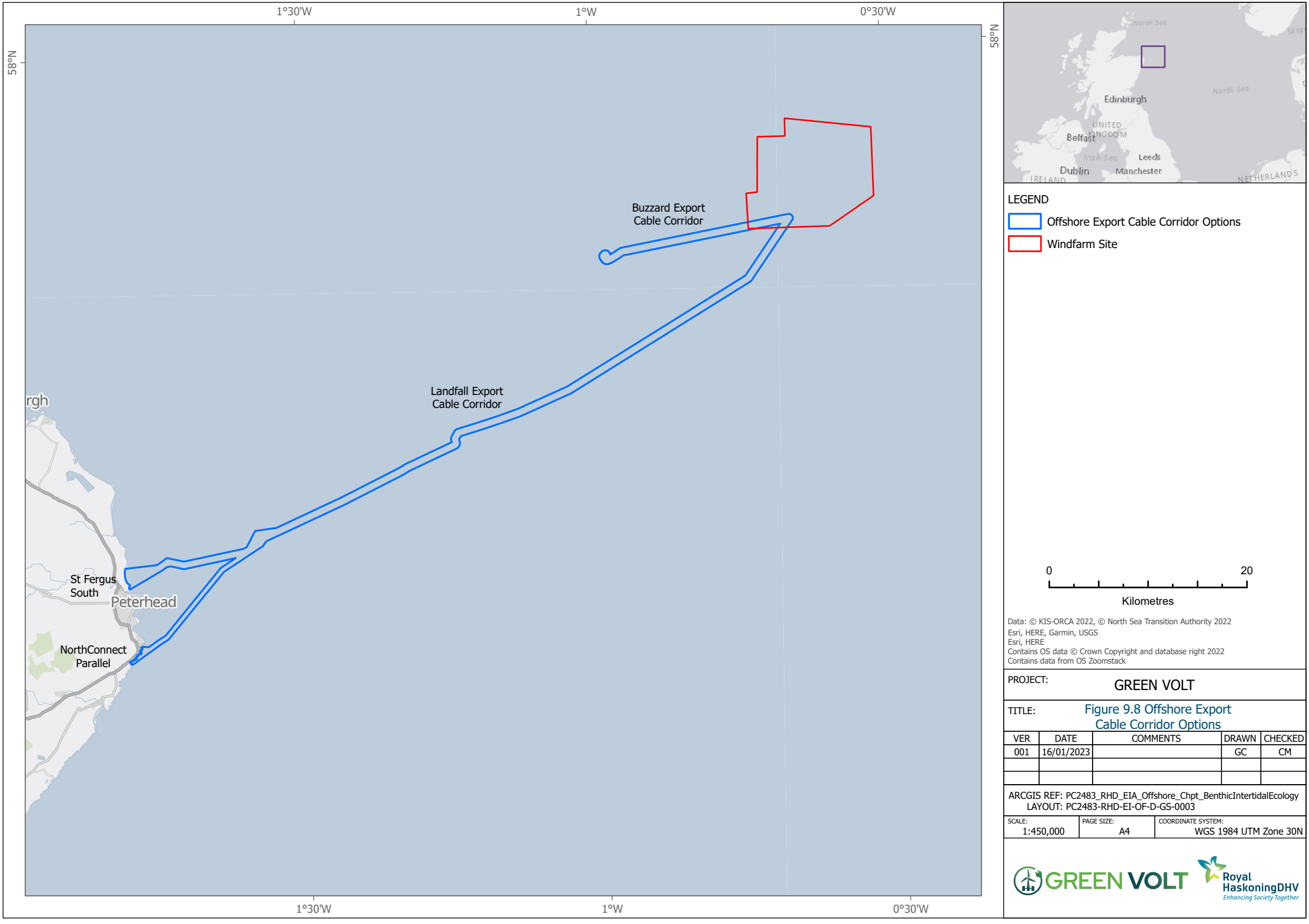
94. The array pattern and position applied will deliberately avoid placing turbines and substructures directly above pipelines and umbilicals remaining in-situ, and abandoned well-centres at the seabed. The final offsets applied will be determined by collaboration with the oil and gas operator via a structured risk assessment approach. Positioning of wind farm equipment on the seabed such as moorings and inter-array cables will also avoid interaction where possible, however, there is a strong likelihood that crossings will be necessary. Such crossings will be finalised with the input and agreement with the oil and gas operator since they will be legally responsible for the notification process and the ongoing liability associated with the decommissioned equipment affected by the crossing.

95. There are currently no plans for CNOOC to remove the drill arisings that are present across the site. They are considered small, and widely distributed as a thin veneer, and do not contain any oil-based mud (**Section 9.6.2**).

9.6.3 Export Cable Route from the Windfarm Site to the Landfall

96. As outlined in **Chapter 5: Project Description** there are two options for the landfall works. Approximately 12 km offshore from Peterhead, the export cable route splits into two options: NorthConnect Parallel Landfall south of Peterhead, and St Fergus South Landfall north of Peterhead. The two potential cable route options are shown in **Figure 9.8**.

97. Surveys on the Offshore Export Cable Corridor from the Windfarm Site to the 12 nm limit from shore were conducted in 2021 by Gardline. These surveys were conducted alongside those described in **Section 9.6.2.1** on the Windfarm Site and the Buzzard Export Cable Corridor. In 2022, surveys were conducted by Green Marine UK on the Offshore Export Cable Corridor from the 12 nm limit and shore. Results for both surveys are provided below and summarised in **Table 9.13**, **Figure 9.6** and **Figure 9.7**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Buzzard Export
Cable Corridor
Landfall Export
Cable Corridor
St Fergus
South
Peterhead
NorthConnect
Parallel
North Sea
Edinburgh
UNITED
KINGDOM
Belfast
Irish Sea
Leeds
Dublin
Manchester
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NETHERLANDS
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Offshore Export Cable Corridor Options
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Figure 9.8 Offshore Export Cable Corridor Options
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98. While the Windfarm Site found the seabed sediments to comprise silty sand with shell fragments, sediments became less silty towards the 12 nm limit (Gardline, 2021), with small, weathered aggregations of *S. spinulosa* present, although these aggregations did not meet the thresholds to be considered Annex I Reef habitat.

99. Surveys conducted along the Landfall Export Cable Corridor within 12 nm of shore (APEM, 2022) recorded taxa including:

- Green urchin *Echinocyamus pusillus*
- Polychaete worms *Glycera lapidum* (aggregate) and *Polycirrus spp*.
- Nematoda (thread worms
- Nemertea (ribbon worms)
- Honeycomb worm *Sabellaria spinulosa*
- Hyroid *Tamarisca tamarisca*
- Syllid worm *Trypanosyllis troll*
- Sipuncula *Nephasoma minutum*
- Bean horse-mussel *Modiolula phaseolina*.

100. The biota was rich and diverse in most samples, with species typical of similar habitats in other areas (APEM, 2022). There were large numbers of S. *spinulosa*. The hydroid *T. tamarisca* is listed as Nationally Scarce (Sanderson, 1996). Several other recorded taxa were poorly known or rarely recorded, including some that were recently described or may include undescribed species. Of these, the most interesting may be the syllid worm *T. troll* and an amphipod that may be *Metopa boeckii*, both previously recorded from Norwegian waters (Ramos *et al*., 2010; Tandberg, 2010) but are so far not formally reported from British waters. The worm *Goniadella gracilis* was recorded and is currently listed as non-native (Minchin *et al*., 2013) but there is limited evidence for this.

101. The PSA data shows that all of the samples consisted of predominantly sand, with varying proportions of gravel and low proportions of silt/clay. None of the concentrations of heavy metals cadmium, mercury and lead exceed the OSPAR threshold in the analysed samples. No values were recorded that exceed the OSPAR Effect Range Low (ERL) for any of the PAHs.

102. The sediment recorded during the NorthConnect (2018) surveys along the Landfall Export Cable Corridor varied between sand, mud and mixed sediments with some gravel and boulders. The majority of the Landfall Export Cable Corridor is a mixture of circalittoral fine sand, circalittoral muddy sand, deep circalittoral sand and circalittoral sandy mud.

103. The NorthConnect EIA Report (2018) also identified a number of pockmarks, corresponding to the more offshore part of the Landfall Export Cable Corridor and overlapping with the Windfarm Site. None of the pockmarks appeared to have carbonate structures on them; therefore, they do not qualify as the Annex I habitat of 'submarine structures made by leaking gas', and no evidence of these features was recorded during the 2021 and 2022 surveys (Gardline 2021 and APEM 2022).

9.6.3.1 Habitats and Species of Conservation Importance

'Sea Pen and Burrowing Megafauna Communities'

104. Analysis of the seabed imagery footage recorded in 2021 (Gardline) identified sediment burrows and sea pens present at all stations along the Landfall Export Cable Corridor from the Windfarm Site to the 12 nm from shore limit, and analysis of the communities determined that 'Sea Pen and Burrowing Megafauna Communities' habitat as defined by OSPAR (2010) were observed at three stations on the Offshore Export Cable Corridor, and two stations were defined as circalittoral sandy mud.

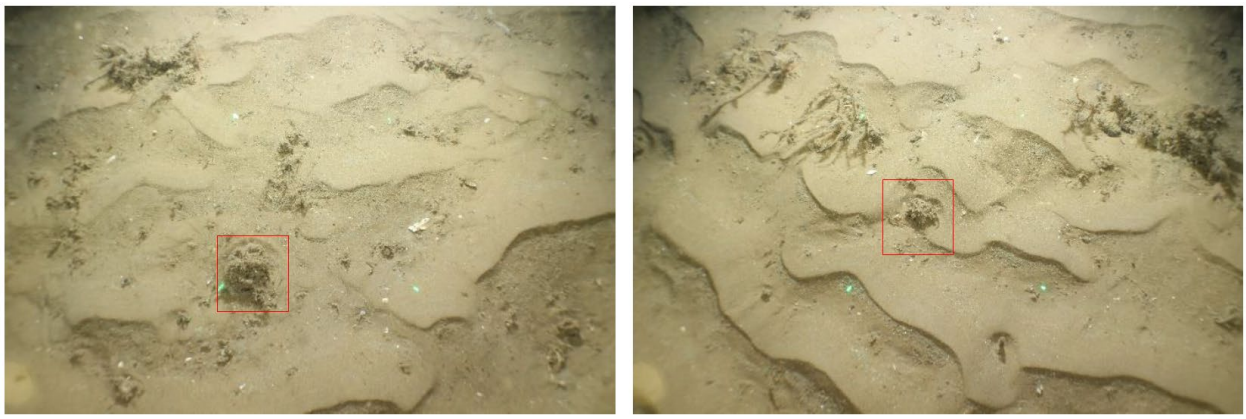
105. The JNCC (2014) clarification report states that to be considered a 'Sea Pen and Burrowing Megafauna Community' habitat, densities of burrows and/or mounds, together with sea pens if present should be classified as 'frequent' or above on the SACFOR scale. A detailed assessment of the seabed imagery on the densities of burrows and seapens was conducted. Where burrows were observed along the export cable route to the 12 nm limit burrow densities ranged from 0.3 burrows per m^2 at Station 11746_ENV4 and 11746_ENV5 to 2.4 burrows per m^2 at Station 11746_ENV1. Two stations along the proposed windfarm site export cable route to the 12 nm limit encompassed 'frequent', Station 11745_ENV18 and Station 11746_ENV1, which lie closest to the Windfarm Site and the results of this assessment and the PSA analysis are summarised for the Landfall Export Cable Route and are presented in **Table 9.13.**

S. spinulosa

106. The *S. spinulosa* features identified during the NorthConnect (2018) surveys (surveys undertaken in 2016 and 2017) were identified up to approximately 5 km offshore from their proposed landfall point (south of Peterhead) (**Figure 9.9**); which also corresponds to the proposed NorthConnect Parallel Export Cable Corridor. The tube formations were densely aggregated and accounted for a coverage of approximated 70-100%, covering a total area of approximately 12,200 m^2 with rich surrounding epifauna. This area of densely aggregated *S. spinulosa* met the criteria of a medium graded reef and qualifies as a potential Annex I Reef. Due in part to this finding, the NorthConnect cable corridor site selection process was designed to avoid these potential Annex I Reef areas and, therefore, avoid potential impacts on these features. The Project site-specific surveys undertaken in 2021 and 2022 (Gardline 2021 and APEM 2022) were designed to incorporate repeats of some stations sampled by the NorthConnect (2018) surveys.

Figure 9.9 Elevated Aggregations of S. spinulosa Tubes Along the NorthConnect (2018) Survey Transect, approximately 5 km Offshore from their Proposed Cable Landfall

107. In 2021 (Gardline) small aggregations of weathered *S. spinulosa* tubes (**Figure 9.10**) were observed at Station 11746_ENV5. The aggregations were eroded and encrusted with faunal turf. However due to the degraded nature and scattered presence of the tubes occurring, and the small amount of this species recorded (imagery analysis the maximum coverage in a single image of *S. spinulosa* was <1%) no further analysis was carried out at this station.



Station: 11746_ENV5 Fix: 12 Station: 11746_ENV5 Fix: 7

Figure 9.10 Examples of S. spinulosa presence

108. Grab sampling in 2022 recorded a total of 164 *S. spinulosa* individuals (APEM, 2022). Stations SFS7, SFS5, SFS6, NCP4 and NCP5 all recorded *S. spinulosa* and were assigned to the biotope *Sabellaria spinulosa* on Stable Circalittoral Mixed Sediment (SS.SBR.PoR.SspiMx, EUNIS MC2211). Stations SFS5, SFS6, NCP4 and NCP5 were the closest fit to the definitions of the biotope, but the abundance of *S. spinulosa* was not high enough to be considered a reef (the criteria threshold of 360 individuals per m^2). Station SFS7 also recorded *S. spinulosa* but numbers were again not high enough to be considered a reef, with 200 individuals per m^2.

109. The recordings of *S. spinulosa* in the 2021 and 2022 surveys were determined to not meet the criteria to qualify as reef habitat, and these locations were also determined not to qualify as reef forming in the NorthConnect surveys (NorthConnect, 2018). In 2016 and 2017 the aggregations which were recorded as potentially qualifying as a reef were identified up to 5 km offshore from the landfall point, and the NorthConnect corridor was modified to avoid these areas

9.6.3.2 EUNIS Classification

110. EUNIS level 3 habitat classification was determined based on geophysical data, seabed imagery interpretation of the seabed composition and the results of the PSA where available. Four stations on the export cable route to the 12 nm limit were classified to EUNIS level 5 habitat type code A5.361 'Seapens and Burrowing Megafauna in Circalittoral Fine Mud'. This category is described by the EEA (2020), as plains of fine mud that may be heavily bioturbated by burrowing megafauna, burrows and mounds may form a prominent feature of the sediment surface with conspicuous populations of sea pens, typically *V. mirabilis* and *P. phosphorea*. The burrowing fauna present typically include *N. norvegicus* and *C. lloydii*.

111. Stations 11746_ENV4 and 11746_ENV5 were classified as level 4 EUNIS habitat type code A5.35, circalittoral sandy mud. This category is described by the EEA (2020), as habitats with typically over 20% silt/clay, occurring below moderate depths of 10m. Sea pens such as *V. mirabilis* and brittlestars such as *Amphiura spp*. are characteristic of this habitat. Results are summarised in **Figure 8.7, Figure 9.6** and **Table 9.13**.

112. Stations SFS7, SFS5, SFS6, NCP4 and NCP5 were assigned to the biotope '*Sabellaria spinulosa* on Stable Circalittoral Mixed Sediment' (SS.SBR.PoR.SspiMx, EUNIS MC2211). Stations SFS5, SFS6, NCP4 and NCP5 were the closest fit to the definitions of the biotope. Station SFS7 represented an impoverished version, showing transitional qualities with the habitat complex Atlantic infralittoral coarse sediment (SS.SCS.ICS, EUNIS MB32), as well as with the '*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand', SS.SSa.CFiSa.EpusOborApri, EUNIS MC5211).

113. SFS8, SFS9 and SFS10 were all assigned to the biotope '*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand' (SS.SSa.CFiSa.EpusOborApri). This feature is component biotope of the offshore subtidal sands and gravels PMF. A summary of the results of this analysis and the PSA analysis is provided in **Table 9.13.**

114. The NorthConnect EIA Report (2018) also identified the following habitats (European University Information Systems organisation (EUNIS) classification; EEA, 2019):

- A3.1 - Atlantic and Mediterranean high energy infralittoral rock
- A4.2 - Atlantic and Mediterranean moderate energy circalittoral rock
- A5.13 - Infralittoral coarse sediment
- A5.14 - Circalittoral coarse sediment
- A5.15 - Deep circalittoral coarse sediment
- A5.25 - Circalittoral fine sand
- A5.26 -Circalittoral muddy sand
- A5.27 - Deep circalittoral sand
- A5.35 - Circalittoral sandy mud
- A5.36/ A5.361 - Circalittoral fine mud/ Sea pens and burrowing megafauna in circalittoral fine mud
- A5.376 - *Paramphinome jeffreysii*, *Thyasira spp*. and *Amphiura filiformis* in offshore circalittoral sandy mud
- A5.44 - Circalittoral mixed sediment
- A5.45 - Deep circalittoral mixed sediments.

115. The following habitat types that correspond to the location of the proposed Landfall Export Cable Corridor leading to the NorthConnect Parallel Export Cable Corridor were also present, although the NorthConnect consenting corridor was designed to exclude them due to their conservation value:

- A4.2211 – '*S. spinulosa* with a Bryozoan Turf and Barnacles on Silty Turbid Circalittoral Rock'.
- A4.213 – '*Urticina felina* and Sand-Tolerant Fauna on Sand-Scoured or Covered Circalittoral Rock' (potential to support the Annex I habitat of bedrock reef or stony reef).
- A5.251 – '*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand' (Priority Marine Feature (PMF)).
- A5.611 – '*S. spinulosa* on Stable Circalittoral Mixed Sediment' (although at the time of survey this was not classed as a reef).

116. The biotopes recorded in the 2021 and 2022 surveys are consistent with the NorthConnect surveys (undertaken in 2016 and 2017), with '*E. pusillus*, *O. borealis* and *A. prismatica* in Circalittoral Fine Sand', '*S. spinulosa* on Stable Circalittoral Mixed Sediment' and 'Sea Pens and Burrowing Megafauna in Circalittoral Fine Mud' recorded along the corridor.

Table 9.13 EUNIS Habitat Classification for the 2021/2022 surveys of the cable corridor from the Windfarm site to Landfall

Station	Easting	Northing	Observed Depth (m)	Modified Folk Classification[3] from PSA Analysis	EUNIS Habitat Classification Habitat Type	Code
11745_ENV18	637534	6411918	115	Mud and sandy mud	Seapens and Burrowing Megafauna in Circalittoral Fine Mud'	SS.SMu.CFiMu.SpnMeg A5.361
11746_ENV1	632705	6406322	121	Mud and sandy mud	Seapens and Burrowing Megafauna in Circalittoral Fine Mud'	SS.SMu.CFiMu.SpnMeg A5.361
11746_ENV2	626493	6402465	110	Mud and sandy mud	Seapens and Burrowing Megafauna in Circalittoral Fine Mud'	SS.SMu.CFiMu.SpnMeg A5.361
11746_ENV3	620234	6398569	98	Mud and sandy mud	Seapens and Burrowing Megafauna in Circalittoral Fine Mud'	SS.SMu.CFiMu.SpnMeg A5.361
11746_ENV4	611323	6394005	82	Sand and muddy sand	Circalittoral sandy mud	SS.SMu.CSaMu A5.35
11746_ENV5	600603	6388686	94	Sand and muddy sand	Circalittoral sandy mud	SS.SMu.CSaMu A5.35
SFS5	422523	850115	64 m - 89 m	Sandy Gravel	*Sabellaria spinulosa* on Stable Circalittoral Mixed Sediment	(SS.SBR.PoR.SspiMx, EUNIS MC2211).
SFS6	424670	851463	64 m - 89 m	Sandy Gravel	*Sabellaria spinulosa* on Stable Circalittoral Mixed Sediment	(SS.SBR.PoR.SspiMx, EUNIS MC2211).
SFS7	426786	853066	64 m - 89 m	Gravelly Sand	*Sabellaria spinulosa* on Stable Circalittoral Mixed Sediment	SS.SBR.PoR.SspiMx, EUNIS MC2211
SFS8	429314	854220	64 m - 89 m	Sandy Gravel	*Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand	SS.SSa.CFiSa.EpusOborApri, EUNIS MC5211
SFS9	431830	431830	64 m - 89 m	Gravelly Sand	*Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand	SS.SSa.CFiSa.EpusOborApri, EUNIS MC5211

[3] Sediment sampling was conducted at five stations along the export cable route to the 12 nm limit, with results in blue.

Station	Easting	Northing	Observed Depth (m)	Modified Folk Classification[3] from PSA Analysis	EUNIS Habitat Classification Habitat Type	Code
SFS10	434149	855957	64 m - 89 m	Gravelly Sand	*Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand	SS.SSa.CFiSa.EpusOborApri, EUNIS MC5211
NCP4	420754	858872	64 m - 89 m	Sandy Gravel	*Sabellaria spinulosa* on Stable Circalittoral Mixed Sediment	(SS.SBR.PoR.SspiMx, EUNIS MC2211).
NCP5	423607	849834	64 m - 89 m	Gravelly Sand	*Sabellaria spinulosa* on Stable Circalittoral Mixed Sediment	(SS.SBR.PoR.SspiMx, EUNIS MC2211).

9.6.3.3 Sediment Contamination

117. The NorthConnect project sampled sediments for chemical analysis at 17 locations along the NorthConnect corridor's length. Overall, the chemical analysis of grab samples conducted during the NorthConnect surveys found that contamination levels were very low.

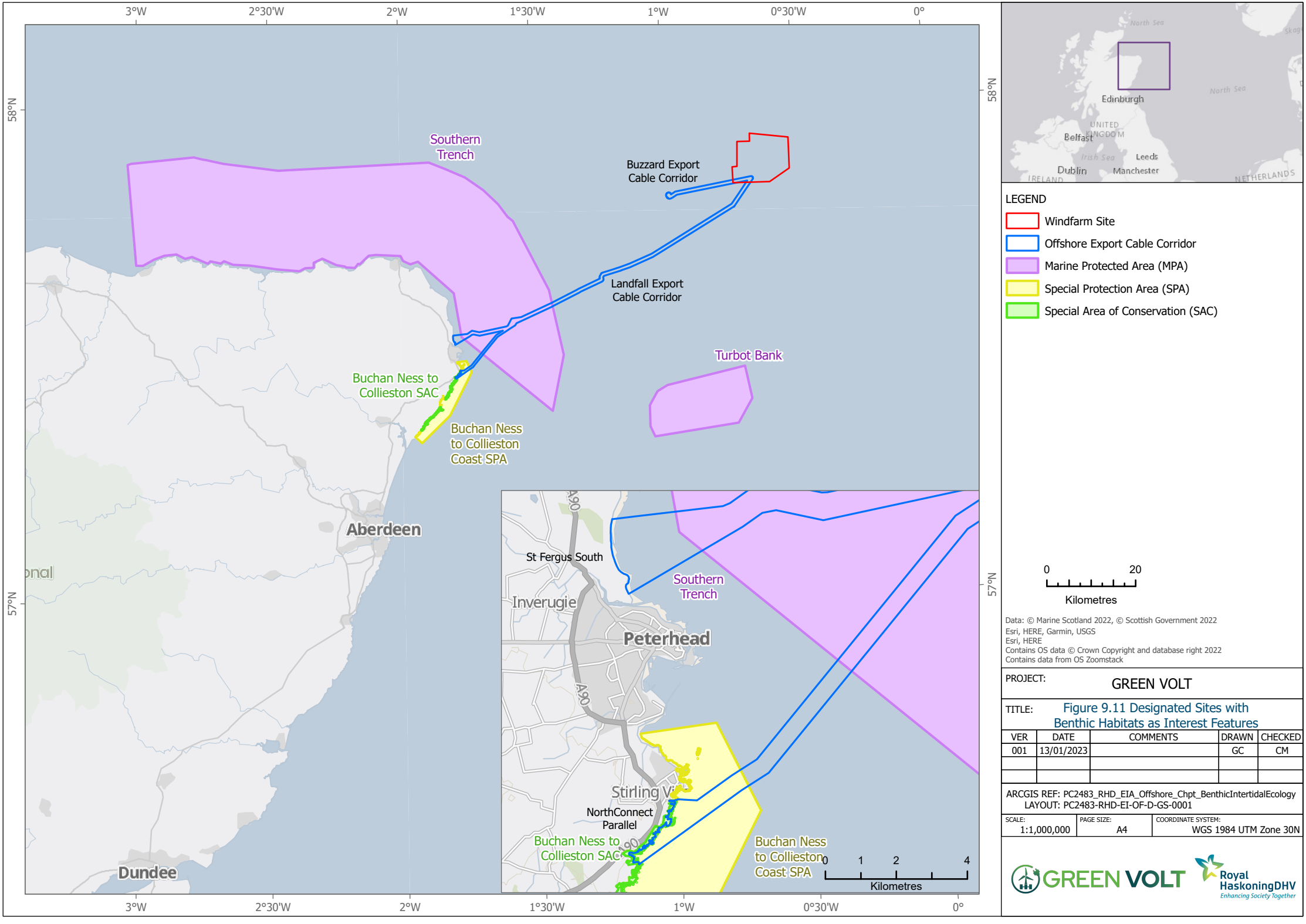
118. Further data was collected in 2022 by Green Marine UK (APEM, 2022) for the section of the Landfall Export Cable Corridor leading to the St Fergus South Landfall. Here too contamination levels were considered to be very low. Full description of sediment quality is presented in **Chapter 8: Marine Sediment and Water Quality.**

9.6.4 Designated Sites

119. European sites designated under the Habitats Regulations are Buchan Ness to Collieston SAC for benthic habitats, and Buchan Ness to Collieston Coast SPA for birds. Information on qualifying interest features for which the SAC is designated, along with the supporting habitats for which the SPA and SAC is designated are reviewed as part of the HRA screening and assessment.

120. Qualifying features for both the SAC and SPA are predominantly located on land or in the intertidal zone. As such, the Applicant has committed to using HDD to mitigate the impacts on these features. HDD is a trenchless technology widely used in cable landing applications offering several benefits compared to the traditional open-cut method. It's use and technology is discussed further in **Chapter 5: Project Description.**

121. As the Applicant has committed to using HDD and will follow best practice guidelines, no impact pathways have been identified to the Buchan Ness to Collieston SAC, and Buchan Ness to Collieston Coast SPA, and these are screened out of further assessment. **Figure 9.11** shows the location of the SAC and SPA in relation to the Project.



PROJECT: GREEN VOLT

TITLE: Figure 9.11 Designated Sites with Benthic Habitats as Interest Features

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Southern Trench Marine Protected Area (MPA)

122. The Southern Trench MPA is located on the east coast of Scotland in the outer Moray Firth and is designated to protect marine mammals (minke whales), burrowed mud, fronts and shelf deeps. The Offshore Export Cable Corridor passes through the MPA (see **Figure 9.11**)

123. The Southern Trench MPA is a 58 km long, 9 km wide, and 250 m deep trench that runs parallel to the coastline. The MPA features a dynamic mixing zone of warm and cold waters that attracts shoals of herring, mackerel and cod to the area, with the soft sands providing abundant habitat for sandeels. These, in turn, provide food for migratory mammals, such as minke whales, to the area (NatureScot, 2020). **Figure 9.12** provides the location of the Southern Trench MPA and the distribution of its protected features.

124. The seabed burrowed mud habitat (SS.Smu.CFiMu.SpnMeg) present in the MPA is characterised by the presence of Norway lobster, crabs, seapens, and anemones.

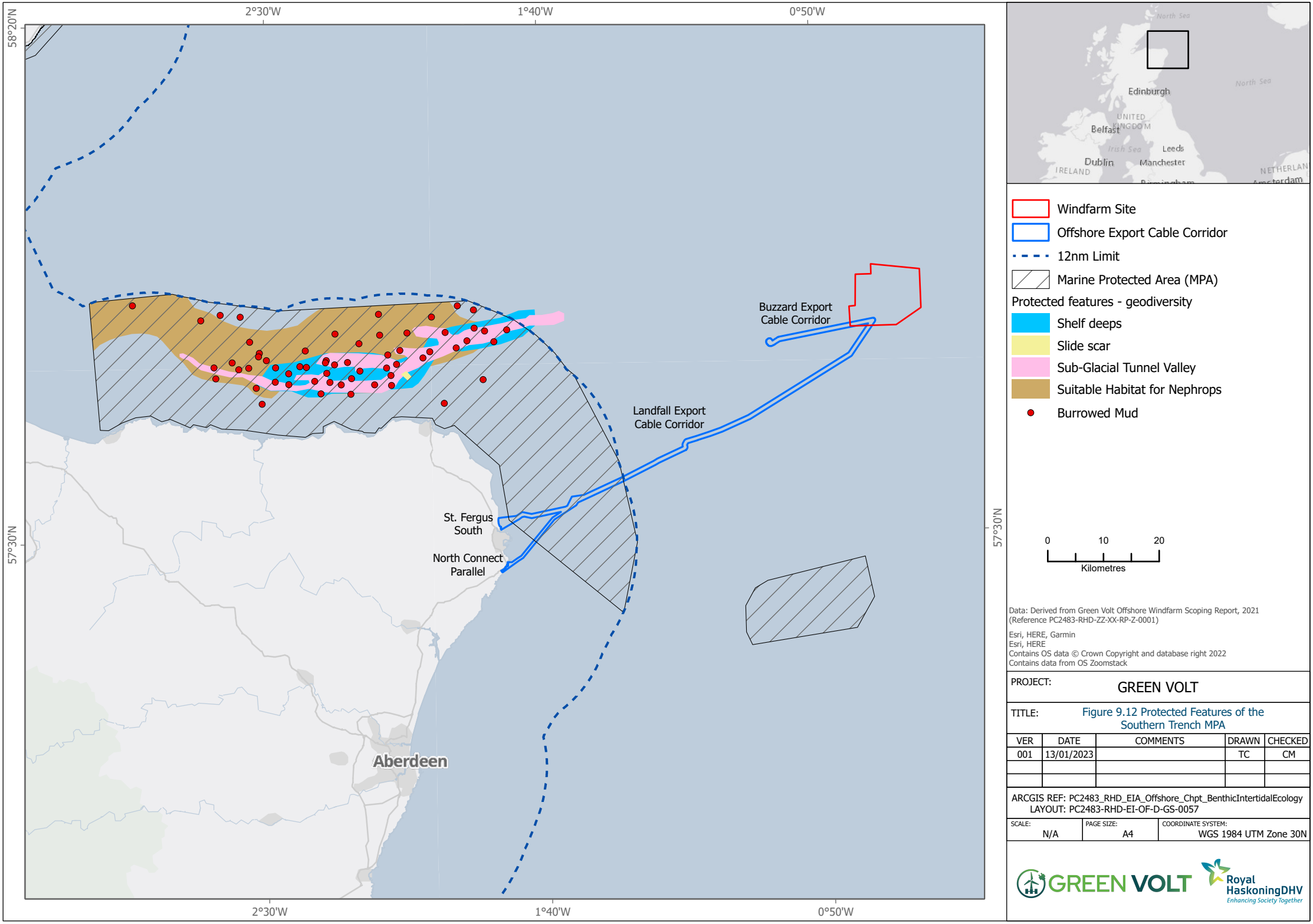
125. The burrowed mud feature is in favourable condition but is listed as 'Threatened and/or Declining' under OSPAR (2008). Burrowed mud habitats are highly sensitive to physical disturbance, including abrasion/removal of seabed, as well as disturbances leading to water flow, wave exposure, and siltation alterations. The burrowing megafauna characteristic of burrowed mud communities are important bioturbators of the sediment they inhabit. This activity creates a three-dimensional structure of burrows which increases the structural complexity and depth of oxygen penetration into the sediments. This enhances the survival of smaller species which can live in the burrows and increases biodiversity in what would otherwise be a generally low diversity habitat (NatureScot, 2020).

126. The conservation objectives of the site are to conserve the extent and functions of the habitat, including to: "Conserve the diversity, abundance and distribution of typical species associated within the burrowed mud (including *N. norvegicus*, *P. phosphorea*, *V. mirabilis*, *Goneplax rhomboides, Munida sp., Calocaris macandreae, Callianassa subterranea*)."

Turbot Bank Nature Conservation Marine Protected Area

127. Turbot Bank MPA is located off the east coast of Scotland, approximately 40 km to the southwest of the Windfarm Site, and 25 km to the south of the Landfall Export Cable Corridor (see **Figure 9.12**). It is important for sandeels, which live buried in sand habitats for months at a time. High numbers of sandeels have been recorded from within the Turbot Bank MPA, and they provide an important food source for larger fish, seabirds and marine mammals. The total site area is 251 km^2.

128. Due to the distance from the Windfarm Site and due to the sedentary and demersal nature of sandeels it is highly unlikely that there will be secondary impacts from construction activities to the MPA, as effects on sandeels from disturbance of sediment will not occur at the distance from the site. Furthermore, sandeels are classed as Group 1 hearing specialists, the least noise-sensitive group of fish species. The underwater noise modelling undertaken as part of this EIA (**Appendix 9.1** of this document, Seiche, 2022) assessed sandeel as having a hearing sensitivity of up to 4.5 km before observing a behavioural impact. Therefore, Turbot Bank has been scoped out of further assessment in the **Offshore Scoping Report** (**Appendix 1.2**) and is not considered further in this report.



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TITLE: Figure 9.12 Protected Features of the Southern Trench MPA

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9.6.5 Future Baseline

129. Whilst benthic environments typically face some degree of change over time, the habitats observed during the recent surveys match those observed during historical surveys. This indicates a relatively stable benthic habitat environment. The benthic ecology environment in the Windfarm Site and the surrounding sites have been surveyed over a series of years, from 2010 to 2021, with the Fugro surveys in 2011 recording the circalittoral muddy sand biotope present throughout the site. The 2014 surveys recorded offshore circalittoral sand biotope, with the sea pen *P. phosphorea* and polychaete tubes recorded frequently. 2021 surveys in the Windfarm Site recorded circalittoral sandy mud and Seapens and Burrowing Megafauna in Circalittoral Fine Mud'. The NorthConnect surveys in 2016 and 2017 (NorthConnect, 2018) adjacent to the Landfall Export Cable Corridor identified A5.251 – '*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand' and '*S. spinulosa* on Stable Circalittoral Mixed Sediment', and these habitats were again identified on the 2022 surveys on the Landfall Export Cable Corridor.

130. Changes in the benthic environment over the lifespan of the Project may result from the physical processes which exist within the North Sea (**Chapter 7: Marine Geology, Oceanography and Physical Processes**), as well as warming sea temperatures as a result of climate change. Warming sea temperatures can result in large scale ecosystem changes. Migration of benthic species from the south to the north likely to occur, altering the benthic community structure (Brierley, & Kingsford, 2009). Alterations to sediment as result of changes to the ocean currents may lead to changes in the distribution of features of conservation importance such as *S. spinulosa* reefs. The timescale over which any discernible change in benthic community may occur as a result of increasing sea temperatures and hydrodynamic changes is largely unknown.

131. It is likely that the species composition present during decommissioning will alter from the baseline, and whilst removal of the infrastructure may result in a return to baseline levels for some aspects of the benthic environment, an assessment on the impacts from decommissioning on the species and biotopes present is likely to be required.

9.7 Potential Impacts

132. The Project received a **Scoping Opinion** from Marine Scotland Licensing and Operations Team (MS-LOT) in April 2022 (MS-LOT, 2022) (**Appendix 1.1**). **Table 9.14** presents the impacts that were proposed to be scoped out in the **Offshore Scoping Report** (**Appendix 1.2**) and the impacts that the **Scoping Opinion** require to be scoped in for the **Offshore EIA Report**.

Table 9.14 Potential impacts scoped in or out of the EIA for benthic ecology

Potential Impact	Construction		O&M		Decommissioning	
	Scoping Report	Scoping Opinion	Scoping Report	Scoping Opinion	Scoping Report	Scoping Opinion
Physical disturbance and temporary loss of seabed habitat	✓	✓	x	x	✓	✓
Physical disturbance and temporary habitat loss of intertidal habitat[4]	✓	✓	x	x	✓	✓

[4] *At the time of drafting the Scoping Report it was not confirmed whether HDD could be utilised at the landfall options. Subsequent to the submission of the Scoping Report and receipt of the Scoping Opinion, HDD has been confirmed as a viable option at both landfall sites. As detailed in the Scoping Report, the impact "Physical disturbance and temporary habitat loss of intertidal habitat" can be scoped out in the event HDD is confirmed.*

Potential Impact	Construction		O&M		Decommissioning	
	Scoping Report	Scoping Opinion	Scoping Report	Scoping Opinion	Scoping Report	Scoping Opinion
Permanent habitat loss and introduction of hard substrate	x	x	✓	✓	x	x
Increased suspended sediments and sediment re-deposition	✓	✓	x	x	✓	✓
Re-mobilisation of contaminated sediment during intrusive works	✓	✓	x	x	✓	✓
Impacts of scour on benthic communities arising from mooring chains and anchors	NA	x	NA	✓	NA	x
Potential introduction of MINNS	NA	✓	NA	✓	NA	✓
Impacts of open trenching for cable at the landfall site (if HDD is not possible)	NA	NA – HDD to be utilised	NA	x	NA	x
Potential impacts on the Southern Trench MPA	✓	✓	x	x	✓	✓
Potential impacts on Turbot Bank MPA	x	x	x	x	x	x
Potential impacts on Buchan Ness to Collieston Coast SAC (and SPA habitats)	x	x	x	x	x	x
Accidental spills and pollution events	x	x	x	x	x	x
Cumulative effects	✓	✓	✓	✓	✓	✓
Transboundary effects	x	x	x	x	x	x

133. The potential impacts from the Project during the construction, operation, and decommissioning phases are outlined below.

134. In addition, the potential for cumulative impacts, as well as inter-relationships and interactions between impacts for the Offshore Development Area will also be determined and assessed.

135. A summary of the potential impacts assessed is provided in **Table 9.15.**

Table 9.15 Potential impact pathways on benthic ecology receptors

Green Volt Project Phase	Potential Impact Pathways
Construction	• Physical disturbance and temporary habitat loss of seabed habitat; • Increased suspended sediments and sediment re-deposition; • Re-mobilisation of contaminated sediment during intrusive works; • Potential impacts on the Southern Trench MPA; and • Potential introduction of MINNS.
O&M	• Permanent habitat loss and introduction of hard substrate; • Impacts of scour on benthic communities arising from the mooring chains and anchors; • EMF; and • Potential introduction of MINNS.
Decommissioning	• Physical disturbance and temporary habitat loss of seabed habitat; • Increased suspended sediments and sediment re-deposition; • Re-mobilisation of contaminated sediment during intrusive works; • Potential impacts on the Southern Trench MPA; and • Potential introduction of MINNS.

136. During decommissioning the potential impacts are anticipated to be similar to those for the construction phase, depending on the methods used. Potential impacts from decommissioning are considered to be less than the worst case impacts for construction as no seabed preparation will be required, and removal of infrastructure will cause a minimal amount of material to be resuspended into the water column.

137. A decommissioning programme will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Scottish Ministers prior to implementation.

9.7.1 Embedded Mitigation

138. Embedded mitigation is proposed to reduce the impacts on benthic ecology. These measures are considered standard industry practice for this type of development and are considered within the assessment in **Section 9.7**. A summary of the embedded mitigation proposed is provided below.

- Infrastructure will not be situated in pockmarks (where there is the potential for submarine structures from leaking gases (also known as MDAC)) due to the risk of shallow gas.
- '*S. spinulosa* and *Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand' PMF are recorded during surveys along the export cable corridor between the windfarm site and the landfall, and cable routing will be microsited to avoid impacts on these features.
- A **CaP** will be developed to set out the installation programme, methods, cable technical specifications, cable burial risk assessment, and management measures for EMF attenuation, for both the export cables and inter-array cables. It will also include any mitigation measures for environmental and navigational issues. The avoidance of sensitive benthic habitats/species and species/habitats of conservation importance will be a key consideration in the detailed design of the final cable routes.
- Cables will be buried, where possible, for both the inter-array and export cables. This strategy aims to reduce the need for additional cable protection, and therefore as the amount of hard substrate required. Should any sections of the marine cable require additional protection following combined lay/burial operation, then this will be provided by post lay jet burial (if possible), engineered, localised rock placement or concrete mattressing. Sections of cable may also be fitted with additional cast iron or synthetic external cladding to provide localised protection in certain areas. Cable protection will be monitored as per cable suppliers' recommendations, and in agreement with power purchase customers.

- A separate **Construction Environmental Management Plan** (CEMP) will be developed prior to construction.
- A **Marine Pollution Contingency Plan** in the CEMP will set out the management measures to be implemented during construction, operation and decommissioning to mitigate the risks of accidental spills of hazardous materials, measures to prevent spills, as well as remedial actions and response measures to be used in the event of a spill or collision. It will also detail measures for refuelling at sea.
- **Biosecurity plans** will be in place including adhering to best practice guidelines for activities such as bilge pumping and use of antifouling. Training on MINNS will be provided to contractors conducting operation and maintenance tasks so that common MINNS can be recognised, and steps to take if such species are observed on moorings to prevent further spread. Should MINNS be identified as part of the offshore Project activities, a management and monitoring plan will be developed to measure the impact of any steps taken to prevent further spread and to reduce MINNS presence.
- The array pattern and position applied will deliberately avoid placing turbines and substructures directly above pipelines and umbilicals remaining in-situ, and abandoned well-centres at the seabed. The final offsets applied will be determined by collaboration with the oil and gas operator via a structured risk assessment approach. Positioning of wind farm equipment on the seabed such as moorings and inter-array cables will also avoid interaction where possible, however, there is a strong likelihood that crossings will be necessary. Such crossings will be finalised with the input and agreement with the oil and gas operator since they will be legally responsible for the notification process and the ongoing liability associated with the decommissioned equipment affected by the crossing.

9.7.2 Worst Case

139. The worst case scenarios with regard to benthic ecology are presented by impact in **Table 9.16**. These values represent the greatest potential for direct impacts on benthic ecology and relate to the largest possible footprint of interaction with the seabed.

140. Detailed UXO and geophysical surveys will be completed prior to construction. There is the potential for physical disturbance of the seabed, a temporary increase in suspended sediment concentrations and a temporary deterioration in water quality due to re-suspension of sediment bound contaminants during both of these activities. The exact type, size and number of possible detonations and duration of UXO clearance operations and the exact number and locations of geophysical survey stations are not known at this stage but the effects on sensitive receptors are considered smaller than for other construction activities, which are assessed below.

141. Details of the Project activities and key Project components is provided in **Chapter 5: Project Description**. As this assessment is using the Design Envelope approach, worst case scenarios for various project options are presented.

Table 9.16 Worst Case Assumptions for Benthic Ecology

Impact	Parameter	Notes
Construction		
Impact C1: Physical disturbance and temporary habitat loss of seabed habitat	If 35 catenary turbines are used the maximum area of physical disturbance and temporary habitat loss of seabed habitat has been quantified based on the following: • The area of active benthic footprint for anchoring systems for catenary turbines is 1,1,34 m^2 per turbine, total area 39,690 m^2. • Cable footprint on seabed: 500 m^2 per cable with two cables per turbine. For 35 turbines this total area is 35,000 m^2.	The worst case scenario for both catenary and TLP turbines is presented. This represents the maximum amount of habitat loss of seabed habitat associated with each option. The OSP jacket substructure options include a 4-legged jacket secured to the seabed by either pile driving a single pile or a single suction pile at each leg. In most places, burial of the inter-array cables will be less than the 1.5 m

Impact	Parameter	Notes
	• Chain anchor scour protection is not required for catenary. • Total area potentially affected by disturbance is approximately 44,250 m^2. For the offshore substation platform (OSP): • Total area of disturbance for OSP foundations = 0.00724 km^2 (based on worst case for suction bucket foundation including scour protection) For the export and interconnector cables: • Total length of cable = 300 km • Maximum depth of burial = 1.5 m • Maximum width of disturbance = 10m (jetting/ploughing) • Total maximum volume of sediment disturbed = 4,500,000 m^3 • Max pre-sweep volume = 35,000 m^3 Total maximum volume of sediment disturbed = 4,535,000 m^3 Burial will be assumed to be via natural infill rather than backfill rock placement as a worst-case for habitat recovery times. Anchoring of vessels will also cause disturbance of the benthic habitat during construction,	maximum and 0.6 m minimum depth. Width of disturbance could also be as low as 3 m depending on installation technique used. Vessels present may include dynamic position heavy lift vessels, tugs/anchor handling vessels, cable installation vessels, support, supply and accommodation vessels.
Impact C2: Increased suspended sediments and sediment re-deposition	For the Windfarm Site: • 35 catenary moored turbines using 6 drag embedment anchors per turbine with a drag length of 50 m each + OSS = 1.42 km^2 seabed disturbance. For the export cable corridors: • 2 offshore export cables and 2 Buzzard cables. Total landfall cable length is 240 km, total Buzzard cable length is 60 km. Total area of disturbance from cable burial is based on a 10m wide disturbance corridor from jet trench burial, and is equal to 3 km^2	The estimates of sediment disturbance are based on the greatest number of turbines and maximum amount of disturbance.
Impact C3: Potential re-mobilisation of contaminated sediment during intrusive works	See Impact C2 - Contaminant resuspension relates to predicted sediment disturbance.	The width of disturbance for installation of cabling is variable depending upon the installation technique. Details of contaminants identified during surveys is provided in **Section 9.6.1.2** and **Chapter 8: Marine Sediment and Water Quality**

Impact	Parameter	Notes
Impact C4: Potential impacts on the Southern Trench MPA	The area of the Southern Trench MPA crossed by the Landfall Export Cable Corridor is approximately 18.4 km^2 for the option that leads to the St Fergus South Landfall and 14.3 km^2 for the option that leads to the NorthConnect Parallel Landfall.	This is the maximum area of the Landfall Export Cable Corridor passing through the MPA. Cable burial and rock placement or concrete mattressing requirements will be assessed following the completion of side scan and sub bottom profiling surveys.
Impact C5: Potential introduction of MINNS	The number of construction vessels required is not yet known.	The greatest risk of introduction of MNNS is through ballast water and biofouling from various vessels required during operation and maintenance (O&M), and the 'stepping-stone effect' of newly introduced hard structures.
Operation		
Impact O1: Permanent habitat loss and introduction of hard substrate	An area total of 0.08 km^2 of rock protection for non-buried cables is assumed and a total of 0.033 km^2 of rock protection for cable and pipeline crossings, giving a total worst case area of permanent habitat loss and hard substrate addition due to rock placement of 0.113 km^2.	The areas represent the hard substrate introduced for the greatest number of Wind Turbine Generators (WTGs).
Impact O2: Impacts of scour on benthic communities arising from the mooring chains and anchors	35 catenary turbines: • Catenary drag footprint - seabed swept zone (catenary radius or diameter of the anchor chains at low water when catenary at maximum): 1,134 m^2. • Maximum number of WTGs = 35 (490 – 560 MW) • Maximum number of anchors: six per WTG (210 total) Anchor types will be drag embedment, torpedo, gravity based or suction piles (no driven or drilled piles) with a maximum seabed footprint of 10 m x 10 m per anchor (up to 600 m^2 total per WTG) For the OSP: • Total area of disturbance for OSP foundations = 0.00724 km^2 (based on worst case for suction bucket foundation including scour protection)	This impact will be relevant for the Windfarm Site.
Impact O3: EMF	Two 3-cored cables operating at 275 kV and a maximum current of 1,024 A. Buried cables: • Minimum burial depth = 0.6 m Non-buried cables with rock protection: • Max. height above seabed = 1.5 m • Change in water depth no greater than 5% of baseline values Max. volume of material = 33,000 m^3	The worst case scenario is for the highest number of WTGs and the greatest length of cable. A full EMF assessment is presented in Appendix 9.2. The study found the magnetic fields produced by both cable routes were found to be highly localised, reducing rapidly from the source due to the single 3-core cables used.

Impact	Parameter	Notes
Impact O4: Potential introduction of MINNS	The number of operation and maintenance vessels required is not yet known.	The greatest risk of introduction of MINNS is through ballast water and biofouling from various vessels required during O&M (small O&M vessels, lift vessel, cable maintenance vessels, auxiliary vessels) and the 'stepping-stone effect' of newly introduced hard structures
Decommissioning		
Impact D1: Physical Disturbance and Temporary Habitat Loss of Seabed Habitat from Removal of Hard Substrate	As a worst case, decommissioning impacts are assumed to be equal to construction impacts.	Impacts are related to the activities associated with the removal of piled foundations and cables, where appropriate. Cabling and scour protection that has been established over the life of the Project may be left in place. However as a worst case full removal has been assessed. Decommissioning activities are assumed to result in the disturbance of sediment and could result in the resuspension of sediments, the remobilisation of contaminants, if present in the sediment. It is possible that decommissioning activities could impact to the Southern Trench MPA.
Impact D2: Increased Suspended Sediments and Sediment Re-Deposition		
Impact D3: Re-mobilisation of contaminated sediment during intrusive works		
Impact D4: Potential impacts on the Southern Trench MPA		
Impact D5: Potential introduction of MINNS	The number of vessels required for decommissioning is not yet known.	The greatest risk of introduction of MINNS is through ballast water and biofouling from various vessels required during decommissioning

9.7.3 Potential Impacts During Construction

9.7.3.1 Impact C1: Physical Disturbance and Temporary Loss of Seabed Habitat

Magnitude of Impact

142. The worst case scenario for physical disturbance and direct temporary seabed habitat loss that may occur in the Offshore Development Area is detailed in **Table 9.16**. Temporary loss/disturbance of subtidal habitat will occur as a result of installation of the OSP and the anchors for the WTGs and associated seabed protection works, installation of inter-array, OSP interconnector, and export cables and the potential for anchor placements during construction.

143. Whilst the seabed along the cable footprint will be directly impacted by jetting/ploughing (worst case), trenching/cutting for cable installation (including pre-sweeping if necessary), by rock placement or concrete mattressing where required for installed cable or at cable/pipeline crossings, the impacts will be short term, highly localised (to the footprint of the affected area, approximately 6.128 km^2[5]) and recoverable over time (due to both backfilling, if undertaken, and natural processes).

144. Construction activities with the potential to cause physical disturbance and temporary habitat loss of seabed habitat will be carried out intermittently throughout the construction period. This represents a low magnitude in relation to the site and the wider region due to the temporary nature of the impact and presence of comparable habitats in the surrounding Blackbird and Ettrick sites, and likely the surrounding area.

Sensitivity of the Receptor

145. In the Windfarm Site and the Buzzard Export Cable Corridor 'Seapens and Burrowing Megafauna in Circalittoral Fine Mud' was the recorded biotope. Burrowing megafauna included *N. Nephrops* and

[5] *6 km^2 seabed disturbed from burial of export cable, 0.08 km^2 seabed disturbed from remedial protection (eg rock armouring, mattressing etc, 0.048 km^2 seabed disturbed from pipeline and cable crossing protection*

sea pen species recorded included *P. phosphorea.* The sensitivity of individual species may differ depending on the spatial scale of impact, with some studies showing the sea pen *P. phosphorea* recovering rapidly after smothering events (Eno *et al,* 2001) but where a proportion of the population is removed or killed, while the species has a high dispersal potential and long-lived benthic larvae, larval recruitment is probably sporadic and patchy and growth is slow, suggesting that recovery may take over ten years; therefore, resilience is assessed as low. Using the MarESA criteria, this habitat type has a medium resistance and low resilience to abrasion/disturbance of the surface of the substratum or seabed; therefore, it is assessed as medium sensitivity for the planned construction activities. Using the FeAST the feature sensitivity of burrowed mud to physical removal of the substratum is also assessed as medium. Physical disturbance and temporary habitat loss of seabed habitat will result in a loss of the characterising species within this habitat type, and so tolerance is assessed as low. Some species may recolonise the area quickly when disturbance has ceased, whereas other species of burrowing megafauna take longer than five years to reach sexual maturity and recover, and so a recoverability rank of medium is reported.

146. MarESA states that recovery rates for *N. norvegicus* are likely dependant on the spatial scale of the impact, but evidence from fishing grounds with targeted removal has shown the species can recover from repeated disturbances and the shrimp and *N. norvegicus* component of the biotope may recover within two to ten years (Ungfors et al. 2013). When faced with substratum loss, *N. norvegicus* is assessed as having medium sensitivity, with a high confidence in this assessment.

147. The small aggregations of weathered *S. spinulosa* tubes observed at Station 11746_ENV5 were eroded and encrusted with faunal turf; therefore, this was not determined to meet the established definitions of 'biogenic reef' and are unlikely to be directly affected by temporary habitat loss. The biotope '*Sabellaria spinulosa* on Stable Circalittoral Mixed Sediment' recorded on the export cable route has a medium sensitivity on MarESA to abrasion/disturbance of the surface of the substratum or seabed, as the seabed occupied by this biotope is already exposed to physical abrasion caused by the scouring of the sand. '*Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand', also recorded on the Landfall Export Cable Corridor has a low sensitivity on MarESA to abrasion/disturbance of the surface of the substratum or seabed, and following severe disturbance, habitats are recolonised rapidly by opportunistic species (Pearson,1978).

148. Overall, the habitat and species affected by the temporary loss of subtidal benthic habitat has been assessed as of medium sensitivity.

Significance of the Effect

149. There is predicted to be short term damage over a period of weeks during construction and, following this period, recolonisation is expected to occur. Whilst some mobile species are likely to be more resilient to disturbance, it is expected that within the footprint of the works habitat will be lost with approximately 4.25 km^2 facing loss, with the works in the Windfarm Site facing a higher degree of habitat loss than the Offshore Export Cable Corridor and disturbance from the activities of installation, with the highest magnitude of impact predicted in the Windfarm Site as low.

150. Whilst the sensitivity of the habitats and species present within the footprint has been assessed on MarESA and FeAST as of medium sensitivity, the presence of PMF features within the Southern Trench MPA and their national value may result in a higher assessment, based on the recorded abundance of Seapens and Burrowing Megafauna in Circalittoral Fine Mud' in the surrounding area. Whilst *S. spinulosa* recorded along the Offshore Export Cable Corridor has not been classed as a reef, the potential for this species to form biogenic reefs which are a priority habitat of conservation interest or importance, the assessment of medium sensitivity is determined to be relevant. The overall significance of effect from physical disturbance and temporary habitat loss of seabed habitat is assessed to be **minor**, which is **not significant**. Impacts on the Southern Trench MPA are discussed further in **Section 9.7.3.2.**

9.7.3.2 Impact C2: Physical Disturbance and Temporary Loss of Seabed Habitat in the Southern Trench MPA

Magnitude of the Impact

151. The Landfall Export Cable Corridor will pass through the Southern Trench MPA. The 2022 surveys by Green Marine UK in the MPA describe this habitat as '*Sabellaria spinulosa* on Stable Circalittoral Mixed Sediment' and *N. norvegicus* was not recorded as present. The distribution maps of the protected features available from NatureScot show that Landfall Export Cable Corridor will predominantly cross areas of gravelly sand, with some sections of slightly gravelly muddy sand, away from the area to the north recorded as supporting burrowed mud suitable for *N. norvegicus*. The approximate distance which the Southern Trench MPA is crossed by Landfall Export Cable Corridor is approximately 18 km for the St Fergus South Landfall option and 15 km for the NorthConnect Parallel Landfall option, and the area within that to be disturbed is approximately 1.32 km^2. The Project design seeks to minimise the footprint of export and inter-array cables within areas of burrowed mud, and further site-specific geophysical and geotechnical surveys post-consent will refine the design. Given the total area of the MPA is 2,398 km^2 and the disturbance is likely to be relevantly small, short term, with species able to recover the magnitude of impact is low.

Sensitivity of the Receptor

152. The Southern Trench MPA is designated to protect minke whale, burrowed mud, fronts and shelf deeps. Fronts in the Southern Trench are created by mixing of warm and cold waters, which creates an area of high productivity, attracting a number of predators to the area. Minke whale are attracted by the fish species brought to the area by the fronts, as well as the abundance of sandeels in the soft sands. NatureScot (2020) advise that, in order to conserve minke whale, the risk of injury and death should be minimised, access to prey resources within the site should be maintained and supporting habitat and species features should also be conserved. The impacts of Project activities on minke whale are assessed in full in **Chapter 11: Marine Mammal Ecology.**

153. The areas of burrowed mud and habitat suitable for *N. norvegicus* (the qualifying feature of the Southern Trench MPA) and sandeels are found to the north of the Windfarm Site, and will not be impacted by the Offshore Infrastructure. The area to the south of the site which will be impacted by the Project has recorded biotopes of '*Sabellaria spinulosa* on Stable Circalittoral Mixed Sediment' and '*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand', neither of which support the protected features of the Southern Trench MPA. The sensitivity of the section of the Southern Trench MPA affected by the cable route is negligible.

Significance of the Effect

154. Given the location of the proposed works through an area of negligible sensitivity with regards to the protected features of the MPA and the low magnitude of impact considering the percentage of the total area of the MPA, the significance of the effect is assessed as **minor.**

9.7.3.3 Impact C3: Increased Suspended Sediments and Sediment Re-Deposition

155. Installation of the anchors of the WTG and the foundations of the service platforms, and installation of cabling and any required seabed preparation is likely to cause temporary increases in suspended sediment concentrations (SSC). Suspended sediment will be deposited on the seabed following disturbance and has the potential to negatively affect benthic habitat, with sediment blocking filter feeding apparatus of many benthic species, and through the smothering of sessile species on the seabed.

Magnitude of Impact

156. The worst case scenario for activities that may result in increased suspended sediment and deposition is provided in **Table 9.16**. As described in **Chapter 7: Marine Geology, Oceanography and Physical Processes,** from the exit point of the HDD to the Offshore Export Cable Corridor to the 12 nm limit, energetic disturbance at or near the seabed will cause temporary increases in suspended sediment concentrations. These will be short in duration and suspended sediment will disperse, either through settling of coarser sediments rapidly to the seabed close to the point of disturbance or, for

finer sediments, as they become entrained within a plume within the water column and widely dispersed by tidal and wave action. The increase in suspended sediment concentrations is not likely to be high in magnitude for prolonged periods of time and is most likely to be within the range of natural variability in the system (e.g. during storms, suspended sediment concentrations will naturally be higher than during calm periods). The magnitude of impact is assessed as low.

Sensitivity of the Receptor

157. In the Windfarm Site and the Buzzard Export Cable Corridor 'Seapens and Burrowing Megafauna in Circalittoral Fine Mud' was the biotope recorded. Burrowing megafauna included *N. norvegicus* and the sea pen species recorded included *P. phosphorea.* MarESA states that sea pens and burrowing megafauna in circalittoral fine mud have high resistance and resilience, and a low sensitivity to increased sediment and light to medium smothering by sediment, and medium sensitivity to heavy smothering, with a low confidence in this assessment. The sea pen *P. phosphorea,* is capable of moving into and out of its burrow, and up to 30 centimetres of fine sediment deposition is shown to have little effect, other than to temporarily suspend feeding and the energetic cost of burrowing. Using FeAST, Burrowed mud also has low sensitivity to increased sediment, with a low confidence in this assessment. Most burrowing megafauna species present within the feature live in the sediment and are able to survive smothering events by burrowing through the additional layer of sediment. An increase in suspended sediment may affect the feeding efficiency of suspension filters, such as *V. mirabilis*, colonies will produce an increased amount of mucus to aid sediment removal or individual colonies may retract into the sediment. The energetic cost of polyp cleaning is probably low, but if feeding rates are reduced, particularly for extended periods, there may be a decline in the population.

158. *S. spinulosa* was identified at one sample site in the 2021 surveys of the Windfarm Site and the Landfall Export Cable Corridor to the 12 nm limit, and was abundant along the Landfall Export Cable Corridor. This species is typically found in areas with some degree of sediment transport essential for tube-building and feeding (Jackson and Hiscock, 2008). They are typically found in turbid waters and so the tolerance of this species to sedimentation may be high. Experiments undertaken by Last *et al.* (2012) found that emergence tubes formed (newly created tubes extending to the surface) under sediment burial allowed *S. spinulosa* to tolerate gradual burial and allowed the species to recolonise following smothering events. MarESA assesses *S. spinulosa* as not sensitive to increase in suspended sediment, with moderate confidence. Tube growth depends upon the presence of suspended particles, and suspended sediment may facilitate tube construction and can result in increased populations. In cases where feeding apparatus is clogged recovery can commence immediately after the event, and individuals may resume feeding and growing. Low will be used for the purposes of this assessment.

159. *N. norvegicus* is a key species in the Southern Trench MPA in burrowed mud and is a macrofaunal species occurring in 'Seapens and Burrowing Megafauna in Circalittoral Fine Mud', as identified during field surveys. *N. norvegicus* has been assessed using MarESA as tolerant of changes in suspended sediment as the species is not dependant on sediment for food availability, as *N. norvegicus* seek food by scavenging and are a mobile species, able to move to find more suitable habitat. This species is assessed as having a low sensitivity, with a low confidence in this assessment.

160. The biotope '*Sabellaria spinulosa* on Stable Circalittoral Mixed Sediment' recorded on the Landfall Export Cable Corridor has a low sensitivity to light smothering and siltation rate changes, and medium sensitivity to heavy smothering and siltation rate changes, and the worms are capable of rapid rebuilding and recovery when damaged. Similarly, '*Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand', also recorded on the export cable route has a low sensitivity to light smothering and siltation rate changes, and medium sensitivity to heavy smothering and siltation rate changes, as these biotopes already face some degree of sediment deposition from weather and tides.

161. Overall the highest sensitivity of receptors affected by this heavy smothering resulting from this activity is medium.

Significance of the Effect

162. The magnitude will be short term in duration, and the increase in suspended sediment concentrations is not likely to be high in magnitude for prolonged periods of time and is most likely to be within the range of natural variability in the system. Therefore, the magnitude of impact is low. The species and habitats present are already somewhat adapted to a natural degree of sedimentation, and to lower levels of sedimentation their sensitivity of the receptors has been assessed as medium, although for much of the area affected by sedimentation this will be low. Therefore, the significance of effects are assessed as **minor**, which is **not significant**.

9.7.3.4 Impact C4: Re-Mobilisation of Contaminated Sediment During Intrusive Works

163. As presented in **Chapter 8: Marine Sediment and Water Quality**, siting of the locations of the anchors will be placed to avoid the need for advance physical seabed preparation. No seabed preparation has been identified for the OSP foundations and so this impact is limited to the installation of the inter-array cables and drilling if pin piles are required for the OSP foundations.

164. Also in **Chapter 8: Marine Sediment and Water Quality**, analysis of sediment chemistry as part of the Ettrick and Blackbird decommissioning programme recorded that overall, TOM, TOC, PAH, alkanes and barium values to generally be within typical background levels for the North Sea (Nexen, 2016), indicating that the background organics were predominately from a natural biogenic origin as opposed to anthropogenic sources, e.g. oil-based drilling muds, flare drop out, etc, apart from at one well location where point source petrogenic contamination was apparent. The levels of barium, alkanes, mercury, iron, lead and zinc were found to be above background levels in the sample taken close to the well, with these elevated levels being attributed to historical drilling contaminants (Genesis, 2016). Sediment data collected as part of the data gathering exercise to inform the NorthConnect project (NorthConnect 2018) (NorthConnect Parallel Landfall option) and site-specific work carried out in the St Fergus South Landfall option does not indicate significant levels of contamination.

Magnitude of the Impact

165. Given that pile installation is only required for up to six legs of the OSP, the impact would be limited both in terms of extent and timescale over which the impact would occur. Where increases in suspended solid concentrations are observed, these would be temporary, localised to the activity and cease following completion of the OSP works. With respect to the inter-array cables, the nature of the seabed (sand) and low current speeds would reduce the risk of significant sediment plumes. Furthermore, with the construction affecting different sections progressively over time (rather than being instantaneous across the whole route at a single point in time) the impact is predicted to be localised to the area in which the installation is occurring.

166. Bottom currents are known to be low in the footprint of the Offshore Development Area (see **Chapter 5: Project Description**); therefore, re-mobilised contaminants are unlikely to travel far from their original location and the footprint of contamination is likely to be localised and small for each disturbance event. Findings of the sediment chemistry analysis both offshore and along the Landfall Export Cable Corridor did not indicate significant levels of contamination, and the magnitude is negligible.

167. Further detail is provided in **Chapter 8: Marine Sediment and Water Quality.**

168. The Windfarm Site array pattern and position applied will deliberately avoid placing turbines and substructures directly above abandoned well-centres at the seabed across the development site, which will likely represent the areas of highest potential seabed contamination where any drill arisings are present. They are considered small, and widely distributed as a thin veneer, and do not contain any oil-based mud (**Section 9.6.2**).

Sensitivity of the Receptor

169. FeAST lists ‘Sea pens and Burrowing Megafauna in Circalittoral Fine Mud’ or ‘Burrowed Mud’ found at the Windfarm Site as sensitive to non-synthetic compound contamination, but not enough information is available to complete one of the sensitivity assessment stages to give a final score.

Therefore, due to concern over potential impacts on this feature it has been assessed as sensitive. Similarly, 'Sea Pens and Burrowing Megafauna in Circalittoral Fine Mud' has not been assessed through FeAST for chemical pressures such as hydrocarbon and PAH contamination.

170. Studies on the impacts of discharges of drilling mud on the benthic communities have found the presence of chemical contaminants in sediments have caused degradation of the benthic community structure, with high concentrations in tissues correlating with reduced benthic species diversity (Swartz, 1982, Becker, 1990). Heavy metals and contaminants have been shown to bioaccumulate in the shells and tissues of marine invertebrates. Barium is nearly insoluble and essentially inert to marine organisms, however barite mixed with or layered on top of marine sediments inhibited colonisation and altered the benthic community of the sediments by altering the sediment texture (Neff, 2002). As discussed above, drill arisings are considered small, and widely distributed as a thin veneer, and do not contain any oil-based mud (**Section 9.6.2**).

171. Metals can accumulate in *N. norvegicus* in the gills and hepatopancreas (Canli and Furness, 1993), and enter the food web, with concentrations reaching highest concentrations in the tissues of top predators (Dietz, 1996). Bioaccumulation of PAH has also been observed in benthic infaunal invertebrate species including polychaetes and bivalves (Neff, 2002).

172. Neither '*Sabellaria spinulosa* on Stable Circalittoral Mixed Sediment' or '*Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand' recorded on the export cable route have been assessed for exposure to contaminants on MarESA, but the high water movement present in the area of seabed occupied by these biotopes may limit the exposure to contaminated sediments, and there is little evidence that the species characterising these biotopes are sensitive to this impact.

173. For the purposes of this assessment a sensitivity level of medium is applied based on a review of the available literature regarding benthic ecology and exposure to contaminated sediments.

Significance of the Effect

174. The magnitude has been assessed as low as the impacts are likely to be localised and small, relating to each disturbance event. The sensitivity of the receptors to contaminants has limited availability of data in the MarESA and FeAST assessment tools, but a review of available literature has highlighted the potential for bioaccumulation in the tissues of species characterising PMF feature of 'sea pens and burrowing megafauna in circalittoral fine mud' present within the site and in the Southern Trench MPA and so the sensitivity been assessed as medium. Therefore, the significance of effects are assessed as **minor**, which in EIA is determined to be **not significant**.

9.7.3.5 Impact C5: Potential Introduction of MINNS

Magnitude of the Impact

175. During construction, MINNS may enter the ecosystem in ballast water and through biofouling associated with construction vessels, with risks of introduced species rapidly becoming established and negatively impacting benthic species and habitats. The introduction of hard substrate in wind farms may provide habitat that may offer new opportunities for non-native species that may have been introduced, or already present (Kerckhof, 2011). The requirement for cable protection in the form of rock placement will be assessed following completion of the side scan and sub bottom profiling surveys, and there may be a need to introduce hard substrate into the MPA. The introduction of pelagic larval particles in ballast water can make use of the introduced hard substrate that would otherwise have been lost offshore. The location of offshore wind farms close to biogeographical barriers can also allow for 'climate migrants' to become established (Adams, 2013). The number of vessels present during construction at any one time is not know at this stage**,** construction is likely to last for 214 days. Adherence to the CEMP during construction will minimise the risk of MINNS being introduced into the environment the magnitude of impact is assessed as negligible.

Sensitivity of the Receptor

176. 'Burrowed mud' on FeAST and 'Seapens and Burrowing Megafauna in Circalittoral Fine Mud' on MarESA have not been assessed for sensitivity to introduction of invasive non-native species, but given the national conservation value of this habitat type and the risk of permanent and irreversible

change that may occur if MINNS are introduced, for the purposes of this assessment this feature has been assessed as of high sensitivity.

177. The sedimentary nature of the habitats present in the existing environment, coupled with the introduction of hard substrate presents opportunity for MINNS to colonise with relative ease, without significant competition as the epifaunal community present in the existing environment will be able to colonise the new hard substrate.

178. A literature review (Gibb *et al.* 2014) assessing the sensitivity of *S. spinulosa* to pressures associated with marine activities found no direct evidence relating to the impacts of the introduction of non-indigenous species on *S. spinulosa* reefs. For many of the non-native species that are found in UK seabed habitats, there are no records to suggest that their distribution overlaps with *S. spinulosa* reefs and *S. spinulosa* was assessed as not sensitive to introduction of MINNS. At the Offshore Wind Farm Egmond aan Zee in the North Sea (Bouma 2021) assessments of non-indigenous species found several MINNs present on hard substrate of the wind farm site, and abundances of Pacific oysters, hairy crab and marine splash midge were observed to increase between survey visits (2008 and 2011).

179. Given the value of the burrowed mud habitat and the potential severity of the impact from the introduction of MINNS, a sensitivity level of high will be used for this assessment.

Significance of the Effect

180. The magnitude has been assessed as negligible. Given the national value of the burrowed mud PMF in the Windfarm Site and in the Southern Trench MPA the sensitivity of the receptors has been assessed as high. With the low risk of introduction but the potential for irreversible change from the introduction of MINNS, assessment of the significance of effects from introduction of MINNS are assessed as **minor,** which in EIA is determined to be **not significant**.

9.7.4 Potential Impacts During Operation and Maintenance

9.7.4.1 Impact O1: Permanent Habitat Loss and Introduction of Hard Substrate

Magnitude of the Impact

181. The presence of the WTG anchors and the OSP foundations and the associated scour protection and cable protection measures will alter the benthic substrate, from soft circalittoral fine mud to hard substrate. This will lead to a permanent loss of soft substrate habitat relating to the operational phase and will impact the benthic communities reliant upon this habitat type. As described in **Table 9.16,** the main loss of habitat will result from the installation of the foundations of the OSP. Introduction of hard substrate and the change in habitat type cannot be considered beneficial ecologically as this represents a change from the existing environment.

182. Monitoring of the benthic species colonising wind turbine structures and scour protection on the Offshore Wind farm Egmond aan Zee in the North Sea (Bouma 2021) has identified the presence of new species not previously observed on the site following the introduction of hard substrate. At least 55 hard substrate species that were not present before the construction of the windfarm were observed colonising infrastructure and local biodiversity was seen to increase between 2008 and 2011. Monitoring of Hywind Scotland Pilot Park (Karlsson *et al.* 2022) identified almost 100% epifaunal colonisation on structures three years after construction.

183. Monitoring of the Horns Rev Wind Farm on the hard substrate introduced identified significant variation between surveys following construction, with particular note of *S. spinulosa* identified on the hard substrate in 2004, which was absent from 2003 surveys (Leonhard and Pedersen, 2004).

184. In the Southern Trench MPA the need to introduce hard substrate in the form of cable protection (e.g. rock dump, mattressing) will be determined following the completion of detailed pre-construction geophysical and geotechnical surveys, although it should be noted that the area affected by the Landfall Export Cable Corridor does not overlap with recorded presence of protected features. Final

design of the Landfall Export Cable Corridor will be consulted upon with relevant stakeholders including fisheries.

185. The change in habitat type is long term and irreversible during the lifespan of the Project but the magnitude is negligible in relation to the surrounding habitat available and the highly localised nature of the impact.

Sensitivity of the Receptor

186. MarESA lists sea pens and burrowing megafauna in circalittoral fine mud as having high sensitivity to physical change to another seabed type, as a change to hard substrata from sedimentary habitat would likely no longer support sea pens and burrowing megafauna. FeAST has assessed burrowed mud with a high sensitivity to changes to another seabed type, as the feature is characterised by finer particles of sediment.

187. *'Sabellaria spinulosa* on Stable Circalittoral Mixed Sediment' present on the Offshore Export Cable Corridors has a high sensitivity to physical change to another seabed type, as a change to hard substrata will also be limited in how it may support this biotope. Similarly, '*Echinocyamus pusillus*, Ophelia borealis and *Abra prismatica* in Circalittoral Fine Sand' a high sensitivity to physical change to another seabed type.

Significance of the Effect

188. The magnitude will be highly localised, has been assessed as negligible. The sensitivity of the receptors has been assessed as high as the habitat is characterised by soft sediment and so cannot adapt to hard substrate. Therefore, the significance of effect is assessed as **minor**, and, therefore, **not significant**.

9.7.4.2 Impact O2: Impacts of Scour on Benthic Communities Arising from the Mooring Chains and Anchors

Magnitude of the Impact

189. The magnitude of scour resulting from the Offshore Development Area is described in detail in **Chapter 7: Marine Geology, Oceanography and Physical Processes**. The seabed in the vicinity of the WTGs will be swept by the catenary action of the mooring lines for each WTG. Benthic habitat in the areas affected by scour will face degradation. The fullest swept area of 1,134 m^2 per WTG would likely face frequent disturbance through the operation and maintenance phase. As determined in **Chapter 7** the impact will be localised and small in magnitude, and although it will persist throughout the operation and maintenance phase it is deemed to be negligible.

190. Note that this impact is not relevant to the Southern Trench MPA.

Sensitivity of the Receptor

191. Using MarESA, 'Seapens and Burrowing Megafauna in Circalittoral Fine Mud' in the windfarm site have a high sensitivity to water flow changes, and using FeAST burrowed mud has a medium sensitivity. Sea pen communities are dependent upon are typically in low energy environments, and the increase in water flow resulting from scour impacts may lead to changes in sediment type and render the habitat unsuitable for sea pens and the burrowing megafauna associated with this habitat type. For the purposes of the assessment the sensitivity of the receptors is deemed to be high.

Significance of the Effect

192. The magnitude has been assessed as negligible using the assessment in **Chapter 7: Marine Geology, Oceanography and Physical Processes** as the impacts are localised and small in magnitude. The impacts of scour may alter the habitat and make this unusable for the species characterising the habitat found here and so the sensitivity of the receptors has been assessed as high, and the significance of effects from scour on benthic communities arising from the mooring chains and anchors are assessed as **minor** and therefore **not significant.**

9.7.4.3 Impact O3: Electromagnetic Fields (EMF)

Magnitude of the Impact

193. EMFs as a result of the presence of inter-array, platform link, interconnector and export cables may be detected by some benthic species. A dedicated EMF modelling study was carried out by National Grid (**Appendix 9.2**), and a summary of the results relevant to benthic ecology is presented here. The study found the magnetic fields produced by both cable routes were found to be highly localised, reducing rapidly from the source due to the single 3-core cables used.

194. The background geomagnetic field in the area is around 48 µT. Given this, the background induced electric field could range between 4.8 and 60 µV/m in tidal velocities ranging between 0.1 m/s and 1.25 m/s. This project operates using AC technology and will not add or subtract to these natural DC fields. AC magnetic fields will, however, induce an electric field within a marine organism located in or moving through the AC magnetic field produced by the cable, which is the important consideration for biological impacts (Swanson and Renew, 1994).

195. The earthed metallic shield that is applied over the insulation of HVAC cables ensures that the electric field will be contained entirely within the insulation, and no external electric field will be emitted. Magnetic fields are not shielded in the same way as electric fields and will be produced outside the cables. The magnetic field produced by the cables will in turn induce electric fields in organisms passing through the field and will be proportional to the magnetic field and the size of the organism. One representative shellfish was included in the EMF modelling study. The magnetic fields produced by both cable routes were highly localised, reducing rapidly from the source due to the singe 3-core cables used. The decrease in magnetic fields occurs both in the vertical water column and horizontally along the seabed. The magnetic fields reduced to below 1 µT at a distance of 5.5 m for the 275 kV cables and 4.3 m from the 66 kV cables.

196. The Applicant proposes to use armoured cables which mitigates both the electric and to an extent the magnetic fields. Cables will be buried to a depth of at least 0.6 m, which again reduces the magnetic fields and is a suggested mitigation technique in NPS EN-3. Assessment of the cumulative impacts of the EMF from the Offshore Infrastructure and the NorthConnect HVDC interconnector determined that there would be no interaction or cumulative impact of these two projects as AC and DC fields do not combine.

197. The magnitude of impact on benthic ecology is predicted to be low.

Sensitivity of the Receptor

198. Evidence for sensitivity to EMFs comes from physiological and behavioural studies on a small number of marine invertebrates and no direct evidence of impacts to invertebrates from undersea cable EMFs exists. Biological impact studies have demonstrated small responses to magnetic fields in the development of echinoderm embryos and in cellular processes in a marine mussel, however at intensity fields far greater than those expected from undersea cables (Tricas and Gill, 2011).

199. Whilst there are no formal limits for EMF exposure which apply to the marine environment, the maximum predicted induced electric field for brown crab on the seabed was 278 mV/m, with the highest field at approximately 24 µT, which is below the below the North Sea natural magnetic field of 50 µT. There is little evidence to suggest exposure at this level will result in biological impacts on benthic fauna, with studies into the impacts of approximately 200 µT showing no change in behaviour on juvenile European lobsters *Homarus gammarus* (Taormina et al 2020). There is little evidence to suggest that benthic species would be adversely impacted by EMF, therefore using a precautionary approach the sensitivity of the benthic ecology receptors is considered to be low.

Significance of the Effect

200. Research into the impacts of EMF at the levels predicted in the EMF modelling report is limited, but available studies suggest that impact on benthic ecology will relate to the proximity of individuals to the source, and as such highly localised. The magnitude of the impact will relate to the immediate area above the cables, and using mitigation regarding cable burying, the magnitude is low and the

sensitivity of receptors is low. The overall significance of effect is assessed as **minor** and therefore **not significant.**

9.7.4.4 Impact O4: Potential Introduction of MINNS

Magnitude of the Impact

201. During the operation and maintenance stages, MINNS may enter the ecosystem in a similar way as construction but on a smaller scale, through biofouling. In the Southern Trench MPA the need to introduce hard substrate in the form of cable protection (e.g. rock dump, mattressing) will be determined following the completion of detailed pre-construction geophysical and geotechnical surveys, although it should be noted that Offshore Development Area does not overlap with recorded presence of protected features. Final design of the Landfall Export Cable Corridor will be consulted upon with relevant stakeholders including fisheries.

202. During construction and operation, the hard substrate will be available to act as habitat for any introduced organisms, and the magnitude will be similar to construction and is assessed as negligible.

Sensitivity of the Receptor

203. The sensitivity of the receptors present is similar to that for construction (**Section 9.7.3.5**). Given the national conservation value of this habitat type and the risk of permanent and irreversible change that may occur if MINNS are introduced, for the purposes of this assessment this feature has been assessed as of high sensitivity.

Significance of the Effect

204. The magnitude has been assessed as negligible. Given the national value of the burrowed mud PMF in the Windfarm Site and in the Southern Trench MPA the sensitivity of the receptors has been assessed as high. With the low risk of introduction but the potential for irreversible change from the introduction of MINNS, assessment of the significance of effects from introduction of MINNS are assessed as **minor,** which is **not significant**.

9.7.5 Potential Impacts During Decommissioning

205. During decommissioning, the potential impacts are anticipated to be similar to those for the construction phase, depending on the methods used. Potential impacts from decommissioning are considered to be less than the worst case impacts for construction as no seabed preparation will be required, and removal of infrastructure will cause a minimal amount of material to be resuspended into the water column. The impacts from decommissioning will relate to the assembly of the habitats present in the future baseline, and how the benthic community has altered.

206. A decommissioning programme will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Scottish Ministers prior to implementation.

9.7.5.1 Impact D1: Physical Disturbance and Temporary Habitat Loss of Seabed Habitat from Removal of Hard Substrate

Magnitude of Impact

207. The activities with the potential to cause physical disturbance and temporary habitat loss of seabed habitat are related to the activities associated with the removal of piled foundations and cables, where appropriate. Scour protection may be left in place to preserve marine life that has been established over the life of the Project, although this will be re-assessed closer to the time of decommissioning. The piled foundations of the substation will be cut below the seabed using methods such as abrasive water jet cutter or diamond wire cutting. The cables may be removed by pulling the cable from the seabed using a grapnel, pulling an under-runner teel cable to push the electrical cable from the seabed, or jetting the seabed material. the magnitude of impact on benthic ecology from this activity is low.

208. Hard substrate introduced from the installation of WTG anchors, OSP foundation and the associated scour protection and cable protection will likely be colonised by benthic and epibenthic species over

the life of the Project. In the Southern Trench MPA the need to introduce hard substrate in the form of cable protection (e.g. rock dump, mattressing) will be determined following the completion of detailed pre-construction geophysical and geotechnical surveys, although it should be noted that Offshore Development Area does not overlap with recorded presence of protected features. The removal of the OSP foundations and WTG anchors will result in a loss of hard substrate and is an expected magnitude of low. The removal of cabling will result in the removal of EMF and a return to baseline levels.

Sensitivity of the Receptor

209. The sensitivities of key species and habitats currently present in the site are provided in **Section 9.7.3.1.** The site-specific surveys conducted in the site have identified soft substrate, and habitats and species dependent upon this type of habitat. With the installation of the WTG anchors, OSP foundation and the associated scour protection and cable protection will introduce hard substrate, which will likely lead to an alteration of the benthic community.

210. Floating turbines are a relatively new technology and studies on the changes in epibenthic communities following installation are limited. Published data on examination of colonisation of mussel aggregations of marine structures such as buoys and oil and gas infrastructure have found distinct alterations in the benthic habitat surrounding structures, implying that the presence of epibenthic communities can alter biodiversity and community structure, influencing processes and function (Causon and Gill, 2018). It is likely the species assemblage will alter, with colonisation of hard structures by species currently absent from the existing environment. Assessment of the sensitivity of the receptors present, if significantly altered from those provided in **Section 9.7.3.1** will be assessed as part of the decommissioning works. For the purposes of this assessment, the sensitivity of medium in **Section 9.7.3.1** is used.

211. Following removal of the structures it is likely that over time the area may be re-colonised by the species present before the installation. As described in **Section 9.7.5.1**, the hard substrate is likely to be colonised by species not currently present in the existing environment. In areas where hard substrate is removed, baseline benthic habitats would likely recover to the state existing before construction, and the likely sensitivity of the species and habitats present would likely equate to baseline levels. Assessment of the sensitivity of the receptors present, if significantly altered from those provided in **Section 9.6** will be assessed as part of the decommissioning works.

212. As described in **Section 9.7.4.1**, monitoring of the Horns Rev Wind Farm on the hard substrate introduced identified significant variation between surveys following construction, with particular note of *S. spinulosa* identified on the hard substrate in 2004, which was absent from 2003 surveys (Leonhard and Pedersen, 2004). Assessment of the distribution of new species of conservation concern ahead of decommissioning will identify areas of development of colonies of species such as *S. spinulosa* if required.

213. For the purposes of the assessment a sensitivity of medium has been assigned.

Significance of the Effect

214. The magnitude of habitat loss will relate to the structures being removed and disturbance will likely be less than that predicted for disturbance, and so the magnitude is low. The assessment of the sensitivity of the receptors that may be present has considered the future baseline and the potential for species of conservation concern to colonise, and this has been assessed as medium. Therefore, the significance of effect from physical disturbance and direct temporary seabed habitat loss from decommissioning are assessed as **minor,** which is **not significant**.

Impact D2: Potential Impacts on the Southern Trench Marine Protected Area

Magnitude of Impact

215. The removal of cabling in the MPA will result in temporary, localised disturbance no greater than that for construction and will result in a return to bassline levels with regards to EMF. The magnitude is predicted to be low.

Sensitivity of the Receptor

216. The sensitivity level for construction will be similar for deconstruction. This is set out in detail in **Section 9.7.3.5** where a sensitivity level of negligible is used.

Significance of the Effect

217. Given the location of the proposed works through an area of negligible sensitivity with regards to the protected features of the MPA and the low magnitude of the percentage of the total area of the MPA, the significance of the effect is assessed as **minor,** which is **not significant.**

9.7.5.2 Impact D3: Increased Suspended Sediments and Sediment Re-Deposition

Magnitude of Impact

218. Increases in SSC and sediment deposition from the decommissioning works will be similar to that for construction and are of a similar magnitude. These are provided in **Section 9.7.3.2** and the magnitude assigned is low.

Sensitivity of the Receptor

219. The sensitivity of the species and habitats currently present are presented in **Section 9.7.3.2**. It is likely that the habitats and species present will alter due to the introduction of hard substrate, but it is unlikely to lead to a change in sensitivity and the level compared to construction and is likely to remain as medium.

Significance of the Effect

220. The magnitude will be short term in duration, and the increase in suspended sediment concentrations is not likely to be high in magnitude for prolonged periods of time and is most likely to be within the range of natural variability in the system and has been assessed as low, and the sensitivity of the receptors has been assessed as medium, although for much of the area affected by sedimentation this will be low. Therefore, the significance of effects from increased suspended sediments and sediment re-deposition are assessed as **minor,** which is **not significant**.

9.7.5.3 Impact D4: Re-Mobilisation of Contaminated Sediment During Intrusive Works

Magnitude of Impact

221. The magnitude of the impact will be less than that set out in **Section 9.7.3.4** as disturbance will be in this same area as during construction, and re-mobilisation of contaminants due to currents and natural events over the life of the Project will have further reduced the levels of contaminants in the disturbed sediments. The magnitude is low.

Sensitivity of the Receptor

222. The sensitivity level for construction will be similar for deconstruction. This is set out in detail in **Section 9.7.3.4** where a sensitivity level of medium is used.

Significance of the Effect

223. The magnitude has been assessed as low as the impacts are likely to be localised and small, relating to each disturbance event. The sensitivity of the receptors has been assessed as medium. Therefore, the significance of effects from re-mobilisation of contaminated sediment during decommissioning are assessed as **minor**, which is **not significant**.

9.7.5.4 Impact D5: Potential Introduction of MINNS

Magnitude of Impact

224. The risk of introduction of MINNS during decommissioning will come from vessel ballast water and biofouling. The number of ships required for decommissioning is not known at this stage but the magnitude will be similar to that during construction. Adherence to the Project Environmental Monitoring Plan (PEMP) during decommissioning will minimise the risk of MINNS being introduced into the environment, and the magnitude of impact is assessed as negligible.

Sensitivity of the Receptor

225. The sensitivity of the receptors is likely to be similar to that for construction (see **Section 9.7.3.5**), although the benthic community is likely to have altered over the lifespan of the Project so there may be presence of species of concern that may be more sensitive to the introduction of MINNS. For the purposes of the assessment the sensitivity of high will be used.

Significance of the Effect

226. The magnitude has been assessed as negligible. Given the national value of the burrowed mud PMF in the Southern Trench MPA the sensitivity of the receptors has been assessed as high. With the low risk of introduction but the potential for irreversible change from the introduction of MINNS, assessment of the significance of effects from introduction of MINNS are assessed as **minor,** which is **not significant**.

9.7.6 Additional Mitigation

227. It is expected that the impacts upon benthic ecology will be small scale, localised and temporary and no further mitigation is recommended.

9.8 Cumulative Impacts

228. Assessment of cumulative impacts has been conducted in a two-stage process. The impacts identified in the impact assessment relating to construction, Operation and maintenance and decommissioning phases are assessed for their potential to lead to cumulative impacts. For this chapter, a 30 km distance is used to identify possible projects as this distance encompasses the Zone of Influence (ZoI) for all relevant impacts as well as incremental changes over the wider area. A review of any known projects with the potential to cause similar impacts throughout the project lifespan is then completed, and the impacts are then assessed for potential to act cumulatively with other projects. The potential cumulative impacts are presented in **Table 9.17.**

229. It was not considered that any cumulative impacts would arise with the decommissioning of oil and gas facilities, and therefore, Decommissioning Plans have not been screened in.

Table 9.17 Potential Cumulative Impacts

Impact	Potential for Cumulative Impact	Rationale
C1: Physical disturbance and temporary habitat loss of seabed habitat	No	Impacts occur at discrete locations, are temporary in nature and are negligible or low in magnitude.
C2: Potential temporary disturbance and loss of seabed habitat in the Southern Trench MPA	No	Impacts are likely to be temporary and limited to the area of works
C3: Increased suspended sediments and sediment re-deposition (subtidal)	No	Impacts occur at discrete locations, are temporary in nature and are negligible or low in magnitude. Contaminant concentrations are considered to be within background levels found in the North Sea
C4: Re-mobilisation of contaminated sediment during intrusive works	No	
C5: Potential introduction of MINNS.	Yes	Adherence to the PEMP and the use of biosecurity plans should reduce cumulative impacts, but the introduction of hard substrate and increased ballast water through vessel movements may increase opportunities for MINNS.
O1: Permanent habitat loss and introduction of hard substrate	No	Impacts are likely to be minor and limited to the WTG anchors and the OSP foundations and the associated scour protection and cable protection measures
O2: Impacts of scour on benthic communities arising from the mooring chains and anchors	No	Impacts are likely to be minor and limited to the area surrounding mooring chains and anchors

Impact	Potential for Cumulative Impact	Rationale
O3: EMF	Yes	Impacts are likely to be minor and limited to the area surrounding cables, but cable crossing points with surrounding projects may result in increased EMF levels.
O4: Potential introduction of MINNS	Yes	Adherence to the PEMP and the use of biosecurity plans should reduce cumulative impacts, but the introduction of hard substrate and increased ballast water through vessel movements may increase opportunities for MINNS.
D1: Physical Disturbance and Temporary Habitat Loss of Seabed Habitat from Removal of Hard Substrate	No	Impacts occur at discrete locations, are temporary in nature and are negligible or low in magnitude.
D2: Potential impacts on the Southern Trench MPA	No	Impacts are likely to be temporary and limited to the area of works
D3: Increased Suspended Sediments and Sediment Re-Deposition	No	Impacts occur at discrete locations, are temporary in nature and are negligible or low in magnitude. Contaminant concentrations are considered to be within background levels found in the North Sea
D4: Re-mobilisation of contaminated sediment during intrusive works	No	
D5: Potential introduction of MINNS	Yes	Adherence to the PEMP and the use of biosecurity plans should reduce cumulative impacts, but the introduction of hard substrate and increased ballast water through vessel movements may increase opportunities for MINNS.

Table 9.18 Summary of Projects considered for the CIA in Relation to Benthic Ecology

Project	Status	Development period	[6]Distance from Green Volt Site (km)	Project definition	Project data status	Included in CIA	Rationale
Scotland's National Marine Plan	While the final National Marine Plan (NMP) was published in 2015, at time of writing no Regional Marine Plan (RMP) has been produced for the northeast region (within which the Project would be located).	Adopted in March 2015 and ongoing	Within	Scotland's NMP provides a framework for managing all developments, activities and interests in or affecting Scotland's marine area (territorial and offshore waters). Adopted in March 2015, the NMP sets out high-level objectives, general policies and sectoral policies. Under the NMP, 11 RMPs are to be prepared by Statutory regional Marine Planning Partnerships (MPPs) in line with the NMP.	High	Yes	Potential for the Project lifespan to coincide with the preparation of the North East RMP, which could influence future decision making on the project.
Acorn Carbon Capture and Storage (CCS) Site	Under development - Section 36 Application submitted end of March 2022 for Peterhead Carbon Capture Power Station	The project received a CO_2 storage licence from the Oil and Gas Authority (now the North Sea Transition Authority) in December 2018 with the project looking to enter operation in the mid-2020s.	2 km north of the Offshore Development Area	Based at the St Fergus gas terminal in North East Scotland, Acorn CCS can repurpose existing gas pipelines to take CO_2 directly to the Acorn CO_2 Storage Site in the North Sea. The project is a designated European Project of Common Interest (PCI). The project received a CO_2 storage licence from the Oil and Gas Authority in December 2018 (the first if its kind issued in the UK), with the project looking to enter operation in the mid-2020s.	High	Yes	Potential for construction activities for Acorn CCS to overlap temporally with the Project, potential for cumulative impacts to occur as a result of sediment disturbance. It is unlikely that there will be any overlap or interaction between the two projects in terms of marine space.
North Buchan Ness disposal site	Open	Currently operating	1.17 from cable route	Open dredge spoil disposal site located approximately 2km from the Scottish coast.	Medium	Yes	Potential for cumulative impact on water and sediment quality and benthic ecology due to sediment disturbance from the disposal site and cable installation activities for the Project.
NorthConnect HVDC Link	Under development - Consent has been received for the project in UK waters but is awaiting consent within Norwegian waters.	TBC	0	High Voltage Direct Current (HVDC) Interconnector cable route. Proposed to carry 1,400MW of power. The HVDC cables will connect the Interconnector Converter Station on the 'Fourfields' site near Boddam, Peterhead to the Converter Station located in Simadalen, Norway.	High	Yes	Potential for construction activities for NorthConnect to overlap spatially and temporally with the Project, potential for cumulative impacts to occur as a result.

[6] *Shortest distance between the considered project and Green Volt – unless specified otherwise.*

Project	Status	Development period	[6]Distance from Green Volt Site (km)	Project definition	Project data status	Included in CIA	Rationale
Eastern Green Link 2 (Scotland / England Green Link / Eastern Link 2)	Consented - The project received consent in May 2021, but works are yet to be undertaken.	Under development - A Report on Proposed Content of the Assessment to Support a Marine Licence Application was submitted to MS-LOT in July 2021 for the project. Ground investigation works onshore near Peterhead began in February 2022.	0 km from cable route	A joint proposal between SHE Transmission and National Grid, Eastern Link 2 is a HVDC cable spanning between Peterhead, Scotland and Drax in North Yorkshire.	High	Yes	Potential for construction activities for the sea wall repair to overlap temporally with the Project, potential for cumulative impacts to occur as a result.
Construction of Outfall Pipe - North Base Jetty, Peterhead Harbour	Application submitted -	Licence application submitted but consent not yet granted.	0.3 km from cable route	Installation of new sea outfall and intake at existing ASCO North Base jetty in Peterhead Harbour, consisting of three submersible pumps suspended from the jetty and a diffuser consisting of three 5x5m frames.	Medium	No	Unlikely for cumulative impacts due to the works small spatial scope, likely to be completed before the Project begins construction.
Sea Wall Repair and Extension - Alexandra Parade	Consented - The project received consent in May 2021, but works are yet to be undertaken.	TBC	Approx. 2.41km south of the northern branch of the export cable corridor.	Works to repair the Alexandra Parade seawall and revetment is located on the northern boundary of Peterhead Harbour adjacent to North harbour, damaged during a storm event in 2012. The seawall and revetment acts as a sea defence to the fish processing facility and harbour related businesses that are vital to the operation of the harbour located behind the revetment. Works to involve re-profiling of the existing revetment, formation of a toe trench and placement of various sizes of rock armour and pre-cast concrete units within the toe trench to create the toe mound, on the existing embankment and along the crest extending to the existing seawall.	High	Yes	Potential for construction activities for Eastern Link 2 to overlap spatially and temporally with the Project, potential for cumulative effects to occur as a result.

9.8.1 Impacts during Construction

230. The Project has potential for cumulative impacts occur through the potential introduction of MINNS (CIA – C5). The projects with potential for cumulative impacts during construction are those within 5 km of the Project area:

- Acorn Carbon Storage Site
- North Buchan Ness disposal site
- NorthConnect HVDC Link.

231. As described in **Section 9.7**, MINNS may enter the ecosystem in ballast water and through biofouling associated with vessels. The projects above are overlap with the Windfarm Site, and both NorthConnect HVDC Link and Acorn Carbon Capture and Storage Site may have construction periods that overlap with the Project construction programme, leading to cumulative increase in vessel traffic and the potential for introduction MINNS. Effects are likely to be no higher than those from the Project in isolation and are determined to be **minor**.

9.8.2 Impacts during Operation and Maintenance

232. The Project has potential for cumulative impacts occur through the potential introduction of EMF (CIA – O3) and MINNS (CIA – O4). The projects with potential to add to cumulative impacts during operation and maintenance are within 5 km of the Project area:

- Acorn Carbon Storage Site
- North Buchan Ness disposal site
- NorthConnect HVDC Link.

233. The introduction of MINNS during operation and maintenance will be similar to those in **Section 9.8.1**, and the magnitude will depend on the construction timescales overlapping with the operation and maintenance period for the Project. During this phase, the hard substrate of the sub-surface infrastructure will be available to MINNS that may enter the ecosystem, and with increase traffic from construction of other projects there is the potential for cumulative impacts relating to the potential introduction of MINNS. Effects are likely to be no higher than for the Project in isolation and are determined to be **minor**.

234. EMF will be highly localised to the area of seabed immediately above cabling and the levels of EMF predicted from modelling will be less than baseline levels in the North Sea. However, at cable crossings the level of EMF is likely to increase, and the cable crossings relating to the projects above may result in cumulative effects, but these are likely to be no higher than for the Project in isolation and are determined to be **minor**.

9.8.3 Impacts during Decommissioning

235. The Project has potential for cumulative impacts occur through the potential introduction of MINNS (CIA – D5). The projects with potential to add to cumulative impacts during decommissioning are within 5 km of the Project area:

- Acorn Carbon Storage Site
- North Buchan Ness disposal site
- NorthConnect HVDC Link.

236. As for other phases of the Project, MINNS may enter the ecosystem via vessel ballast. During decommissioning, removal of hard substrate will return some conditions to baseline, and adherence to the biosecurity plan during decommissioning will provide contractors with instruction on steps to take should MINNS be discovered during decommissioning. Effects are likely to be no higher than those from the Project in isolation and are determined to be **minor**.

9.9 Transboundary Impacts

237. Due to the localised and small-scale nature of the impacts on benthic ecology from the Project, significant transboundary effects are considered to be unlikely. The closest maritime boundary is with Norway at approximately 130 km to the boundary of the Windfarm Site (**Figure 9.1**). Therefore, transboundary benthic impacts are scoped out from further consideration within the EIA.

9.10 Inter-relationships

238. Some of the impacts presented in this chapter may impact other receptors as well as benthic ecology, and a summary is presented in **Table 9.19.**

Table 9.19 Chapter Topic Inter Relationships

Topic and description	Related Chapter	Where addressed in this Chapter
Marine Geology, Oceanography and Physical Processes	**Chapter 7: Marine Geology, Oceanography and Physical Processes**	**Section 9.7**
Marine Sediment and Water Quality	**Chapter 8: Marine Sediment and Water Quality**	**Section 9.7**
Fish and Shellfish Ecology	**Chapter 10: Fish and Shellfish Ecology**	**Section 9.6.2.1**

9.11 Summary

239. The benthic ecology receptors were identified using Project-specific surveys and previous surveys carried out for the oil and gas industry (Fugro, 2008; Fugro, 2011a; Fugro, 2011b; RPS, 2013; Calesurvey and BSL, 2013), as well as published data.

240. In general, the Windfarm Site is mainly characterised as being low in diversity, with epifauna sparsely distributed comprising mainly of sea pens, hydroids, bryozoans, hermit crabs and N. norvegicus. 'Sea Pen and Burrowing Megafauna Communities' habitat as defined by OSPAR (2010) were observed at all stations within the Windfarm Site and the Buzzard Export Cable Corridor.

241. On the Landfall Export Cable Corridor the biota was found to be richer and more diverse than the Windfarm Site at most sampling stations. Habitats identified were Sea pens and burrowing megafauna in circalittoral fine mud, Circalittoral sandy mud, '*Sabellaria spinulosa* on Stable Circalittoral Mixed Sediment' and '*Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand'. Analysis of *S. spinulosa* aggregations recorded in surveys in 2021 and 2022 determined that these do not meet the criteria to be biogenic reefs, although aggregations not meeting reef thresholds/criteria have been noted as present in the NorthConnect survey corridor (2018).

242. The construction, operation and decommissioning phases of the Offshore Infrastructure would cause a range of impacts on the benthic ecology which are summarised in **Section 9.7.** The magnitude of these impacts has been assessed using expert judgement, assessments from other chapters of this **Offshore EIA Report**, and has drawn on evidence from other offshore wind farms and other projects.

243. The effects that have been assessed are anticipated to result in changes of **minor adverse** significance to the above-mentioned receptors. No additional mitigation measures, other than those which form part of the embedded mitigation (**Section 9.7.6**), are suggested.

244. A summary of the findings of the impact assessment is provided in **Table 9.20.** Impacts during construction, operation and maintenance and decommissioning have been considered during this assessment, Embedded mitigation and any additional mitigation identified during the assessment has been included, and a final assessment of residual impacts is provided.

Table 9.20 Summary of Potential Impacts Identified for Benthic Ecology

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
Construction						
C1: Physical disturbance and temporary habitat loss of seabed habitat	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	Medium	Low	Minor	None required	Minor adverse– not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, Ophelia borealis and *Abra prismatica* in Circalittoral Fine Sand					
C2: Physical disturbance and temporary loss of seabed habitat in the Southern Trench MPA	Burrowed mud and habitat suitable for Nephrops	Medium	Negligible	Minor	None required	Minor adverse– not significant
C3: Increased suspended sediments and sediment re-deposition	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	Low	Low	Minor	None required	Minor adverse– not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, Ophelia borealis and *Abra prismatica* in Circalittoral Fine Sand					
C4: Re-mobilisation of contaminated sediment during intrusive works	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	Medium	Low	Minor	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, Ophelia borealis and *Abra*					

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	prismatica in Circalittoral Fine Sand					
C5: Potential introduction of marine invasive non-native species (MINNS).	Burrowed mud habitat	High	Negligible	Minor	None required	Minor adverse – not significant
	Seapens and Burrowing Megafauna in Circalittoral Fine Mud habitat					
Operation & Maintenance						
O1: Permanent habitat loss and introduction of hard substrate	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	High	Negligible	Minor	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, *Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand					
O2: Impacts of scour on benthic communities arising from the mooring chains and anchors	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	High	Negligible	Minor	None required	Minor adverse – not significant
	Sabellaria spinulosa					

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
O3: Electromagnetic Fields (EMF).	Benthic communities	Low	Low	Minor	None required	Minor adverse – not significant
O4 Potential introduction of marine invasive non-native species (MINNS).	Burrowed mud habitat	High	Negligible	Minor	None required	Minor adverse – not significant
	Seapens and Burrowing Megafauna in Circalittoral Fine Mud habitat					
Decommissioning						
D1: Physical Disturbance and Temporary Habitat Loss of Seabed Habitat from Removal of Hard Substrate	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	Medium	Low	Minor	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, *Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand					
D2: Potential impacts on the Southern Trench MPA	Burrowed mud and habitat suitable for Nephrops	Negligible	Low	Minor	None required	Minor adverse – not significant
D3: Increased suspended sediments and sediment re-deposition	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	Medium	Low	Minor	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	Echinocyamus pusillus, *Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand					
D4: Re-mobilisation of contaminated sediment during intrusive works	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	Medium	Low	Minor	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, *Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand					
D5: Potential introduction of marine invasive non-native species (MINNS)	Burrowed mud habitat	High	Negligible	Minor	None required	Minor adverse – not significant
	Seapens and Burrowing Megafauna in Circalittoral Fine Mud habitat					
Cumulative						
CIA – C5: Potential introduction of MINNS	Burrowed mud habitat	High	Negligible	Minor	None required	Minor adverse – not significant
	Seapens and Burrowing Megafauna in Circalittoral Fine Mud habitat					
CIA - O3: EMF	Seapens and Burrowing Megafauna in Circalittoral Fine Mud	Low	Low	Minor	None required	Minor adverse – not significant
	N. norvegicus					
	Sabellaria spinulosa on Stable Circalittoral Mixed Sediment					
	Echinocyamus pusillus, *Ophelia borealis* and *Abra*					

Potential Impact	Receptor	Value/ Sensitivity	Magnitude of Impact	Significance of Effect	Mitigation	Residual Effect
	prismatica in Circalittoral Fine Sand					
CIA - O4: Potential introduction of MINNS	Burrowed mud habitat	High	Negligible	Minor	None required	Minor adverse – not significant
	Seapens and Burrowing Megafauna in Circalittoral Fine Mud habitat					
CIA – D5: Potential introduction of MINNS	Burrowed mud habitat	High	Negligible	Minor	None required	Minor adverse – not significant
	Seapens and Burrowing Megafauna in Circalittoral Fine Mud habitat					
Transboundary						
Scoped out						

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