Cambois Connection – Marine Scheme

MPA and MCZ Assessment

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Contents

TABLES

Figures

Acronyms

Acronym	Definition
BBWF	Berwick Bank Wind Farm
BBWFL	Berwick Bank Wind Farm Limited
BSH	Broadscale Habitats
BtoSM	Berwick to St Mary’s
CEA	Cumulative Effects Assessment
CEMP	Construction Environment Management Plan
CtoSM	Coquet to St Mary’s
DEFRA	Department for Environment, Food and Rural Affairs.
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMF	Electro-Magnetic Field
ES	Environmental Statement
FE	Farnes East
FeAST	Feature Activity Sensitivity Tool
FOCI	Features of Conservation Importance
FoFBC	Firth of Forth Banks Complex
GMF	Geomagnetic Field
HDD	Horizontal Direct Drilling
HPMA	Highly Protected Marine Area
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
INNS	Introduction of Non-native Species
JNCC	Joint Nature Conservation Committee
LPA	Local Planning Authority
MarESA	Marine Evidence based Sensitivity Assessment

Acronym	Definition
MCCIP	Marine Climate Change Impacts Partnership
MCZ	Marine Conservation Zone
MD-LOT	Marine Directorate Licensing and Operations Team
MHLS	Mean High Water Springs
MLA	Marine License Application
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MPA	Marine Protected Area
MS	Marine Scotland
NCC	Northumberland County Council
ncMPA	Nature Conservation Zone Marine Protected Area
NE	Natural England
NEMP	North-East Marine Plan
NTS	Non-Technical Summary
PDE	Project Design Envelope
SNMP	Scotland National Marine Plan (2015)
SSC	Suspended Sediment Concentration
SSER	SSE Renewables
UK MPS	UK Marine Policy Statement (2011)
ZoI	Zone of Influence

Glossary

Term	Description
Berwick Bank Wind Farm (BBWF)	Refers to the offshore wind farm from which the Cambois Connection (the Project) will export part of the generated electricity. The consent applications for BBWF are currently being determined.
Cambois Connection (the Project)	Offshore Export Cables, Onshore Export Cables, an onshore converter station and associated onshore grid connection at the existing National Grid ESO, Blyth substation near Cambois in Northumberland. The purpose of this infrastructure is to facilitate the export of a portion of the green electricity from BBWF, allowing the BBWF to reach its full generation capacity by the early 2030s.
EIA Regulations	Collectively, this term is used to refer to the suite of Environmental Impact Assessment Regulations which are of relevance to the Marine Scheme and to the Onshore Scheme. For the Marine Scheme, this is The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended). For the Onshore Scheme, this is the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (as amended).
Environmental Impact Assessment	Assessment of the consequences of a plan, project or activity on the ecological features of the receiving environment.
Firth of Forth	Estuary or Firth of the River Forth in Scotland which flows into the North Sea and is flanked by Fife to the north and West Lothian, City of Edinburgh and East Lothian to the south.
Grid Substation	Refers to the point at which electricity is connected into the UK transmission network. For the Onshore Scheme, this is the National Grid ESO substation at Blyth.
Habitats Directive	The Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora.
Habitats Regulations	The Conservation of Habitats and Species Regulations 2017 and the Conservation of Offshore Marine Habitats and Species Regulations 2017, which are collectively referred to as the ‘Habitats Regulations’.
Horizontal Directional Drilling	Horizontal Directional Drilling or ‘HDD’ refers to a trenchless method of drilling generally used for installation of underground utilities which does not require any direct works and which can aid installation of crossings with sensitive or challenging features and obstructions.
High Voltage Alternating Current (HVAC)	Refers to high voltage electricity in alternating current (‘AC’) form. The GB’s transmission and distribution network infrastructure consists of AC form.
High Voltage Direct Current (HVDC)	Refers to high voltage electricity in direct current (‘DC’) form. In relation to transmission, HVDC is often selected for longer transmission infrastructure on the basis that losses are typically

Term	Description
	lower when compared to transmission infrastructure utilising alternating current.
Intertidal	The area of seabed located between Mean High Water Springs and Mean Low Water Springs.
Landfall	Area and activities associated with the Offshore Export Cables carrying power from BBWF to the shore and which connect the offshore and onshore infrastructure. The Landfall includes areas and activities that extend beyond both MLWS and MHWS.
Local Planning Authority	Local Planning Authority (or 'LPA') refers to the local government body legally empowered to exercise terrestrial (onshore) planning functions for a given area. In the case of the Project, this is Northumberland County Council (NCC).
Marine Licence	A licence granted under the Marine and Coastal Access Act 2009.
Marine Scheme	Activities required as part of the Project extending seawards below Mean High Water Springs
Marine Scheme in English waters	Activities required as part of the Marine Scheme located within English territorial waters (MHWS – 12 nm) and English offshore waters (12 – 200 nm).
Marine Scheme in Scottish waters	Activities required as part of the Marine Scheme located within Scottish offshore waters (12-200 nm).
Maximum Design Parameters	The maximum range of design parameters of each Marine Scheme asset.
Mean High Water Springs	Monthly tides are defined as 'Springs' or 'Spring tides' when the tidal range is 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).
Mean Low Water Springs	The height of Mean Low Water Springs (MLWS) is the average throughout a year of the heights of two successive low waters during periods of 24 hours (approximately once a fortnight).
National Site Network	Formerly referred to as Natura 2000 this now refers to the national site network within the UK territory. It is comprised of the protected sites that were designated under the European Union (EU) Nature Directives (Habitats Directive (as defined) and certain elements of the Wild Birds Directive (Directive 2009/147/EC)) until the UK's exit of the EU, and any further sites designated under the Habitats Regulations (as defined).
Offshore Converter Station Platform (OCSP)	Power generated by the wind turbines is transferred to the Offshore Converter Station Platform (OCSP) via the inter array cables. The electricity generated by the wind turbines is HVAC. The OCSPs are then used to convert the HVAC electricity into HVDC electricity for exporting to the onshore converter station.

Term	Description
Offshore Export Cable	High voltage cable used for exporting power from the offshore convertor station platforms located within the array area of BBWF to Onshore Export Cables at the Landfall.
Offshore Export Cable Corridor	The area within which the Offshore Export Cables will be located. This area will be refined post consent following detailed engineering design.
Onshore Converter Station	Infrastructure used to convert electricity from Direct Current (DC) to Alternating Current (AC)
Onshore Export Cable	High voltage cable used for exporting power produced by BBWF between the Offshore Export Cables and the onshore convertor station.
Onshore Scheme	Activities required as part of the Project extending landwards above Mean Low Water Springs
Project Design Envelope	A series of maximum design parameters which are defined for the Marine Scheme and which are considered to be the worst case for any given assessment.
Transition Joint Bay	A concrete structure where Offshore Export Cables and Onshore Export Cables are spliced together.

1. Introduction

1.1. Introduction

1. Berwick Bank Wind Farm Limited (BBWFL) is a wholly owned subsidiary of SSE Renewables (SSER) (hereafter referred to as 'the Applicant'). The Applicant is proposing the development of Offshore Export Cables, Onshore Export Cables, an onshore Converter Station and associated grid connection at Blyth in Northumberland (the Cambois Connection, hereafter referred to as 'the Project'). The offshore components of the Project, seaward of mean high water springs (MHWS) comprise the Marine Scheme, which is the subject of this report.

2. The purpose of this infrastructure is to facilitate the export of green energy from the generation assets associated with the Berwick Bank Wind Farm (BBWF), located in the outer Firth of Forth. A separate application for developing a grid connection to Branxton, East Lothian, has been included as part of the Applicant's application for consent for BBWF, currently being determined separately[1]. The Project will enable the BBWF to reach full generating capacity by the early 2030's.

3. Xodus Group Ltd (Xodus) was commissioned to undertake a Marine Protected Area (MPA) and Marine Conservation Zone (MCZ) assessment for the Marine Scheme and this document represents the final MPA/MCZ assessment to accompany the Marine Licence Applications (MLAs) for the Marine Scheme. Specific consideration of ncMPAs and MCZs is required for consent applications in UK waters. The Marine and Coastal Access Act 2009 introduced provisions to support the management of ncMPAs and MCZs under section 126 of the Marine and Coastal Access Act 2009, the licensing authorities are required to consider whether the licensable activity applied for is capable of affecting (other than insignificantly) a protected feature in an ncMPA / MCZ or any ecological or geomorphological process on which the conservation of any protected feature in an ncMPA / MCZ is dependent. The methodology of this assessment therefore deviates slightly from the over-arching Environmental Impact Assessment (EIA) methodology found in ES, Volume 2, Chapter 3: EIA Methodology, so as to consider the conservation objectives of each ncMPA/MCZ and the methodology adopted is set out in section 3.

4. This assessment is informed by the following technical chapters:

- ES, Volume 2, Chapter 7: Offshore Physical Environment and Seabed Conditions;
- ES, Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology; and
- ES, Volume 2, Chapter 10: Offshore and Intertidal Ornithology.

1.2. Purpose of this Chapter

5. This ncMPA / MCZ Assessment:

- Presents the existing environmental baseline established from desk studies, site-specific surveys and feedback obtained during technical engagement with stakeholders;
- Identifies any assumptions and limitations encountered in compiling the environmental information;
- Presents the potential impact pathways to ncMPAs and MCZs arising from the Marine Scheme, and reaches a conclusion on the potential of hindering the conservation objectives

[1] BBWF is subject to a separate consenting process. An application for consent under Section 36 of the Electricity Act 1989 (as amended) was submitted to MD-LOT and accepted in December 2022.

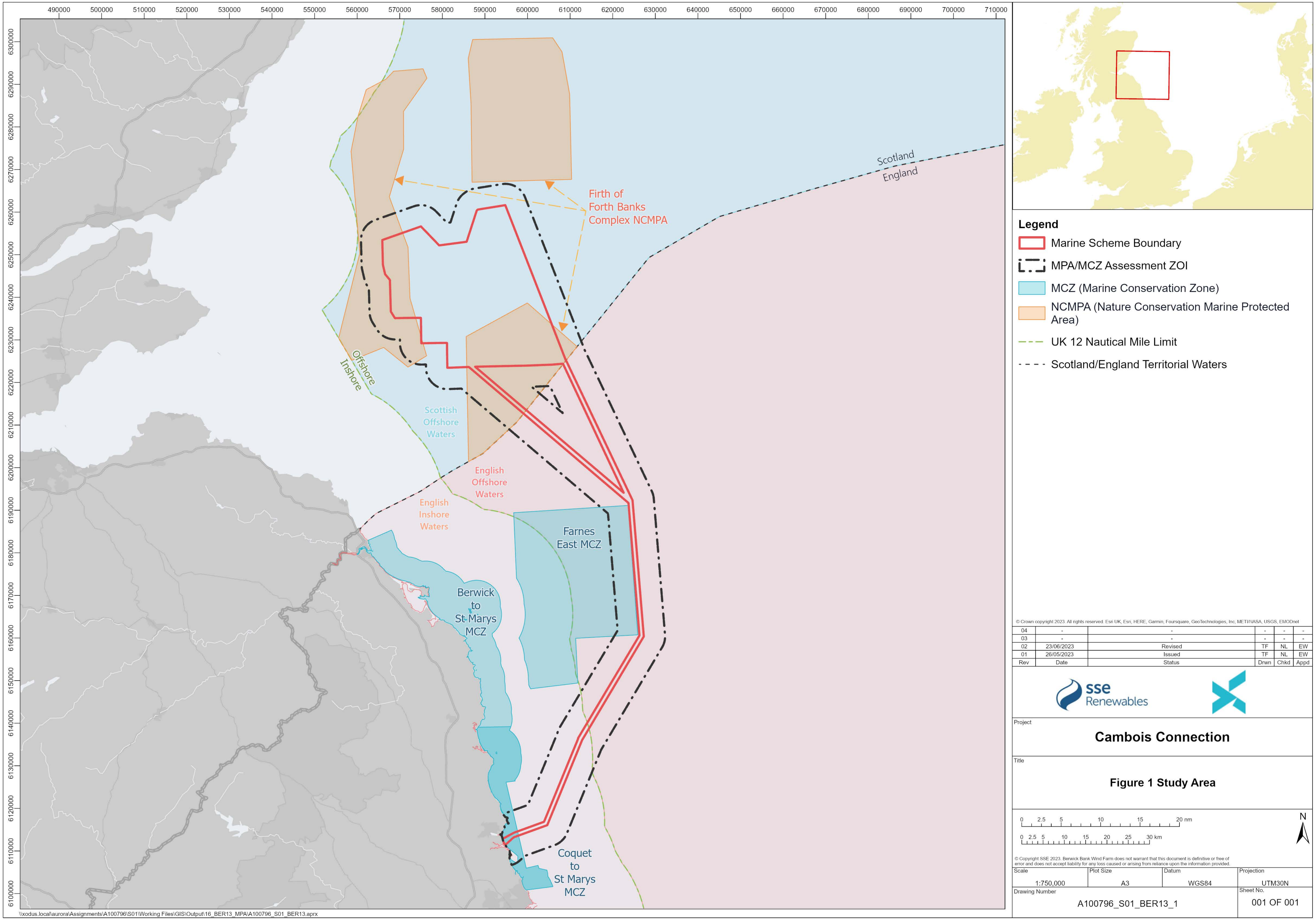
for each ncMPA and MCZ - based on the information gathered and the analysis and assessments undertaken;

- Highlights any necessary monitoring and/or mitigation measures recommended to prevent, minimise, reduce or offset the potential of the Marine Scheme to hinder the conservation objectives of ncMPAs and MCZs; and
- Presents a cumulative effects assessment (CEA) to identify the potential for other plans and projects to hinder the conservation objectives of the ncMPA or MCZs in combination with the Marine Scheme

1.3. Study Area

6. The ncMPA and MCZ assessment Study Area is defined as the boundary for the Marine Scheme and the maximum Zone of Influence (ZoI). For the Marine Scheme, the maximum ZoI is 5 km and this is in relation to the mean annual tidal excursion which is approximately 5 km (see ES, Volume 2, Chapter 7: Physical Environment and Seabed Conditions), also encompassing nearshore construction activity that could cause disturbance to ornithological receptors (ES, Volume 2, Chapter 10: Offshore and Intertidal Ornithology).

7. Figure 1 depicts the study area for the ncMPA and MCZ assessment.



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04	-	-	-	-	-
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02	23/06/2023	Revised	TF	NL	EW
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sse Renewables

Project

Cambois Connection

Title

Figure 1 Study Area

Scale	Plot Size	Datum	Projection
1:750,000	A3	WGS84	UTM30N

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1.4. Policy and Legislative Context

8. Policy and legislation in relation to the assessment of impacts on ncMPAs and MCZs, is set out in detail in ES, Volume 2, Chapter 2: Policy and Legislative Context. A summary of the policy and legislative provisions relevant to ncMPAs and MCZs are provided in Table 1.1 and Table 1.2 below.

Table 1.1 Summary of Scottish and English policy provisions relevant to the ncMPA and MCZ Assessment

Relevant Policy	Summary of Relevant Policy Framework	How and Where Considered in the ES
Scotland and England (UK)		
UK Marine Policy Statement (MPS) 2011	The UK MPS provides a framework for preparation of the Marine Plans and decisions within the marine environment. The MPS promotes sustainable economic development, enabling the UK to move towards a low-carbon economy, ensuring a sustainable marine environment which promotes healthy, functioning marine ecosystems and protects marine habitats, species and heritage assets and contributes to the societal benefits of the marine area. The UK MPS is implemented throughout the UK through marine plans which provide detailed policy and spatial guidance for a marine area that will contribute to the overall aims of the MPS. The relevant marine plans for the Marine Scheme are considered in further detail below.	The Marine Plans which are relevant to the Marine Scheme have been taken into account in the preparation of this ncMPA and MCZ Assessment. Alongside this, a Marine Plan compliance checklist has been prepared by the Applicant; this is provided within ES, Volume 3, Appendix 2.1 of the Marine Scheme ES.
Scotland		
Scotland National Marine Plan (SNMP) 2015	The SNMP provides an overarching framework for marine activities within 12 nm and offshore (12 nm to 200 nm). The SNMP is designed to enable sustainable development and use of the marine area in a way which will protect and enhance the marine environment, whilst promoting both existing and emerging industries. The strategic objectives of the SNMP integrate the ecosystem approach through the adoption of the eleven descriptors of Good Environmental Status (GES) from the Marine Strategy Framework Directive (MSFD) (EU Directive 2014/89/EU)), and integrate the guiding principles to sustainable development through the adoption of the UK High Level Marine Objectives: • Achieving a sustainable marine economy; • Ensuring a strong, healthy and just society; • Living within environmental limits; • Promoting good governance; and • Using sound science responsibly.	The Marine Plans which are relevant to the Marine Scheme have been taken into account in the preparation of this ncMPA and MCZ Assessment. Section 4.46 to 4.47 of the SNMP sets out the requirements for regulators to consider ncMPAs prior to reaching consent decisions. Section 4.47 refers to detailed guidance available within Marine Scotland's Nature Conservation Marine Protected Areas Draft Management Handbook (Marine Scotland, 2015a). This has been archived however in the absence of updated guidance, the ncMPA and MCZ Assessment has been informed by the handbook. A Marine Plan compliance checklist has been prepared by the Applicant; this is provided within ES, Volume 3, Appendix 2.1 of the Marine Scheme ES
Firth of Forth Banks Complex Marine Protected Area Order 2014	Designation Order, made by the Scottish Ministers, in exercise of the powers conferred by the Marine and Coastal Access Act 2009(a).	In accordance with the requirements of the Marine and Coastal Access Act 2009, an ncMPA and MCZ

Relevant Policy	Summary of Relevant Policy Framework	How and Where Considered in the ES
	The Order is made for the purposes of conserving marine flora and fauna, marine habitats and types of such habitats, and features of geomorphological interest. The protected features of the marine protected area are: • Ocean quahog aggregations; • Offshore subtidal sands and gravels; • Shelf banks and mounds; and • Quaternary of Scotland – moraines. The conservation objectives of the Firth of Forth Banks Complex MPA are that the protected features: (a) so far as already in favourable condition, remain in such condition; and (b) so far as not already in favourable condition, be brought into such condition, and remain in such condition.	Assessment has been carried out by the Applicant. An assessment of the potential for the project to hinder the conservation objectives of the Firth of Forth Banks Complex ncMPA is provided in section 5.
England		
North East Inshore and North East Offshore Marine Plan 2021 (North East Marine Plan (NEMP))	The NEMP provides a framework intended to shape and inform decisions on how the marine environment will be developed, protected and improved over the next 20 years. Through its vision for economic, environmental and social prosperity, the NEMP aims to ensure effective and sustainable use of the marine environment and its resources. The objectives of the NEMP align under the UK High Level Marine Objectives; there are thirteen objectives which fall under the following categories: • Achieving a sustainable marine economy; • Ensuring a strong, healthy and just society; and • Living with environmental limits.	The NEMP recognises the presence of MCZs along the north east coast but does not provide any detailed policy in relation to their specific features or management. A Marine Plan compliance checklist has been prepared by the Applicant; this is provided within ES, Volume 3, Appendix 2.1 of the Marine Scheme ES.
National Policy Statements[2][3]	UK Government guidelines and policies relating in part to the development, safety, sustainability, environment, and energy demand of national energy infrastructure. The Overarching NPS for Energy (EN1) notes the critical need for the UK to develop and secure electricity supplies and sets out the relationship between the NPS and marine licencing	The Marine Scheme does not require development consent under the Planning Act 2008 and does not fall to the Planning Inspectorate to consider, as explained in Chapter 2: Policy and Legislative Context.

[2] Whilst it is acknowledged that neither BBWF nor the Marine Scheme comprise or form part of an NSIP (please see Volume 2: Chapter 2: Policy and Legislative Context), NPSs are however a statement of government intention relating, in this case, to renewable energy projects, therefore can be taken into consideration during the preparation of this assessment.

[3] A suite of draft revised Energy NPSs were published and consulted on by the UK Government in March 2023, and consultation closed on 23rd June. The consultation responses will be subject to consideration and the draft revised NPSs may now be revised before the NPSs are formally adopted. There is currently no date for the next stage of the review process and therefore this ES presents the current adopted NPSs which have been considered during the preparation of this ES. It is however noted by the Applicant that the new draft NPSs state that they may be material considerations in other applications which are not considered under the Planning Act (2008), this includes the Marine Scheme. Further detail on the consideration of the draft NPSs in this ES is provided in Volume 2 Chapter 2 Policy and Legislative Context.

Relevant Policy	Summary of Relevant Policy Framework	How and Where Considered in the ES
	decisions undertaken by the MMO. In particular, the NPS for Electricity Networks (EN-5) details policies regarding proposed cable projects.	NPSs are a statement of government intention relating, in this case, to renewable energy projects. Therefore, whilst the Marine Scheme is not an NSIP, NPSs can be taken into consideration. Paragraphs 1.2.2 and 4.1.6 of EN-1 provide details of how this NPS may be relevant to the decisions of the Marine MMO and how the NPS - and any applicable Marine Plan - may be relevant to regulatory decisions. No MCZ-specific direction is provided by EN-1. EN-5 recognises that the new electricity generating infrastructure that the UK needs to move to a low carbon economy will be "'heavily dependent on the availability of a fit for purpose and robust electricity network"'. EN-5 also highlights that "'when considering impacts for electricity networks infrastructure, all of the generic impacts covered in EN-1 are likely to be relevant, even if they only apply during one phase of the development […] or only apply to one part of the development"'.
The Farnes East Marine Conservation Zone Designation Order 2016	Designation Order, made by the Secretary of State, in exercise of the powers conferred by the Marine and Coastal Access Act 2009(a). The Order designates an area as a marine conservation zone (which may be referred to as "the Farnes East Marine Conservation Zone"). The Order is made for the purposes of conserving marine habitats and the species of marine fauna specified in Schedule 2 to the Order. The protected features of the Zone are: • Moderate energy circalittoral rock; • Subtidal coarse sediment; • Subtidal mixed sediments; • Subtidal sand; • Subtidal mud; • Seapen and burrowing megafauna communities; and • Ocean quahog (*Arctica islandica*). The conservation objective of the Zone is that the protected features: (a) so far as already in favourable condition, remain in such condition; and (b) so far as not already in favourable condition, be brought into such condition, and remain in such condition.	In accordance with the requirements of the Marine and Coastal Access Act 2009, an ncMPA and MCZ Assessment has been carried out by the Applicant. An assessment of the potential for the project to hinder the conservation objectives of the Farnes East MCZ is provided in section 6.

Relevant Policy	Summary of Relevant Policy Framework	How and Where Considered in the ES
The Berwick to St Mary's Marine Conservation Zone Designation Order 2019	Designation Order, made by the Secretary of State, in exercise of the powers conferred by the Marine and Coastal Access Act 2009(a). The Order designates an area as a marine conservation zone (which may be referred to as "the Berwick to St Mary's Marine Conservation Zone"). The Order is made for the purposes of conserving species of marine fauna. The species of marine fauna which is the protected feature of the Zone is common eider (*Somateria mollisima).* The conservation objectives of the Zone are that, in relation to common eider (*Somateria mollissima*): (a) the habitat used by members of that species ("supporting habitat"); • so far as already in favourable condition, remain in such condition, and • (ii) so far as not already in favourable condition, be brought into such condition and remain in such condition; (b) the population of that species: • so far as already in favourable condition, remain in such condition, and • (ii) so far as not already in favourable condition, be brought into such condition, and remain in such condition.	In accordance with the requirements of the Marine and Coastal Access Act 2009, an ncMPA and MCZ Assessment has been carried out by the Applicant. An assessment of the potential for the project to hinder the conservation objectives of the Berwick to St Mary's MCZ is provided in section 7.
The Coquet to St. Mary's Marine Conservation Zone Designation Order 2016	Designation Order, made by the Secretary of State, in exercise of the powers conferred by the Marine and Coastal Access Act 2009(a). The Order designates an area as a marine conservation zone (which may be referred to as "the Coquet to St. Mary's Marine Conservation Zone"). The Order is made for the purposes of conserving species of marine habitats specified in Schedule 2 to the Order.	In accordance with the requirements of the Marine and Coastal Access Act 2009, an ncMPA and MCZ Assessment has been carried out by the Applicant. An assessment of the potential for the project to hinder the conservation objectives of the Coquet to St Mary's MCZ is provided in section 8.

Table 1.2 Summary of legislative provisions relevant to the ncMPA and MCZ Assessment

Relevant Legislation	Summary of Relevant Legislative Framework	How and Where Considered in the ES
Scotland and England (UK)		
Marine and Coastal Access Act 2009	Affords protection to MCZs within English territorial and offshore waters, and ncMPAs within Scottish offshore waters (i.e., beyond 12 nm). Under Section 116(7) of the Marine and Coastal Access Act 2009 an MCZ designated by Scottish Ministers under Section 116 is to be known as an ncMPA and any reference to an MCZ within the Marine and Coastal Access Act 2009 is to be read as a reference to an ncMPA. Under Section 126, MD-LOT and the MMO have a duty to consider ncMPAs and MCZs during the decision-making processes for a Marine Licence Application. Section 126 applies where: • A public authority has the function of determining an application for authorisation of the doing of an act; and • The act is capable of affecting (other than insignificantly) […]: ○ the protected features of an ncMPA/MCZ […] • any ecological or geomorphological process on with the conservation of any protected feature of the ncMPA/MCZ is wholly or partially dependent […]	In accordance with the requirements of the Marine and Coastal Access Act 2009, an ncMPA and MCZ Assessment has been carried out by the Applicant. This assessment has followed the available guidance, including the Marine Conservation Zones and Marine Licencing (MMO, 2013) and Scotland's Nature Conservation Marine Protected Areas Draft Management Handbook (Marine Scotland, 2015a) in both Scottish and English waters. It has also been informed by pre-application advice from both MD-LOT and the MMO.

1.5. Consultation and Technical Engagement

9. A summary of the key issues raised during consultation and technical engagement activities undertaken to date specific to the ncMPA and MCZ Assessment is presented in Table 1.3 below, together with how these issues have been considered in the production of this chapter. Further detail is presented within ES, Volume 2, Chapter 4: Stakeholder Consultation and Engagement.

Table 1.3 Summary of key consultation and technical engagement undertaken for the Marine Scheme relevant to the ncMPA and MCZ Assessment

Date	Consultee and Type of Consultation	Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
Relevant consultation and engagement undertaken to date			
13 January 2022	Northumberland County Council (NCC)	The Applicant held an introductory meeting with NCC, as the Local Planning Authority (LPA) for the Onshore Scheme associated with the Cambois Connection. Owing to the requirement for a landfall along the Cambois coastline, the approach to the impact assessment for this area was discussed (including in terms of specific sensitivities and any potential overlap in assessments). It was agreed that whilst NCC are not a signatory to the Coastal Concordat, the underlying principles would be adopted (in practical terms, this was intended to streamline the EIAs for the Onshore Scheme and the Marine Scheme, reducing overlap and regulatory burden).	Whilst the advice from NCC was used to inform the landfall selection process. Following the discussions with NCC regarding the coastal concordat, an aligned approach to the Marine Conservation Zone (MCZ) Assessment has been followed.
16 March 2022	MMO and MD-LOT	The Applicant introduced the Cambois Connection to both relevant marine regulators for the Marine Scheme. The approach to the ensuing EIA and marine licence applications (MLAs) was presented, as well as the intended approach regarding MLA submissions in both Scotland and England. The requirements for an ncMPA and MCZ Assessment in Scottish and English waters was discussed. It was confirmed and agreed that the Applicant would seek to maximise efficiency throughout this process and avoid – wherever possible – overlap.	Advice from both regulators was used to inform approach to the ncMPA and MCZ Assessment. Advice from both the MMO and MD-LOT was used to inform the decision taken by the Applicant to avoid the Farnes East MCZ, as discussed further in Volume 1, Chapter 6: Route Appraisal and Consideration of Alternatives.
17 March 2022	Natural England	The Applicant introduced the Cambois Connection and discussed a range of topics of relevance to ecology and nature conservation, as well as the intended approach and scope of the ensuing EIA, Habitats Regulations Appraisal / Assessment and ncMPA and MCZ Assessment. The intended approach to the impact assessment for ornithology was discussed.	Advice from Natural England was used to inform the identification of a broad corridor from BBWF to Cambois, and then further refinement of the offshore export cable corridor of the Marine Scheme. Advice from Natural England was used to inform the decision taken by the Applicant to avoid the Farnes East MCZ, as discussed further in ES, Volume 2, Chapter 6: Route Appraisal and Consideration of Alternatives.

Date	Consultee and Type of Consultation	Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
			Advice from Natural England was used to inform the approach to the ncMPA and MCZ Assessment.
06 July 2022	Natural England	The Applicant held a further meeting with Natural England to discuss the scope of and approach to a suite of surveys planned for 2022, including offshore geophysical and benthic surveys. Interactions with relevant designated sites were discussed, as was the Applicant's position with regards to overwintering birds, including the proposed scope of the assessment, use of existing data and the need for supporting surveys. Based on the wealth of existing ornithological data in the area, the Applicant did not propose overwintering (non-breeding) bird surveys; Natural England were accepting of this, but suggested it may lead to a risk of seasonal conditions.	Advice from Natural England associated with a number of designated sites was used to inform the selection of a preferred corridor. In order to ensure the required level of seasonal flexibility for the likely landfall locations along the Cambois coastline, the Applicant commissioned a programme of overwintering (non-breeding) surveys. Natural England were consulted on the scope of and approach to surveys; they were completed in winter 2022/23.
Consultation on the Marine Scheme: Scoping Opinion			
20 January 2023	Natural England – Scoping Opinion Response	The ES should consider including information on the impacts of this development on MCZ interest features, to inform the assessment of impacts on habitats and species of principle importance for this location. When assessing impacts in designated sites, impacts should be measured in relation to the proportion of a feature impacted rather than the proportion of the site. Conservation advice for the majority of inshore SPAs and MCZs can be found on Natural England's Designated Sites Views website: https://designatedsites.naturalengland.org.uk/ Conservation Advice for Farnes East can be found on the JNCC website: https://jncc.gov.uk/our-work/farnes-east-mpa/ Conservation Advice for Berwick to St Mary's MCZ is currently in development. An examination of the Conservation Advice provided for eider in Lindisfarne SPA will provide a good basis for this MCZ assessment.	Conservation advice on the designated features of the relevant ncMPAs and MCZs have informed the assessment in Section 4.5. The assessment of the likely significant effects of the Marine Scheme on the designated sites under the EIA Regulations is contained in ES, Volume 2, Chapter 8: Benthic and Intertidal Ecology, Chapter 9: Physical Environment and Seabed Conditions and Chapter 10: Offshore and Intertidal Ornithology.

Date	Consultee and Type of Consultation	Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
20 January 2023	Natural England – Scoping Opinion Response	Where there is potential for removals, deposition, the introduction of noise or other disturbance into designated sites, these will need to be assessed through HRAs and MCZ assessment	The impact of all scoped in impact pathways on the designated features of the relevant MCZs are detailed in section 4.3 and assessed in the site-specific assessments (sections 6-8).
20 January 2023	Natural England – Scoping Opinion Response	Natural England welcomes consideration of decommissioning. If removal could be achieved, then whilst the impacts would no longer be permanent, they would still last for the lifetime of the infrastructure (35 years) and potentially longer as a residual impact. Therefore, because this impact is lasting / long term and site recovery wouldn't be assured, Natural England's view is that reasonable scientific doubt would likely remain regarding the impact of the proposals on the conservation objectives for designated sites. Accordingly, we advise that a precautionary approach is required when considering the impacts to the designated site features both alone and cumulatively.	The impacts of decommissioning are considered within the assessment for each designated site. A Decommissioning Plan is included as designed in mitigation, as detailed in Section 3.6. Decommissioning measures will be informed by available technology, regulations and industry practice at the time. As a worst case for temporary impacts, it is assumed that the Offshore Export Cables and associated cable protection will be fully removed. However, it is noted that this will depend on the type of protection used and condition of the protection at the time of removal. A precautionary approach to assessment of the potential to hinder the conservation through permanent habitat loss has been included where appropriate.
20 January 2023	Natural England – Scoping Opinion Response	We will require information on a worst-case-scenario for the predicted type, location (maps) and quantity of suspended sediment mobilisation and deposition. We will require information on a worst-case-scenario for the predicted type, location (maps) and quantity of habitat loss, disturbance and change. This should include (but not necessarily be limited to) rock protection, concrete / frond mattresses or other forms of cable protection. Any cable protection is likely to require mitigation through avoidance, reduction or other mitigation. We advise this is included in the Environmental Statement, HRA and MCZ assessment.	The Maximum Design Scenario relevant to each designated site is provided in each assessment, sections 5, 6, 7 and 8. The cable protection requirements across the Marine Scheme have been estimated through an Indicative Cable Burial Appraisal. As part of this assessment, the Marine Scheme Offshore Export Cable Corridor has been divided into discrete sections for which protection zone categories have been applied and are shown in Figure 3. Further detail on increases in suspended sediment and the nature and distribution of re-deposition is fully detailed within ES, Volume 2, Chapter 7: Physical Environment and Seabed Conditions.
20 January 2023	Natural England – Scoping Opinion Response	We welcome the inclusion of the broad impacts scoped in and advise the following pressures are assessed in the ES, HRA and MCZ assessments: • Abrasion / disturbance of the seabed	In addition to assessment in the relevant ES Chapters, project activities with the potential to exert these pressures on benthic, geomorphological and ornithology features of the ncMPA and MCZs are screened in section 4.

Date	Consultee and Type of Consultation	Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
		• Changes in suspended solids • Penetration and / or disturbance of the substratum below the surface of the seabed, including abrasion • Physical change (to another seabed type) • Physical change (to another sediment type) • Smothering and siltation rate changes • Barrier to species movement • Habitat structure changes – removal of substratum • Introduction of other substances (solid, liquid or gas) • Vibration • Above water noise • Visual disturbance	Screened in activities and pressures are assessed in sections 5, 6, 7 and 8, Buried cables with limited cable protection do not represent a barrier to species movement and so are not considered further.
23 February 2023	MD-LOT – Scoping Opinion Response	In relation to the approach to EIA proposed by the Applicant, the Scottish Ministers advise that the assessment must consider all three areas within the Firth of Forth Banks Complex ncMPA with respect to the geodiversity features both alone and in combination and direct the Applicant to the NatureScot representation on this topic which should be fully addressed in the EIA Report, including the provision of more detailed information, maps and figures to aid assessment. With regard to the approach to assessment, the Scottish Ministers advise that all three areas of the Firth of Forth Complex ncMPA must be assessed with respect to the offshore subtidal sands and gravels feature, both alone and in-combination and direct the Applicant to the NatureScot representation for further detailed advice on the maps and level of detail that should be provided within the EIA Report.	Figure 7 and Figure 9 detail all three areas within the Firth of Forth Banks Complex ncMPA with respect to the geodiversity features. More detailed maps are included in ES, Volume 2, Chapter 9: Physical Environment and Seabed Conditions. The ncMPA assessment for the Firth of Forth Banks Complex ncMPA is presented in section 5 and considers the potential to hinder the conservation objectives of the site for each feature.
23 February 2023	MD-LOT – Scoping Opinion Response	In relation to the approach to cumulative impacts discussed at section 4.7 of the Scoping Report, the Scottish Ministers advise that the EIA Report should consider the cumulative effect of key impacts such as habitat disturbance and/or loss in relation to the Firth of Forth Banks Complex nature conservation Marine Protected Area (“ncMPA”) and other developments that overlap with this ncMPA. In addition to those projects detailed in Table 4-5, the Seagreen Alpha and Bravo offshore wind farms and Seagreen 1A export cable should be included and other neighbouring developments in the Firth and Tay area should be considered, particularly those which overlap with the Firth of Forth Banks Complex ncMPA.	Developments considered within the CEA are detailed in Table 4.4. Cumulative impacts relevant to the designated features of the Firth of Forth Banks Complex ncMPA are assessed in section 5.6.

Date	Consultee and Type of Consultation	Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
23 February 2023	MD-LOT – Scoping Opinion Response	In relation to cumulative effects detailed at section 6.8, the Scottish Ministers draw attention to NatureScot representation advising that habitat disturbance and/or loss from the Berwick Bank wind farm, in combination with neighbouring wind farms in the Forth and Tay area, and in particular with regard to those which overlap with the Firth of Forth Banks Complex ncMPA, should be explicitly included within the cumulative impact assessment. The Scottish Ministers consider that the Seagreen Alpha and Bravo wind farm and the Seagreen 1A export cable corridor should be included in Table 4-5 in this regard.	Developments considered within the CEA are detailed in Table 4.4. Cumulative impacts relevant to the designated features of the Firth of Forth Banks Complex ncMPA, including habitat loss and disturbance are assessed in section 5.6.
23 February 2023	MD-LOT – Scoping Opinion Response	With regard to the cumulative impacts on benthic subtidal and intertidal receptors considered by the Applicant at section 8.8, the Scottish Ministers advise that the assessment must consider cumulative impacts in combination with the proposed Berwick Bank wind farm and neighbouring (consented) wind farms in the Forth and Tay area, with their associated export cables, especially in relation to impacts to the ncMPA.	Cumulative impacts relevant to the designated features of the Firth of Forth Banks Complex ncMPA are assessed in section 5.6.
9 January 2023	Nature Scot – Scoping Response	[Centre for Fisheries and Aquaculture Science] Cefas notes the Farnes East MCZ overlaps partly with the proposed export cable corridor. Cefas defer to the recommendations of the relevant statutory nature conservation bodies regarding the impact of the cable installation, and any associated cable protection measures, on the protected features of designated sites. Cefas also recommend that consideration of the option to avoid installing cables within the Farnes East MCZ by routing the export cable within the scoping area, yet outside of the Farnes East MCZ (Figure 1).	Advice from both the MMO and MD-LOT was used to inform the decision taken by the Applicant to avoid the Farnes East MCZ, as discussed further in ES, Volume 2, Chapter 6: Route Appraisal and Assessment of Alternatives.
9 January 2023	Nature Scot – Scoping Response	The EIAR should consider the cumulative effect of key impacts such as habitat disturbance and/or loss in relation to the Firth of Forth Banks Complex ncMPA and other developments that overlap with this ncMPA. In Table 4-5, the Seagreen Alpha & Bravo wind farm and Seagreen 1A export cable are omitted from the long list of projects to be considered in the Cumulative Impact Assessment. We advise that both Seagreen developments are included, given that they also overlap with the Firth of Forth Banks Complex ncMPA. Other neighbouring developments in the Firth and Tay area should also be considered.	Cumulative impacts relevant to the designated features of the Firth of Forth Banks Complex ncMPA are considered in section 5.6
19 December 2022	Nature Scot – Scoping Response	Section 8.4 captures key desktop datasets and reports, however it should also include and consider features' sensitivity to proposed activities using the FEAST – Feature Activity Sensitivity Tool as well as the information published in the Site Information Centres, especially the information in the Supplementary Advice on the Conservation Objectives (SACO), for the Firth	FeAST, MarESA, the Firth of Forth Banks Complex ncMPA SACO and site specific surveys have been used to inform the assessment on the ncMPA in section 6.

Date	Consultee and Type of Consultation	Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
		of Forth Banks Complex ncMPA. We welcome the input from site-specific benthic surveys to help inform baseline characterisation.	
19 December 2022	Nature Scot – Scoping Response	Section 8.5.2 incorrectly identifies the features that the Firth of Forth Banks Complex ncMPA is designated for. The Firth of Forth Banks Complex ncMPA is designated for ocean quahog aggregations, offshore subtidal sands and gravels, shelf banks and mounds, and quaternary geology and geomorphology, including moraines representative of the Wee Bankie key geodiversity area. For clarification, edible crab and brittlestars are not designated features for this site. We expect the EIAR to make a clear assessment against all designated features of the Firth of Forth Banks Complex ncMPA, including ocean quahog. We understand that this may be a qualitative assessment.	The potential to hinder the conservation objectives for each designated feature of the ncMPA are assessed in section 6.
19 December 2022	Nature Scot – Scoping Response	Firth of Forth Banks Complex ncMPA is a composite site and the boundaries of each of the three areas reflect the presence and extent of the important features contained within them. All three areas within the ncMPA need to be considered with respect to the offshore subtidal sands and gravels feature, both alone and in-combination, as part of the assessment on the site. The EIAR should therefore include detailed information and figures on the potential impact to the three areas, as well as the overall ncMPA. We recommend a separate, more detailed map is presented for overlap of the Cambois Connection (without the Berwick Bank array) with the Firth of Forth Banks Complex ncMPA. Additional detailed maps should also be included in the EIAR, showing the Firth of Forth Banks Complex ncMPA, particularly in relation to the Cambois Connection, Berwick Bank wind farm, Seagreen Alpha & Bravo wind farm and Seagreen 1A export cable. We also advise that further maps should be included which show the location of protected features within the ncMPA – please see JNCC mapper for further information.	Figure 7 and Figure 9 detail all three areas within the Firth of Forth Banks Complex ncMPA with respect to the geodiversity features. More detailed maps are included in ES, Volume 2, Chapter 9: Physical Environment and Seabed Conditions. The impact assessment considering the impact pathways scoped in this assessment is considered in section 6.
19 December 2022	Nature Scot – Scoping Response	As discussed above, the EIAR must consider the cumulative effect of key impacts such as habitat disturbance/loss from Berwick Bank wind farm in combination with the neighbouring wind farms in the Forth and Tay area, especially in relation to impacts across the Firth of Forth Banks Complex ncMPA as discussed above. It would be beneficial for the analysis to contain tables, or another format, to enable accurate assessment of the impact of the project alone and in combination with the neighbouring offshore wind projects, and any other relevant marine activities, which will occur in the Firth of Forth Banks Complex ncMPA. This will need to cover the three areas of the ncMPA, as well as overall for this composite site.	Cumulative impacts relevant to the designated features of the Firth of Forth Banks Complex ncMPA are considered in section 6.

2. Marine Scheme Description

2.1. Introduction

10. The following section provides detail on the key aspects of the Marine Scheme relevant to the ncMPA and MCZ Assessments.

2.2. Pre-Installation Surveys (Scottish and English Waters)

11. A number of pre-installation surveys (geophysical, geotechnical and unexploded ordnance (UXO)) will be required along the length of the Offshore Export Cable Corridor to:

- Further assess seabed conditions and morphology (e.g. to inform UXO assessment work);
- Identify presence and absence of potential obstruction, hazards or sensitive features (e.g., archaeological or ecological sensitivities); and
- Inform detailed design work e.g., specific cable routes and final landfall location.

12. These surveys will be conducted across the Offshore Export Cable Corridor. Timings of surveys will be dependent on programme and survey vessel availability and the duration of the surveys could range from a few weeks e.g., four to six weeks to six months (or longer) depending on the nature of the survey and accounting for factors such as weather downtime for example.

13. The pre-installation surveys are likely to involve a range of industry-standard techniques, such as:

- Geotechnical;
- Bathymetry;
- Side Scan Sonar (SSS);
- Sub-bottom Profiling (SBP); and
- Magnetometer/gradiometer.

2.3. Cable Route Preparation (Scottish and English Waters)

14. Prior to installation of the Offshore Export Cables, seabed features (e.g., sandwaves and boulders) and obstacles (e.g., out of service cables, discarded fishing gear and other debris) identified within the Offshore Export Cable Corridor may need to be cleared or avoided, depending on the final cable route (a relatively flat seabed surface is typically required for installation tools to achieve target burial depth). Seabed levelling/clearance techniques are anticipated to include:

- **Seabed levelling:** required to level the seabed prior to cable installation. Involves levelling or lowering of seabed features e.g., sandwaves to create a flat surface for cable installation;

- **Boulder clearance:** where large boulders are present along the final cable routes these will also need to be cleared within a swathe of 25 m along each cable route to enable cable installation;

- **Pre-lay grapnel run (PLGR):** this is required to clear debris and other obstacles from the cable routes and involves towing a heavy grapnel with a series of specially designed hooks along the centreline of the route to gather debris such as trawler warps or crane wires from ships;

- **Crossing preparation:** Along the length of the Offshore Export Cable Corridor, there are a number of crossings with third-party assets. Each specific crossing will be designed in detail as part of the development and agreement of crossing and / or proximity agreements for each asset crossed by the Marine Scheme; and

- **Sea Trials:** In areas of especially hard or soft seabed, installation tools may be trialled by the installation contractor(s) to determine their capability to achieve the required depth. This could include trials of pre-trenching using a displacement plough, mechanical trencher / jet trencher or other similar means and to determine the efficacy of boulder clearance methodologies so as to minimise the potential use of cable protection.

2.4. Cable Installation (Scottish and English Waters)

15. A full description of the cable installation activity is provided in ES, Volume 2, Chapter 5: Project Description; a brief summary of this activity is included below.

16. The Offshore Export Cables will originate at the Offshore Converter Station Platforms (OCSPs) within the BBWF array area from where they will be installed within the installation corridor to a landfall location at Cambois, Northumberland.

17. The Offshore Export Cables will transfer power from the OCSPs within the BBWF array area, however for the reasons explained in ES, Volume 2, Chapter 5: Project Description, the exact location of the OCSPs is not currently defined. The Offshore Export Cables will connect into the OCSPs via a J-tube arrangement.

18. The Marine Scheme will consist of up to a maximum of four HVDC cables. The cable circuits are made up of the Offshore Export Cable in either a bipole or symmetrical monopole configuration and will transmit power at a voltage up to 525 kV.

19. A range of cable installation tools may be required to install and bury the Offshore Export Cables to the minimum target burial depths, including:

- **Jet trenching:** water is injected at high pressure in the area surrounding the cable using a jetting tool. The cable sinks to the required target burial depth and sediment reconstitutes above the cable achieving simultaneous burial;
- **Mass Flow Excavator (MFE):** A method of trenching which can be used to precisely excavate material without direct interaction with the seabed by using a specialist MFE tool;
- **Mechanical trenching:** a trench is excavated in the seabed into which the cable is laid. This is generally used for hard/stiff sediments; and
- **Cable plough:** a towed plough is used to create a trench, into which the cable is simultaneously inserted. These can also be used to backfill trenches post cable installation.

20. The main options being considered for the burial of the offshore export cables are as follows:

- Separate cable lay and burial campaigns - cable is pre-laid (placed on the seabed in advance of trenching and burial);
- Simultaneous cable lay and burial (Figure 2) – cable is laid at the same time as cable trenching and burial; and
- Separate trench and burial campaigns – cable is laid directly into pre-cut cable trenches, for example by plough.

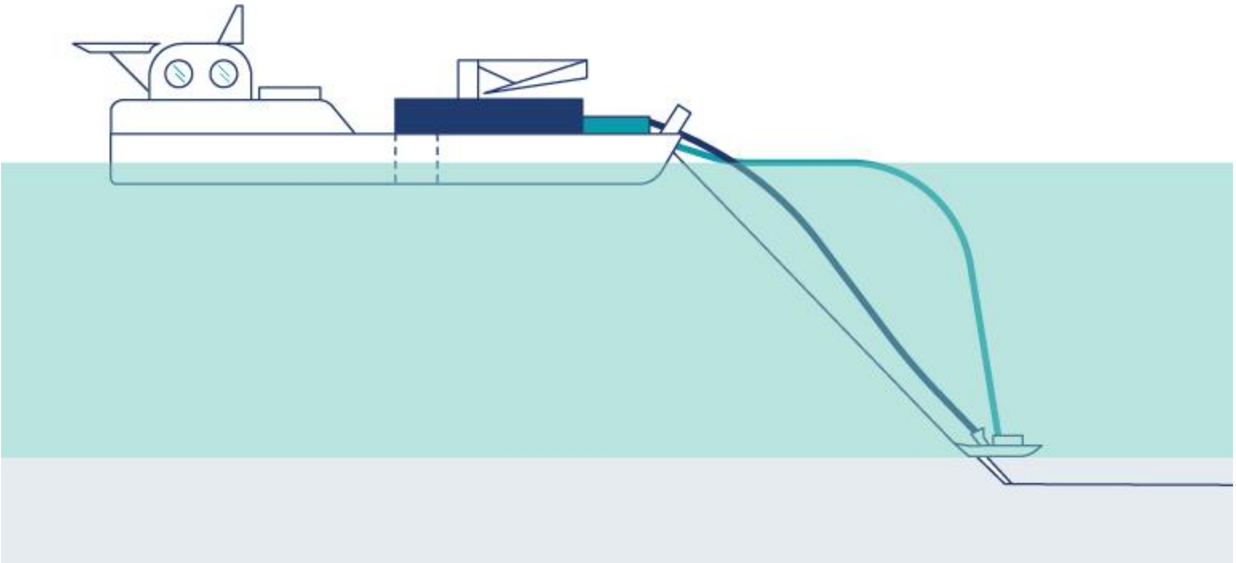


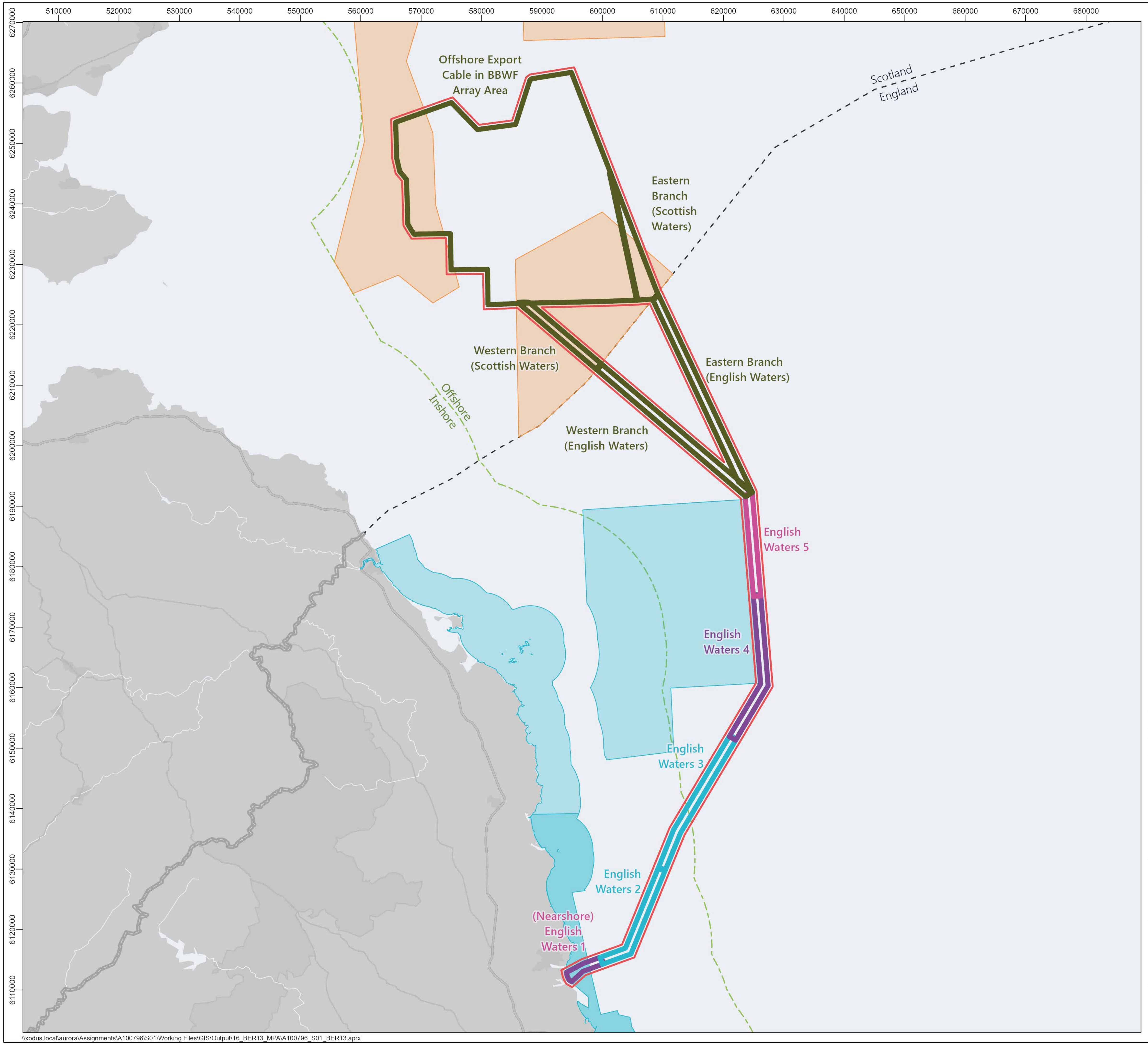
Figure 2 Simultaneous cable lay and burial

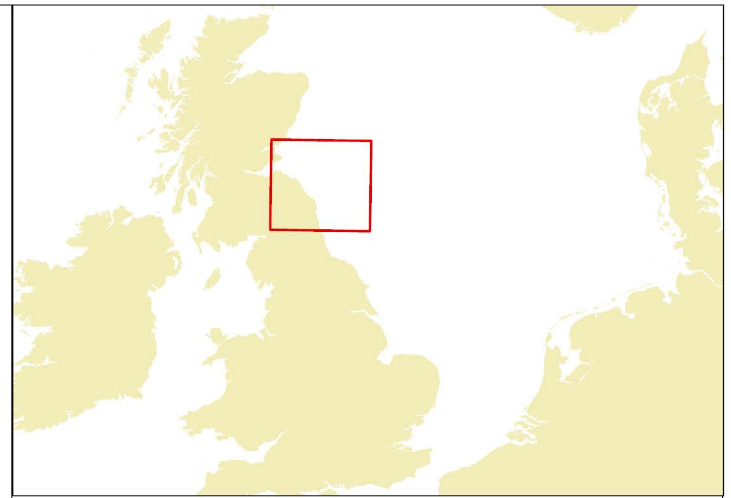
2.5. Cable Protection Methods (Scottish and English Waters)

21. As discussed in ES, Volume 2, Chapter 5: Project Description, the primary aim is to achieve minimum target burial depths through burial of the cables in the seabed. Where it is not possible to achieve minimum target burial depth (0.5 m) due to seabed conditions, additional cable protection will be required to protect the cable from third party damage or future exposure. A range of additional cable protection measures are being considered for the Marine Scheme. These include:

- Rock protection;
- Concrete mattresses;
- Sand, rock and grout bags; and
- Cable protection systems (integrated into cable design).

22. The cable protection requirements across the Marine Scheme have been estimated through an Indicative Cable Burial Appraisal. As part of this assessment, the Marine Scheme Offshore Export Cable Corridor has been divided into discrete sections for which protection zone categories have been applied, as shown in Figure 3.





Legend

- Marine Scheme Boundary and Study Area
- MCZ (Marine Conservation Zone)
- NCMPA (Nature Conservation Marine Protected Area)

Offshore Cable Protection Zone Categories

- Category - 0-15%
- Category - 15-25%
- Category - 25-35%
- Category - 35-45%
- Scotland/England Territorial Waters
- UK 12 Nautical Mile Limit

Rev	Date	Status	Drwn	Chkd	Appd
04	-	-	-	-	-
03	-	-	-	-	-
02	12/07/2023	Revised	TF	NL	EW
01	28/04/2023	Issued	TF	JG	EW

sse Renewables

Project

Cambois Connection

Title

Figure 3 Indicative Cable Protection Zones

0 2.5 5 10 15 20 nm

0 2.5 5 10 15 20 25 30 km

N

Scale	Plot Size	Datum	Projection
1:600,000	A3	WGS84	UTM30N

Drawing Number	Sheet No.
A100796_S01_BER13_2	001 OF 001

2.6. Cable Crossings (English Waters)

23. It is anticipated that up to five cable crossings (all within English waters) will be required across the extent of the Offshore Export Cable Corridor This count includes:

- (1) North Sea Link (NSL) developed by National Grid Ventures (installed);
- (2) Eastern Green Link 1 (EGL1): Torness to Hawthorn Pit, understood to be jointly developed by National Grid Electricity Transmission (NGET) and ScottishPower Transmission (SPT) (in planning);
- (3) Blyth Offshore Demonstrator Project Array 2 (Phase 1) export cable (installed).
  - Whilst it is unlikely the final route for the Marine Scheme Offshore Export Cables will cross this export cable, it is included as a potential crossing as a worst case;
- (4) Blyth Offshore Demonstrator Project Array 4 (Phase 2) export cable (consented);
  - The exact location and timescales for construction are unknown, however, this asset is included as a potential crossing as a worst case;
- (5) Blyth Offshore Demonstrator Project Array 3a export cable (consented);
  - The exact location and timescales for construction are unknown, however, this asset is included as a potential crossing as a worst case.

2.7. Cable Installation Vessels (Scottish and English Waters)

24. A range of installation vessels in Scottish and English waters will be required to complete the cable installation works. The types of vessels anticipated to be required for the installation activities are summarised below. Installation methods and technologies will be confirmed on award of the installation contract and will be within the maximum design scenario described. All vessels specified may also be supported by guard vessels. Vessels anticipated to be required include:

- Cable Lay Vessel (CLV) / cable installation vessel;
- Shallow-hull barge;
- Jack-up barge;
- Cable protection installation vessels;
- Support vessels; and
- Crew transfer vessels.

2.8. Offshore Export Cable Landfall (English Waters)

25. The landfall location at Cambois forms the interface between the Marine Scheme and Onshore Scheme where the Offshore Export Cables will be brought ashore, as shown in ES, Volume 4, Figure 5.2. The landfall corridor is approximately 1.5 km wide at Cambois beach, at the widest point between the River Wansbeck and the Port of Blyth. The final location of the landfall on Cambois beach is still to be determined but will be located within the wider landfall corridor.

26. The Offshore Export Cables will be installed at the Landfall using a trenchless technology such as HDD. This involves installing an underground cable duct by drilling a hole (or holes) from one point to another. The Offshore Export Cables are then installed through the duct(s). The holes will be drilled from a trenchless technology compound which will be located above MHWS (onshore) to an agreed 'punch out' location in the nearshore marine area (below MLWS), therefore completely bypassing the intertidal zone.

27. HDD is a trenchless installation methodology which avoids direct interactions within the intertidal zone, as shown in Figure 4.

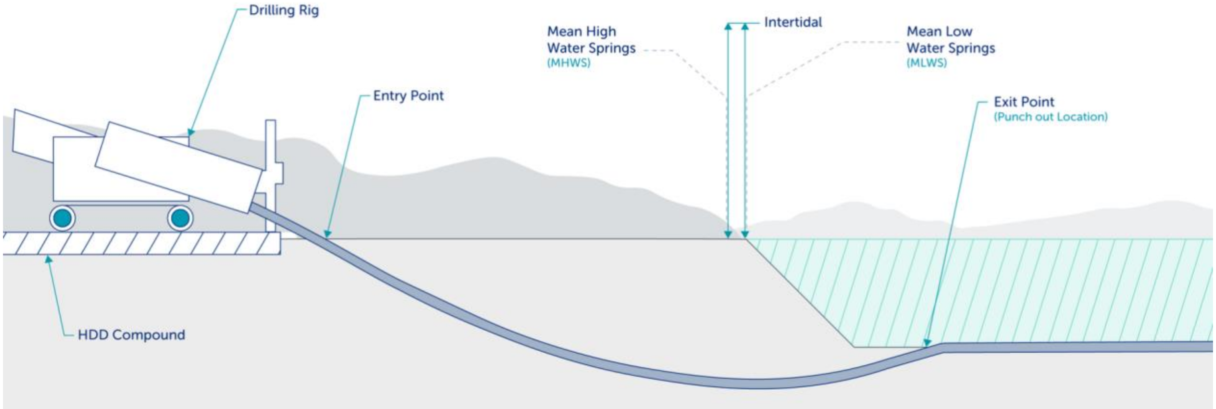


Figure 4 Offshore export cable landfall

2.9. Operation and Maintenance (Scottish and English Waters)

28. Once in place and buried (where reasonably practicable), offshore export cables do not typically require regular routine maintenance. Routine inspection surveys of the offshore export cables will be required up to annually to monitor condition and burial throughout the life of the Marine Scheme. Any inspections would be undertaken using offshore surveys, including the use of remotely operated vessels (ROVs). Where inspection work concludes that work may be required along any length of the offshore export cable route, maintenance would be carried out. This may involve re-positioning of rock protection or placement of additional rock protection.

29. The installation methods described above are designed to reduce the requirement for cable repair. However, natural processes and human activity may uncover buried cable and damage cable protection. The requirement for maintenance will be identified by inspections carried out by the Applicant. Where sections of the Offshore Export Cables require repair or replacement, it is expected that this will be undertaken by a number of different vessels consistent with those described above for the installation process, and depending on the location and seabed conditions where the repair is required (e.g., intertidal or subtidal). Cable repairs will be undertaken in a similar process to that described above.

30. Routine inspections of the Offshore Export Cables will be undertaken to monitor the condition of the cables and the cable protection methods. It is expected that these will be undertaken using a survey vessel, unmanned survey vessel (USV) or ROV. It is anticipated that routine inspections will initially be required up to annually in the initial years of operation.

2.10. Decommissioning

31. At the end of the operational lifetime of the Marine Scheme, the operator of the Marine Scheme will develop and agree a solution for the onward handling of the Offshore Export Cables with the regulator. This decision will be based on the advice from the marine regulator at the time and informed by the prevailing environmental regulatory requirements at that time, and relevant good practice.

32. The approach to decommissioning will align with regulatory guidance, requirements and industry good practice at the time of decommissioning and will be agreed with the relevant stakeholder and regulatory bodies. It is proposed that Offshore Export Cables will be removed where practicable and appropriate to do so. This approach will be reviewed at the time of decommissioning following

the most up to date and good practice guidance. For the purpose of this MPA/MCZ assessment, the most adverse scenario (in terms of potential for adverse effects to the protected features of an MCZ/MPA or on any ecological or geomorphological process on which those features depend) has been assessed for each receptor identified for assessment.

33. A Decommissioning Plan and supporting decommissioning environmental management plan will be prepared prior to commencement of decommissioning and will be subject to its own MCZ/MPA assessment. It is anticipated that this will be secured via a requirement of seabed leases from Crown Estate Scotland and The Crown Estate; decommissioning conditions are also anticipated to be secured on Marine Licences issued by MD-LOT and the MMO in Scottish and English waters respectively.

3. Methodology to Inform MPA and MCZ Assessments

3.1. Introduction

34. The Marine Scheme spans both Scottish and English waters; the methodology followed for the ncMPA and MCZ assessment has therefore been developed to ensure full compliance with both Scottish and English requirements, and to adequately follow the relevant best-practice and industry guidance in both jurisdictions.

35. The Marine and Coastal Access Act 2009 introduced provisions to support the management of ncMPAs. Under section 126 of the Marine and Coastal Access Act 2009, the licensing authorities (the MMO and MD-LOT) are required to consider whether the licensable activity applied for is capable of affecting (other than insignificantly) a protected feature in an ncMPA / MCZ or any ecological or geomorphological process on which the conservation of any protected feature in an ncMPA / MCZ is dependent.

3.2. MPA Methodology (Scotland)

36. At the time of submission of the MLA to MD-LOT, Marine Scotland's Nature Conservation Marine Protected Areas: Draft Management Handbook (Marine Scotland, 2014a) remains archived and replacement or updated guidance has not been issued. Although this document remains archived, it contains guidance which is still considered to be relevant to the completion of an ncMPA assessment. Marine Scotland and JNCC have also set out founding principles of ncMPAs, and preliminary guidance on management of ncMPAs (Marine Scotland, 2014b); whilst now also archived and with no current replacement, the ncMPA assessment is cognisant of this guidance.

37. The Draft Management Handbook recommends a staged approach to ncMPA assessments; broadly, this process can be summarised as follows:

1. **Screening:** This initial screening stage should focus on what can reasonably be predicted as a consequence of the proposal and whether it is 'capable of affecting (other than insignificantly)' a protected feature of an ncMPA. The screening should use information currently available and consider aspects such as the 'scale, timing and duration of proposed activities'. The potential for 'affecting' which is remote and hypothetical should not be the basis of a conclusion that further assessment is required. Where the conclusion is that the act or function is capable of affecting (other than insignificantly) the protected features of an ncMPA then the main assessment must be carried out considering the conservation objectives.

2. **Main Assessment:** The main assessment stage focuses on determining whether the exercise of a function would or might significantly hinder (s125 M&CAA), or there is or may be a significant risk of the act hindering (s126 M&CAA), the achievement of the conservation objectives. As with the initial screening, aspects such as scale, timing and duration of the proposed activities or developments should all be considered. However, whilst the initial screening focuses on whether the Marine Scheme is capable of affecting (other than insignificantly) the protected features or any ecological or geomorphological processes on which they depend, this part of the assessment focuses on the Marine Scheme's risk of hindering the achievement the conservation objectives of the protected features. The assessment should build on the initial screening assessment that considers the pressures associated with the activity and the sensitivity of the protected features, and information on the likely spatial overlap.

3. Should it be determined that there is significant risk that the achievement of the Conservation Objectives will be hindered, the applicant must satisfy the public authority that:

   i. there are no other means of proceeding that would create a substantially lower risk;

ii. the benefit to the public clearly outweighs the risk of damage to the environment; and
iii. measures will be undertaken of equivalent environmental benefit to the damage which will or is likely to occur.

3.3. MCZ Methodology (England)

38. Under Section 126 of the MCAA, the MMO has a duty to consider MCZs during Marine Licence decision making. Guidance published by the MMO (MMO, 2013) provides a summary of how MCZ Assessments should be undertaken during the course the MLA decision making process. The MMO guidance recommend that a staged approach to assessment is followed, involving three sequential stages described below:

1. **Screening**: This stage is carried out to determine whether or not the licensable activity is taking place within or within the vicinity of an area designated as an MCZ or recommended for designation. The screening stage also considers whether the licensable activity is capable of affecting (other than insignificantly) either (i) the protected features of an MCZ, or (ii) any ecological or geomorphological process on which the conservation of any protected feature of an MCZ is (wholly or in part) dependent. In the event that the answer to either question is yes, a Stage 1 Assessment must follow.

2. **Stage 1 Assessment**: This stage is carried out to ensure that the MMO is satisfied that there is no significant risk of the licensable activity hindering the conservation objectives for the MCZ (and to ensure that the licensing authority can exercise its functions to further the conservation objectives of the MCZ). If the licensing authority is not satisfied regarding environmental risk to the MCZ and the fulfilment of their functions, they must consider whether there are other means of delivering the licensable activity with a lesser environmental impact and therefore a lower risk of hindering the conservation objectives of an MCZ. In the event there is continued concern, a Stage 2 Assessment must follow.

3. **Stage 2 Assessment**: This stage considers whether the benefit to the public clearly outweighs the environmental risk associated with the licensable activity. This stage may also involve the agreement of commitments by the Applicant to undertake measures of 'equivalent environmental benefit' to the damage which the licensable activity may have on the MCZ.

39. Figure 5 below provides a summary of this process (MMO, 2013).

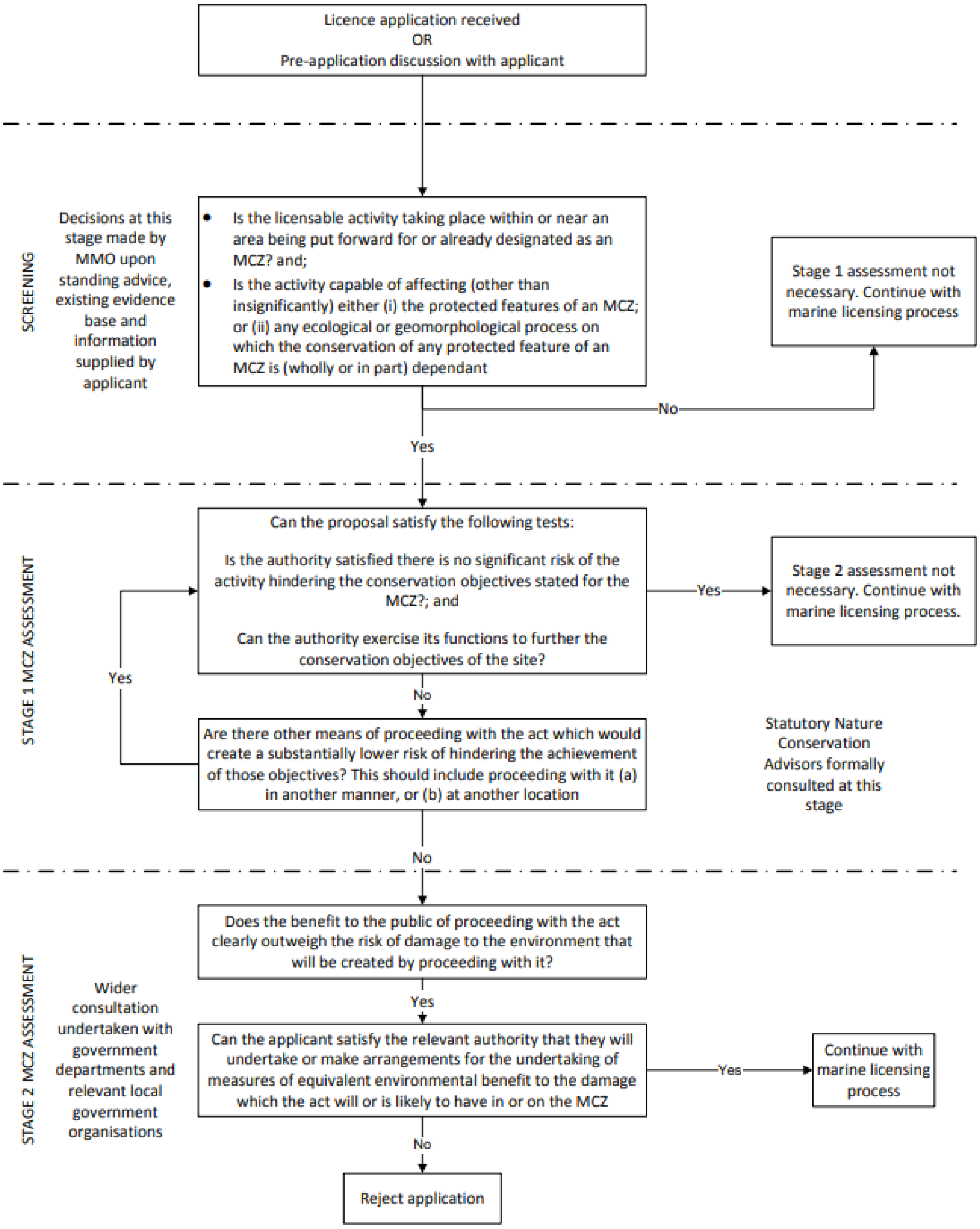


Figure 5 Summary of the MCZ assessment process used by the MMO in Marine Licence decision making (MMO, 2013)

40. At the screening stage, a risk-based approach is recommended by the MMO when determining the proximity of an activity to an MCZ (MMO, 2013). The application of appropriate buffer zones to the protected features of an MCZ under consideration, as well as consideration of the risk of impacts from activities at greater distances from the MCZ is necessary.

41. If certain activities, sites or impacts are screened into the ncMPA Assessment process, these are then considered within the main assessment if significant risks to the achievement of the ncMPA conservation objectives have been identified by the initial screening.

3.4. Impact Assessment Criteria

42. Information about the Marine Scheme and the proposed activities across all phases (construction, operation and maintenance, and decommissioning) shall be combined with information about the environmental baseline to identify the potential interactions between the Marine Scheme and the environment. Notwithstanding, the criteria for the ncMPA and MCZ Assessment differ from those set out in Chapter 2: EIA methodology.

43. ES, Volume 2, Chapter 7: Physical Environment and Seabed Conditions, ES, Volume 2, Chapter 8: Benthic and Intertidal Ecology, and Chapter 10: Offshore and Intertidal Ornithology have presented assessments of the impacts of the Marine Scheme with definitions of impact, effect, and significance of effects on the identified receptors (including protected features of relevant ncMPA / MCZ sites) drawn from guidelines published in the Design Manual for Roads and Bridges (DMRB) (Highways Agency, 2020).

44. This ncMPA and MCZ Assessment is *informed* by the information presented in the technical chapters detailed above to support the conclusions made about whether the Marine Scheme hinders the achievement of conservation objectives for the relevant ncMPA / MCZ.

45. In line with the relevant guidance described above, the ncMPA and MCZ Assessment has considered whether there is a potential that the Marine Scheme would hinder the achievement of the conservation objectives (other than insignificantly) for ncMPA and MCZ sites. This includes assessing the risks in the context of the conservation status of each of the individual ncMPAs and MCZ's protected features. Further detail on specific conservation objectives relevant to each site (ncMPA/MCZ) is provided in section 4.2.

46. The ncMPA and MCZ Assessment considers each protected feature of each relevant ncMPA or MCZ, to determine whether impact-receptor pathways exist for the activities screened into the assessment. This in turn allows an assessment to be made as to the potential for the Marine Scheme to significantly hinder the conservation objectives of the ncMPA / MCZ.

47. For each site assessment (sections 5 to 8) the assessment considers both project alone impacts (Marine Scheme only) and cumulative effects (Marine Scheme together with other plans and projects).

3.5. Maximum Design Scenario

48. In accordance with best practice, the Marine Scheme has utilised a MDS approach to inform the EIA. The same approach has been adopted for the purpose of this ncMPA / MCZ Assessment.

49. This MDS approach allows a range of parameter values to be presented for each aspect of the Marine Scheme and ensures that flexibility is retained in the design. The MDS covers all components of and activities associated with the construction, operation and maintenance, and decommissioning of the Marine Scheme described in section 2 of this ncMPA / MCZ Assessment.

50. The design parameters which represent the realistic MDS for the ncMPA / MCZ Assessment have been determined on a case-by-case basis, depending on the protected features of the ncMPA / MPA (or any ecological or geomorphological process on which they depend), their conservation objectives and the potential effects on those features and processes or risk of hindering the achievement of the conservation objectives. Realistic combinations of design parameters have been considered to ensure that the 'worst-case' scenario options are not overly precautionary or unrealistic. Under this approach, the combination of Marine Scheme design options constituting the worst-case scenario may necessarily differ from one feature to another and from one impact to another. The end result is an ncMPA / MCZ Assessment which has been based on clearly defined

parameters that have defined the range of Marine Scheme design possibilities and hence the effects on the protected features or associated ecological or geomorphological processes or risk of hindering the achievement of the conservation objectives that could result from the Marine Scheme.

51. The MDS for the ncMPA / MCZ Assessments have been set out in full for each site (sections 5 to 8). Given that the assessment has been based on the design option (or combination of options) that represent the greatest realistic potential for effect, confidence can be held that development of any alternative options within the MDS will not give rise to a greater risk of hindering the achievement of the ncMPA/MCZ conservation objectives than those assessed within this ncMPA / MCZ Assessment.

3.6. Measures Adopted as Part of the Marine Scheme

52. As part of the project design process, a number of measures have been proposed to reduce the potential for impacts on physical environment, benthic and ornithological receptors (see Table 3.1). These include measures which have been incorporated as part of the Marine Scheme's design (referred to as 'designed in measures') and measures which will be implemented regardless of the impact assessment (referred to as 'tertiary mitigation'). As there is a commitment to implementing these measures, they are considered inherently part of the design of the Marine Scheme and have therefore been considered in the screening (section 4) and site-specific assessments (sections 5 to 8) below. These measures are considered standard industry practice for this type of development.

Table 3.1 Measures adopted as part of the Marine Scheme (designed in measures & tertiary mitigation)

Mitigation Measure	Justification	Applicable Jurisdiction
Route Selection and Avoidance.	The Marine Scheme has been specifically refined to avoid interactions with key designations, environmental sensitivities, and notable inshore fishing grounds as far as reasonably practicable. On the approach to the Landfall at Cambois, the route has been selected to minimise the footprint within European Sites. Nearshore routes with greater levels of interactivity with European Sites along the English and Scottish coast have been de-selected. Further detail on this is provided in Volume 2, Chapter 6: Route Appraisal and Consideration of Alternatives	Scottish and English waters
Cable protection.	The use of cable protection will be minimised as far as practicable, and only used where required. Additional external cable protection (e.g. rock placement) will only be used where the minimum target burial depth cannot be achieved, for example in areas of hard ground or at third-party crossings. This will be informed by outputs from the Cable Burial Risk Assessment completed by the installation contractor(s) prior to the commencement of installation. Rock utilised in berms will be clean with low fines. Use of graded rock and 1:3 profile berms at areas of rock protection will reduce potential fishing gear snagging risk.	Scottish and English waters
Material for cable protection.	Where possible, cable protection will match up as much as possible with the existing hard substrate, in terms of size, shape and type of rock/ materials used in order to reduce habitat alteration	Scottish and English waters
Cable burial depth.	Cables will be buried to a minimum target depth of 0.5 m and only protected using external protection (e.g., rock berms) where minimum target burial depth is not achieved or at third-party crossings. Application of target cable burial depth will reduce the potential for cable exposure from interactions between metocean regimes (e.g. wave, sand, and currents) and will reduce interaction with fishing gear. Cable burial also reduces risk of interference with magnetic position fixing equipment.	Scottish and English waters
Monitoring of cable burial and protection.	Infrastructure will be monitored through post lay and burial inspection surveys to identify exposures and any requirements for repair and reburial, with remedial action taken as appropriate and as soon as practicable. Findings will be shared with the fishing industry in order to facilitate co-existence, prevent potential damage to and from fishing gear, and minimise potential safety risks.	Scottish and English waters

Mitigation Measure	Justification	Applicable Jurisdiction
Vessel best-practice / MARPOL.	Compliance with MARPOL regulations and best-practice protocols to prevent and manage incidents of accidental release of marine contaminants.	Scottish and English waters
Shipboard Oil Pollution Emergency Plan (SOPEP).	All vessels to be used as part of any phase of the Project will adopt a waste management plan in line with the requirements set out as part of the International Convention for the Prevention of Pollution from Ships (MARPOL) and the SOPEP.	Scottish and English waters
Adherence to Scottish Marine Wildlife watching code.	Project vessels (in both Scottish and English waters) will adhere to the protocols supplied in the Scottish Marine Wildlife Watching Code and will protect and reduce the risk of direct interactions and disturbance to marine wildlife, including marine mammals, seabirds and waterfowl.	Scottish and English waters
Cable grouping.	Grouping cables of opposite polarity will result in deleterious interference between the EMFs from adjacent cables, which will further reduce the field EMF strengths resulting from the Marine Scheme. Furthermore, the design of the Marine Scheme will be further refined, informed by onward detailed engagement with the supply chain and various technical, practical, and commercial considerations. As part of this refinement, the cable configuration will be optimised and options to reduce EMF assessed. Beyond the configuration commitment detailed above, practical solutions for reducing EMF arising from the Offshore Export Cables may include reducing cable separation or adopting a bundled solution.	Scottish and English waters
Environmental Management Plan (EMP).	An EMP will be developed and employed to ensure potential release for pollutants will be reduced as far as practicable. This will include a Marine Pollution Contingency and Control Plan (MPCCP) and an Invasive and Non-Native Species Management Plan (INNSMP). An outline EMP has been provided as part of this application (Volume 5, Appendix 5.1) and will be updated for submission to MMO and MD-LOT prior to construction.	Scottish and English waters
Decommissioning Plan.	The aim of this plan is to adhere to the existing UK and international legislation and guidance, with decommissioning industry practice applied. Overall, this will reduce the amount of long-term disturbance to the environment as far as reasonably practicable. While this measure has been committed to as part of the Marine Scheme, the maximum design scenario for the decommissioning phase has been considered in each of the assessments of effects.	Scottish and English waters
Invasive Non-Native Species Management Plan (INNSMP).	An INNSMP will be implemented to manage and reduce the risk of potential introduction and spread of INNS as far as reasonably practicable. The plan will include, but may not be limited to, measures to facilitate vessel compliance with the International Maritime Organisation (IMO) ballast water management guidelines	Scottish and English waters

Mitigation Measure	Justification	Applicable Jurisdiction
	(International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004) and adherence to the IMO guidelines for the control and management of ships' biofouling to minimise the transfer of invasive aquatic species (Biofouling Guidelines). It will consider the origin of vessels and contain standard housekeeping measures for such vessels as well as measures to be adopted in the event that a high alert species is recorded. An outline INNSMP has been provided as part of this application (Volume 5, Appendix 5.1.B) and will be updated for submission to MMO and MD-LOT prior to construction.	
Cable Plan (CaP).	Suitable implementation and monitoring of cable protection through the Marine Scheme and adherence to a CaP. This will be produced and consulted on (in line with consent conditions) prior to installation and will include a detailed cable laying plan including geotechnical data, cable laying techniques and informed by a Cable Burial Risk Assessment (CBRA) which will include details on minimum target burial depths.	Scottish and English waters
Pose Little or No Risk (PLONOR) substances.	During trenchless installation activities at Landfall, there will be an interface between the sea and the drilling fluids used to create the exit pits at the breakouts. Small quantities of drilling fluids may be discharged to the marine environment, however best practice mitigation will be implemented to reduce the amount of drill mud / cuttings released in the event of a release. To limit environmental damage, only biologically inert PLONOR listed drilling fluid will be used.	England
Landfall construction.	Trenchless techniques, such as Horizontal Directional Drilling (HDD) will be used at the Landfall for the construction of the Marine Scheme. Works associated with Landfall construction activities will avoid any works in the intertidal environment and will reduce the potential for sediment disturbance.	England

3.7. Data Sources

3.7.1. Desktop Study

53. Information on designated features within the ncMPA and MCZ Assessment Study Area was collected through a detailed desktop review of existing studies and datasets. These are summarised in Table 3.2 below.

Table 3.2 Summary of key desktop studies & datasets

Title	Source	Focus[4]	Year	Author
Berwick Bank Wind Farm Environmental Impact Assessment Report: ES, Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology, and, ES, Volume 3, Appendix 8.1: Benthic Subtidal and Intertidal Ecology Technical Report	https://marine.gov.scot/node/23315	FoFBC ncMPA	2022	BBWFL
Marine Environmental Data and Information Network (MEDIN)	https://www.medin.org.uk/	All	Accessed April 2023	https://www.medin.org.uk
European Marine Observation and Data Network (EMODnet) broadscale seabed habitat map for Europe (EUSeaMap)	EMODnet-Seabed Habitats	FoFBC ncMPA; FE MCZ, CtoSM MCZ	2019	European Commission
The Marine Scotland National Marine Plan Interactive (NMPI) maps	MSS	FoFBC ncMPA	2019	2019 MMS for the Scottish Government
A big data approach to macrofaunal baseline assessment, monitoring and sustainable exploitation of the seabed	Cefas	FoFBC ncMPA; FE MCZ, CtoSM MCZ	2017	Cooper and Barry
SeaSearch Marine Surveys in Scotland	NBN Atlas	FoFBC ncMPA	2017	SeaSearch
Firth of Forth Banks Complex ncMPA: Assessment against ncMPA Selection Guidelines	Joint Nature Conservation Committee (JNCC)	FoFBC ncMPA	2014	JNCC
Analysis of seabed imagery from the 2011 survey of the Firth of Forth Banks Complex, the 2011 International Bottom Trawl Survey (IBTS) Quarter 4 (Q4) survey and additional deep-water sites from Marine Scotland Science surveys	JNCC	FoFBC ncMPA	2014	Axelsson, M., Dewey, S. and Allen, C.
Mapping habitats and biotopes from acoustic datasets to strengthen the information base of ncMPAs in Scottish waters – Phase 2	JNCC	FoFBC ncMPA	2014	Sotheran, I. and Crawford-Avis, O.
Mapping habitats and biotopes from acoustic datasets to strengthen the information base of ncMPAs in Scottish waters – Phase 1	JNCC	FoFBC ncMPA	2013	Sotheran, I. and Crawford-Avis, O.

[4] FoFBC: Firth of Forth Banks Complex, FE: Farnes East, BtoSM: Berwick to St Mary's, CtoSM: Coquet to St Mary's

Title	Source	Focus[4]	Year	Author
Characterising Scotland's marine environment to define search locations for new ncMPAs. Part 2: The identification of key geodiversity areas in Scottish waters Scottish National Heritage	(SNH, now NatureScot)	FoFBC ncMPA	2013	2013 Brooks, A.J. Kenyon, N.H. Leslie, A., Long, D. and Gordon, J.E
Seagreen Phase 1 (Seagreen Alpha and Seagreen Bravo) Marine Protected Area Assessment	Marine Scotland	FoFBC ncMPA	2012	Marine Scotland
Seagreen Phase 1 (Seagreen Alpha and Seagreen Bravo) Environmental Statement Benthic Ecology and Intertidal Ecology	Seagreen Wind Energy	FoFBC ncMPA	2012	Seagreen Wind Energy
North Sea Network Cable Landfall: Intertidal Survey Report	CMACS	CtoMS MCZ	2012	CMACS
Benthic and intertidal ecology appraisal for the Norway-UK Marine Environmental Statement	National Grid NSN and Statnett	CtoMS MCZ	2014	National Grid NSN and Statnett
Subtidal habitat appraisal for the Norway-UK Marine Environmental Statement (Appendix Volume 1)	National Grid NSN and Statnett	CtoMS MCZ	2014	National Grid NSN and Statnett
Interpretive geophysical report for the North Sea Network (101444-S2N-MMT-SUR-REP-GEOPH001)	MMT	CtoMS MCZ	2013	National Grid NSN and Statnett
Notice to Mariners: Subsea Rock Placement on HVDC Cables close to Cambois Beach (NSL-1.2.3-TE3-RE-0005)	National Grid NSN and Statnett	CtoMS MCZ	2019	National Grid NSN and Statnett
Interpretive geophysical report for the North Sea Network (101444-S2N-MMT-SUR-REP-GEOPH001)	MMT	CtoMS MCZ	2013	National Grid NSN and Statnett
Environmental survey report for the North Sea Network (101444-S2N-MMT-SUR-REP-ENVIRON1)	MMT	CtoMS MCZ	2013	National Grid NSN and Statnett
Blyth Offshore Demonstrator Project – post-construction benthic monitoring report	https://www.marinedataexchange.co.uk/	CtoMS	2019	Blyth Offshore Demonstrator Limited

3.7.2. Site-specific Surveys

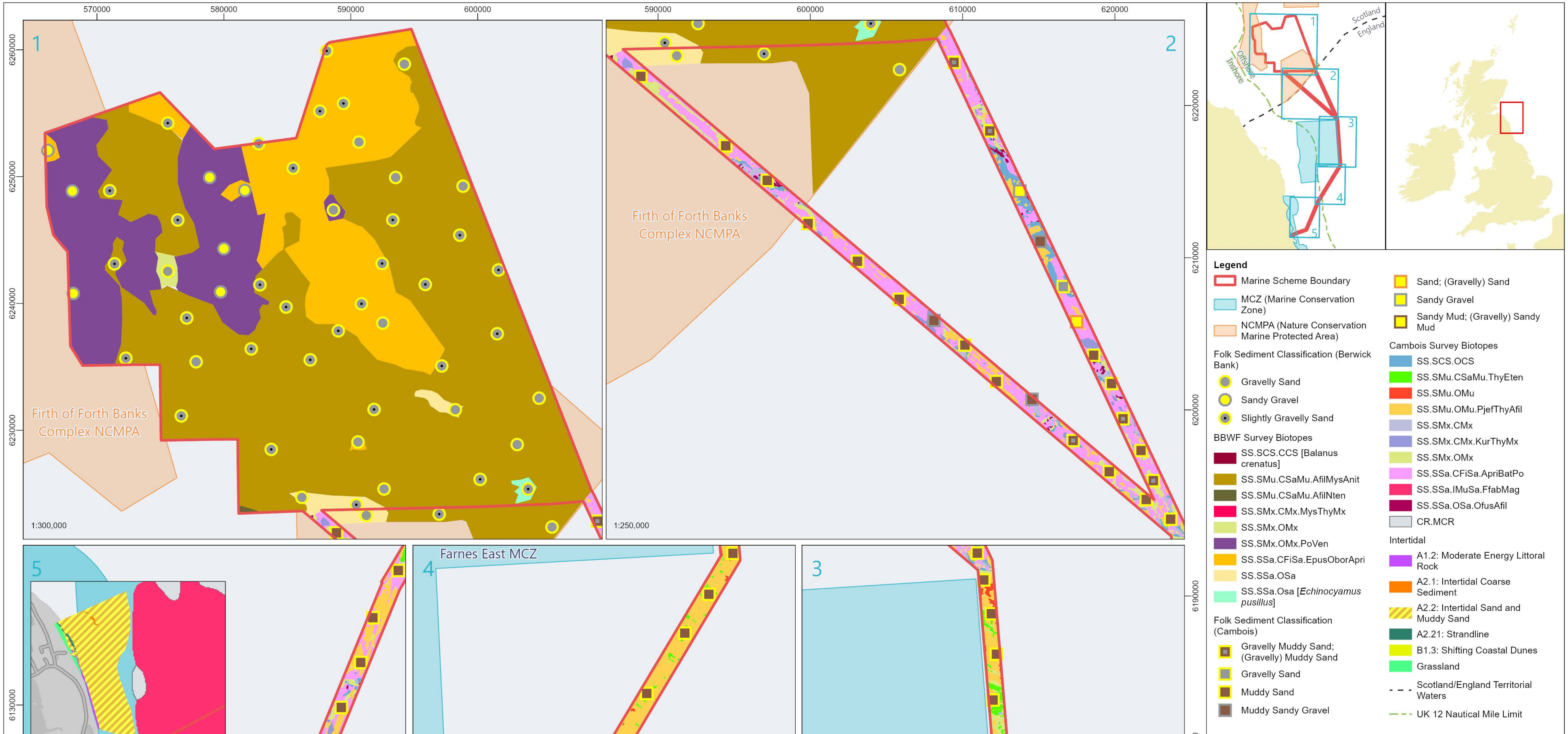
54. To inform the ncMPA and MCZ Assessment, site-specific surveys were undertaken, as informed by pre-application engagement with key stakeholders such as Natural England and the MMO (please refer to Section 1.5 above for further details). This has included a geophysical survey (encompassing Multi-Beam Echo Sounder, Sub-Bottom Profiler and Sound Velocity Profiler) and benthic campaign (encompassing grab samples, drop-down video, particle size analysis and sampling for analysis of potential contaminants). The Applicant also commissioned an intertidal ecology survey, as reported in ES, Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology and summarised below.

55. A summary of the surveys undertaken to inform the ncMPA and MCZ Assessment are outlined in Table 3.3, and site specific survey biotopes are presented in Figure 6.

Table 3.3 Summary of site-specific survey data

Title	Extent of Survey	Overview of Survey	Survey Contractor	Date	Reference to Further Information
Geophysical Survey	Proposed Offshore Export Cable corridor	Geophysical study to establish bathymetry, seabed geology, morphology, and sediments	XOCEAN Ltd.	2022	XOCEAN (2022)
Cambois Overwintering (Non-Breeding) Bird Survey	Intertidal Study Area, Cambois	The surveys focused on the Marine Scheme landfall area at Cambois, covering a range of times of day and tidal states. The observations of this survey considered the number and nature of species within the area. As agreed with Natural England, these surveys did not consider the marine portion of the cable route due to the nature of cable installation activities and the associated limited potential for disturbance to offshore and intertidal ornithology features.	SLR Consulting	October 2022 – March 2023	ES, Volume 2, Chapter 10: Offshore and Intertidal Ornithology ES, Volume 3, Appendix 10.1: Non-Breeding / Over-Wintering Bird Survey Report
Cambois Connection Intertidal Survey Report	Intertidal Study Area, Cambois	Visual survey to characterise and map the benthic habitats present across the intertidal zone associated with the cable landfall area. The survey took place at two sites along Cambois Beach, Northumberland and involved the collection of aerial imagery accompanied by walkover surveys to gather detailed information on the benthic communities present for subsequent habitat / biotope mapping purposes. A comprehensive suite of images and target notes were collected across the full extent of the intertidal survey areas at each site between Mean Low Water Springs (MLWS) and Mean High Water Springs (MHWS).	Ocean Ecology	2022	ES, Volume 3, Appendix 8.2: Intertidal Survey Report
Cambois Connection Benthic Ecology Baseline – Phase 1 and Phase 2 Survey Report	Proposed Offshore Export Cable corridor	Benthic subtidal survey – including grab samples (0.1 m2 mini-Hamon grab) at 58 locations within the Marine Scheme Offshore Export Cable Corridor to collect information on physical sediment characteristics and infauna. Subsamples were collected for Particle Size Analysis (PSA) and Total Organic Carbon (TOC) analysis. Grab samples (0.1 m2 day grab) were also collected at a subset of 15 sampling stations for contaminants analysis, located in areas of finer sediment suitable for this analysis and closer to shore where higher contamination levels were expected. DDV transects using a Remotely Operation Vehicle (ROV) were conducted at 70 sampling locations to gather information on sediment conditions, seabed features and epifauna. Where potential reef features were encountered, assessments were made using current available guidance notes i.e., Gubbay (2007) and Limpenny et al. (2010) for potential Sabellaria reefs, and Golding et al. (2020) and Irving (2009) for potential cobble reefs.	Natural Power	2023	ES, Volume 3, Appendix 8.1: Benthic Survey Report (Phase 1 and 2)

Title	Extent of Survey	Overview of Survey	Survey Contractor	Date	Reference to Further Information
Benthic subtidal survey	BBWF array area and Offshore Export Cable Corridor into Branxton, East Lothian	This included combined DDV and grab samples (0.1 m^2 mini-hamon grab) at 92 locations, 15 additional DDV only transects and 15 epibenthic trawls. Day grabs samples were collected for sediment chemistry analysis at nine of the 92 sampling locations.	Ocean Ecology	2020	BBWFL (2022)



Rev	Date	Status	Drwn	Chkd	Appd
04	-	-	-	-	-
03	-	-	-	-	-
02	12/07/2023	Revised	TF	NL	EW
01	26/05/2023	Issued	TF	NL	EW

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Figure 6 Biotope Map with Protected Sites

Scale	Plot Size	Datum	Projection
multiple	A3	WGS84	UTM30N

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4. MPA and MCZ Screening

4.1. Introduction

56. The methodology for the ncMPA and MCZ Assessment is set out in section 3. Specific to the ncMPA and MCZ Assessment, the following guidance documents have also been considered:

- Marine Scotland (2014a) Nature Conservation Marine Protected Areas: Draft Management Handbook
- MMO (2013) Marine conservation zones and marine licensing

57. In addition, the ncMPA and MCZ Assessment has complied with the legislative framework as defined above (principally, this relates to the staged process for the assessment of ncMPA and MCZ sites within Scottish and English waters respectively). On this basis, this section provides a screening assessment for relevant ncMPA and MCZ sites whilst sections 5 to 8 provide the 'main assessment' for each site (in terms of Scottish ncMPA assessment terminology) which is considered one-and-the-same as the 'Stage 1' assessment (in terms of English MCZ assessment terminology).

4.2. Site Details and Protected Features

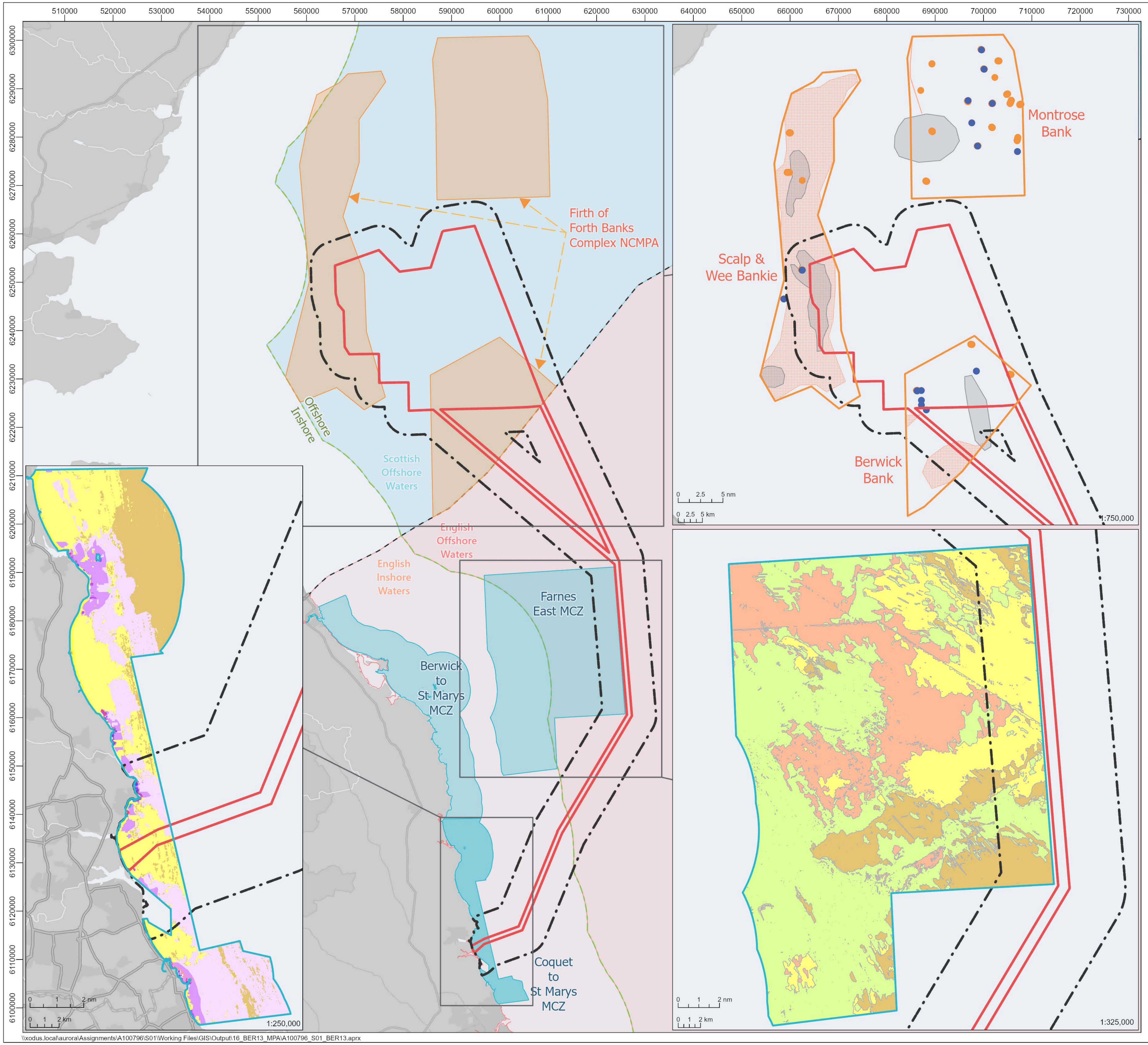
58. The sites requiring consideration in this ncMPA / MCZ Assessment, and their protected features are listed in Table 4.1 below. The locations of these sites relative to the Marine Scheme are illustrated in Figure 7. The sites screened into the assessment are based on the ncMPA and MCZ assessment Study Area (the boundary for the Marine Scheme and the maximum ZoI). For the Marine Scheme, the maximum ZoI is 5 km and this is in relation to the mean annual tidal excursion which is approximately 5 km (see ES, Volume 2, Chapter 7: Physical Environment and Seabed Conditions), also encompassing nearshore construction activity that could cause disturbance to ornithological receptors (ES, Volume 2, Chapter 10: Offshore and Intertidal Ornithology).

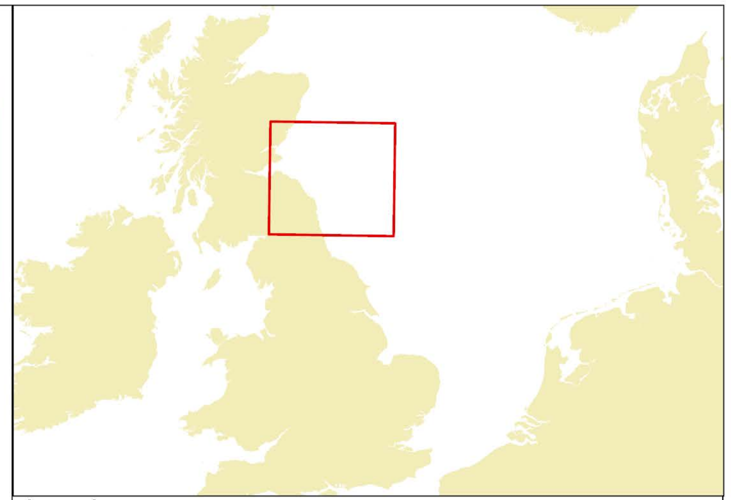
59. The Firth of Forth Banks Complex ncMPA is comprised of three distinct areas; Montrose Bank, Scalp and Wee Bankie, and Berwick Bank. The assessment of whether the Marine Scheme has the potential to hinder the conservation objectives of the ncMPA will include assessment of the ncMPA as a whole as well as for each of the three distinct areas.

Table 4.1 Site Details and Protected Features

Site	Sub Section	Distance from Marine Scheme	Location relative to Marine Scheme	Protected Features
Firth of Forth Banks Complex ncMPA	N/A	0 km	In Scottish offshore Waters. The Marine Scheme boundary in Scottish Waters directly overlaps the ncMPA.	Offshore subtidal sands and gravels Shelf banks and mounds Ocean quahog aggregations Moraines representative of the Wee Bankie key geodiversity area
	Berwick Bank part of Firth of Forth Banks Complex ncMPA	0 km	In Scottish offshore Waters. The Marine Scheme boundary in Scottish Waters directly overlaps the Berwick Bank part of the ncMPA.	Offshore subtidal sands and gravels Ocean quahog aggregations Shelf banks and mounds Moraines representative of the Wee Bankie key geodiversity area

Site	Sub Section	Distance from Marine Scheme	Location relative to Marine Scheme	Protected Features
	Wee Bankie part of Firth of Forth Banks Complex ncMPA	0 km	In Scottish ioffshore Waters. The Marine Scheme boundary in Scottish Waters directly overlaps the Wee Bankie part of the ncMPA.	Offshore subtidal sands and gravels Ocean quahog aggregations Shelf banks and mounds Moraines representative of the Wee Bankie key geodiversity area
	Montrose Bank part of Forth Banks Complex ncMPA	5.6 km	The northern extent of the Marine Scheme is located south of the Montrose Bank part of the ncMPA.	Offshore subtidal sands and gravels Ocean quahog aggregations Shelf banks and mounds
Farnes East MCZ	N/A	0.7 km (at nearest point)	The offshore section of the Marine Scheme in English waters passes to the east of the Farnes East MCZ.	Moderate energy circalittoral rock Subtidal coarse sediment Subtidal mixed sediments Subtidal sand Subtidal mud Seapen and burrowing megafauna communities Ocean quahog (*Arctica islandica*)
Berwick to St Mary's MCZ	N/A	0 km	The Landfall / nearshore section of the Marine Scheme in English waters is located within the Berwick to St Mary's MCZ.	Common eider (*Somateria mollisima)*
Coquet to St Mary's MCZ	N/A	0 km	The Landfall / nearshore section of the Marine Scheme in English waters is located within the Coquet to St Mary's MCZ.	Low energy intertidal rock Moderate energy intertidal rock High energy intertidal rock Intertidal mixed sediments Intertidal coarse sediment Intertidal sand and muddy sand Intertidal mud Intertidal underboulder communities Peat and clay exposures Moderate energy infralittoral rock High energy infralittoral rock Moderate energy circalittoral rock Subtidal coarse sediment Subtidal sand Subtidal mixed sediments Subtidal mud





Legend

- MPA Study Area
- Marine Scheme Boundary
- MCZ (Marine Conservation Zone)
- NCMPA (Nature Conservation Marine Protected Area)

NCMPA Protected Features (JNCC, 2023)

- Ocean quahog aggregations
- Offshore subtidal sands and gravels
- Shelf Banks and Mounds
- Moraines

MCZ Protected Features (Natural England, 2023)

- High energy intertidal rock (A1.1)
- Moderate energy intertidal rock (A1.2)
- Low energy intertidal rock (A1.3)
- Intertidal coarse sediment (A2.1)
- Intertidal sand and muddy sand (A2.2)
- Intertidal mud (A2.3)
- Intertidal mixed sediments (A2.4)
- High energy infralittoral rock (A3.1)
- Moderate energy infralittoral rock (A3.2)
- Moderate energy circalittoral rock (A4.2)
- Subtidal coarse sediment (A5.1)
- Subtidal sand (A5.2)
- Subtidal mud (A5.3)
- Subtidal mixed sediments (A5.4)
- UK 12 Nautical Mile Limit
- Scotland/England Territorial Waters

Rev	Date	Status	Drwn	Chkd	Appd
04	-	-	-	-	-
03	-	-	-	-	-
02	12/07/2023	Revised	TF	NL	EW
01	26/05/2023	Issued	TF	NL	EW

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Figure 7 Protected Features

Scale	Plot Size	Datum	Projection
1:750,000	A3	WGS84	UTM30N

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4.3. Impacts Requiring Assessment

60. Table 4.2 below identifies the impacts requiring assessment as part of the ncMPA/MCZ Assessment.

Table 4.2 Impacts requiring assessment as part of the ncMPA / MCZ Assessment

Site	Impacts Requiring Assessment	
	Construction and Decommissioning Impacts	**Impacts during Operation and Maintenance (O&M)**
Firth of Forth Banks Complex ncMPA	• Temporary benthic habitat / species loss or disturbance. • Increased suspended sediment concentrations (SSC) and associated deposition (including mobilisation of potential contaminants).	• Permanent habitat / species loss or disturbance • Colonisation of hard structures (including potential introduction and spread of INNS). • Increased suspended sediment concentrations (SSC) and associated deposition (including mobilisation of potential contaminants). • EMF effects. • Thermal emissions from operational cables. • Changes in physical processes from cable protection measures.
Farnes East MCZ	• Increased suspended sediment concentrations (SSC) and associated deposition (including mobilisation of potential contaminants).	• Increased suspended sediment concentrations (SSC) and associated deposition (including mobilisation of potential contaminants). • Colonisation of hard structures (including potential introduction and spread of INNS).
Berwick to St Mary's MCZ	• Disturbance and displacement as a result of construction and decommissioning activities (vessel presence and nearshore area construction activities). • Change in prey availability resulting from increased suspended sediment concentrations, reduced water quality/contamination disturbance and temporary habitat loss/disturbance.	• Disturbance and displacement as a result of operation and maintenance activities (vessel presence). • Change in prey availability resulting from increased SSC, EMF and thermal emissions, and long term habitat loss/disturbance
Coquet to St Mary's MCZ	• Temporary benthic habitat / species loss or disturbance. • Increased suspended sediment concentrations (SSC) and associated deposition (including mobilisation of potential contaminants).	• Permanent habitat / species loss or disturbance • Colonisation of hard structures (including potential introduction and spread of INNS). • Increased suspended sediment concentrations (SSC) and associated deposition (including mobilisation of potential contaminants). • EMF effects. • Thermal emissions from operational cables. • Changes in physical processes from cable protection measures.

4.3.1. Impacts Screened Out of the Assessment

61. Impacts screened out of the assessment were agreed with key stakeholders through consultation following receipt of the Scoping Opinion from MD-LOT and MMO in February and March 2023 respectively. These are listed below[5].

- Temporary increase in underwater noise on benthic species (C & D);
- Increased risk of introduction of INNS from the movement of vessels and equipment (C & D)[6]; and
- Accidental release of pollutants (C & O & D).

4.4. Conclusions from ncMPA / MCZ Stage 1 Assessment

62. This initial screening stage focuses on what can reasonably be predicted as a consequence of the Marine Scheme and whether it is 'capable of affecting (other than insignificantly)' a protected feature of an ncMPA / MCZ or any ecological or geomorphological process on which the conservation of any protected feature of the site is (wholly or in part) dependent. In accordance with the relevant guidance described above, the potential for 'affecting' which is remote (in terms of likelihood of occurrence) and hypothetical should not be the basis of a conclusion that further assessment is required.

63. Table 4.3 below provides an initial screening assessment for relevant ncMPA and MCZ sites.

[5] C = Construction, O = Operation and maintenance, D = Decommissioning

[6] Please note that the assessment of the introduction and spread of INNS during the operation and maintenance phase will be assessed under colonisation of hard structures.

Table 4.3 Stage 1 Assessment of the Marine Scheme on the ncMPA/ MCZ site features

Site Name	Feature(s)	Potential Impact Pathway(s) - Construction and Decommissioning	Potential Impact Pathway(s) – O&M	Likelihood of Interaction(s)
Scottish waters				
Firth of Forth Banks Complex ncMPA	• Offshore subtidal sands and gravels • Shelf banks and mounds • Ocean quahog (*Arctica islandica*) aggregations • Moraines representative of the Wee Bankie key geodiversity area	• Temporary benthic habitat / species loss or disturbance. • Increased suspended sediment concentrations (SSC) and associated deposition (including mobilisation of potential contaminants).	• Permanent benthic habitat / species loss or disturbance. • Increased SSC and associated deposition from cable repairs and reburial. • Colonisation of hard structures and introduction of INNS. • EMF effects. • Thermal emissions from operational cables. • Changes in physical processes from cable protection measures.	All of the designated features of the Firth of Forth Banks Complex ncMPA have been identified as having the potential to be affected (other than insignificantly) by the Marine Scheme. Based on the appraisal methodology described above and the direct overlap of the Marine Scheme with the ncMPA, all features have been Screened-In for a full assessment. **Screening Outcome:** Screened-In for all features; a full assessment is provided in section 5.
English waters				
Farnes East MCZ	• Moderate energy circalittoral rock • Subtidal coarse sediment • Subtidal mixed sediments • Subtidal sand • Subtidal mud • Seapen and burrowing megafauna communities • Ocean quahog (*Arctica islandica*)	• Increased SSC and associated deposition (including mobilisation of potential contaminants).	• Colonisation of hard structures and introduction of INNS. • Increased SSC and associated deposition (including mobilisation of potential contaminants).	As informed by advice from key stakeholders during the pre-application process, previous route options through the eastern edge of the MCZ were discounted; this is described in full within Chapter 6 (Route Appraisal and Consideration of Alternatives). Owing to the approximate distance between the Marine Scheme and the MCZ (~0.07 km at the closest point), the following impact pathways are screened out as there is deemed to be no risk potential to the conservation objectives: direct temporary or permanent habitat loss resulting from cable installation and cable protection; SSC generation during operation and maintenance activities.

Site Name	Feature(s)	Potential Impact Pathway(s) - Construction and Decommissioning	Potential Impact Pathway(s) – O&M	Likelihood of Interaction(s)
				Based on the appraisal methodology described above and the proximity of the Marine Scheme to the MCZ, all features have been Screened-In for a full assessment: **Screening Outcome:** Screened-in for all features. A full assessment is provided in section 6.
Berwick to St Mary's MCZ	• Common eider (*Somateria mollisima*)	• Disturbance and displacement as a result of construction and decommissioning activities. • Change in prey availability resulting from increased suspended sediment concentrations, reduced water quality/contamination, disturbance and temporary habitat loss/disturbance.	• Disturbance and displacement as a result of operation and maintenance activities. • Change in prey availability resulting from long term subtidal habitat loss/change.	The designated feature of the Berwick to St Mary's MCZ has been identified as having the potential to be affected by the Marine Scheme. Based on the appraisal methodology described above and the direct overlap of the Marine Scheme with the MCZ, the single designated feature (and supporting habitat) has been Screened-In for a full assessment. **Screening Outcome:** Screened-In; a full assessment is provided in section 7.
Coquet to St Mary's MCZ	• High energy infralittoral rock • Low energy intertidal rock • Moderate energy intertidal rock • High energy intertidal rock • Intertidal mixed sediments • Intertidal coarse sediment • Intertidal sand and muddy sand • Intertidal mud • Intertidal underboulder communities • Moderate energy circalittoral rock	• Temporary benthic habitat / species loss or disturbance. • Increased SSC and associated deposition (including mobilisation of potential contaminants).	• Permanent benthic habitat / species loss or disturbance • Colonisation of hard structures and introduction of INNS • Increased SSC and associated deposition from cable repairs and reburial. • EMF effects. • Thermal emissions from operational cables. • Changes in physical processes from cable protection measures.	The designated features of the Coquet to St Mary's MCZ have been identified as having the potential to be affected by the Marine Scheme. Based on the appraisal methodology described above and the direct overlap of the Marine Scheme with the MCZ, all designated features have been Screened-In for a full assessment. **Screening Outcome:** Screened-In for all features; a full assessment is provided in section 0.

Site Name	Feature(s)	Potential Impact Pathway(s) - Construction and Decommissioning	Potential Impact Pathway(s) – O&M	Likelihood of Interaction(s)
	• Moderate energy infralittoral rock • Peat and clay exposures • Subtidal coarse sediment • Subtidal mixed sediments • Subtidal mud • Subtidal sand			

4.5. MPA / MCZ Screening – In-Combination Effects

64. As part of ncMPA / MCZ Screening it has also been necessary to identify other plans and projects that could hinder the conservation objectives of the ncMPA or MCZs in-combination with the Marine Scheme. Other plans and projects identified as requiring further assessment as part of the site assessments (sections 5 to 8) are listed in Table 4.4 below. Where plans or projects have been screened out of the ncMPA / MCZ Assessment, justification for this conclusion is also provided.

65. There is no single, agreed approach to the completion of a CEA for an MPA/MCZ assessment however, as agreed as part of the ncMPA / MCZ screening process, the following guidance has been used to help inform the approach to the assessment of cumulative effects:

- Cumulative Effects Assessment (Planning Inspectorate, 2019) provides guidance on the assessment of cumulative effects relevant to Nationally Significant Infrastructure Projects (NSIPs). Whilst the Marine Scheme is not an NSIP, the well-tested and robust methodology is valuable to informing approach to assessment;
- A strategic Framework for Scoping Cumulative Effects (MMO, 2014) provides guidance for the assessment of cumulative effects within the marine environment; and
- Marine Scotland (2018) Offshore wind, wave and tidal energy applications: consenting and licensing manual.

66. The CEA has considered all other relevant plans, projects, and activities where detail to inform the assessment is publicly available three months prior to the Marine Licence Application for the Marine Scheme.

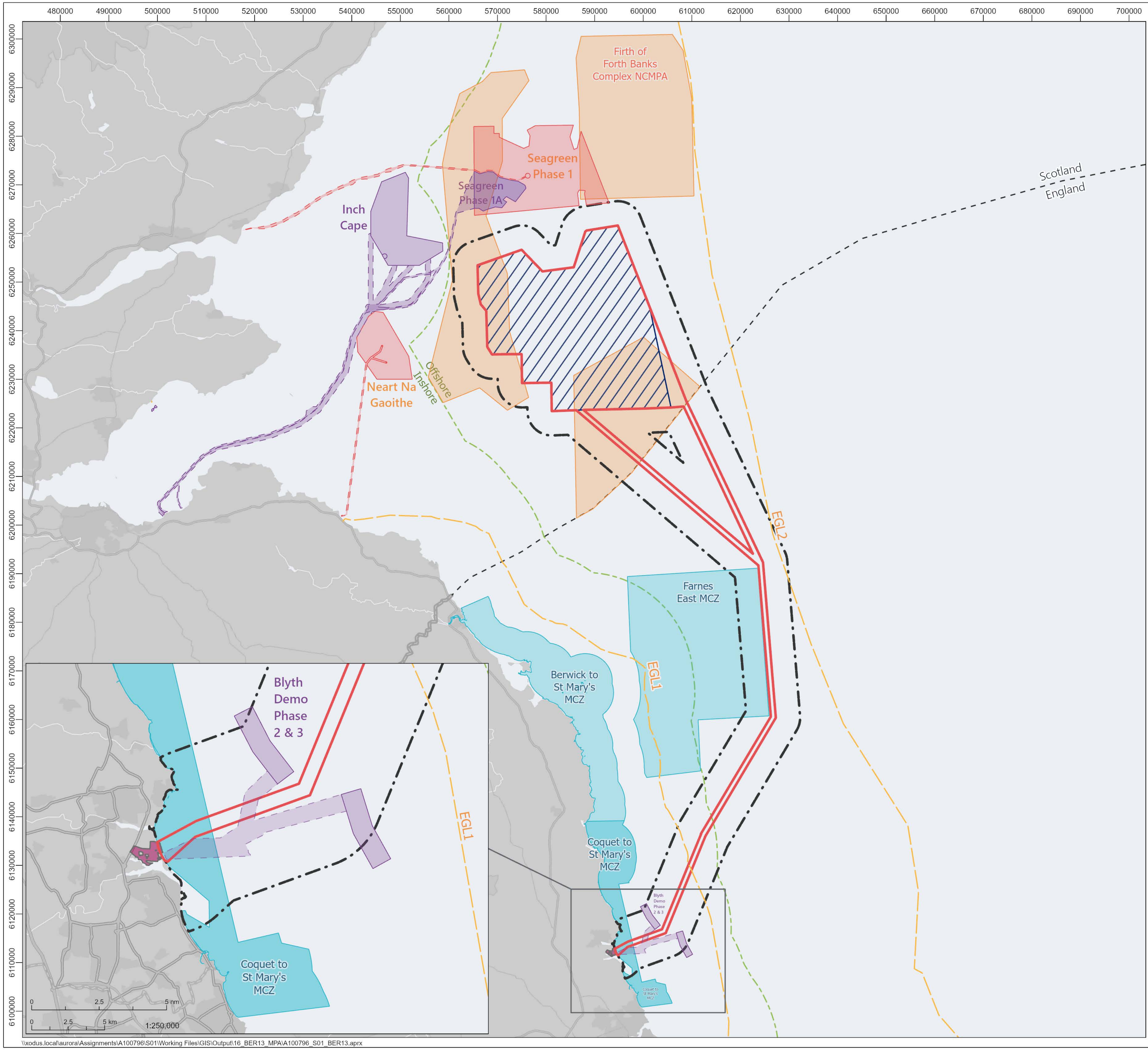
67. The developments selected as relevant to the CEA presented within this ncMPA / MCZ Assessment are based upon the results of a screening exercise and the development of a 'long list' of cumulative developments relevant to the Marine Scheme (see the ES, Volume 3, Appendix 3.1). The potential for each development to hinder the conservation objectives of each designated site has been considered on a case-by-case basis for screening in or out of this assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved, to create the 'short list' as summarised in Table 4.4 and presented in Figure 8.

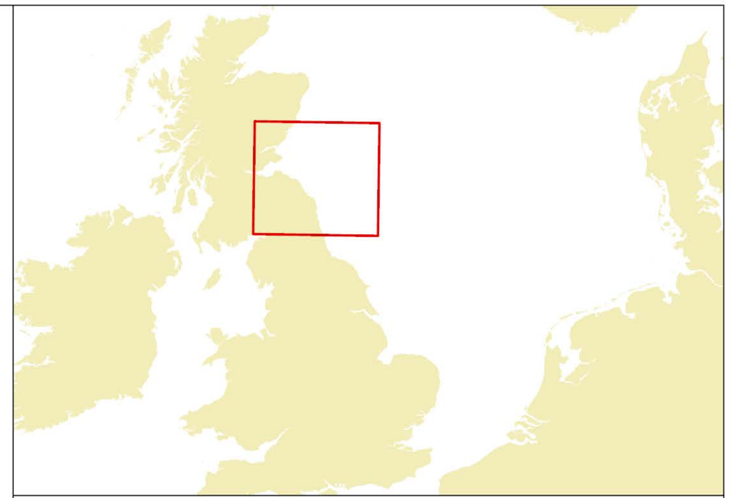
Table 4.4 List of other developments considered within the CEA for the ncMPA and MCZ Assessment

Development/ Plan	Status	Distance from Marine Scheme (km)	Description of Development /Plan	Dates of Construction (If applicable)	Dates of Operation (If applicable)	Relevant to In-Combination Assessment?[7]				Justification
						FoFBC ncMPA	FE MCZ	BtoSM MCZ	CtoSM MCZ	
Cambois Connection Onshore Scheme	In planning	0 km	Onshore cables, converter station and associated works to connect into the National Grid substation at Blyth	Construction anticipated to be 2026 to 2030	Anticipated to be operational from 2030 for 35 years	Scoped out	Scoped out	Scoped in (C)	Scoped out	Relevant to Landfall only and therefore not spatially proximate and no impact pathway to hinder conservation objectives of the FoFBC ncMPA or FE MCZ. Due to use of trenchless technique no interaction pathway with potential to hinder conservation objectives for features of CtoSM MCZ. Potential disturbance interaction with ornithology feature of BtoSM MCZ during Construction.
BBWF	In planning	0 km (direct physical overlap)	Offshore wind farm and associated grid connection infrastructure	Construction anticipated to be 2025 to 2032	Operational from 2032	Scoped in (C, O&M)	Scoped out	Scoped out	Scoped out	Scoped in for FoFBC ncMPA due to direct overlap between Marine Scheme, BBWF array area and FoFBC ncMPA. No interactions in English waters and therefore not spatially proximate and no impact pathways to FE MCZ, BtoSM MCZ or CtoSM MCZ.
Eastern Green Link 1 (EGL1)	In planning	0 km (direct physical overlap)	HVDC electricity cable from the Torness area in East Lothian (Scotland) to Hawthorn Pit in County Durham	Construction anticipated to be 2024 to 2027	Operational from ~2027 for ~50 years	Scoped in (C)	Scoped in (C)	Scoped out	Scoped out	Potential interaction with Marine Scheme during construction for FE MCZ. Marine scheme des not overlap the MCZ and construction activities unlikely to physically interact. Scoped out for FoFBC ncMPA, BtoSM MCZ and CtoSM MCZ as very limited potential for overlapping activities in English waters during construction and thus no impact pathway.
Eastern Green Link 2 (EGL2)	In planning	Approximately 3 km	A sub-sea HVDC cable from Sandford Bay at Peterhead, Scotland to Drax in England.	Construction anticipated to be 2025 to 2029	Operational from ~2029	Scoped in (C)	Scoped in (C)	Scoped out	Scoped out	Potential interaction during construction with Marine Scheme in Scottish and English waters. Located immediately adjacent to FoFBC ncMPA. Potential for cumulative impact pathway during construction and operation and maintenance for FoFBC ncMPA. Potential for cumulative impact pathway during construction for FE MCZ. Scoped out for FE MCZ during operation as no direct overlap. Scoped out for BtSM MCZ and CtoSM MCZ due to distance from Landfall and thus no potential interaction during O&M.
Eastern Green Link 3 (EL3)	Pre-planning	Limited information in the public domain, however potential for direct overlap	Subsea electricity cable(s)	Earliest in service date noted as 2031	Earliest potential operational date of 2031 – further information unavailable	Scoped out	Scoped out	Scoped in (C)	Scoped out	Construction periods may overlap and thus potential impact pathway to BtoSM MCZ. No defined route therefore insufficient information to inform the CEA for FoFBC ncMPA, FE MCZ or CtoSM MCZ.
Eastern Green Link 4 (EL4)	Pre-planning	Limited information in the public domain, however	Subsea electricity cable(s)	Earliest in service date noted as 2031	Earliest potential operational date of 2031 – further information unavailable	Scoped out	Scoped out	Scoped out	Scoped out	Construction periods may overlap and thus potential impact pathway to BtoSM MCZ. No defined route therefore insufficient information to inform the CEA for FoFBC ncMPA, FE MCZ or CtoSM MCZ.

[7] FoFBC: Firth of Forth Banks Complex, FE: Farnes East, BtoSM: Berwick to St Mary's, CtoSM: Coquet to St Mary's

Development/ Plan	Status	Distance from Marine Scheme (km)	Description of Development /Plan	Dates of Construction (If applicable)	Dates of Operation (If applicable)	Relevant to In-Combination Assessment?[7] FoFBC ncMPA	FE MCZ	BtoSM MCZ	CtoSM MCZ	Justification
		potential for direct overlap								
Neart Na Gaoithe Offshore Wind	Under Construction	15 km	Offshore wind farm	2022 - 2024	Anticipated to be operational from 2024 for 25 years	Scoped in (O&M)	Scoped out	Scoped out	Scoped out	No overlap of construction periods. No spatial overlap with the Marine Scheme in Scottish waters nor with the FoFBC ncMPA, however is in close proximity therefore scoped in for FoFBC ncMPA for O&M activities. Scoped out for FE MCZ, BtoSM MCZ and CtoSM MCZ in English waters as no impact pathway during operation and maintenance phases.
Seagreen 1	Under Construction	5 km	Offshore wind farm	2022 - 2023	Anticipated to be operational from 2023 for 25 years	Scoped in (O&M)	Scoped out	Scoped out	Scoped out	No overlap of construction periods. Overlap with operation and maintenance period. Direct overlap with FoFBC ncMPA thus scoped in for operation & maintenance period. Scoped out for FE MCZ, BtoSM MCZ and CtoSM MCZ in English waters as no impact pathway due to distance.
Seagreen 1A Project	Consented	23km	Transmission infrastructure	2024 - 2026	Unknown	Scoped in (C, O&M)	Scoped out	Scoped out	Scoped out	Construction and operation and maintenance periods overlap. Overlap with FoFBC ncMPA. Scoped in for FoFBC ncMPA for construction and operation and maintenance periods. Scoped out for FE MCZ, BtoSM MCZ and CtoSM MCZ in English waters as no impact pathway due to distance.
Blyth Demonstrator Offshore Wind Farm - Phase 1	Operational	1.9	Offshore wind farm	N/A	Unknown	Scoped out	Scoped out	Scoped in (O&M)	Scoped out	Overlap with operation and maintenance period. Direct overlap with BtoSM MCZ and CtoSM MCZ. Vessel traffic during O&M activities may coincide with Marine Scheme construction activities.
Blyth Demonstrator Offshore Wind Farm – Phase 2	Consented	1	Offshore wind farm	Completed by 2025	Current lease secured until 2050	Scoped out	Scoped out	Scoped in (O&M)	Scoped out	Overlap with operation and maintenance period.
Blyth Demonstrator Phase 2 (&3) Cable Corridor	In planning	Unknown (potential for direct physical overlap)	OWF demonstrator of innovative floating offshore wind technology	Unknown	Anticipated to be operational from 2025	Scoped out	Scoped out	Scoped in (O&M)	Scoped out	Overlap with operation and maintenance period. Direct overlap with the Marine Scheme and BtoSM MCZ and CtoSM MCZ.





Legend

- Marine Scheme Boundary
- MPA Study Area
- Berwick Bank Wind Farm Array Area
- Onshore Scheme Boundary

Marine protected areas

- MCZ (Marine Conservation Zone)
- NCMPA (Nature Conservation Marine Protected Area)

Offshore Wind Farm Site Agreements

- Active/In Operation
- Under Construction
- Consented

Offshore Wind Farm Site Cable Corridors

- Under Construction
- Consented
- Power (Consented/Planned)
- UK 12 Nautical Mile Limit
- Scotland/England Territorial Waters

Rev	Date	Status	Drwn	Chkd	Appd
04	-	-	-	-	-
03	-	-	-	-	-
02	-	-	-	-	-
01	18/07/2023	Issued	TF	NL	EW

Project

Cambois Connection

Title

Figure 8 In-Combination Effects - Developments Considered in the CEA

0 2.5 5 10 15 20 25 30 nm

0 2.5 5 10 15 20 25 30 35 40 45 50 km

N

Scale	Plot Size	Datum	Projection
1:750,000	A3	WGS84	UTM30N

Drawing Number	Sheet No.
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5. MPA Assessment – Firth of Forth Banks Complex ncMPA

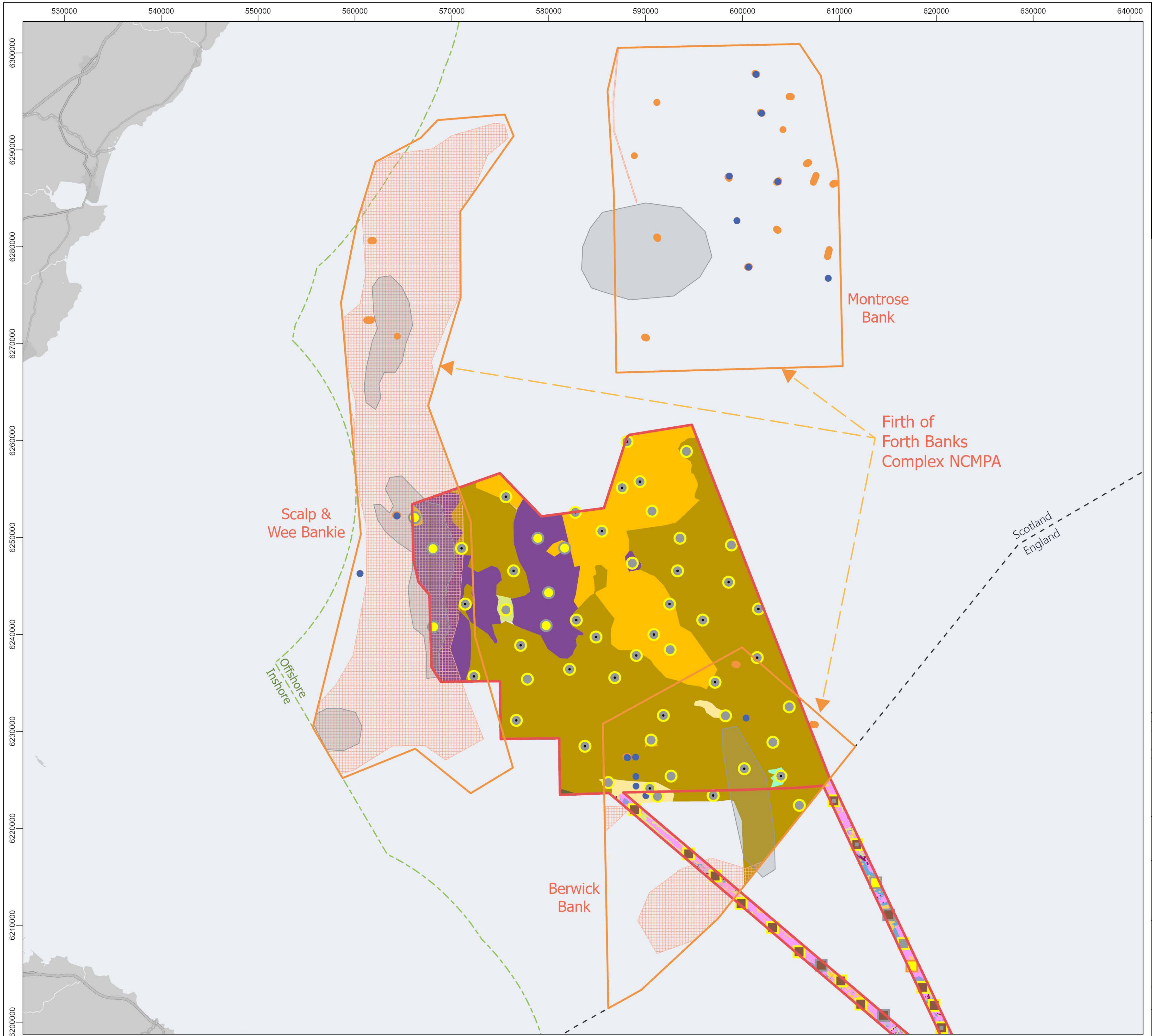
5.1. Introduction

68. The Firth of Forth Banks Complex ncMPA, which was designated in July 2014, is located in offshore waters off the east coast of Scotland (Figure 9). The extent of overlap between the Marine Scheme and the Firth of Forth Banks Complex ncMPA is approximately 361.7 km^2, which equates to 17% of the total area of the ncMPA (Total area, 2,130 km^2 (JNCC, 2021)). This can be further divided between the two sections of the Firth of Forth Banks Complex ncMPA which overlap with the Marine Scheme as follows (see Table 5.1).

- 259.5 km^2 of the Marine Scheme overlaps with the Berwick Bank part of the ncMPA – this equates to 48% of the area of the Berwick Bank part of the ncMPA and represents 72% of the Marine Scheme overlap with the ncMPA; and
- 102.2 km^2 of the Marine Scheme overlaps with Scalp and Wee Bankie part of the ncMPA – this equates to 12% of the area of Scalp and Wee Bankie and represents 28% of the Marine Scheme overlap with the ncMPA.

Table 5.1 Summary of the Extent of the Overlap Between the Marine Scheme and the Firth of Forth Banks Complex ncMPA (as a Whole, and for the Component Parts)

Marine Scheme Area (km^2)	Firth of Forth Banks Complex ncMPA (km^2)	Area of Overlap between Marine Scheme and the ncMPA (km^2) (% of ncMPA)	Area of Overlap between Marine Scheme and the Berwick Bank part of ncMPA (km^2) (% Berwick Bank part of ncMPA)	Area of Marine Scheme within Scalp and Wee Bankie part of ncMPA (km^2) (% Scalp and Wee Bankie part of ncMPA)	Area of Marine Scheme within Montrose Bank part of ncMPA (km^2) (% Montrose Bank part of ncMPA)
1,232.2 km^2	2,130 km^2	361.7 km^2 (17.0%)	259.5 km^2 (47.9%)	102.2 km^2 (12.3%)	0 km^2



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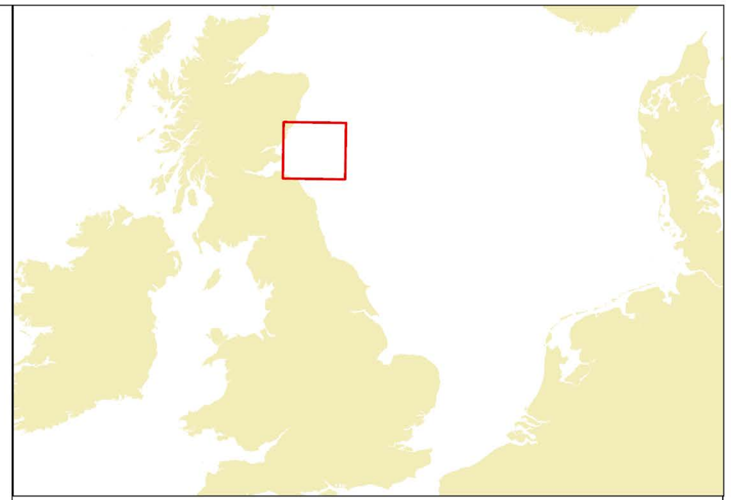

Legend

Marine Scheme Boundary

NCMPA (Nature Conservation Marine Protected Area)

NCMPA Protected Features (JNCC, 2023)

- Ocean quahog aggregations
- Offshore subtidal sands and gravels
- Shelf Banks and Mounds
- Moraines

Folk Sediment Classification (Berwick Bank)

- Gravelly Sand
- Sandy Gravel
- Slightly Gravelly Sand

BBWF Survey Biotopes

- SS.SCS.CCS [Balanus crenatus]
- SS.SMu.CSaMu.AfilMysAnit
- SS.SMu.CSaMu.AfilNten
- SS.SMx.CMx.MysThyMx
- SS.SMx.OMx
- SS.SMx.OMx.PoVen
- SS.SSa.CFiSa.EpusOborApri
- SS.SSa.OSa
- SS.SSa.Osa [*Echinocyamus pusillus*]

Folk Sediment Classification (Cambois)

- Gravelly Muddy Sand; (Gravelly) Muddy Sand
- Gravelly Sand
- Muddy Sand
- Muddy Sandy Gravel
- Sand; (Gravelly) Sand
- Sandy Gravel

Cambois Survey Biotopes

- SS.SCS.OCS
- SS.SMu.OMu.PjefThyAfil
- SS.SMx.CMx
- SS.SMx.CMx.KurThyMx
- SS.SMx.OMx
- SS.SSa.CFiSa.ApriBatPo
- SS.SSa.OSa.OfusAfil

UK 12 Nautical Mile Limit

Scotland/England Territorial Waters

Rev	Date	Status	Drwn	Chkd	Appd
04	-	-	-	-	-
03	-	-	-	-	-
02	-	-	-	-	-
01	12/07/2023	Issued	TF	NL	EW

sse Renewables

Project

Cambois Connection

Title

Figure 9 Firth of Forth Banks Complex NCMPA with Survey Biotopes

0 2.5 5 10 15 nm

0 2.5 5 10 15 20 25 km

N

Scale	Plot Size	Datum	Projection
1:375,000	A3	WGS84	UTM30N

Drawing Number	Sheet No.
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5.2. Baseline

69. The Firth of Forth Banks Complex ncMPA, which was designated in July 2014, is located in offshore waters off the east coast of Scotland and covers a total area of approximately 2,130 km^2 (Figure 9). The ncMPA is composed of three distinct sections: Berwick Bank (541.2 km^2); Scalp and Wee Bankie (827.1 km^2) and Montrose Bank (761.8 km^2). Strongly influenced by ocean currents, the mosaic of different types of sands and gravels create a unique mixture of habitats that overlie the underwater shelf banks and mounds within the ncMPA and support ocean quahog (*Arctica islandica*) aggregations. Ocean quahog are a low-mobility mollusc that is slow growing and can live for over 100 years. This species is a designated feature of the ncMPA and is also an OSPAR Threatened and/or Declining species. The Wee Bankie includes moraines, formed from underwater glacial ridges deposited during the last Ice Age. The moraines are scientifically important for their role in improving the understanding of the history of glaciation around Scotland (JNCC,2018a).

70. The ncMPA is characterised by four protected features: ocean quahog aggregations; offshore subtidal sands and gravels; shelf banks and mounds; and moraines (which are representative of the Wee Bankie Key Geodiversity Area). Supplementary Advice on Conservation Objectives for Firth of Forth Banks Complex Nature Conservation ncMPA (JNCC, 2018b) states that offshore subtidal sands and gravels have been mapped using full coverage bathymetry and backscatter data, as well as benthic video and image sample data, which demonstrated that >99% of the ncMPA is modelled as offshore subtidal sands and gravels. Offshore subtidal sands and gravels and supporting habitat for ocean quahog aggregations are therefore assumed to extend across the whole of the ncMPA. The offshore subtidal sands and gravels and ocean quahog aggregations are considered to be in unfavourable condition.

71. The shelf banks and mounds protected feature characterises sizable areas within each of the sections of the ncMPA and overall covers ~264 km^2 within the ncMPA. The moraines representative of the Wee Bankie Key Geodiversity Area feature occur most extensively in the Scalp and Wee Bankie section of the ncMPA, but are also mapped within Berwick Bank and a small area within Montrose Bank; overall this feature covers ~750 km^2 of the ncMPA. Shelf banks and mounds large-scale feature and Wee Bankie Key Geodiversity Area are considered to be in favourable condition.

72. The ocean quahog is listed on the OSPAR List of Threatened and/or Declining Species and Habitats. It is a slow growing and long-lived filter feeder that lives buried in soft sediments, meaning it is often slow to recover following disturbance, and this region (OSPAR Region II) is particularly under threat from seabed disturbance (OSPAR Commission, 2009).

73. The benthic infaunal analysis and epibenthic trawl analysis for the BBWF array area recorded ocean quahog at eight grab sample locations in the north of the BBWF array area, one of which was located within the Firth of Forth Banks Complex NCMPA. Most recorded individuals were juvenile; however, two mature specimens were recorded in the north-east of the BBWF Array Area (BBWFL, 2022). Ocean quahog were also recorded in two epibenthic trawls at the east of the BBWF array area. No ocean quahog were recorded within the ncMPA during the Marine Scheme Export Cable Corridor survey (ES, Volume 3, Appendix 8.1: Benthic Survey Report (Phase 1 and 2).

74. A desk-based review of EIAs and monitoring reports for nearby developments indicates that similar biotopes have been recorded in the wider regional area. The Seagreen 1 and Seagreen 1A developments, approximately 5 km from the Marine Scheme and overlapping the ncMPA, were characterised by a mixture of coarse and mixed biotopes associated with polychaetes and bivalves (e.g. SS.SMx.OMx.PoVen and *Moerella* spp. with venerid bivalves in infralittoral gravelly sand (SS.SCS.ICS.MoeVen)) as well as '*Sabelleria spinulosa* on stable circalittoral mixed sediment' (SS.SBR.PoR.SspiMx) (Seagreen, 2012). The key biotopes recorded during site-specific surveys for the Inch Cape array area, approximately 8 km north-west of the Marine Scheme, were muddy sand and gravel sediments with bivalves, such as *Kurtiella bidentata* and *Thyasira* spp. (SS.SMx.CMx.KurThyMx), and also offshore circalittoral coarse sediment (SS.SCS.OCS) (Inch Cape Offshore Limited, 2011). For the Neart na Gaoithe array area, located 16 km west of the Marine Scheme, muddy habitats associated with Amphiura filiformis dominated, specifically

SS.SMu.CSaMu.AfilNten, interspersed with coarse and sandy biotopes (e.g. circalittoral coarse sediment (SS.SCS.CCS) and offshore circalittoral sand (SS.SSa.OSa) (EMU, 2010).

75. Sediment bound contaminants in the marine environment are often associated with sediments that have a high fines content, especially clay and silt fractions. However, as described in ES, Volume 2, Chapter 8: Benthic and Intertidal Ecology, sands and gravel dominated the habitats found across the ncMPA area and the fines component was generally recorded as low. Six of the nine sediment samples from the BBWF surveys that were analysed for sediment chemistry are located within or just outside the BBWF Array area (BBWFL, 2022). None of the sediment samples from the Berwick Bank Wind Farm array area surveys exceeded Cefas Action Level 1 (AL1)/Action Level 2 (AL2) or the Canadian Sediment Quality Guidelines (CSQG; CCME, 2001) thresholds for heavy metals, organotins, polychlorinated biphenyls and polyaromatic hydrocarbons (PAHs). However, the Canadian TEL for arsenic was exceeded at five sample stations in the northwest of the BBWF array area (BBWFL, 2022).

76. Subtidal sands and gravels are listed under Section 2(4) of the Nature Conservation (Scotland) Act 2004 (formally UK Biodiversity Action Plan (BAP) Priority Habitat), with offshore sediments considered a Priority Marine Feature in Scottish waters. They are one of the most common habitats in UK waters supporting an array of biotopes and benthic life. Shelf banks and mounds are elevated areas of seabed created by strong currents, formed by the accumulation of great volumes of sediments. Their structure creates an ideal surface for species to colonise and support the growth of benthic communities.

77. Based on the nature of the protected features, there is considered to be no notable seasonal temporal change. However, in terms and medium and long-term change, it is necessary to take account of potential effects of climate change on the marine environment. Variability and long-term changes on physical influences may bring direct and indirect changes to benthic habitats and communities in the mid to long term future (Department for Business, Energy and Industrial Strategy (BEIS), 2016).

78. A strong base of evidence indicates that long term changes in the benthic ecology may be related to long term changes in the climate or in nutrients (BEIS, 2016), with climatic process driving shifts in abundances and species composition of benthic communities (Marine Climate Change Impacts Partnership (MCCIP), 2015). Benthic communities are also predicted to be influenced by anthropogenic activities including contamination or seabed disturbing activities such as trawling, dredging and development (Kröncke, 1995). This finding has been validated for the ncMPA by a review of the geophysical survey output, which shows areas of trawl marks within the ncMPA as well as areas of deposition and erosion.

79. Studies of North Sea benthic ecology over the last three decades have shown that biomass has increased by at least 250% to 400%; opportunistic and short-lived species have increased; and long-living sessile animals have decreased (Kröncke, 1995; Kröncke, 2011). Since the end of the 1980s, the temperature of oceanic water flowing past Scotland has increased at a rate of between 0.22°C to 0.40°C per decade, with a longer-term (1990-2006) trend of around 0.04°C (Hughes *et al.,* 2016). The effect of this temperature rise is expected to have a different impact on each benthic group altering aspects such as distribution and reproduction (Hiscock et al., 2001).

80. As such, the baseline described for the ncMPA Assessment is a 'snapshot' of the present benthic ecosystem within a gradual yet continuously changing environment. Any changes that may occur during the design life span of the Marine Scheme should be considered in the context of both greater variability and sustained trends occurring on national and international scales in the marine environment.

5.3. Conservation Objectives

81. The status of the conservation features are summarised in Table 5.2 and discussed further below.

Table 5.2 Conservation Objectives for the Firth of Forth Banks Complex ncMPA

Protected Feature	Spatial Extent (km^2)	Condition	Conservation Objectives
Offshore subtidal sands and gravels	~2,130	Unfavourable	Recover to favourable condition
Shelf banks and mounds	~264	Favourable	Maintain in favourable condition
Ocean quahog aggregations	~2,130	Unfavourable	Recover to favourable condition
Moraines representative of the Wee Bankie key geodiversity area	~750	Favourable	Maintain in favourable condition

82. The conservation objectives for the ncMPA site are that the protected features are:

- so far as already in favourable condition, remain in such condition; and
- so far as not already in favourable condition, be brought into such condition, and remain in such condition.

83. For the offshore subtidal sands and gravel protected feature within the ncMPA, "favourable condition" is when:

- extent is stable or increasing; and
- structures and functions, quality, and the composition of characteristic biological communities (which includes a reference to the diversity and abundance of species forming part of or living within the habitat) are such as to ensure that they remain in a condition which is healthy and not deteriorating.

84. For the shelf banks and mounds protected feature within ncMPA, "favourable condition" is when:

- the extent, distribution and structure is maintained;
- the function is maintained to ensure that it continues to support its characteristic biological community (which includes a reference to the diversity of any species associated with the large- scale feature), and their use of the site for, but not restricted to, feeding, courtship, spawning, or use as nursery grounds; and
- the processes necessary to support the feature are maintained.

85. For the ocean quahog aggregations protected feature, "favourable condition" is when:

- the quality and quantity of its habitat and the composition of its population in terms of number, age, and sex ratio are such as to ensure that the population is maintained in numbers which enable it to thrive.

86. For the moraines representative of the Wee Bankie key geodiversity area within the Firth of Forth Banks Complex ncMPA, "favourable condition" is when:

- its extent, component elements and integrity are maintained;
- its structure and function are unimpaired; and
- its surface remains sufficiently unobscured for the purposes of determining whether the above criteria are satisfied.

5.4. Assessment Information

5.4.1. Impacts Requiring Assessment

- Temporary benthic habitat / species loss or disturbance (C & D)
- Increased suspended sediment concentrations (SSC) and associated deposition (including mobilisation of potential contaminants) (C, O & M, & D);

- Permanent habitat loss (O & M);
- EMF effects (O & M);
- Thermal emissions from operational cables (O & M);
- Colonisation of hard structures (including potential introduction and spread of INNS) (O & M); and
- Changes in physical processes from cable protection measures (O & M).

5.4.2. Maximum Design Scenario

87. The maximum design scenario(s) summarised here have been selected as those having the potential to result in the greatest effect on key features of the Firth of Forth Banks Complex ncMPA. These scenarios have been selected from the details provided in the ES, Volume 2, Chapter 5: Project Description.

88. Site preparation works, in advance of construction, are predicted to commence in Q4 of 2026 and will continue until all installation activities have ceased. Export cable installation is expected to begin in Q3 2028 and is expected to last until Q4 of 2029. All activities associated with the Marine Scheme are predicted to conclude by the end of 2029. Until detailed design of the Marine Scheme is progressed and further refined pre-construction, this programme for the Marine Scheme as a whole is indicative and is subject to further refinement, but is used to inform assessment of construction phase impacts for the Marine Scheme.

89. Given that the maximum design scenario is based on the design option (or combination of options) that represents the greatest potential for change, confidence can be had that development of any alternative options within the design parameters will give rise to no greater risk of hindering the achievement of ncMPA's conservation objectives than assessed in this impact assessment. Table 5.3 presents the maximum design scenario for potential impacts on the ncMPA during construction, operation and maintenance and decommissioning.

Table 5.3 MDS for Assessment of Effects on the Firth of Forth Banks Complex ncMPA

Potential Impact	Maximum Design Scenario (Marine Scheme whole)	Maximum Design Scenario (Scottish waters)	Justification
Construction and decommissioning			
Temporary benthic habitat / species loss or disturbance	Maximum duration of the construction phase of up to 39 months.	**Scottish waters:** Up to 4 km^2 of temporary habitats loss / disturbance due to: • Installation of up to four cables with seabed disturbance width of 25 m for cable installation and seabed preparation activities including PLGR, boulder clearance, route preparation at sandwaves, sea trials, pre-sweep and pre-installation trenching through harder sediment.	Maximum footprint which would be affected during the construction phases. Based on the assumption that the width of disturbance for seabed levelling at sandwaves (across 20% of the Marine Scheme in Scottish waters) and all other seabed preparation activities encompasses subsequent cable installation as repeat disturbance. For the purposes of this assessment, it is assumed that all of the temporary habitat disturbance predicted within Scottish waters (4 km^2), could occur entirely within the ncMPA. As the final locations of the OCSPs within the BBWF array area will be subject to detailed design, the locations of the Offshore Export Cables within the BBWF array area, and thus ncMPA, are unknown.
Increased suspended sediment concentration (SSC) and associated deposition (including mobilisation of potential contaminants)	Maximum duration of the construction phase of up to 39 months.	**Scottish waters:** Seabed preparation: • Pre-lay grapnel run, boulder clearance, sea trials (as required), and pre-installation trenching through harder sediment; • Seabed levelling at sandwaves across a width of 25 m, average height 5 m and clearance along approximately 20% of the Marine Scheme length in Scottish waters (0.8 km$^{2.}$). Cable installation:	Greatest volume of sediment released into the water column (see ES, Volume 2, Chapter 7). Cable installation by MFE has the greatest potential to increase suspended sediments as this method fluidises the sediment. In some areas, a trench depth of 3 m may not be achieved and therefore the assessment provides the upper bound in terms of suspended sediment and dispersion potential.

Potential Impact	Maximum Design Scenario (Marine Scheme whole)	Maximum Design Scenario (Scottish waters)	Justification
		• Offshore export cables length up to 160 km; • Installation using any of the following methods: ploughs (displacement and/or non-displacement), jetting machines, mechanical trenchers, MFE. Of these, MFE has been assumed as the worst case with regards to SSC; • Installation mobilises sediments from a 3 m deep and 2.5 m wide trench.	
Operation and Maintenance			
Permanent benthic habitat / species loss or disturbance	Operation and maintenance phase of up 35 years.	**Scottish waters:** Up to 0.23 km^2 of permanent habitat loss due to: • Up to 0.23 km^2 of cable protection associated with 6 km per cable (24 km in total). Operation and maintenance phase of up 35 years.	Maximum footprint which would be affected during the operation and maintenance phase. For the purposes of this assessment, it is assumed that all of the permanent habitat loss/disturbance predicted within Scottish waters (0.23 km^2), could occur entirely within the ncMPA. As the final locations of the OCSPs within the BBWF array area will be subject to detailed design, the locations of the Offshore Export Cables within the BBWF array area, and thus ncMPA, are unknown.
Increased SSC and associated deposition	Operation and maintenance phase of up 35 years.	**Scottish waters:** Repair / reburial activities; • Four cable repair events of up to 1 km each across the operation and maintenance phase; and Four cable reburial events of up to 1 km each across the operation and maintenance phase.	Greatest volume of sediment released into the water column (see ES, Volume 2, Chapter 7). The maximum number of cable repair and reburial events result in the highest frequency of increased suspended sediment concentrations during the operation and maintenance stage.

Potential Impact	Maximum Design Scenario (Marine Scheme whole)	Maximum Design Scenario (Scottish waters)	Justification
EMF and thermal load effects.	Operation and maintenance phase of up 35 years.	**Scottish waters:** • Presence of up to four 40 km long HVDC cables in a 320 kV symmetrical monopole arrangement or two 40 km long HVDC cables as a bipole arrangement at 525 kV; and • Minimum target burial depth of 0.5 m. Operation and maintenance phase of up 35 years.	Modelling completed for the Marine Scheme provides data on the level and attenuation of EMF for a symmetrical monopole configuration at 320 kV and a bipole configuration at 525 kV, assuming a horizontal separation distance of 25 m (further details are provided in ES, Volume 2, Chapter 5: Project Description). The worst-case EMF level and attenuation is calculated for each HVDC cable as a worst-case under the assumption that a bundled arrangement will not be used. Based on this modelling, the maximum design scenario is associated with a bi-pole arrangement at 525 kV.
Colonisation of hard structures (including potential introduction and spread of INNS).	Operation and maintenance phase of up 35 years.	**Scottish waters:** Up to 0.23 km^2 of long-term habitat creation due to: • Up to 0.23 km^2 of cable protection associated with 6 km of per cable (24 km in total)	Maximum footprint which would be affected during the operation and maintenance phase. For the purposes of this assessment, it is assumed that all of the long-term habitat predicted within Scottish waters (0.23 km^2), could occur entirely within the ncMPA. As the final locations of the OCSPs within the BBWF array area will be subject to detailed design, the locations of the Offshore Export Cables within the BBWF array area, and thus ncMPA, are unknown.
Changes in physical processes from cable protection measures	Operation and maintenance phase of up to 35 years.	**Scottish waters:** • Cable protection along 24 km of up to 1.5 m height and 9.5 m width	Maximum cable protection hight, with and area would result in the largest obstruction to flow (see ES, Volume 2, Chapter 7).

5.4.3. Feature Sensitivity Assessment

90. Table 5.4 summarises the sensitivities of the protected features of the Firth of Forth Banks Complex ncMPA, as described in section 5.3. The sensitivities provided are as per the Feature Activity Sensitivity Tool (FEAST), as published by Marine Directorate, and the Marine Evidence-based Sensitivity Assessment (MarESA).

Table 5.4 FEAST and MarESA Feature Sensitivities

FEAST Feature	Pressure	FEAST Sensitivity	MarESA Sensitivity
Continental Shelf Coarse sediments	Water flow (tidal current) changes - local	Low	Not sensitive
	Electromagnetic changes	Not assessed	
	Surface abrasion	High[8]	Low
	Sub-surface abrasion/penetration	Medium[9]	Low
	Water clarity changes	Not Sensitive	Low
	Introduction or spread of non-indigenous species & translocations (competition)	Medium[10]	High
	Non-synthetic compound contamination (inc. heavy metals, hydrocarbons, produced water)	Sensitive	Not assessed
	Physical change (to another seabed type)	Medium	High
	Physical removal (extraction of substratum)	High[10]	Medium
	Siltation changes (high)	Medium[9]	Medium
	Siltation changes (low)	Medium[9]	Low
	Temperature changes - local	Not sensitive	Low
Continental Shelf Mixed Sediments	Water flow (tidal current) changes - local	Low	Not sensitive
	Electromagnetic changes	Not assessed	
	Surface abrasion	Medium	Low
	Sub-surface abrasion/penetration	High	Low
	Water clarity changes	Medium[7]	Not sensitive to low
	Introduction or spread of non-indigenous species & translocations (competition)	High[9]	High
	Non-synthetic compound contamination (inc. heavy metals, hydrocarbons, produced water)	Sensitive	Not assessed
	Physical change (to another seabed type)	High	High
	Physical removal (extraction of substratum)	High[11]	Medium
	Siltation changes (high)	Medium	Low to medium
	Siltation changes (low)	Not sensitive	Not sensitive to low
	Temperature changes - local	Medium	Low
Ocean quahog (aggregations)	Water flow (tidal current) changes - local	Low	Not sensitive
	Electromagnetic changes	Not assessed	Not assessed
	Surface abrasion	Low	High

[8] Tillin et al. (2010) consider the feature to have a range in sensitivity from not sensitive to high. The degree to which particular examples of the habitat is sensitive to the pressure will be dependent on the species present.

[9] Tillin et al. (2010) consider the feature to have a range in sensitivity from low to the assigned sensitivity. The degree to which particular examples of the habitat is sensitive to the pressure will be dependent on the species present.

[10] Tillin et al. (2010) report the feature as having a ranging sensitivity to the pressure from not sensitive the assigned sensitivity, but with no evidence provided to support this assessment.

[11] Tillin et al. (2010) conclude that the feature has a high sensitivity to the pressure but with no supporting evidence provided.

FEAST Feature	Pressure	FEAST Sensitivity	MarESA Sensitivity
	Sub-surface abrasion/penetration	High	High
	Water clarity changes	Not exposed	Not sensitive
	Introduction or spread of non-indigenous species & translocations (competition)	Not assessed	No evidence
	Non-synthetic compound contamination (inc. heavy metals, hydrocarbons, produced water)	Sensitive	Not assessed
	Physical change (to another seabed type)	High	High
	Physical removal (extraction of substratum)	High	High
	Siltation changes (high)	High	Not sensitive
	Siltation changes (low)	Not sensitive	Not sensitive
	Temperature changes - local	High	Medium
Bank (unknown substrate)	Water flow (tidal current) changes - local	High	Feature not assessed
	Electromagnetic changes	Not assessed (not relevant)	
	Surface abrasion	Not sensitive	
	Sub-surface abrasion/penetration	Low	
	Water clarity changes	Medium[12]	
	Introduction or spread of non-indigenous species & translocations (competition)	Not assessed (not relevant)	
	Non-synthetic compound contamination (inc. heavy metals, hydrocarbons, produced water)	Not assessed (not relevant)	
	Physical change (to another seabed type)	Medium	
	Physical removal (extraction of substratum)	Medium	
	Siltation changes (high)	Not sensitive	
	Siltation changes (low)	Not assessed (not relevant)	
Moraines	Changes in local water flow (tidal current) / wave exposure (tidal current) changes – local	Medium	Feature not assessed
	Electromagnetic changes	Not assessed (not relevant)	
	Surface abrasion	Low	
	Sub-surface abrasion/penetration	Medium	
	Water clarity changes	Not sensitive	
	Introduction or spread of non-indigenous species & translocations (competition)	Not assessed (not relevant)	
	Non-synthetic compound contamination (inc. heavy metals, hydrocarbons, produced water)	Not assessed (not relevant)	
	Physical change (to another seabed type)	Not sensitive	
	Physical removal (extraction of substratum)	High	
	Siltation changes (high)	Not sensitive	
	Siltation changes (low)	Not assessed	

[12] Significant changes to the water column characteristics could, in theory, affect long term rates of biogenic sediment supply to these bedforms. Because a change in sediment supply could potentially result in partial and localised damage to the feature's surface or stratigraphy, a medium resistance rating has been assigned.

5.5. Assessment of Effects – Project Alone

5.5.1. Potential Effects During Construction

5.5.1.1. TEMPORARY HABITAT / SPECIES LOSS OR DISTURBANCE

91. During the construction phase, temporary habitat / species loss or disturbance of the protected features within the Berwick Bank and Scalp and Wee Bankie parts of the Firth of Forth Banks Complex ncMPA may occur as a result of the following activities:

- Seabed preparation activities (including boulder clearance, seabed levelling, PLGR and pre-lay trenching); and
- Cable installation activities (including trenching, laying, burial and protection).

111. The relevant MarESA and FeAST pressures are therefore:

- Surface abrasion;
- Sub-surface abrasion/ penetration; and
- Removal of substratum (extraction).

92. For the purposes of this assessment, temporary habitat / species loss or disturbance refers to the impact of activities and events which will produce effects in the short term. In the case of buried cables, following the cessation of the activities associated with this impact a shift toward the original baseline of the environment will occur via the recovery of the sediments themselves and subsequently the associated communities. Temporary impacts to sediment features and benthic communities have been considered separately from permanent habitat loss which considers the maximum potential footprint of seabed which will be occupied by cable protection over its 35 year lifetime. Finally, where there is the potential for cable protection to remain on the seabed following the decommissioning process and thus remain in perpetuity, this is referred to, and has been assessed, as permanent habitat alteration on the basis that this habitat will be recolonised over time.

5.5.1.1.1. MAGNITUDE OF IMPACT

93. Seabed disturbance from seabed preparation and export cable installation activities are considered to be of short term and of a limited spatial extent (4 km^2 within Scottish waters). A recent study reviewed the effects of cable installation on subtidal sediments and habitats, drawing on monitoring reports from over 20 UK offshore wind farms (RPS, 2019). This review showed that following cable installation, sandy sediments recover quickly as trenches naturally infilled, with little or no evidence of disturbance in the years following cable installation and that benthic communities associated with soft sediments (e.g. muds, sands and gravels) readily recover into areas if the sediment type is reflective of the baseline environment. It also presented evidence that remnant cable trenches in coarse and mixed sediments were visible for several years after installation. However, these shallow depressions were of limited depth (i.e. tens of centimetres) relative to the surrounding seabed, over a horizontal distance of several metres and therefore did not represent a large shift from the baseline environment (RPS, 2019).

94. For the purposes of this assessment, it is assumed that all of the temporary habitat disturbance predicted within the ncMPA (4 km^2) could occur entirely within supporting habitat for ocean quahog aggregations and the subtidal sand and gravels habitat. As the final locations of the OCSPs within the BBWF array area will be subject to detailed design, the locations of the Offshore Export Cables within the BBWF array area, and thus ncMPA, are unknown. Applying a precautionary approach, if the full extent of cable installation activities occurred within supporting habitat for ocean quahog and subtidal sands and gravels habitat within the ncMPA area (totalling 1,230 km^2), this would equate to temporary habitat disturbance of up to 0.002% of the extent of these features within the ncMPA (see Table 5.1). However, the use of cable protection materials will be reduced as far as

practicable, and are likely to be employed in areas of relatively harder substrate (that do not allow burial) and will be non-continuous in nature.

95. The Marine Scheme overlaps with 64.67 km^2 of the large-scale shelf banks and mounds feature of the ncMPA (see Figure 7). This equates to 24.50% of the total spatial extent of this feature within the ncMPA. However, as described above, only 4 km^2 of temporary disturbance resulting from cable installation activities, will be located in Scottish waters. Applying a precautionary approach, if the full extent of cable installation activities occurred within the shelf banks and mounds feature of the ncMPA (264 km^2), this would equate to temporary habitat disturbance of up to 1.52% of the extent of this feature within the ncMPA (see Table 5.1).

96. The Marine Scheme overlaps with 79 km^2 of the large-scale 'Moraines representative of the Wee Bankie key geodiversity area' feature of the ncMPA (see Figure 7). This equates to 10.5% of the total spatial extent of this feature within the ncMPA. However, as described above, only 4 km^2 of temporary disturbance resulting from cable installation activities will be located in Scottish waters. Applying a precautionary approach, if the full extent of cable installation activities occurred within the moraines feature of the ncMPA (750 km^2), this would equate to temporary habitat disturbance of up to 17% of the extent of this feature within the ncMPA (see Table 5.1).

5.5.1.1.2. SENSITIVITY OF RECEPTORS

97. The impact to the geomorphological, geological and sedimentary feature receptors relates to the potential loss or alteration of the seabed due to disturbance. The worst-case seabed loss and disturbance within the Marine Scheme resulting in changes to seabed levels and changes to seabed properties is associated with the seabed preparation and cable installation activities. The changes to seabed levels and changes to seabed properties identified will be localised and composed of native material which may be deposited through sedimentation, therefore the structure and function of the seabed is of low vulnerability and recoverable.

98. Offshore subtidal sands and gravels biotopes were identified in the site-specific benthic surveys for the Berwick Bank Windfarm (2020) and the Cambois Connection (Figure 9) and included 'Offshore circalittoral coarse sediment' (SS.SCS.OCS), *Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand (SS.SSa.CFiSa.ApriBatPo) and *Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (SS.SSa.CFiSa.EpusOborApri) (BBWFL, 2022; ES, Volume 3, Appendix 8:1: Benthic Survey Report (Phase 1 and 2)). According to the FEAST assessment tool, continental shelf coarse sediments have a medium sensitivity to abrasion and penetration and continental mixed sediments have a high sensitivity (Table 5.4). However, these features are noted to have a range in sensitivities depending on the species present. Using MarESA, the identified biotopes have a low sensitivity to penetration and surface abrasion and medium sensitivity to removal of substratum. This soft sediment environment is characterised by burrowing polychaetes and burrowing bivalves with some epifauna with impacts expected to be restricted to a localised decline in species richness. The recovery of these biotopes is likely to occur as a result of a combination of recruitment from adjacent habitats and larval dispersal. According to the MarESA assessments, recovery is likely to occur within two years following cable installation.

99. As detailed in Table 5.4, ocean quahog aggregations are highly sensitive to subsurface abrasion/ penetration. Likewise, MarESA reports that ocean quahog are highly sensitive to physical abrasion, and damage caused by penetration and disturbance of the sediment as ocean quahog live at the surface of the sediment while feeding but burrow to depths of 14 cm periodically (Strahl *et al*., 2011). Ocean quahog vulnerability is due to its long lifespan, slow growth, uncertain recruitment, low productivity, and poor estimates of stock biomass and capture efficiency (Thorarinsdottir and Jacobson, 2005; Thorarinsdottir *et al*. 2010). Damage can increase the mortality of ocean quahog either through the damage itself, increased vulnerability to predation or high intensity pressures such as the use of hydraulic dredges (Thorarinsdottir *et al*., 2009). Within the Firth of Forth Banks Complex ncMPA, demersal trawling has been recorded as highest in Wee Bankie, for which over 2,500 hours of dredge fishing were recorded during 2016 (JNCC, 2018b).

100. Recovery of the extent and distribution of ocean quahog from the effects of temporary disturbance is typically slow (Tyler-Walters and Sabatini, 2017), and a full recovery from activities such as dredge fishing which penetrate the seabed may take decades (Ragnarsson *et al*., 2015). Recovery of ocean quahog populations is also dependent on the age of sexual maturity at which population expansion can begin. Ocean quahogs reach sexual maturity at between 5 and 11 years and may be dependent upon growth rate and locality (Thorarinsdóttir, 1999).

101. Regarding the potential to hinder conservation objectives, based on the information presented above, the following can be concluded with respect to the attributes of the protected features of the Firth of Forth Banks Complex ncMPA.

5.5.1.1.2.1. Offshore subtidal sands and gravels

102. The extent and distribution of the offshore subtidal sands and gravels feature will be maintained in the long term following cable installation activities, with only a small proportion of the total extent of this feature within the ncMPA affected. The temporary disturbance effects on the offshore subtidal sands and gravels feature resulting from the installation activities will be temporary and reversible with recovery of sediments occurring following completion of installation.

103. The sediment composition of the offshore subtidal sands and gravels protected feature is unlikely to be affected by temporary habitat disturbance resulting from cable installation and preparation activities. Whilst seabed levelling will temporarily remove sediment, it will be deposited locally, and the high rate of sedimentation will ensure rapid redistribution of material. Given the relative prevalence of boulders throughout the Marine Scheme, and the fact that they will only be moved a short distance, it is highly unlikely that a significant number of boulders will be placed within an area of sandy seabed. Since no sediment/substrate is being removed and given the existing patchiness of the distribution of cobbles and boulders in the offshore environment, this is considered unlikely to represent a significant shift in the baseline situation.

104. With respect to the key influential species that have a core role in determining the structure and function of the offshore subtidal sands and gravels feature, and characteristic communities that make up the habitat and reflect the habitat's overall character and conservation interest, it is considered that they will be minimally affected, with only a small proportion of the total extent of this feature within the ncMPA affected, enabling the maintenance of the diverse composition of communities in this feature. Following temporary habitat disturbance, leading to localised reductions in species richness, a full recovery of these communities, into these affected areas would be expected within the short term following disturbance. These processes ensure that the key and influential species and characteristic communities of the offshore subtidal sands and gravels protected features will be maintained in the long term across the Firth of Forth Banks Complex ncMPA.

105. The function of the offshore subtidal sands and gravel feature, which is defined by its ecological services of biological productivity, nutrition provision and climate regulation, will be maintained throughout the construction period of the Marine Scheme. The highly localised and temporary nature of the disturbance to the benthic environment will ensure that the stability and composition of the sediment feature is maintained, enabling it to maintain its function as a productive habitat, spawning ground for commercially and ecologically important fish species, and a carbon sink. Temporary disturbance to spawning habitat of fish species, such as herring, sandeels and elasmobranchs, can cause mortality to some eggs should activities occur during the spawning period and recovery of spawning habitat is dependent on recovery of the sediments.

106. PSA data gathered for the BBWF in Scottish waters showed that the majority of the BBWF array area was unsuitable sediment for herring spawning. Only a small patch of suitable (marginal to sub-prime) habitat was identified in the northwest section of the BBWF array area (BBWFL, 2022). On the whole, these BBWF survey findings were in alignment with herring spawning expectations based on EMODnet seabed substrate data (BBWFL, 2022). Conditions were considered to be 'unsuitable' for herring spawning at all sampling stations for the Marine Scheme Offshore Export Cable Corridor in Scottish waters (Natural Power, 2023).

107. Therefore, the area of herring spawning grounds affected by this impact is expected to be of negligible extent (see ES, Volume 2, Chapter 9: Fish and Shellfish Ecology).

108. The sandeel spawning areas potentially affected by the installation activities are minor compared to the abundance of similar substrate types within the Marine Scheme and the Firth of Forth Banks Complex ncMPA. Sandeel are dependent on the seabed for the majority of their life cycle, beyond spawning. Consequently, the Scottish Government FeAST tool states that sandeel have a high sensitivity to sub-surface abrasion or penetration and a medium sensitivity to surface abrasion (Scottish Government, 2023). Impacts on fish spawning habitat are expected to be largely limited to sandeel, and that proposed activities will occur intermittently over the approximate 3 year duration of seabed preparation and installation activities, it is unlikely that considerable populations of sandeel would be affected.

109. It is concluded that potential effects on the offshore subtidal sands and gravel feature, due to temporary habitat loss / disturbance would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **recover structure and function; and**
- **conserve supporting processes.**

5.5.1.1.2.2. Ocean Quahog aggregations

110. The pressure exerted on the ocean quahog feature during construction will be temporary in nature and will not result in any change in substrate, which would be detrimental, as described above. For context, dredge fishing disturbs sediment over a much greater area than that expected to be disturbed by the Marine Scheme and also occurs as a repeated activity, whereas repeat habitat disturbance as a result of the construction of the export cables will be limited to the vicinity of seabed preparation areas where disturbance has already occurred. Additionally, sediment removed during sand wave clearance will be deposited locally and will therefore remain as available habitat for ocean quahog. The construction activities are therefore unlikely to affect the extent and distribution of ocean quahog and its supporting habitats within the ncMPA.

111. The structure of ocean quahog refers to the densities and age classes of individuals from a population within a site. The population structure of the site is currently unknown, although the baseline surveys conducted within the BBWF array area found only one juvenile and one adult within the part of the Marine Scheme array area that overlaps with the ncMPA and the Marine Scheme and no records within the ncMPA from the Marine Scheme Offshore Export Cable Corridor (BBWFL, 2022, ES, Volume 3, Appendix 8.1: Benthic Survey report (Phase 1 and 2)). For the population to recover, the conservation objectives seek to encourage recruitment and preserve juveniles already in the ncMPA. Mortality of all individuals impacted as a result of construction activities is not predicted and some individuals not directly impacted by installation equipment, such as cable installation tools, could be reasonably expected to survive. The temporary, localised, and intermittent nature of the habitat disturbance will ensure minimal impacts to both larva and juveniles, and following construction, habitat conditions will return to the baseline and recovery of any individuals affected, and their supporting habitats, will occur.

112. The function of ocean quahog aggregations relates to the ecosystem services provided, including carbon cycling and nutrient transport within the ncMPA, as well as acting as direct records of climate and environmental change (although there is currently no direct evidence). The temporary and localised nature of the temporary habitat disturbance associated with the installation activities are unlikely to disrupt these long term functions. Where disturbance to carbon cycling and nutrient transport occur due to sediment disturbance and surface penetration, these will be able to recover following the completion of construction as the baseline will return to pre-construction conditions. Overall, the intermittent and temporary nature of this disturbance is unlikely to cause a disturbance to these functions within the ncMPA.

113. It is concluded that potential effects on the ocean quahog aggregations feature, due to temporary habitat loss / disturbance would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structure and function; and**
- **conserve supporting processes.**

5.5.1.1.2.3. Shelf banks and mounds

114. The extent and distribution of the shelf banks and mounds feature is determined by the prevailing hydrodynamic regime. As described above, the activities involved in the seabed preparation and installation of the export cable will not result in significant changes to the sediment transport processes and prevailing hydrodynamic regime of the area. Where processes are disrupted by the removal and deposition of sediment for seabed preparation or cable installation the effects will be temporary. As there is no permanent removal of sediment or permanent changes to the seabed morphology during the construction phase, the hydrodynamic regime will not be impacted. Overall, this protected feature will be conserved throughout the construction phase and following the conclusion of construction the protected feature will quickly recover from the effects of this temporary impact.

115. The strong currents in the ncMPA have resulted in the formation of the banks which can rise ~30 m to 50 m above the surrounding seabed and are composed of a mosaic of sediment types caused by the shelf banks and mounds interacting with the tidal currents. As discussed above, the hydrodynamic regime will not be impacted through temporary habitat disturbance, and due to the large scale of the features, it is unlikely that installation activities will have an impact. The physical nature of the shelf banks and mounds feature is therefore not expected to be affected due to the temporary and localised nature of the activities and the large scale of the protected feature.

116. The ecological features and thus functional role of this protected feature is largely the same as the offshore subtidal sands and gravels protected feature but with greater focus placed upon its importance as a spawning ground for commercially important species and the health and biodiversity of Scotland’s seas, including as foraging ground for marine mammals and seabirds. The ecological features of the shelf banks and mounds are understood to be tolerant to the temporary impacts associated with construction as they are composed of similar communities as offshore subtidal sands and gravels, which, as described above, are largely tolerant to the pressures imposed by temporary habitat disturbance. The impact of temporary habitat disturbance on sandeel spawning sites will be highly localised within a broader area of suitable spawning habitat. The long-term maintenance of these benthic habitats ensures the function of the food web it supports is maintained, including valuable seabird and marine mammal communities which are reliant on species such as sandeel.

117. It is concluded that potential effects on the shelf banks and mounds feature, due to temporary habitat loss / disturbance would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structure and function; and**
- **conserve supporting processes.**

5.5.1.1.2.4. Wee Bankie Key Geodiversity Area - MORAINES

118. As described for Offshore subtidal sands and gravels, all impacts to the seabed associated with construction activities will be temporary in nature and no sediment will be permanently removed from the system. Any material removed during seabed preparation activities will be deposited locally such that there will be no overall loss of the geodiversity feature’s extent or distribution. Furthermore, the scale of the potential temporary impacts to this feature are predicted to be very small, with the Marine Scheme overlapping 12% of the total extent of the Wee Bankie Key Geodiversity Area feature in the ncMPA, and the scale of cable installation works set to be significantly less than this.

119. The structure of the moraines in the ncMPA are defined by their height above the surrounding seabed (~20 m), their steep western edges, more gradually sloping eastern edges and large scale (Wee Bankie has a width of ~20 km and length of ~70 km). The temporary and localised sediment

disturbance associated with construction activities are unlikely to result in large scale changes to this feature.

120. The function of the Wee Bankie Geodiversity Area moraine protected feature is as an important site of scientific study of deglacial history. Additionally, the moraines provide habitat that is an integral part of the offshore subtidal sands and gravel protected feature, supplying substrate to the sedimentary biological communities. Any disturbance to sediment during the construction phase will be temporary, localised and very small in the context of the wider extent of this feature and will not affect the functions provided by this geodiversity feature.

121. It is concluded that potential effects on the Wee Bankie Key Geodiversity Area feature, due to temporary habitat loss / disturbance would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structure and function: and**
- **That the feature surface will remain sufficiently unobscured for the purposes of determining whether the above criteria are satisfied.**

5.5.1.1.3. SECONDARY MITIGATION AND RESIDUAL EFFECT

122. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the ncMPA.

5.5.1.2. INCREASED SUSPENDED SEDIMENT CONCENTRATIONS (SSC) AND ASSOCIATED DEPOSITION

123. Increases in SSC and associated deposition in subtidal habitats will occur as a result of site preparation activities (which includes boulder clearance and sandwave levelling) and cable installation using cable protection methods, notably cable burial or remedial cable protection techniques.

124. The relevant MarESA and FeAST pressures for this impact are:

- Water clarity changes;
- Siltation changes (high);
- Siltation changes (low);
- Hydrocarbon & PAH contamination; and
- Transition elements & organo-metal contamination.

125. Based on the sediment properties within the Marine Scheme, only a very small percentage of the sediment bulk will form a plume (on average and as informed by site-specific survey activity, this is anticipated to occur at less than 10% of the Marine Scheme). The majority of sediments (i.e. the remaining 90%) are anticipated to fall directly to the seabed owing to their fraction.

126. Boulder clearance in discrete areas will take place across the Marine Scheme to ensure cable lay can occur safely and effectively, thereby reducing the requirement for external cable protection. The act of removing the boulders a short distance from the cable corridor is a very low level of mechanical disturbance of short-term duration and while this may lead to an increase in bed roughness in the immediate locality of the activity, this will not be sufficient to generate a plume of any description. The expectation would be that any disturbed sediment would immediately fall to the seabed. Consequently, boulder clearance is not considered further within the context of changes to SSC affecting the conservation objectives of the ncMPA.

127. FeAST concludes that ocean quahog are not sensitive to changes in SSC and the associated deposition due to their ability to burrow back to the surface following sediment deposition, and this has been found to have no negative effect on growth or population structure (Powilliet *et al*., 2006; 2009). Ocean quahog are also not directly sensitive to changes in light availability although an

increase in turbidity could lead to a release of higher-than-normal levels of nutrients resulting in increased levels of food availability (FeAST, 2013a).

5.5.1.2.1. MAGNITUDE OF IMPACT

128. Sandwave clearance and cable burial activities (MFE considered as worst-case) have the potential to generate a sediment plume. The instantaneous increase in SSC which could result in a plume would only occur in the immediate vicinity of the disturbance activity, although much smaller and reduced sediment concentrations could advect over larger distances.

129. As described in ES, Volume 2, Chapter 7: Offshore Physical Environment and Seabed Conditions , sedimentation from active deposition would be transient along the route of the Offshore Export Cables, with instantaneous increases in SSC concentration at high levels in the immediate vicinity of the disturbance (MFE) activities, at several orders of magnitude above representative background concentrations of <1 mg/l. However, based on the fact that only a small proportion of sediments will enter into suspension in the first place this is highly localised and would be very transient. Water turbidity will be affected temporarily during construction activities, although any effects will be limited spatially and temporally, occurring intermittently throughout the construction phase and returning to background levels following the cessation of the works.

130. Sediments deposited as a result of a plume, though more far reaching, will be minimal, decreasing in thickness with increasing distance, reaching only millimetres of deposition that would largely be indiscernible from the background and natural variation, and be rapidly incorporated into the local sediment transport regime. Deposition of fine gravel sediments of thicknesses of approximately 0.4 m may occur over an area of 0.33 km^2 within Scottish waters, based on flow speeds being 0.4 m/s, as is typical of the Marine Scheme area (see ES, Volume 2, Chapter 7: Offshore Physical Environment and Seabed Conditions).

131. Modelling was undertaken as part of the BBWF ES to determine the increases in SSC as a result of the offshore export cables from the BBWF array area (BBWFL, 2022a). Average levels of SSC increased to between 50 mg/l and 500 mg/l as a result of offshore export cable installation to the trenchless technique (e.g. HDD) transition where circa 400,000 m^3 of material may be mobilised. These levels drop to background levels on the slack tide. Peak currents within the BBWF array area are of a similar magnitude to the Marine Scheme Offshore Export Cables within the ncMPA. Therefore, it can be predicted that any changes in SSC as a result of the Marine Scheme cable will be of a similar magnitude to the changes in SSC as a result of cable installation.

132. The impact will be highly localised and of short-term duration, therefore not affecting the natural sedimentation rate within the ncMPA

133. Sediment bound contaminants in the marine environment are most often associated with sediments that have a high fines content, especially clay and silt fractions. As described above, the potential dispersion of sediments is limited and sediment contaminant levels are low. A rapid dilution of suspended particular matter is also anticipated and in the context of natural disturbance of sediment during storm events that will also release sediment-bound contaminants, the potential release of sediment-bound contaminants during the construction phase of the Marine Scheme are not expected to result in a significant exceedance beyond baseline levels.

5.5.1.2.2. SENSITIVITY OF RECEPTORS

134. The sedimentary and geomorphological features of Firth of Forth Banks Complex ncMPA may be susceptible to changes in seabed levels, changes to seabed properties due deposition of SSC. However, the sedimentation will be localised and composed of native material, therefore the structure and function of the designated features is of low vulnerability and recoverable. Sedimentation from active deposition would be transient along the Offshore Export Cables, with the thickest areas of sedimentation located closest to the area of disturbance activity, decreasing in thickness with increasing distance. Once deposited, sedimentation from active deposition in relation to natural settling velocity of the region will form part of the sediment transport regime.

Deposition from the plume extent could result in deposition at the protected site, however, this would primarily be only millimetres of deposition and any changes to seabed levels and seabed properties will be localised and composed of native material, therefore the structure and function of the seabed is of low vulnerability and recoverable.

135. The subtidal sands and gravels and subtidal mixed sediments mainly support infaunal communities and to a lesser extent crustaceans and echinoderms associated with the identified biotopes SS.SSa.CFiSa.ApriBatPo and SS.SSa.CFiSa.EpusOborApri. These biotopes are assessed by MarESA as having a low to medium sensitivity to increased suspended solids (water quality) and light or heavy level smothering and siltation. The FeAST tool assesses continental coarse ad mixed sediments as having a medium sensitivity to heavy smothering and siltation, expected only in the immediate vicinity of installation activities (Table 5.4). However, it is noted that this depends on the species present and considering the results of the MarESA assessments for the identified biotopes, this assessment is expected to be overly precautionary for the relevant biotopes for the Marine Scheme.

136. The communities characteristic of subtidal sands and gravel features have a low sensitivity to the pressures exerted through changes to water clarity and light smothering. The characteristic species groups of these biotopes are burrowing polychaetes and bivalves which are able to tolerate the levels of deposition associated with the construction phase (<600 mm) with the potential exception of directly next to seabed preparation activities. Ocean quahog is one of the key influential species which characterise the offshore subtidal sands and gravels feature. Ocean quahog are not sensitive to the pressures which characterise this impact (Table 5-4). The increase in turbidity may also directly impact upon the phytoplankton, which rely on light, which will indirectly impact upon the bivalves and polychaetes by reducing the amount of food available (Tillin, 2016; 2022).

137. The FeAST tool reports that continental shelf coarse and mixed sediments are sensitive to non-synthetic contaminants, whereas no assessment has been conducted under MarESA. The sensitivity of benthic receptors to exposure to contaminants varies between faunal groups. Some of the characterising fauna associated these habitats such as bivalve species are known to accumulate heavy metals and high level contamination can impair physiological function. Echinoderms are intolerant to contamination from oil. However, many infaunal annelid species are tolerant of sediment contamination. Epifaunal bryozoans and hydroids may also have sensitivity to increased contaminants. It is considered that the subtidal sands and gravels habitat have a generally low sensitivity to the release of sediment bound contaminants.

138. Ocean quahog are reported as sensitive to non-synthetic compound contaminants under the FeAST assessment, however this is reported as low confidence as there is no available data regarding the sensitivity of ocean quahog populations to sediment contaminants (Tyler-Walters & Sabatini, 2017). While the sensitivity to sediment contaminants is unknown, ocean quahog are expected to be resilient to nutrient and organic enrichment. For this purpose of this impact assessment, in consideration of the low levels of contaminants reported in the site specific surveys, ocean quahog is considered to have a low sensitivity to the release of sediment bound contaminants.

139. The largely low level, temporary and localised nature of SSC and associated deposition, including the limited area of high deposition in the immediate vicinity, is unlikely to result in a change in the distribution of these key/influential species across the protected feature as the sediment composition will be maintained through the construction phase. Additionally, the temporary nature of these effects allows for greater level of recovery than the ongoing dredge fishing which currently occurs within the Firth of Forth Banks Complex ncMPA.

140. Changes to SSC as a result of passive deposition from sediment plumes is not anticipated to affect any of the geological features within the designated sites. Deposition from the plume extent could result in deposition at the protected site, however, this would be only millimetres of deposition that would largely be indiscernible from the background and natural variation. The Wee Bankie Key Geodiversity Area and its moraines feature are not discussed further in relation to this impact as changes to water clarity and light smothering are not relevant to a geodiversity feature (FeAST,

2013d). As such, the shelf banks and mounds, and Wee Bankie Geodiversity Area (moraines) are not considered further in this assessment.

141. Based on the information presented above, the following can be concluded with respect to the attributes of the protected features of the Firth of Forth Banks Complex ncMPA.

5.5.1.2.2.1. Shelf Banks and Mounds

142. It is not anticipated that increases in SSC would be of sufficient magnitude in terms of plume creation and dispersion, deposition thickness and composition, or duration, to change in seabed level, seabed properties, or the hydrodynamic or sedimentation regimes. As such, the extent and distribution, and structure and function of the offshore banks and mounds feature will be maintained.

143. It is concluded that potential effects on the shelf banks and mounds feature, due to increased SSC and associated deposition would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structure and function; and**
- **conserve supporting processes.**

5.5.1.2.2.2. Wee Bankie Geodiversity Area – Moraines

144. As for the shelf banks and mounds feature, SSC generation and deposition will not be of sufficient magnitude to alter the extent and distribution or morphology and function of the moraine features within the Wee Bankie Geodiversity Area Feature.

145. It is concluded that potential effects on the Wee Bankie Key Geodiversity Area feature, due to temporary habitat loss / disturbance would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structure and function; and**
- **That the feature surface will remain sufficiently unobscured for the purposes of determining whether the above criteria are satisfied.**

146. No objective has been set for supporting processes of this feature. The Wee Bankie Key Geodiversity Feature is a relict geological feature. As such, supporting processes are not relevant.

5.5.1.2.2.3. Ocean Quahog Aggregations

147. Ocean quahog are not sensitive to increased SSC and associated deposition. It is concluded that potential effects to the ocean quahog aggregations feature, due increased SSC and associated deposition, would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structure and function; and**
- **conserve supporting processes.**

5.5.1.2.2.4. Offshore subtidal sands and gravels

148. The extent and distribution of the offshore subtidal sands and gravels feature will be maintained in the long term following cable installation activities as the increase in SSC and associated deposition is predicted to affect only a small proportion of the offshore subtidal sands and gravels feature intermittently during the construction phase. The effects will be temporary and reversible with recovery of sediments occurring following completion of installation.

149. The structure and function of the feature, including the composition of characteristic communities and their resultant ecological services, will remain in (or recover to) a condition which is healthy and not deteriorating. Recovery of the seabed sediment will occur within a few tidal cycles following with completion of construction activities. The key and influential species are tolerant of the effects

of SSC, with full recovery of characteristic communities expected. These communities will be supported by an undisturbed hydrodynamic regime which will continue to form the fine scale features of the ncMPA.

150. It is concluded that potential effects on the offshore subtidal sands and gravel feature, due to increased SSC and deposition would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **recover structure and function; and**
- **conserve supporting processes.**

5.5.1.2.3. SECONDARY MITIGATION AND RESIDUAL EFFECT

151. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the ncMPA.

5.5.2. Potential Effects During Operation and Maintenance

5.5.2.1. PERMANENT BENTHIC HABITAT / SPECIES LOSS OR DISTURBANCE

152. Permanent habitat loss and habitat alteration will arise as a result of the placement of cable protection, as described within the maximum design scenario (Table 5.3). Cables will be buried wherever practicable across the Marine Scheme, however, where the target burial depth is not achieved cable protection will be required. This represents a localised habitat alteration and physical change to another seabed type away from the subtidal sands and gravel feature that dominates the ncMPA. It should be noted that this habitat loss will initially occur during the construction phase and the effects will continue to be realised through to the operation and maintenance phase. At the point of decommissioning, some cable protection may be left *in situ* as it may not be practical to remove, and so permanent habitat loss is assessed here as a worst case.

153. The relevant MarESA and FeAST pressure is therefore:

- Physical change (to another seabed type).

5.5.2.1.1. MAGNITUDE OF IMPACT

154. As described in Section 5.4.2, up to 0.23 km^2 of cable protection material may be installed in Scottish waters, and thus for the purposes of this assessment the full extent of this material is assumed to be placed within the ncMPA. However, the use of cable protection materials will be reduced as far as practicable, and are likely to be employed in areas of relatively harder substrate that do not allow burial and will be non-continuous in nature.

155. With up to 0.23 km^2 of cable protection in place within the ncMPA, this will constitute a reduction in the subtidal sands and gravels habitat feature, and subsequently habitat available to ocean quahog within the ncMPA, of only 0.01%. If all of the cable protection was located within the Berwick Bank section of the nMPA, this would equate to a permanent loss of habitat of approximately 0.04%. Likewise, if the full extent of the potential cable protection was located within the Wee Bankie section of the ncMPA, this would equate to a spatial reduction in available subtidal sand habitat of approximately 0.03%.

5.5.2.1.2. SENSITIVITY OF THE RECEPTOR

156. The biotopes identified in association with the offshore subtidal sands and gravel feature, including ocean quahog as described in section 5.5.1, have a high sensitivity to the pressure of 'physical change to another substratum' (Table 5-4). As these biotopes are typically characterised by infauna, the physical change to another substrate type, i.e. the hard surface cable protection for

cables, would not allow for the continued presence of these communities at those locations, therefore they are highly intolerant of changes to new substrate.

157. Some studies have shown that the installation and operation of offshore wind farms have no significant impact on the wider soft sediment environments beyond the immediate impact of the loss of habitat. De Backer *et al*. (2021) found that the soft sediment epibenthos underwent no drastic changes over the eight to nine years after the installation of offshore wind farms in Belgium. Moreover, the species originally inhabiting the sandy bottom were still present and remained dominant. The most recent benthic post-construction monitoring data of wind turbine foundations from Beatrice offshore wind farm (APEM, 2021) found foundation colonisation of wind turbines has resulted in zonation on the foundation itself but had little influence on the sedimentary habitat below.

158. It can be concluded that the installation of limited cable protection will result in the loss of some sedimentary habitat directly below it, and potentially with a very small radius around it, however the remaining sedimentary habitat will not be continually degraded and will largely remain unchanged as a result of the introduction and colonisation of hard substrate. There may be some benefits for epifaunal species which prefer hard substrates as a result of the reef effect, but this is unlikely to affect the species characteristic of the offshore subtidal sands and gravels habitat.

159. Ocean quahog are assessed by the FeAST and MarESA tools as having a high sensitivity to physical change to another seabed type (Table 5-4). Ocean quahog are a burrowing species and the introduction of artificial hard substrate will remove the sedimentary habitat required by this species. However, it is important to highlight that the areas of permanent habitat loss will be highly localised, and that only low numbers of ocean quahog were recorded during the site-specific surveys. Thus, this would not represent a population level impact to the ocean quahog aggregations feature.

160. The impact to the geomorphological, geological and sedimentary feature receptors relates to the permanent reduction in surface sediment extent within the footprint of the cable protection, which will not recover for as long as the cable protection remains in place, and thus have no physical resistance.

5.5.2.1.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

161. Based on the information presented above, the following can be concluded with respect to the attributes of the protected features of the Firth of Forth Banks Complex ncMPA.

5.5.2.1.3.1. Subtidal sands and gravels

162. The extent and distribution of offshore subtidal sands and gravels feature will be largely maintained within the MPA. While installation of cable protection is predicted to result in long term habitat loss and alteration of a very small proportion of the protected feature (i.e. up to 0.01% of the offshore subtidal sands and gravels feature), the effect will be highly localised to discrete areas within the MPA. The majority will be habitat alteration associated with cable protection which represents a shift in substrate type rather than a total loss of habitat (see section 5.5.2.2). The wider extent of this sediment feature within the MCZ will be unaffected during the operation and maintenance phase and provide suitable habitat for the associated infauna biotopes. This is consistent with the 'conserve' objective of the extent and distribution attribute for this feature.

163. The characteristic communities associated with this feature will be maintained across the ncMPA following the placement of cable protection, as only a small proportion of this habitat (0.01%) will be affected in discrete locations. Due to these localised impacts and the wide extent of this feature, the characteristic communities are likely to be maintained throughout the feature.

164. The permanent loss or alteration of habitat will not be a contributor to any change in the prevailing hydrodynamic regime as the change is of such negligible magnitude. Any effects on hydrodynamic processes are assessed below. .

165. Likewise, the functional aspects of this feature, including the fine scale topographic features and sediment composition within this habitat that rely on the prevailing hydrodynamic regime will be not be impacted by the permanent habitat loss and alteration.

166. It is concluded that potential effects on the offshore subtidal sands and gravel feature, due to permanent benthic habitat / species loss, would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **recover structure and function; and**
- **conserve supporting processes.**

5.5.2.1.3.2. Ocean quahog Aggregations

167. The extent and distribution of ocean quahog aggregations will be largely maintained given the loss of a minute proportion of the available habitat (0.01%) within the entire ncMPA. This will reduced as far practicable via burial of the cables. Beyond the immediate footprint of loss of habitat, ocean quahog aggregations will still be provided with a stable environment in which to feed and reproduce with no ongoing disturbance from the discrete patches of surface infrastructure.

168. As described previously, the population structure of the ocean quahog aggregations is dependent on the continued ability of ocean quahogs to reproduce at the site. The small proportion of habitat loss will not result in any long term impacts upon reproduction and recruitment, as over approximately 99.9% of available stable and viable habitat will remain (see section on subtidal sands and gravels, above).

169. It is concluded that potential effects on the offshore subtidal sands and gravel feature, due to temporary habitat loss / disturbance would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **recover structure and function; and**
- **conserve supporting processes.**

5.5.2.1.3.3. Shelf Banks and Mounds

170. The permanent presence of cable protection materials will represent a highly localised changed to surface sediment type. However, the extent and distribution of the shelf banks and mounds feature is determined by the prevailing hydrodynamic regime, which is assessed below.

171. Likewise, the structure and function of this feature relates to the physical nature of the feature and the functional role it plays in supporting the wiser health and biodiversity of Scotland's seas. The extremely limited magnitude of permanent cable protection deposit across either or both the Wee Bankie and Scalp Bank and Berwick Bank areas of the ncMPA will not represent a material change to the physical nature or functional role of this large-scale feature.

172. It is concluded that potential effects on the shelf banks and mounds feature, due to permanent habitat / species loss would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structure and function; and**
- **conserve supporting processes.**

5.5.2.1.3.4. Wee Bankie Key Geodiversity Area - MORAINES

173. The structure of the moraines are defined by their height above the surrounding seabed (~20 m), their steep western edges, more gradually sloping eastern edges and large scale (Wee Bankie has a width of ~20 km and length of ~70 km). The highly localise permanent presence of cable protection materials will not be sufficient in magnitude to result in large scale changes to this feature.

174. Similarly, due to the highly localised nature of the impact and the maintenance of the hydrodynamic regime of the site, the function of the Wee Bankie Moraine protected feature as an important site of scientific study of deglacial history will not be degraded.

175. It is concluded that potential effects on the Wee Bankie Key Geodiversity Area feature, due to temporary habitat loss / disturbance would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structure and function: and**
- **That the feature surface will remain sufficiently unobscured for the purposes of determining whether the above criteria are satisfied.**

176. No objective has been set for supporting processes of this feature. has The Wee Bankie Key Geodiversity Feature is a relict geological feature. As such, supporting processes are not relevant.

5.5.2.2. COLONISATION OF HARD STRUCTURES AND INTRODUCTION OF INNS

177. The preferred method of protected for Offshore Export Cables is burial to a minimum target depth of 0.5 m, with external cable protection used where required (such as in areas of hard substrate, meaning up to approximately 0.23 km^2 of cable protection material may be installed within the Marine Scheme Offshore Export Cable Corridor, within Scottish waters). The presence of cable protection materials has the potential to impact soft sediment features of the Firth of Forth Banks Complex ncMPA. Provision of novel hard substrate can result in colonisation by epilithic species and increases the habitat complexity and biodiversity of the area, as protective materials act as *de facto* artificial reefs (Degraer *et al.,* 2020).

178. The introduction of hard infrastructure, such as cable protection, alters previously soft sediment habitat areas. Provision of novel hard substrate can result in colonisation by epilithic species and increases the habitat complexity and biodiversity of the area, as protective materials act as *de facto* artificial reefs (Degraer *et al.,* 2020).

179. The novel habitat provided by offshore structures could play a role in providing so-called 'stepping-stones' for INNS, by which geographical barriers to species dispersal might be passed (Adams *et al.,* 2014). INNS can have a detrimental effect on the benthic ecology through predation on existing wildlife or outcompeting for prey and habitat. To date, there has been mixed evidence from post-construction monitoring to suggest that hard structures provide new or unique opportunities for INNS which could facilitate their introduction (e.g. Linley *et al.,* 2007). Furthermore, no spread of INNS caused by submarine cabling has yet been documented (Taormina *et al*., 2018).

180. No INNS were identified in the Study Area through the BBWF or Marine Scheme Offshore Export Cable Corridor surveys (BBWFL, 2023; ES, Volume 3, Appendix 8:1: Benthic Survey Report (Phase 1 and 2)). Therefore, the risk of the spread of any existing INNS is considered to be low. Furthermore, the risk of spreading newly introduced INNS will be mitigated by reducing the use of cable protection as far as practicable and through the development and implementation of an INNS management plan.

181. The environmental pressures associated with this impact are the same as those associated with long term subtidal habitat loss as the physical change (to another substratum type) pressure involves the permanent loss of one marine habitat type with an equal creation of a different marine habitat type (Tillin and Tyler-Walters, 2015; 2014a,b).

182. The relevant MarESA and FeAST pressures are therefore:

- Physical change (to another seabed type); and
- Introduction or spread of invasive non-indigenous species.

183. This impact only relates to potential alterations to the ecology of the ncMPA, namely fauna associated with the offshore subtidal sands and gravels feature, shelf banks and mounds and ocean quahog aggregations. As there is no physical change associated with this pressure, noting

that habitat loss and changes to physical processes are assessed separately, there is no impact pathway between colonisation of hard infrastructure and the protected large-scale geological feature of the Wee Bankie Geodiversity Area.

5.5.2.2.1. MAGNITUDE OF IMPACT

184. As described in Table 5.3, up to 0.23 km^2 of cable protection material may be installed in Scottish waters, and thus for the purposes of this assessment the full extent of this material is assumed to be placed within the ncMPA. However, the use of cable protection materials will be reduced as far as practicable, and are likely to be employed in areas of relatively harder substrate that do not allow burial and will be non-continuous in nature.

185. With up to 0.23 km^2 of cable protection in place, this will constitute a replacement of 0.01% of the distribution of subtidal sand habitat within the ncMPA with new hard substrate with associated colonisation potential.

5.5.2.2.2. SENSITIVITY OF THE RECEPTOR

186. Continental shelf coarse and mixed sediments have medium to high sensitivity to the introduction of INNS, however this is dependent on the biological communities present (Table 5.4). The identified characteristic biotopes (SS.SSa.CFiSa.ApriBatPo and SS.SSa.CFiSa.EpusOborApri) are considered to be most at risk from the slipper limpet, *Crepidula fornicata*, and potentially invasive colonial ascidians and predatory gastropods. However, the sedimentary and high energy nature of the environment is however thought to be challenging for most INNS with very few species able to colonise mobile sands due to the high levels of sediment disturbance (Tillin, 2022).

187. Colonisation of cable protection may have indirect adverse effects on the baseline communities and habitats due to increased predation on and competition with the existing soft sediment species. However, the communities which will colonise the hard structures will be adapted to hard substrates and therefore unlikely to colonise the sedimentary habitat, which is occupied by the key and influential species, as supported by the research of De Backer *et al*., 2021; APEM, 2021. The biotopes which characterise this offshore subtidal sands and gravel feature are predominantly soft sediment communities, and the introduction of new hard substrate will represent a shift from the baseline conditions from soft substrate areas (i.e. sands and gravels) to hard substrate in the areas where infrastructure is present. This may produce some potentially beneficial effects, for example increase in biodiversity and individual abundance of reef species. Species which are typical of rocky and intertidal habitats, epilithic species, are likely to be the ones to colonise the new hard substrate.

188. Studies have shown that there is potential for reef effects to occur in association with hard structures, however many of these studies consider large infrastructure such as wind turbine foundations and oil and gas platforms. The structural complexity of the hard substrate may provide refuge as well as increasing feeding opportunities for larger and more mobile species. The presence of mobile benthic organisms is thought to be dependent on sufficient food sources, cover of epibenthic communities, and appropriate habitat with shelter opportunities to hide from predators (Langhamer, and Wilhelmsson, 2009).

189. In conclusion the installation of hard structures will result in the loss of limited sedimentary habitat directly below it and in the immediate vicinity, however the remaining sedimentary habitat and supported biotopes will not be continually degraded and will largely remain unchanged as a result of the introduction and colonisation of hard substrate, including extremely limited risk of INNS.

190. The shelf banks and mounds feature has the same sensitivity as the subtidal sands and gravel feature as it contains the same biotopes.

191. The sensitivity of ocean quahog aggregations to the colonisation of hard structures is considered to be low. As discussed above, studies suggests that the hard substrate adapted species which colonise offshore wind farm infrastructure will not have an impact on the soft sediment environment below and around them (De Backer *et al*., 2021; APEM, 2021).

192. MarESA and FeAST report that there is no evidence to suggest that ocean quahog populations are particularly sensitive to the introduction of INNS (Table 5-4). As such, ocean quahog are considered to have a low sensitivity to INNS.

5.5.2.2.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

193. Based on the information presented above, the following can be concluded with respect to the attributes of the protected features of the Firth of Forth Banks Complex ncMPA.

5.5.2.2.3.1. Subtidal Sands and Gravels

194. The sediment composition of the offshore subtidal sands and gravels has the potential to be impacted in a limited capacity by the presence colonised hard substrate. However, given the limited scale and discrete placement of cable protection, any level of deposition is unlikely to have an impact on the sediment composition beyond the immediate vicinity of the infrastructure.

195. The key influential species of this protected feature are unlikely to be affected by the biological communities which will colonise the cable protection material, including INNS. Whilst some reef effects may result in expansion of taxa normally associated with hard substrates colonising areas of subtidal coarse sediment or subtidal sand, these effects are likely to be disparate and limited to the immediate vicinity of the cable protection and will not result in changes to the species composition of communities associated with the offshore subtidal sands and gravels feature across the wider ncMPA. The low likelihood of INNS spread, due to the small and discrete nature of the cable protection, will also not compromise the baseline community compositions. As above the characteristic communities within this protected feature are adapted to the sands and gravels of the ncMPA, resulting in no cross over of habitat and therefore preventing competition.

196. The function of this protected feature is unlikely to be affected by the colonisation of hard structures or increased risk of INNS. As there is no impact on the physical attribute of this feature, the climate regulation function and productivity of the feature will not be negatively affected. This feature functions as a spawning ground for fish such as plaice and sandeels however, due to the limited extent of cable protection, the vast majority (>99%) of the offshore sands and gravels feature will be maintained and will remain suitable for spawning.

197. It is concluded that potential effects on the offshore subtidal sands and gravel feature, due to colonisation of hard structures and introduction of INNS, would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **recover structure and function; and**
- **conserve supporting processes.**

5.5.2.2.3.2. Shelf Banks and Mounds

198. The only impact from this pressure is via any changes to the biotopes associated with this feature, which are the same as the subtidal sands and gravel feature. As discussed for the subtidal sands and gravels feature, given the limited scale, present only in the and discrete placement of cable protection, the function of this protected feature is unlikely to be affected by the colonisation of hard structures or increased risk of INNS.

199. It is concluded that potential effects on the shelf banks and mounds feature, due to colonisation of hard structures and introduction of INNS, would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structure and function; and**
- **conserve supporting processes.**

5.5.2.2.3.3. Ocean Quahog

200. The supporting habitat of this feature is offshore subtidal sands and gravels and as explained above, the extent and distribution of this feature will not be affected by this impact and therefore continue to support ocean quahog aggregations throughout the Firth of Forth Banks Complex ncMPA.

201. The structure of ocean quahog aggregations, referring to densities and age classes, is unlikely to be impacted upon by the colonisation of hard structures due to their adaptations for distinctly different habitats (hard substrate vs soft sediment), resulting in them posing no competitive threat to larva, juvenile or adult forms of ocean quahogs which reside in the Firth of Forth Banks Complex ncMPA.

202. There is no direct evidence regarding the function of ocean quahogs however it is suggested that they could be a key part of the food web, act as a link between the benthic and pelagic environments, help carbon and nutrient cycling, as well as being the subject of scientific study due to their ability to indicate climate and environmental change (Schöne, 2013). These functions will not be impacted due to the colonisation of hard substrate as >99% of ocean quahog habitat will be sustained throughout the operation and maintenance phase, enabling the maintenance of ocean quahog densities in similar number to pre-construction and thus not impairing ecological functions.

203. It is concluded that potential effects on the offshore subtidal sands and gravel feature, due to colonisation of hard structures and introduction of INNS, would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **recover structure and function; and**
- **conserve supporting processes.**

5.5.2.2.4. SECONDARY MITIGATION AND RESIDUAL EFFECT

204. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the ncMPA.

5.5.2.3. INCREASED SUSPENDED SEDIMENT CONCENTRATIONS (SSC) AND ASSOCIATED DEPOSITION

205. Cable repair and reburial events may result in short-term increases in suspended sediments during the operation and maintenance phase. As described in Table 5.3, the maximum design scenario is for cable repair and reburial of up to 4 km (i.e. four cable repair and reburial events of up to 1 km each) over the operation and maintenance phase (35 years). It should be noted that this scenario covers the entire Marine Scheme, but for the purposes of this assessment it is assumed that all four events could be within the Berwick Bank and Scalp and Wee Bankie areas of the Firth of Forth Banks Complex ncMPA.

206. The increases in suspended sediment may result in a sediment plume in the water column that is then deposited at a distance from the Marine Scheme and impact benthic receptors as described for potential effects during construction (section 5.5.1).

5.5.2.3.1. MAGNITUDE OF IMPACT

207. The length of cable requiring repair or reburial will be significantly less than the length of cable installed during the construction phase and the magnitude of impact is expected to be significantly lower than during construction. The resulting sediment plumes and sedimentation footprints would be dependent on which section of the cable is being repaired and thus the sediment type. Considering the far reduced scale, the impacts of the operation and maintenance activities (i.e. cable repair and reburial) are predicted to be no greater than those for construction, assessed in section 5.5.1.

5.5.2.3.2. SENSITIVITY OF THE RECEPTOR

208. The sensitivity of the protected features are as described for the assessment of increased SSC during the construction phase (section 5.5.1).

5.5.2.3.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

209. Based on the information presented above, the following can be concluded with respect to the attributes of the protected features of the Firth of Forth Banks Complex ncMPA.

5.5.2.3.3.1. Shelf Banks and Mounds

210. It is not anticipated that increases in SSC would be of sufficient magnitude in terms of plume creation and dispersion, deposition thickness and composition, or duration, to change in seabed level, seabed properties, or the hydrodynamic or sedimentation regimes. As such, the extent and distribution, and structure and function of the offshore banks and mounds feature will be maintained.

211. It is concluded that potential effects on the shelf banks and mounds feature, due to increased SSC and associated deposition would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structure and function; and**
- **conserve supporting processes.**

5.5.2.3.3.2. Wee Bankie Geodiversity Area – Moraines

212. As for the shelf banks and mounds feature, SSC generation and deposition will not be of sufficient magnitude to alter the extent and distribution or morphology and function of the moraine features within the Wee Bankie Geodiversity Area Feature.

213. It is concluded that potential effects on the Wee Bankie Key Geodiversity Area feature, due to temporary habitat loss / disturbance would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structure and function; and**
- **That the feature surface will remain sufficiently unobscured for the purposes of determining whether the above criteria are satisfied.**

214. No objective has been set for supporting processes of this feature. The Wee Bankie Key Geodiversity Feature is a relict geological feature. As such, supporting processes are not relevant.

5.5.2.3.3.3. Ocean Quahog Aggregations

215. Ocean quahog are not sensitive to increased SSC and associated deposition. It is concluded that potential effects to the ocean quahog aggregations feature, due increased SSC and associated deposition, would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structure and function; and**
- **conserve supporting processes.**

5.5.2.3.3.4. Offshore subtidal sands and gravels

216. The extent and distribution of the offshore subtidal sands and gravels feature will be maintained in the long term following cable maintenance activities as the increase in SSC and associated deposition is predicted to affect only a small proportion of the offshore subtidal sands and gravels feature intermittently during the operation and maintenance phase. The effects will be temporary and reversible with recovery of sediments occurring following completion of maintenance activities.

217. The structure and function of the feature, including the composition of characteristic communities and their resultant ecological services, will remain in (or recover to) a condition which is healthy and not deteriorating. Recovery of the seabed sediment will occur within a few tidal cycles following with completion of activities. The key and influential species are tolerant of the effects of SSC, with full recovery of characteristic communities expected. These communities will be supported by an undisturbed hydrodynamic regime which will continue to form the fine scale features of the ncMPA.

218. It is concluded that potential effects on the offshore subtidal sands and gravel feature, due to increased SSC and deposition, would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **recover structure and function; and**
- **conserve supporting processes.**

5.5.2.3.4. SECONDARY MITIGATION AND RESIDUAL EFFECT

219. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the ncMPA.

5.5.2.4. EMF EFFECTS

220. The operation of the Offshore Export Cables will result in emission of localised EMFs. EMFs have the potential to alter the behaviour of marine organisms that are able to detect electric (E-fields, measured in volts per metre (V/m)) or magnetic (B-field, measured in micro Tesla, (µT)) components of the fields. The B-field penetrates most materials, and therefore, is emitted into the marine environment, thus resulting in an associated induced electric (iE)-field. The direct E-fields are blocked by the use of conductive sheathing within the cable, and hence are not considered further. When relative motion is present between B-fields and a conductive medium (e.g. sea water), iE-fields are produced. The Earth has its own natural geomagnetic field (GMF) with associated B and iE-fields which species rely on for navigation (Gill and Desender, 2020; Winklhofer, 2009). The natural iE-fields result from sea water interacting with the natural GMF, due to relative motion caused by the Earth's rotation, and tidal currents (Gill and Desender, 2020).

221. The strength of B-fields (and iE-fields) decreases rapidly in all directions with distance from the source due to field decay. Consequently, burying a cable results a reduced B-field at the seabed as a result of field decay with distance from the cable (Nordmandeau et al., 2011; CSA, 2019; Hutchison *et al*., 2021).

222. Modelling has been completed for the Marine Scheme on the level and attenuation of the EMF emissions (B-fields only) for both a symmetrical monopole configuration rated at 320 kV and a bipole configuration rated at 525 kV, as detailed in ES, Volume 2, Chapter 5: Project Description. As iE fields are dependent on the B-field strength, B-fields are generally the main focus of potential impacts on the marine environment (Gill and Desender, 2020).

223. The effects of EMFs on benthic communities are not well understood, however, recent studies suggest that benthic communities growing along cable routes are similar to those in nearby baseline areas, and where species are not found this is likely due to the physical presence of the cable and surface properties, rather than an EMF effect (Copping and Hemery, 2020).

224. This impact only relates to potential impacts to the ecology of the ncMPA, namely ocean quahog aggregations and fauna associated with the offshore subtidal sands and gravels and shelf banks and mounds features. As there is no physical change associated with this pressure, there is no impact pathway between EMF and the protected large-scale geological feature of the Wee Bankie Geodiversity Area.

225. The relevant MarESA and FeAST pressure is therefore:

- Electromagnetic changes.

226. The MarESA and FeAST tool benchmark for EMF changes is set as a change in the local E-field of 1 V/m or local B-field of 10 μT, due to anthropogenic means.

5.5.2.4.1. MAGNITUDE OF IMPACT

227. There may be up to 40 km of HVDC cables buried to a minimum depth of 0.5 m situated within the ncMPA (Table 5.3). In any areas where burial cannot be achieved, remedial cable protection will be installed.

228. High level modelling has been completed for the Marine Scheme on the level and attenuation of the EMF emissions (B-fields only) for both a paired symmetrical monopole configuration rated at 320 kV (comprising 4 HVDC cables) and a bipole configuration rated at 525 kV (2 HVDC cables), as detailed in ES, Volume 2, Chapter 5: Project Description.

229. As detailed in Table 5.3, the maximum EMF strengths are associated with a bipole cable configuration rated at 525 kV. The four cable 320 kV symmetrical monopole configuration resulted in lower EMF strengths, but a wider footprint of elevated EMF levels given the additional two HVDC cables. The modelling estimates that:

- For the 525 kV bipole configuration including a pair of HVDC cables separated by 25 m and buried to a minimum depth of 0.5 m, the resulting EMF strength is approximately 658 µT. This is shown to decay with distance to the natural GMF strengths for the Marine Scheme (50 µT) at a distance of between 10-20 m from the cable, both vertically and horizontally and falls below the FeAST tool benchmark within 10 m of the cables. In reality, it is likely that the cables will be buried to a greater depth than this in some areas with favourable ground conditions, where EMF strengths will dissipate to the GMF even more rapidly.
- For the 320 kV bipole configuration including four HVDC cables, separated by 25 m and buried to a minimum depth of 0.5 m, the resulting EMF strength is approximately 541 µT. This is shown to decay with distance to the natural GMF strength at a distance of between 10-20 m from the cable, both vertically and horizontally and falls below the FEAST tool benchmark within 5-10 m of the cables. In reality, it is likely that the cables will be buried to a greater depth than this in some areas with favourable ground conditions, where EMF strengths will dissipate to the GMF even more rapidly.

230. Although the burial of cables and other protective measures such as placement of remedial protection are not considered to be effective ways to mitigate magnetic emissions into the marine environment entirely, burial and cable protection separate the most sensitive species from the source of the emissions (Copping *et al*., 2020). In addition, design parameters and installation methods are expected to conform to industry standard specifications, which include shielding technology to reduce the direct emission of EMFs.

231. EMF will be continuously emitted throughout the lifetime of the Marine Scheme (35 years). The current through the export cables and subsequently the strength of resulting EMF, will be dependent on the generation output from the BBWF. However, the modelling undertaken assumes the maximum capacity of the cables is utilised, so the actual field strengths will not exceed those outlined above.

232. As noted above, the extent of any increases in EMF associated with the Marine Scheme is very spatially limited and is not expected to result in a widespread effect on the characteristic communities of the subtidal sands and gravels feature.

5.5.2.4.2. SENSITIVITY OF THE RECEPTORS

233. The relevant FeAST and MarESA pressure for EMF is electromagnetic changes. However, no evidence is available in relation to this pressure for any of the biotopes within the ncMPA or for ocean quahog (Table 5.4).

234. The effects of EMFs on benthic communities are considered to be not well understood and based on a limited number of studies. Recent studies suggest that benthic communities growing along cable routes are similar to those in nearby baseline areas, and where there are differences in species abundance, this is considered to be likely due to the physical presence of the cable and surface properties, rather than an EMF effect (Gill and Desender, 2020). Similarly, a recent review of the effects of EMF on invertebrates reported that no direct impact on individual survival has been identified in the literature (Hervé, 2021). These communities however are not exposed to the maximum EMF emissions due to cable burial creating a physical distance between the cable and the seabed surface, although the EMF which reaches the surface is measurable at biologically relevant scales at the seabed and in the water column (Hutchinson *et al*., 2020).

5.5.2.4.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

235. Based on the information presented above, the following can be concluded with respect to the attributes of the protected features of the Firth of Forth Banks Complex ncMPA.

5.5.2.4.3.1. Subtidal sands and gravels

236. The extent and distribution of the offshore subtidal sands and gravels feature will be maintained in the long term following cable installation activities, with only a small proportion of the biotopes characteristic of this feature affected by EMF.

237. With respect to the key influential species that have a core role in determining the structure and function of the offshore subtidal sands and gravels feature, and the characteristic communities that make up the habitat and reflect the habitat's overall character and conservation interest, it is considered that they will be minimally affected by EMF, with only a small proportion of the total extent of this feature within the ncMPA affected, enabling the maintenance of the diverse composition of communities in this feature. Likewise, the ecological services of biological productivity, nutrition provision and climate regulation, will be maintained.

238. The highly localised effects of EMF will not be sufficient to prevent the maintenance of the subtidal sands and gravels feature as a spawning ground for commercially and ecologically important fish species. Pelagic species are unlikely to encounter the EMF associated with the Offshore Export Cables as these species are not closely associated with the seabed. Conversely, demersal species, including eggs and larvae, on or above the seabed may overlap with the EMF associated with the buried cables. As described in ES, Volume 2, Chapter 9: Fish and Shellfish Ecology, the expectation is that most marine finfish can only detect EMF within a very small distance of the cables. Given the intention to bury the Marine Scheme cables, EMF levels are likely to decay such that impacts on spawning fish species are unlikely to be notable.

239. It is concluded that potential effects on the offshore subtidal sands and gravel feature, due the effects of EMF, would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **recover structure and function; and**
- **conserve supporting processes.**

5.5.2.4.3.2. Shelf banks and mounds

240. The extent and distribution of the shelf banks and mounds feature is determined by the prevailing hydrodynamic regime, and as such there is no impact pathway for EMF effects. As such extent and distribution will be maintained.

241. Similarly, in the physical context of large-scale features, supporting processes refers to the role that the hydrodynamic regime plays in maintaining the functional significance of the feature within the site. There is no impact pathway for EMF effects and as such the supporting processes of the shelf banks and mounds feature will be maintained.

242. The ecological features and thus functional role of this protected feature is largely the same as the offshore subtidal sands and gravels protected feature but with greater focus placed upon its importance as a spawning ground for commercially important species and the local community, and also as foraging ground for marine mammals and seabirds. As described in ES, Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology and Chapter 9: Fish and Shellfish Ecology, the magnitude of the impact is deemed to be low for the ecological features of the ncMPA and the sensitivity of the receptors is considered to be negligible to medium.

243. It is concluded that potential effects on the shelf banks and mounds feature from the effects of EMF would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structure and function; and**
- **conserve supporting processes.**

5.5.2.4.3.3. Ocean Quahog Aggregations

244. The extent of any increases in EMF associated with the Marine Scheme is spatially limited and emissions would only directly impact a small proportion of these features in relation to their distribution across the ncMPA. Ocean quahog are considered to be tolerant of to changes in EMF strengths, and no direct impact on individual ocean quahog survival has been identified in the literature. Therefore, it is expected that the extent and distribution of the ocean quahog feature will be maintained.

245. Ecosystem services provided by ocean quahog include carbon cycling and nutrient transport within the ncMPA as well as acting as direct records of climate and environmental change (although there is currently no direct evidence). The highly localised nature of EMF emissions are unlikely to disrupt these long term functions.

246. It is concluded that potential effects on the offshore subtidal sands and gravel feature, due to EMF effects, would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **recover structure and function; and**
- **conserve supporting processes.**

5.5.2.4.4. SECONDARY MITIGATION AND RESIDUAL EFFECT

247. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the ncMPA.

5.5.2.5. THERMAL EMISSIONS FROM OPERATIONAL CABLES

248. Power cables in the marine environment generate and dissipate heat. Heat emitted into the sediment from the buried Offshore Export Cables has the potential to directly affect benthic ecology receptors. Water has a high heat capacity, therefore thermal emissions from the Offshore Export Cables will not be able to heat the overlying seawater. Consequently, only sediments along the proposed cable route may be subject to potential heating.

249. The relevant MarESA and FeAST pressure is therefore:

- Temperature changes – local.

250. This impact only relates to potential alterations to the ecology of the ncMPA, namely ocean quahog aggregations and fauna associated with offshore subtidal sands and gravels and shelf banks and mounds features. As there is no physical change associated with this pressure, there is no impact pathway between thermal emissions and the protected large-scale geological feature of the Wee Bankie Geodiversity Area.

5.5.2.5.1. MAGNITUDE OF IMPACT

251. When electricity is transported, a certain amount dissipates as heat energy, potentially increasing the temperature at the cable surface and in the surrounding sediment. There is evidence that this heat (also known as thermal emissions) can occur from high voltage subsea cables and is detectable within the surrounding sediments (Meißner 2006; Taormina *et al.,* 2018). However, Taormina *et al.* (2018) found that a maximum increase of 2.5°C occurs 50 cm directly below the cable whereas sediment temperature increases above the cables were reduced, due to the increasing influence of the seawater towards the seabed.

252. Thermal radiation can modify physical and chemical properties of the seabed, resulting in a development of microorganism communities and/or result in displacement of demersal mobile organism (Taormina *et al*., 2018). It is expected that the zone of influence from any thermal radiation will be limited to the immediate vicinity of each cable and that heat will dissipate relatively rapidly.

253. Emeana *et al*. (2016) found that heat transfer within sediments was dependent on sediment type, with coarse silts experiencing the greatest temperature change. However, this greatest difference was more localised to the source. In comparison, very coarse sediments had a lower temperature change but were affected over a greater distance. This is due to the increased interstitial space between coarser sediment particles. Considering the nature of the offshore sands and gravels, including that of the shelf banks and mounds feature, it is likely that the increase in temperature within the sediments will be highly localised to the source, only impacting a small proportion of the available biotopes across the ncMPA, but for the duration of the operational lifetime of the project.

5.5.2.5.2. SENSITIVITY OF THE RECEPTOR

254. Similar to EMF, there is also a paucity of evidence on the potential effects of thermal emissions on invertebrates. The potential impact on the benthic fauna of the ncMPA is therefore largely unknown (Boehlert & Gill, 2010; Taormina et al. 2018).

255. The relevant MarESA and FeAST tool pressure and benchmark for thermal emissions from operational cables is temperature increase (local). The benchmark for this pressure is a 5°C increase in temperature for one month period, or 2°C for one year.

256. The FeAST tool assesses continental shelf coarse sediments as not sensitive to localised temperature increase and continental shelf mixed sediments as having a medium sensitivity. As for EMF effects discussed above, sensitivity is dependent on the associated fauna. According to MarESA, the biotopes recorded within the ncMPA have low sensitivity to this pressure (see ES, Volume 2, Chapter 8: Benthic and Subtidal and Intertidal Ecology).

257. Benthic and demersal fish species associated with the subtidal sands and gravels feature includes species such as cod, plaice, sandeel and whiting. Given the predicted extent of thermal emissions, only those species which spend time within the sediment, such as sandeel and plaice, are expected to be affected. Sandeel and plaice burrow within sediments

258. Sandeel productivity is understood to be affected by temperature in multiple life stages including during their reproductive cycle (Wright *et al*., 2017a, 2017b) and during their egg development (Régnier *et al*., 2018). However, the available research largely focusses on wider temperature increases associated with warming seas. Conversely, heating of seabed sediments is so highly localised that it is unlikely demersal species will experience any effects because of thermal emissions.

259. Furthermore, sandeel and plaice are shallow burrowers (Ruiz, 200; Rowley, 2008). Therefore, they are not likely to encounter thermal emissions from the Marine Scheme cables as this will be minimal in the uppermost layers of sediment.

260. Ocean quahog are assessed as having a medium sensitivity to temperature increases by MarESA and as having a high sensitivity by the FeAST tool. Severe increases in temperature may affect the spawning success in ocean quahog, but juveniles can survive in temperatures as high as 20°C and adults 16°C (Merrill et al., 1969; Cargnelli et al., 1999), far above the temperature increases that

would be predicted as a result of the installed cables. Furthermore, ocean quahog typically inhabit the top few centimetres of sediment, burrowing deeper in winter months (up to 14 cm) and remaining shallower in warmer months (Thorarinsdottir *et al*. 2009, Strahl *et al*. 2011). Nevertheless, prolonged increases in temperature of up to 2°C may result in mortality and the resilience of this species to significant increases in mortality is low, due to the sporadic and variable nature of recruitment in bivalves (Tyler-Walters and Sabatini, 2017). However, this low mobility species would be expected to move away from unfavourable sediment conditions caused by any thermal emissions. Furthermore, only low numbers of ocean quahog were recorded within the Marine Scheme and the spatial extent of thermal emissions from operational cables during the operation and maintenance phase will be highly localised, particularly in comparison to the wide spatial distribution of this species and the subtidal sands and gravels habitat.

5.5.2.5.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

261. Based on the information presented above, the following can be concluded with respect to the attributes of the protected features of the Firth of Forth Banks Complex ncMPA.

5.5.2.5.3.1. Subtidal sands and gravels

262. The extent and distribution of the offshore subtidal sands and gravels feature will be maintained in the long term following cable installation activities, with only a small proportion of the biotopes characteristic of this feature affected by thermal emissions.

263. With respect to the key biotopes that have a core role in determining the structure and function of the offshore subtidal sands and gravels feature, and the characteristic communities that make up the habitat and reflect the habitat's overall character and conservation interest, it is considered that they will be minimally affected by thermal emissions, with only a small proportion of the total extent of this feature within the ncMPA affected. This will enable the maintenance of the diverse composition of communities in this feature. Likewise, the ecological services of biological productivity, nutrition provision and climate regulation, will be maintained.

264. The highly localised effects of thermal emissions will not be sufficient to prevent the maintenance of the subtidal sands and gravels feature as a spawning ground for commercially and ecologically important fish species. Pelagic species are unlikely to encounter the thermal emissions associated with the Offshore Export Cables. Likewise, the burrowing activity of sandeel and plaice do not extend deep enough into the sediment to encounter significant thermal emissions.

265. It is concluded that potential effects on the offshore subtidal sands and gravel feature, due to thermal emissions form operational cables, would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **recover structure and function; and**
- **conserve supporting processes.**

5.5.2.5.3.2. Shelf Banks and Mounds

266. The extent and distribution of the shelf banks and mounds feature is determined by the prevailing hydrodynamic regime, and as such there is no impact pathway for EMF effects. As such extent and distribution will be maintained.

267. Similarly, in the physical context of large-scale features, supporting processes refers to the role that the hydrodynamic regime plays in maintaining the functional significance of the feature within the site. There is no impact pathway for EMF effects and as such the supporting processes of the shelf banks and mounds feature will be maintained.

268. The ecological features and thus functional role of this protected feature is largely the same as the offshore subtidal sands and gravels protected feature but with greater focus placed upon its importance as a spawning ground for commercially important species and the local community, and also as foraging ground for marine mammals and seabirds. As described above, and further

detail in ES, Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology and ES, Volume 2, Chapter 9: Fish and Shellfish Ecology, the impact of thermal emissions on the ecological receptors of the shelf banks and mounds feature are expected to be negligible to minor.

269. It is concluded that potential effects on the shelf banks and mounds feature from the effects of thermal emissions from operational cables would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structure and function; and**
- **conserve supporting processes.**

5.5.2.5.3.3. Ocean quahog aggregations

270. The extent of any increases temperature associated with the operational cables is highly spatially limited and thus thermal emissions are not expected to materially impact ocean quahog burrowed in the top layers of sediment. The highly limited potential impact to this feature is thus unlikely to represent a detrimental impact at the population level, thus maintaining the extent and distribution and structure and function of this feature. Likewise, there will be no disruption to the ecosystem services provided by ocean quahog aggregations across the ncMPA.

271. It is concluded that potential effects on the offshore subtidal sands and gravel feature, due to thermal emissions from operational cables, would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **recover structure and function; and**
- **conserve supporting processes.**

5.5.2.5.4. SECONDARY MITIGATION AND RESIDUAL EFFECT

272. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the ncMPA.

5.5.2.6. CHANGES IN PHYSICAL PROCESSES FROM CABLE PROTECTION MEASURES

273. Alteration of seabed habitat arising from effects on physical processes during the operation and maintenance phase of the Marine Scheme in the Firth of Forth Banks Complex ncMPA may occur as a result of the presence of cable protection for cables and cable crossings. Full detail on the project envelope assumptions and maximum design for cable installation and seabed levelling is provided in Table 5.3..

274. ES, Volume 2, Chapter 7: Offshore Physical Environment and Seabed Conditions provides a full description of the environmental impact assessment of alteration of seabed habitat arising from effects of physical processes.

275. Potential changes to the tide regime will occur when the cable protection on the seabed has the capacity to locally block the incident flows. These changes can have associated consequences on the water column and seabed, due to blockage effects. The scale of any blockage relates to the cross-sectional area of the infrastructure on the seabed and its protruding heights.

5.5.2.6.1. MAGNITUDE OF IMPACT

276. The total footprint of cable protection estimated to be required in Scottish waters, and thus potentially within the Berwick Bank and Scalp and Wee Bankie areas, is 0.23 km^2. Protection will have a maximum height of 1.5 m and width of 9.5 m and will protrude into the water column with a submerged cross-sectional profile. However, the use of cable protection materials will be reduced as far as practicable, and are likely to be employed in areas of relatively harder substrate (that do not allow burial) and will be non-continuous in nature.

277. Results of the completed analyses, described in ES, Volume 2, Chapter 7: Offshore Physical Environment and Seabed Conditions, indicate that there will be no discernible change to water levels upstream or downstream of the cable protection berm and thus no alteration to flow speeds.

278. Sediment transport is driven by both the tidal and wave regimes, the magnitude of both is described above. As discussed in detail in ES, Volume 2, Chapter 7: Offshore Physical Environment and Seabed Conditions, the changes to tidal currents, and sediment transport are insignificant in terms of the hydrodynamic regime.

5.5.2.6.2. SENSITIVITY OF THE RECEPTOR

279. The potential changes to the tidal, wave and sediment transport regimes as a result of blockage effects from cable protection measures relate to the geophysical features of the ncMPA, subtidal sands and gravels, shelf banks and mounds, and the Wee Bankie Geodiversity Area. These features have a low capacity to accommodate and a moderate ability to recover from changes to physical processes and thus the sensitivity is considered to be medium. However, considering the negligible change expected from the limited amounts of cable protection potentially installed within the ncMPA, these large-scale features are understood to not be sensitive to the resulting level of potential impact.

5.5.2.6.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

280. Based on the information presented above, the following can be concluded with respect to the attributes of the protected features of the Firth of Forth Banks Complex ncMPA.

5.5.2.6.3.1. Subtidal sands and gravels

281. Based on the information provided above, underpinned by the modelling and assessment undertaken in ES, Volume 2, Chapter 7: Offshore Physical Environment and Seabed Conditions, the impacts to the subtidal sands and gravels feature of the ncMPA are expected to be minimal. Any changes to tidal, wave and sediment transport regimes as a result of blockage effects from cable protection measures are considered to be minimal and will not alter the sediment composition of this feature to any significant level. As such the extent and distribution of this feature will be maintained.

282. The structure and function, and thus supporting processes of the subtidal sands and gravels, relating to the hydrodynamic regime, topography and sediment composition across the ncMPA will also be maintained as the changes to localised physical processes will be minimal.

283. It is concluded that potential effects on the offshore subtidal sands and gravel feature, due to changes in physical processes from cable protection measures, would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **recover structure and function; and**
- **conserve supporting processes.**

5.5.2.6.3.2. Shelf banks and mounds

284. As described for the subtidal sands and gravels feature, any impacts on the shelf banks and mounds feature are expected to be minimal. The limited installation of cable protection within the ncMPA will not be of sufficient magnitude to change the prevailing hydrodynamic regime. As such the extent and distribution of this large-scale geological feature will be conserved.

285. Similarly, as there will be no change to the hydrodynamic regime across the site and the physical nature of the shelf banks and mounds will be maintained, so too will the structure and function, and thus supporting processes.

286. It is concluded that potential effects on the shelf banks and mounds feature due to changes in physical processes from cable protection measures would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structure and function; and**
- **conserve supporting processes.**

5.5.2.6.3.3. Wee Bankie Geodiversity Area - Moraines

287. Any changes to physical processes will be highly localised to the cable protection and of short duration. As such, there will be no potential for loss of material from moraines within the site and thus the extent and distribution of the feature within the ncMPA will be maintained.

288. Likewise, as there will be no material impact to the physical nature of the feature, the structure of the moraines will be conserved, as will the function of Wee Bankie as a feature for scientific study and habitat provision.

289. It is concluded that potential effects on the Wee Bankie Key Geodiversity Area feature, due to changes in physical processes from cable protection measures, would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structure and function: and**
- **That the feature surface will remain sufficiently unobscured for the purposes of determining whether the above criteria are satisfied.**

290. No objective has been set for supporting processes of this feature. has The Wee Bankie Key Geodiversity Feature is a relict geological feature. As such, supporting processes are not relevant.

5.5.2.6.4. SECONDARY MITIGATION AND RESIDUAL EFFECT

291. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the ncMPA.

5.5.3. Potential Effects During Decommissioning

292. Given the nature of the decommissioning activities, which will largely be a reversal of the installation process, the impacts during decommissioning are expected to be similar to, or less than those assessed for the construction phase. In the absence of detailed information regarding decommissioning works, the implications for the ncMPA are considered analogous with or likely less than those identified and assessed for the construction phase. It is also assumed that the designated feature sensitivities will not materially change over the life cycle of the Marine Scheme.

293. Cables and protection for cables will be fully removed where it is possible and appropriate to do so noting this will depend on the type of protection used and condition of the protection at the time of removal.

294. Should complete removal of the Offshore Export Cables be required, the activities are expected to result in similar impacts to those assessed as part of the construction phase of the Marine Scheme. Impacts are anticipated to be of similar or lower magnitude to the construction phase (depending on the decommissioning option selected). Complete removal of the Offshore Export Cables represents the most significant adverse effects, and therefore if the other decommissioning options were to be progressed, they would have no more significant adverse effects.

295. The maximum design scenario for the extent of habitat changes arising from the introduction of new hard substrate within the Firth of Forth Banks Complex ncMPA which will persist following the decommissioning phase is assumed to be same as for the operation and maintenance phase.

296. Based on the information presented across the assessment of effects resulting from installation and operation & maintenance activities, it can be concluded that the impacts of resulting from decommissioning will not lead to a significant risk of hindering the achievement of the conservation objectives for the physical and biological features of the Firth of Forth Banks Complex ncMPA.

5.5.3.1. SECONDARY MITIGATION AND RESIDUAL EFFECT

297. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the ncMPA.

5.5.4. Assessment of Effects - Project Alone Conclusion

298. Based on the information presented for all features, conservation objectives and attributes set out above, there will be no significant risk of hindering the achievement of the conservation objectives for all features of the Firth of Forth Banks Complex ncMPA.

5.6. Assessment of Effects – In-Combination

5.6.1. Other Plans and Projects Included in the In-Combination Assessment

299. Table 5.5 lists the other plans and developments that have been identified as having potential to have an effect on the Firth of Forth Banks Complex ncMPA in combination with the Marine Scheme in Scottish Waters.

300. It should be noted that the Marine Scheme and the BBWF are both being developed by Berwick Bank Wind Farm Ltd., however they are separate projects and hence BBWF is included in this assessment of cumulative effects.

Table 5.5 Other Plans and Projects with Potential for In-Combination Effects on the Firth of Forth Banks Complex ncMPA

Development	Status	Distance from Marine Scheme (km)	Description of Development/ Plan	Dates of Construction (if Applicable)	Dates of Operation (if Applicable)	Phase Overlap with the Marine Scheme
BBWF	In planning	0 km (direct physical overlap)	Offshore wind farm and associated transmission infrastructure	Construction anticipated to be 2025 to 2032	Operational from 2032	Construction and operation and maintenance
Neart Na Gaoithe Offshore Wind	Under Construction	15 km	Offshore wind farm	2022 - 2024	Anticipated to be operational from 2024 for 25 years	Operation and maintenance
Eastern Green Link (EGL) 2	In planning	Approximately 10 km (Scottish waters)	A sub-sea HVDC cable from Sandford Bay at Peterhead, Scotland to Drax in England.	Construction anticipated to be 2025 to 2029	Operational from ~2029	Construction
Seagreen 1	Under Construction	5 km	Offshore wind farm	2022 - 2023	Anticipated to be operational from 2023 for 25 years	Operation and maintenance
Seagreen 1A Project	Consented	23 km	Transmission infrastructure	2022 - 2026	Unknown	Construction and operation and maintenance
Inch Cape Offshore Wind Farm	Consented	19 km	Offshore wind farm	Unknown	Unknown	Construction and operation and maintenance

5.6.2. Potential Effects During Construction

5.6.2.1. TEMPORARY BENTHIC HABITAT / SPECIES LOSS OR DISTURBANCE

Table 5.6 Firth of Forth Banks Complex ncMPA: Area of cumulative temporary habitat / species loss

Development	Total Area of Temporary Habitat Disturbance Within the MPA (km2) (% of the MPA area)	Source
Marine Scheme	4 km (0.19%)	Section 5.4.2
BBWF	24.69 km (1.16%)	BBWFL (2022)
Seagreen 1A	The EIA Report for this project does not quantify the temporary habitat disturbance footprint associated with maintenance activities, however it states that depending on the installation methods used, temporary direct impacts may occur within an anticipated maximum working width of 100 m around the installation works with an approximate cable length of 110 km (a proportion of this can be assumed to be within the MPA).	Seagreen Wind Energy Ltd (2021)

301. The developments listed in Table 5.6 which met the CEA criteria may result in some temporary benthic habitat / species loss or disturbance.

302. The cumulative project with the greatest extent of project temporal and spatial overlap is the BBWF, given that the Marine Scheme overlaps with the full array area boundary. The construction and operation of the BBWF, which has been submitted for consent and is currently being determined, will overlap with the Firth of Forth Banks Complex ncMPA and temporally overlap with the construction of the Marine Scheme. The development consists of the offshore components of the BBWF include the offshore wind farm (the wind turbines, their foundations and associated inter-array cabling), together with associated infrastructure of the Offshore Transmission Asset, Offshore Substation Platforms (OSPs)/ Offshore convertor station platforms, their foundations, and the offshore export cables and cable protection.

303. Alone, disturbance from seabed preparation and export cable installation activities associated with the Marine Scheme are considered to be of short term and of a limited spatial extent (4 km^2 within Scottish waters[13]). The maximum extent of temporary benthic habitat and species loss or disturbance arising from the BBWF is approximately 24.69 km^2 (this equates to approximately 1.16% of the total area of the ncMPA). On this basis, there may be up to 28.69 km^2 of cumulative temporary habitat disturbance associated with the BBWF and the Marine Scheme. The Marine Scheme does not overlap the Montrose Bank area and it will not be impacted. The 28.69 km^2 of temporary habitat loss would equate to approximately 2.1% of the combined area for the Berwick Bank and Scalp and Wee Bankie parts of the ncMPA.

304. The offshore subtidal sands and gravels feature, and thus habitat for ocean quahog, extends across the entirety of the Firth of Forth Banks Complex MPA and therefore, for the purposes of this assessment, it has been assumed all of the cumulative temporary habitat disturbance could occur

[13] It is important to note that whilst the total extent of overlap between the Marine Scheme and the Firth of Forth Banks Complex MPA is 469.2km^2, this is based on the boundary provided for the Marine Scheme and not the *actual* installation footprints for Offshore Export Cables. As explained in Volume 1, Chapter 5: Project Description, the exact location of the Offshore Export Cables cannot yet be determined which is the reason for the required level of flexibility within the BBWF array area. As explained in this chapter, only a small proportion of the boundary for the Marine Scheme is actually going to be required for the Offshore Export Cables.

within the offshore subtidal sands and gravels feature and available habitat for ocean quahog aggregations.

305. The disturbance associated with the Marine Scheme will be localised (25 m width of potential disturbance per cable) and the potential for repeat disturbance is considered low and unlikely to lead to cumulative impacts over time. It is also important to note that the repeat disturbance to specific areas within the ncMPA is made more unlikely by the fact that the Applicant for BBWF will install generation assets, inter-array cables and export cables with avoidance of the Marine Scheme and vis-versa, owing to the need to preserve safety of assets (save for a very discrete area of intentional interaction where the Marine Scheme will connect into up to two OCSPs).

306. The limited extent of this cumulative disturbance is unlikely to affect, or delay, the recovery timescales for the ecological communities, including ocean quahog, owing to the widespread undisturbed habitat and communities within the ncMPA which will act as a source for recolonisation once construction activities cease. As such the recovery timescales described for the Marine Scheme alone are considered likely to apply.

307. The Seagreen 1A export cable will be located within the Montrose Bank part of the ncMPA and the construction timelines (2022 – 2026) may temporally overlap with that of the Marine Scheme (Seagreen Wind Ltd, 2021). The Seagreen 1A cable corridor overlaps 88.89 km2 of the Montrose Bank part of the ncMPA, equating to 3.8% of the whole ncMPA, however the actual temporary disturbance footprint will be significantly less; the cable trench will be up to 3 m width, around which will be a maximum working width of 100 m. As the Seagreen 1A development is located within the Montrose Bank part of the ncMPA, there will be no direct spatial overlap with the Marine Scheme (Seagreen Wind Ltd, 2021).

308. A quantitative assessment of cumulative disturbance between the Marine Scheme and the Seagreen 1A development cannot be made, however, any disturbance from the installation of the offshore Seagreen 1A will be short-term and localised (Seagreen Wind Ltd, 2021). The additional impact of 4 km^2 of temporary disturbance resulting from the Marine Scheme will not be sufficient to hinder the conservation objectives for any of the widespread features of the ncMPA (Table 5.7).

Table 5.7 CEA of the Firth of Forth Banks Complex ncMPA for temporary benthic habitat / species loss – Construction phase.

Protected Feature	Conclusion
Subtidal sands and gravels	There will be up to 24.69 km^2 of cumulative temporary disturbance to this feature. This equates to 1.16% of entire feature and 2.1% of the combined Berwick Bank and Scalp and Wee Bankie areas. No impact to Montrose Bank. Small proportion of the feature will be impacted and of temporary duration. Sediment composition will be maintained and biological communities within the footprint of activities will recover. Temporary disturbance only to spawning grounds. No significant impact to the hydrodynamic regime. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • recover structure and function; and • conserve supporting processes.
Ocean quahog aggregations	Ocean quahog habitat within the ncMPA is the subtidal sands and gravels feature. As such, the footprints of disturbance are as described above. A small proportion of the feature will be impacted and of temporary duration. Construction activities will lead to mortality of individuals within the disturbance footprint. The extent is not sufficient for a population level effect. Following construction habitat will be available and recovery to baseline conditions is expected. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structure and function; and • conserve supporting processes.
Shelf banks and mounds	The extent of the temporary disturbance to the shelf banks and mounds feature from the Marine Scheme is not known. The BBWF predicted temporary disturbance to 1.48 km^2 (0.56%) of this feature within the Berwick Bank area and 3.33 km^2 (1.26%) within the Scalp and Wee Bankie. The scale of the Marine Scheme is significantly less (4 km^2 within Scottish waters) and only a small proportion of that would be expected to overlap with this feature. A small proportion of the feature will be impacted and of temporary duration. The scale of the cumulative disturbance will not be sufficient to affect the prevailing hydrodynamic regime or sediment transport processes. As such there will be no change to the seabed morphology. Conditions within the footprint of disturbance would be expected to quickly recover to baseline conditions. The ecological aspects of this feature would likewise be only temporarily and minorly affected. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structure and function; and • conserve supporting processes.
Wee Bankie Geodiversity Area - moraines	The Marine Scheme could create up to 0.65 km^2 (0.09% of the ncMPA feature) of seabed disturbance across the moraines feature of the Berwick Bank area within the export cable corridor. However a calculation cannot be made for the Scalp and Wee Bankie area as the locations of cables within the array area are not known at this time.

Protected Feature	Conclusion
	The BBWF ES predicted up to 5.45 km^2 (0.73%) of temporary habitat disturbance to the moraines features within the Scalp and Wee Bankie area and 0.03 km^2 (0.004%) within the Berwick bank part of the site. A small proportion of the feature will be impacted and of temporary duration. As described for offshore subtidal sands and gravels, there will be no overall loss of the geodiversity feature's extent or distribution as no sediment will be removed from the system and the disturbed sediment is expected to recover following construction activities. Likewise, as the hydrodynamic regime will not be altered, the function of the feature as a site of scientific study of deglacial history, and habitat for biological communities will be maintained following recovery. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • recover structure and function; and • that the feature surface will remain sufficiently unobscured for the purposes of determining whether the above criteria are satisfied.

5.6.2.1.1. INCREASED SUSPENDED SEDIMENT CONCENTRATIONS (SSC) AND ASSOCIATED DEPOSITION

Table 5.8 Firth of Forth Banks Complex ncMPA: Other plans and projects with potential for cumulative effects of increased SSC and associated deposition during construction of the Marine Scheme

Development	Development phase	Source
Marine Scheme	Construction	Section 5.4.2
BBWF	Construction	BBWFL (2022)
Seagreen 1	Operation and Maintenance	Marine Scotland (2014b)
Seagreen 1A	Construction	Marine Scotland (2014b), Seagreen Wind Ltd (2021)
Inch Cape Offshore Wind Farm	Construction	Inch Cape Offshore Limited (ICOL) (2018)
Neart Na Gaoithe Offshore Wind	Operation and maintenance	Mainstream Renewable Power (2019)
Eastern Green Link (EGL) 2	Construction	NGET & SHE Transmission plc (2022)

309. The developments listed in Table 5.8 which met the CEA criteria may result in some temporary increases in SSC including the potential resuspension of contaminants and subsequent sediment deposition.

310. The construction timeline for the Inch Cape Offshore Wind Farm is unknown. The cable corridor is located to the west of the Marine Scheme and does not overlap the Firth of Forth Banks Complex ncMPA. Should trenching activities be undertaken simultaneously, there is no evidence to suggest that they would interact with the limited plumes produced during construction activities for the Marine Scheme.

311. The planned construction period for the Eastern Green Link 2 (EGL2) cable overlaps with that of the Marine Scheme. EGL2 will be located to the west of the ncMPA, running immediately adjacent to the western boundary of Montrose Bank. The planned route for the cable is approximately 10 km from the Marine Scheme in Scottish waters and the maximum distance travelled by fine sediments in suspension was assessed to be 1.5 km.

312. During the construction phase of the Marine Scheme, the Neart na Gaoithe Offshore Wind Farm and the Seagreen 1 offshore wind farm will be in their operational phases and maintenance activities may result in increased suspended sediment concentrations. However, these activities would be of limited spatial extent and frequency and unlikely to interact with sediment plumes from Marine Scheme.

313. The Seagreen 1A cable corridor overlaps the Scalp and Wee Bankie part of the ncMPA, north of the Marine Scheme. There may be a short period, a matter of months, in which seabed preparation activities for the marine Scheme are undertaken at the same time as construction of the Seagreen 1A export cable. Deposition of fine fractions of the sediment plumes generated by the development will fall out of suspension within a maximum of 2-3 km from the cable. The MPA assessment undertaken for the Seagreen 1A export cable, together with the Seagreen 1 OWF, concluded that the (combined) project was only capable of affecting, other than insignificantly, the ocean quahog aggregations and offshore subtidal sand and gravel protected features of the Firth of Forth Banks Complex MPA.

314. The MPA assessment undertaken for the BBWF, and in assessing cumulative impact with the Seagreen 1 and Seagreen 1A developments, also concluded no potential for a significant impact to the large scale shelf banks and mounds and the Wee Bankie Key Geodiversity Area moraines features.

315. As detailed within ES, Volume 2, Chapter 7: Offshore Physical Environment and Seabed Conditions and discussed above, the maximum distance the plume has the potential to travel the extent of the tidal ellipse in the direction of the tidal flow which is approximately 5 km. This means that locally although SSC may increase by several orders of magnitudes, the effect will be very short-lived in the order of minutes, followed by the sediment being redeposited to the seabed. As such, there is no possibility of an interaction of SSC plumes between the Marine Scheme and EGL2, Seagreen 1A, Inch Cape Offshore Wind Farm and Neart Na Gaoithe Offshore Wind, should construction and operation and maintenance activities occur simultaneously.

316. During the construction phase of the Marine Scheme, there is the potential for cumulative impacts with the construction phase of the BBWF, as described above. The BBWF may directly impact the Firth of Forth Banks Complex ncMPA and construction phase is anticipated to overlap with the construction phase of the Marine Scheme.

317. As detailed in ES, Volume 2, Chapter 9: Benthic Subtidal and Intertidal Ecology, low concentrations of contaminants were recorded within the export cable corridor and BBWF. As such, there is no expectation of detrimental effects to fauna as a result of the suspension and subsequent deposition of sediments within the ncMPA. Contamination levels of sediments were not reported or discussed in the Seagreen 1A EIAR or combined Seagreen 1 and Seagreen 1A MPA Assessment. As there is no suggestion of a potential detrimental impact to the ecological features of the ncMPA, this is not discussed further.

318. As described in section 5.5.1 the ocean quahog aggregation feature according to FeAST and MarESA, is not sensitive to changes in SSC and associated deposition due to their ability to burrow back to the surface following sediment deposition. Ocean quahog are also not directly sensitive to changes in light availability, although an increase in turbidity could lead to a release of higher-than-normal levels of nutrients resulting in increased levels of food availability.

319. Based on the information included within the environmental assessments undertaken for the BBWF, the following was concluded with respect to all of the physical attributes of all the protected features of the ncMPA for the BBWF:

- Sediment composition and distribution will not be affected due to increases in SSC and associated deposition, with most of the sediment mobilised during foundation and cable installation as well as seabed preparation falling out of suspension in close proximity to the location of the activity and therefore within the same sediment type. Fine sediments will travel further away from their original location although where they settle, they will not affect the overall sediment composition;
- The sedimentation rate will be maintained. As detailed above any effects of sediment mobilisation will be highly localised in extent and of short-term duration, therefore not affecting the natural sediment transport processes, maintaining the supporting processes and physical nature of these features; and
- Water turbidity will be affected temporarily during construction activities, although any effects will be limited spatially and temporally, occurring intermittently throughout the construction phase and returning to background levels following the cessation of the works.

320. As largely physical attributes, the cumulative activities are unlikely to have an effect upon the large scale features offshore subtidal sands and gravels, shelf banks and mounds or moraines, which extend across the Firth of Forth Banks Complex ncMPA (2,130 km^2). The increases in SSC and associated deposition are predicted to result in temporary changes to the environment and those changes involve the transport and deposition of sediment within the ncMPA, the effects of which will be short lived with conditions returning to baseline within a few tidal cycles. Overall, the magnitude of these impacts suggests a minor short-term impact on the sediment composition and the fine scale topography of the protected features.

321. The impact of the BBWF installation is likely to result in a low magnitude of impact, especially as the increase in SSC and associated deposition will be highly localised to the installation site which covers a very small proportion of the ncMPA. Considering the cumulative effect of the Marine Scheme and the BBWF, increases in SSC and associated deposition arising from both developments are unlikely to greatly the potential to adversely affect the conservation objectives of the ncMPA when considered together.

322. Based on the information presented here, it can be concluded that cumulative increases in SSC and associated deposition during the Marine Scheme construction phase will not lead to a significant risk of hindering the achievement of the conservation objectives for any feature of the Firth of Forth Banks Complex ncMPA (Table 5.9).

Table 5.9 CEA of the Firth of Forth Banks Complex ncMPA for increased SSC and associated deposition – Construction phase.

Protected Feature	Potential impact
Subtidal sands and gravels	The cumulative increases in SSC and subsequent deposition are predicted to temporarily affect a small proportion of the feature across all parts of the ncMPA during the construction phase. Sediment composition will be maintained and characteristic biological communities will recover following construction activities. Temporary disturbance only to spawning grounds. No significant impact to the hydrodynamic regime. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • recover structure and function; and • conserve supporting processes.

Protected Feature	Potential impact
Ocean quahog aggregations	Ocean quahog are highly tolerant of increases in SSC and associated deposition. The small extent and temporary nature of SSC will not impact the population. Construction activities will lead to mortality of individuals within the disturbance footprint. The extent and duration is not sufficient for a population level effect. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structure and function; and • conserve supporting processes.
Shelf banks and mounds	Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structure and function; and • conserve supporting processes.
Wee Bankie Geodiversity Area - moraines	Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • recover structure and function; and • that the feature surface will remain sufficiently unobscured for the purposes of determining whether the above criteria are satisfied.

5.6.3. Potential Effects During Operation

5.6.3.1. PERMANENT BENTHIC HABITAT / SPECIES LOSS OR DISTURBANCE

Table 5.10 Firth of Forth Banks Complex ncMPA: Other plans and projects with potential for cumulative effects of permanent benthic habitat / species loss or disturbance during the operation and maintenance of the Marine Scheme

Development	Total Area of Permanent Habitat Disturbance Within the MPA (km^2) (% of the MPA area)	Source
Marine Scheme	0.23 (0.01%)	Section 5.4.2
BBWF	1.96 (0.0.09%)	BBWFL (2022)
Seagreen 1	1.03 (0.05%)	Marine Scotland (2014c)
Seagreen 1A Project	Not specified in the EIA Report or MPA Assessment	Marine Scotland (2014c) Seagreen Wind Energy Ltd. (2021)
Total	**3.22 (0.15%)**	

323. All developments listed in Table 5.10 which met the CEA criteria may result in some permanent habitat and species loss and/or disturbance. These developments have been considered

cumulatively here. For the purposes of this assessment, the full extent of cumulative material is assumed to be placed within the ncMPA[14].

324. During the operation and maintenance phase of the Marine Scheme, there is the potential for cumulative impacts with the BBWF, a proposed offshore wind farm in the outer Firth of Forth, as described above. There may be up to 1.96 km^2 of hard substrate installed within the Berwick Bank and Scalp and Wee Bankie parts of the ncMPA, the boundary of which directly overlaps the Marine Scheme and the operation phases of both projects are anticipated to overlap. The BBWF MPA assessment concluded that in combination with the Seagreen 1 and Seagreen 1A projects, there was no risk to hindering the conservation objectives of the site.

325. The Offshore EIA Report and MPA Assessment undertaken for Seagreen 1 and Seagreen 1A does not quantify the long term habitat loss specifically attributable to the presence of the Seagreen 1A cable protection. The MPA Assessment undertaken for these developments assumes that the Seagreen 1A cable protection will be 6 m wide and may cover up to 20% of the 110 km offshore export cables, not all of which will be installed within the ncMPA. The impact of permanent habitat loss is highly localised/occur in discrete locations across the Scalp and Wee Bankie and Montrose Bank areas, and therefore the area of impact from long term habitat loss as a result of the Seagreen 1A Export Cable Corridor will be small. NatureScot, therefore, acknowledged that although the works would be capable of affecting these features of the MPA, any effects would be insignificant and that no further assessment of the MPA was required.

326. With up to 3.22 km^2 of hard substrate in place within the ncMPA, this will constitute a reduction in the subtidal sands and gravels habitat feature, and subsequently habitat available to ocean quahog within the ncMPA, of only 0.16%.

327. If all of the cumulative permanent habitat loss across the four projects was located within the Scalp and Wee Bankie section of the ncMPA, this would equate to a spatial reduction in available subtidal sand habitat of approximately 0.39%. If all of the BBWF and Marine Scheme permanent habitat loss was located within the Berwick Bank section of the nMPA (noting that Seagreen and Seagreen 1A do not overlap this part), this would equate to a cumulative permanent loss of habitat of approximately 0.4% for this part of the ncMPA. As the Marine Scheme does not overlap the Montrose Bank part, there will be no cumulative impact in that component of the MPA.

328. As set out within the environmental assessments undertaken for BBWF, long term habitat loss and habitat alteration resulting from the BBWF construction and operation and maintenance phase will not lead to a significant risk of hindering the achievement of the overall conservation objective for the offshore subtidal sands and gravels (i.e. “recover to favourable condition”) feature of the Firth of Forth Banks Complex MPA.

329. Given the small proportions of habitat loss described here, and considering that this represents a greater proportion of habitat loss than will be realised as cable protection will be minimised as far as practicable and is unlikely to be wholly located within the ncMPA (as assumed above), the extent and distribution of offshore subtidal sands and gravels feature will be largely maintained within the ncMPA. The wider extent of this sediment feature within the ncMPA will be unaffected during the operation and maintenance phase and provide suitable habitat for the associated soft-sediment biotopes. This is consistent with the ‘conserve’ objective of the extent and distribution attribute for this feature.

330. The characteristic communities associated with this feature will be maintained across the ncMPA following the placement of cable protection, as only a small proportion of this habitat (0.015%) will

[14] However, the use of cable protection materials will be minimised as far as practicable, and are likely to be employed in areas of relatively harder substrate that do not allow burial and will be non-continuous in nature.

be affected in discrete locations. Due to these localised impacts and the wide extent of this feature, the characteristic communities are likely to be maintained throughout the feature.

331. As a result of the extent of the worst-case spatial overlap assessed, it can be concluded that cumulative permanent benthic habitat / species loss will not lead to a significant risk of hindering the achievement of the conservation objectives for any feature of the Firth of Forth Banks Complex ncMPA (Table 5.11).

Table 5.11 CEA of the Firth of Forth Banks Complex ncMPA for permanent benthic habitat / species loss – Operation and maintenance phase.

Protected Feature	Conclusion
Subtidal sands and gravels	Up to 3.22 km^2 of cumulative permanent habitat/ species loss to this feature. This equates to 0.16% of entire feature across the ncMPA. A small proportion of the feature will be impacted with maintenance of the extent and distribution of the vast majority of the feature, both across the ncMPA and within its component parts. Large areas of the site will be unaffected which will enable the feature to persist. The impact to the hydrodynamic regime will be negligible and thus no alteration to the topography or sediment composition of the feature is expected. Sediment composition will be maintained and biological communities within footprint of activities will recover. Temporary disturbance only to spawning grounds. No significant impact to the hydrodynamic regime. The characteristic communities at a population level will not be impacted as the majority of available habitat will be maintained. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • recover structure and function; and • conserve supporting processes.
Ocean quahog aggregations	Ocean quahog habitat within the ncMPA is the subtidal sands and gravels feature. As such, the extent of habitat loss and negligible effects to hydrodynamic regime are as described above. A small proportion of the feature will be impacted with maintenance of the extent and distribution of the vast majority of the feature, both across the ncMPA and within its component parts. The structure of the ocean quahog aggregations is dependent on the continued ability of ocean quahog to reproduce at the site. The small proportion of habitat loss will not result in any long term impacts upon ocean quahog or affect their ability to reproduce in the area as >99% of suitable habitat will be maintained. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structure and function; and • conserve supporting processes.
Shelf banks and mounds	The scale of the cumulative habitat loss will not be sufficient to affect the prevailing hydrodynamic regime or sediment transport processes. As such there will be no change to the seabed morphology. The ecological aspects of this feature would likewise be only minorly affected and be maintained in the vast majority of unaffected habitat. Cumulatively, the projects will not hinder the conservation objective to:

Protected Feature	Conclusion
	• conserve extent and distribution; • conserve structure and function; and • conserve supporting processes.
Wee Bankie Geodiversity Area - moraines	A small proportion of the feature will be impacted and will not hinder the maintenance of the vast majority of this feature. There will be no overall loss of the geodiversity feature's extent or distribution as no sediment will be removed from the system. Likewise, as the hydrodynamic regime will not be altered, the function of the feature as a site of scientific study of deglacial history, and the vast majority of habitat for biological communities will be maintained. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • recover structure and function; and • that the feature surface will remain sufficiently unobscured for the purposes of determining whether the above criteria are satisfied.

5.6.3.1.1. INCREASED SUSPENDED SEDIMENT CONCENTRATIONS (SSC) AND ASSOCIATED DEPOSITION

Table 5.12 Firth of Forth Banks Complex ncMPA: Other plans and projects with potential for cumulative effects of increased SSC and associated deposition during operation and maintenance of the Marine Scheme

Development	Development phase	Source
Marine Scheme	Operation and maintenance	Section 5.4.2
BBWF	Construction, Operation and maintenance	BBWFL (2022)
Seagreen 1	Operation and maintenance	Marine Scotland (2014b)
Seagreen 1A	Operation and maintenance	Marine Scotland (2014b), Seagreen Wind Ltd (2021)
Inch Cape Offshore Wind Farm	Construction, Operation and maintenance	Inch Cape Offshore Limited (ICOL) (2018)
Neart Na Gaoithe Offshore Wind	Operation and maintenance	Mainstream Renewables Power (2019)
Eastern Green Link 2 (EGL2)	Operation and maintenance	NGET & SHE Transmission plc (2022)

332. All developments listed in Table 5.12 which met the CEA criteria may result in some temporary increases in SSC and subsequent deposition during the operation and maintenance phase of the Marine Scheme. These developments have been considered cumulatively here.

333. The neighbouring projects of Inch Cape offshore wind farm and Neart na Gaoithe offshore wind farm do not spatially overlap with the Firth of Forth Banks Complex MPA (located 1.24 km and 3.22

km from the Firth of Forth Banks Complex MPA, respectively). They do, however, have the potential to overlap temporally with the Proposed Development and have therefore been considered within the cumulative assessment for increased SSC.

334. During the operation and maintenance phase, the Marine Scheme will temporally overlap with the end of the construction phase and the operation and maintenance phase of the BBWF, and the operation and maintenance phase of the Seagreen 1 OWF, and Seagreen 1A and EGL2 transmission cables.

335. The projects in their operational phases will undertake periodic maintenance activities which may result in increased suspended sediment concentrations, however these activities would be of limited spatial extent and frequency and unlikely to interact with sediment plumes from the Marine Scheme.

336. As discussed in section 5.6.2, the MPA assessment undertaken for the Seagreen 1 and Seagreen 1A Project, together, concluded that the project was only capable of affecting, other than insignificantly, the ocean quahog aggregations and offshore subtidal sand and gravel protected features of the Firth of Forth Banks Complex MPA. The shelf banks and mounds and the Wee Bankie Key Geodiversity Area (Moraines) designated features have, therefore, not been considered in relation to the cumulative temporary habitat disturbance associated with the Seagreen 1 and Seagreen 1A Project.

337. The ocean quahog aggregation habitat feature is not being considered for this pressure because FeAST and MarESA both find ocean quahog to be not sensitive to changes in to changes in SSC and the associated deposition due to their ability to burrow back to the surface following sediment deposition.

338. The low sensitivities of the biological attributes of the protected features to increases in SSC and associated sediment deposition is as described in section 5.6.2 and are not expected to be greater either for the SSC generated during construction activities for of the BBWF (~ 3 years), Inch Cape OWF and EGL 2 cable and for intermittent generation of SSC associated with maintenance activities across the Marine Scheme, BBWF (following construction), Seagreen 1A cable, Seagreen 1 OWF, Inch Cape OWF and Neart ne Gaoithe OWF.

339. As the physical and biological attributes of this protected feature will be preserved in this phase of the Proposed Development it is unlikely that the function will be compromised therefore any potential affect will the same as described in the project alone assessment.

340. The magnitude of SSC production and associated deposition during the operation and maintenance phase of the Marine Scheme will be reduced to that of the construction phase, both in terms of project alone and cumulatively with the identified other developments, as they too will progress over time into their operation and maintenance phases.

341. It can be concluded that cumulative increases in SSC and associated deposition during the Marine Scheme operation and maintenance phase will not lead to a significant risk of hindering the achievement of the conservation objectives for any feature of the Firth of Forth Banks Complex ncMPA (Table 5.13).

Table 5.13 CEA of the Firth of Forth Banks Complex ncMPA for increased SSC and associated deposition – Operation and maintenance phase.

Protected Feature	Potential impact
Subtidal sands and gravels	The cumulative increases in SSC and subsequent deposition are predicted to temporarily affect a small proportion of the feature across all parts of the ncMPA during the construction phase. Sediment composition will be maintained, and characteristic biological communities will recover following construction activities. Temporary disturbance only to spawning grounds. No significant impact to the hydrodynamic regime. Cumulatively, the projects will not hinder the conservation objective to:

Protected Feature	Potential impact
	• conserve extent and distribution; • recover structure and function; and • conserve supporting processes.
Ocean quahog aggregations	Ocean quahog are highly tolerant of increases in SSC and associated deposition. The small extent and temporary nature of SSC will not impact the population. Construction activities will lead to mortality of individuals within the disturbance footprint. The extent and duration is not sufficient for a population level effect. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structure and function; and • conserve supporting processes.
Shelf banks and mounds	Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structure and function; and • conserve supporting processes.
Wee Bankie Geodiversity Area - moraines	Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • recover structure and function; and • that the feature surface will remain sufficiently unobscured for the purposes of determining whether the above criteria are satisfied.

5.6.3.1.2. EMF EFFECTS

342. Based on the information provided in the project alone assessment (section 5.5.2) the spatial extent of thermal and EMF impacts are highly localised to the immediate proximity of the operational cables. Given this similarity in magnitude, both pressures are assessed here together.

Table 5.14 Firth of Forth Banks Complex ncMPA: Other plans and projects with potential for cumulative effects of EMF and thermal emissions during the operation and maintenance of the Marine Scheme

Development	Total Length of Cable Within the MPA (km)	Source
Marine Scheme	160 (total assuming 4 40 km long cables)	Section 5.4.2
BBWF	527	BBWFL (2022)
Seagreen 1	346	Marine Scotland (2014c)
Seagreen 1A Project	Not specified in the EIA Report or MPA Assessment	Marine Scotland (2014c) Seagreen Wind Energy Ltd. (2021)
Total	**1033**	

343. All developments listed in Table 5.14 which met the CEA criteria may result in localised increases in EMF and thermal emissions. These developments have been considered cumulatively here.

344. This impact only relates to potential alterations to the ecology of the ncMPA, namely ocean quahog aggregations and fauna associated with offshore subtidal sands and gravels and shelf banks and mounds features. As there is no physical change associated with this pressure, there is no impact pathway between thermal emissions and the protected large-scale geological feature of the Wee Bankie Geodiversity Area.

345. Table 5.14 shows the cumulative length of cable within the Firth of Forth Banks Complex MPA which is directly linked to the potential area impacted by EMF and thermal emissions. For the purposes of this assessment, the full extent of cumulative material is assumed to be placed within the ncMPA[15].

346. The BBWF and Seagreen 1 and Seagreen 1A projects are expected to install 873 km of cables within the Firth of Forth Banks Complex MPA, including a combination of inter-array and offshore export cables.

347. The BBWF cables may be installed within the Berwick Bank and Scalp and Wee Bankie parts of the ncMPA, the boundary of which directly overlaps the Marine Scheme and the operation phases of both projects are anticipated to overlap. The Seagreen 1 project overlaps both the Montrose Bank and Scalp and Wee Bankie parts of the ncMPA. However, for the purposes of this assessment it is assumed that the full extent of installed cables for Seagreen 1 and Seagreen 1A are located in the Scalp and Wee Bankie. The Marine Scheme export cables will represent an additional 160 km of cable (15% of cumulative cable extent) in one or both of the Scalp and Wee Bankie and Berwick Bank parts of the ncMPA.

348. The effects of EMFs on benthic communities are not well understood, however, recent studies suggest that benthic communities growing along cable routes are similar to those in nearby baseline areas, and where species are not found this is likely due to the physical presence of the cable and surface properties, rather than an EMF effect (Copping and Hemery, 2020).

349. Given the overlap with the BBWF array area, it is likely that the Marine Scheme Offshore Export Cables and BBWF cables (inter array, interconnector and export) will be in close proximity for this section of the Marine Scheme, however it is assumed that there will not be any crossings of the BBWF cables. While there is potential for some cumulative impact between the Marine Scheme and BBWF, the extent of EMF effects will be within close proximity of the source, likely within 10-20 m prior to decaying to natural GMF (as is the case for the Marine Scheme; section 5.5.2). Therefore, even when other development cables are in close proximity to the Marine Scheme the extent of impact is limited. Consequently, the magnitude of impact is considered to be the same as for the Marine Scheme assessment alone.

350. Thermal emissions can modify physical and chemical properties of the seabed, resulting in a development of microorganism communities and/or result in displacement of demersal mobile organism (Taormina *et al*., 2018). It is expected that the zone of influence from any thermal radiation will be limited to the immediate vicinity of each cable and that heat will dissipate relatively rapidly. Indeed, considering the composition of the offshore sands and gravels, including that of the shelf banks and mounds feature, it is likely that the increase in temperature within the sediments will be highly localised to the source, only impacting a small proportion of the available infaunal biotopes across the ncMPA, but for the duration of the operational lifetime of the project.

351. Due to the localised effects of EMF and thermal emissions, the sensitivities of the ncMPA features described for the project alone assessment (section 5.5.2) also apply for the cumulative assessment. The extent of any increases in EMF and thermal emission associated with the Marine Scheme is very spatially limited and is not expected to result in a widespread effect on the

[15] However, the use of cable protection materials will be minimised as far as practicable, and are likely to be employed in areas of relatively harder substrate that do not allow burial and will be non-continuous in nature.

characteristic communities of the subtidal sands and gravels feature. Based on the information presented here, it can be concluded that cumulative increases in EMF and thermal emissions during operation will not lead to a significant risk of hindering the achievement of the conservation objectives for any feature of the Firth of Forth Banks Complex ncMPA (Table 5.15).

Table 5.15 CEA of the Firth of Forth Banks Complex ncMPA for EMF and thermal emissions – Operation and maintenance phase.

Protected Feature	Conclusion
Subtidal sands and gravels	The cumulative impact to the characteristic communities of the sands and gravels feature is expected to be highly localised. The key and influential species are not predicted to be affected by the EMF emitted by electrical cables based on current research. Similarly, thermal emissions will rapidly dissipate and any change to infaunal composition will be restricted to the sediment immediately adjacent to the cables. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • recover structure and function; and • conserve supporting processes.
Ocean quahog aggregations	Ocean quahog are considered to be unaffected by EMF, although this field is still developing and has yet to evaluate in detail the impact of EMF on molluscs. The burrowing behaviour of ocean quahog (top few centimetres of sediment) is unlikely to result in interaction with thermal emissions from buried cables and no population level impacts are predicted. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structure and function; and • conserve supporting processes.
Shelf banks and mounds	As for the sands and gravels feature, the cumulative impact to the characteristic communities of the sands and gravels substrate is expected to be highly localised. The key and influential species are not predicted to be affected by the EMF emitted by electrical cables based on current research. Similarly, thermal emissions will rapidly dissipate and any change to infaunal composition will be restricted to the sediment immediately adjacent to the cables. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structure and function; and • conserve supporting processes.

5.6.3.1.3. COLONISATION OF HARD STRUCTURES AND INTRODUCTION OF INNS

352. All developments listed in Table 5.10 for permanent habitat/ species loss, which met the CEA criteria may introduce additional hard substratum which may be colonised by benthic organisms. These developments have been considered cumulatively here.

353. This impact only relates to potential alterations to the ecology of the ncMPA, namely fauna associated with the offshore subtidal sands and gravels feature, shelf banks and mounds and ocean quahog aggregations. As there is no physical change associated with this pressure, noting that habitat loss and changes to physical processes are assessed separately, there is no impact pathway between colonisation of hard infrastructure and the protected large-scale geological feature of the Wee Bankie Geodiversity Area

354. Colonisation is likely to occur on all infrastructure installed within these developments. The Marine Scheme will introduce up to 0.23 km^2 of cable protection to the site where burial is not achievable. For the BBWF, and Seagreen 1/ Seagreen 1A projects, colonisation of hard substrate may result from wind turbine generator foundations, offshore substation and meteorological mast foundations (if required), scour protection and cable protection. As a result the amount of hard substrate available for colonisation is likely to be similar to the estimate of long term habitat loss of 3.22 km^2, equating to 0.15% of the total ncMPA.

355. As discussed above, novel habitat created by Seagreen 1 and Seagreen 1A Project will be located within both Scalp and Wee Bankie and Montrose Bank. Neither BBWF or the Marine Scheme coincide with Montrose Bank therefore there will be no cumulative impact in that component of the MPA.

356. The project alone assessment for the BBWF, of which the Marine Scheme overlaps in its entirety, concluded that colonisation of hard substrate will not impact upon the biological features of the ncMPA. As discussed for the Marine Scheme project alone assessment, the key influential species of the subtidal sands and gravels feature, including ocean quahog, are unlikely to be affected by the biological communities which will colonise the hard structures of the BBWF. This is because the communities which will colonise the hard structures will be epilithic and therefore unlikely to colonise the sedimentary habitat which is occupied by the key and influential species, removing the potential for competition. Whilst some reef effects may result in expansion of taxa normally associated with hard substrates colonising areas of subtidal coarse sediment or subtidal sand, these effects are likely to be limited to the immediate vicinity of offshore structures and will not result in changes to the species composition of communities associated with the offshore subtidal sands and gravels feature across the wider MPA.

357. The novel habitat provided by offshore structures could also play a role in providing so-called ‘stepping-stones’ for INNS, by which geographical barriers to species dispersal might be passed (Adams *et al.,* 2014). No INNS were identified in the ncMPA through the BBWF or Marine Scheme Offshore Export Cable Corridor surveys (BBWFL, 2023; ES, Volume 3, Appendix 8:1: Benthic Survey Report (Phase 1 and 2)). Therefore, the risk of the spread of any existing INNS is considered to be low. The small scale of the Marine Scheme cable protection would not represent a significant increase in risk of INNS introductory or spread to the ncMPA.

358. The BBWF assessed the cumulative risk of colonisation of hard structures to the ncMPA including consideration of the Seagreen 1, Seagreen 1A projects. The effects of the colonisation of cumulative hard substrates were concluded to very similar to the project BBWF alone assessment due to the same type of habitat being additionally provided by Seagreen 1 and Seagreen 1A projects. The cumulative assessment concluded in combination, colonisation of hard structures during the operation and maintenance phases of the BBWF, Seagreen 1 and Seagreen 1A projects will not lead to a significant risk of hindering the achievement of the conservation objectives.

359. The addition of up to 0.23 km^2 of cable protection material available for colonisation by the Marine Scheme, in discrete locations, will not be of sufficient extent to increase the risk to the protected features of the site through reef effects, competition for resource or INNS. It can be concluded that cumulatively the developments will not lead to a significant risk of hindering the achievement of the conservation objectives for any feature of the Firth of Forth Banks Complex ncMPA (Table 5.16).

Table 5.16 CEA of the Firth of Forth Banks Complex ncMPA for colonisation of hard structures and INNS – Operation and maintenance phase.

Protected Feature	Conclusion
Subtidal sands and gravels	The cumulative colonisation of hard structures is predicted to have a near negligible effect on the offshore subtidal sands and gravels feature. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • recover structure and function; and • conserve supporting processes.
Ocean quahog aggregations	Cumulative colonisation of hard structures is predicted to have a near negligible effect on the suitable habitat for ocean quahog during the operation and maintenance phase. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structure and function; and • conserve supporting processes.
Shelf banks and mounds	The cumulative colonisation of hard structures is predicted to have a near negligible effect on the offshore subtidal sands and gravels feature that make up the sediment of this feature, and thus support the same communities. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structure and function; and • conserve supporting processes.

5.6.3.1.4. CHANGES IN PHYSICAL PROCESSES FROM CABLE PROTECTION MEASURES DURING OPERATION.

Table 5.17 Firth of Forth Banks Complex ncMPA: Other plans and projects with potential for cumulative effects of changes in physical processes during operation and maintenance of the Marine Scheme

Development	Development phase	Source
Marine Scheme	Operation and maintenance	Section 5.4.2
BBWF	Operation and maintenance	BBWFL (2022)
Seagreen 1	Operation and maintenance	Marine Scotland (2014b)
Seagreen 1A	Operation and maintenance	Marine Scotland (2014b), Seagreen Wind Ltd (2021)
Inch Cape Offshore Wind Farm	Operation and maintenance	Inch Cape Offshore Limited (ICOL) (2018)
Neart Na Gaoithe Offshore Wind	Operation and maintenance	Mainstream Renewables Power (2019)
Eastern Green Link 2 (EGL2)	Operation and maintenance	NGET & SHE Transmission plc (2022)

360. All developments listed in Table 5.17 which met the CEA criteria may result in some changes to the tidal, wave and sediment transport regimes during the operation and maintenance phase of the Marine Scheme. These developments have been considered cumulatively here.

361. The neighbouring projects of Inch Cape offshore wind farm and Neart na Gaoithe offshore wind farm do not spatially overlap with the Firth of Forth Banks Complex ncMPA (located 1.24 km and 3.22 km from the Firth of Forth Banks Complex MPA, respectively). They do, however, have the potential to overlap temporally with the Marine Scheme and have therefore been considered within the cumulative assessment for changes in physical processes.

362. Assessment of the changes to the tidal and sediment transport regimes in relation to the Marine Scheme in isolation (section 5.5.2), is considered to be minor as a result of the Marine Scheme with no risk of hindering the conservation objectives of the site. There is the potential for the nearby developments to act cumulatively with the Marine Scheme during shared operational periods with respect to changes to tide, wave and sediment transport regime from blockage resultant from nearby cables, seabed structures and associated protection measures.

363. The environmental assessments for the BBWF and Seagreen 1 OWF concluded that changes to wave and tidal climate are minimal and will only result in impacts in the immediate vicinity of infrastructure and will be reversed following decommissioning (following the removal of the wind turbine/OSP-Offshore convertor station platform foundations). With respect to the BBWF with fixed structures, the relative separation of the foundation structures is such that the development as a whole is unlikely to cause a blockage to the progression of flows and waves as presented in BBWFL (2022). The Seagreen 1 offshore wind farm is approximately 5 km from the Marine Scheme, with the potential for blockage effects being less than that described for the BBWF. Overall, it is considered that there is little to no pathway for connectivity between the offshore wind farm structures and Marine Scheme and is therefore unlikely to give rise to effects sufficient to alter the hydrodynamic regime of the site, so these nearby projects are not considered further.

364. With respect to the nearby cable projects Seagreen 1A and EGL2 and Inch Cape OFT, and the inter array, interconnector, and export cables of the BBWF, including any applied cable protection, it can be assumed that the potential changes to the tidal and sediment transport regimes as a result of blockage are of a similar nature to the Marine Scheme, on the basis that similar protection would be applied. As described above, the BBWF, which overlaps the Marine Scheme within the ncMPA, concluded that the project, including up to 1.24 km^2 of cable protection within the ncMPA, would not.

365. lead to a significant risk of hindering the achievement of the overall conservation objectives of the ncMPA (BBWFL, 2022). The limited potential cable protection that could be installed for the Marine Scheme within the ncMPA (0.23km^2) would not give rise to effects sufficient to alter the hydrodynamic regime of the site. As a result, it is not anticipated that there would be any cumulative changes to the tidal regime as the assessment of blockage effects in relation to the protection proposed for the Marine Scheme with no disruption to flow conditions.

366. With respect to the potential for changes to sediment transport, as there is no change to flows there is not considered to be any onward changes to the sediment transport potential. In terms of the potential for blockage to sediment transport, the presence of the berm on the seabed at the outset will act as a localised sink. With time, and as the voids fill, sediment would ultimately bypass the protection berm with no change in the medium to long-term sediment transport regime. As determined for the Marine Scheme, the same is again considered to be applicable to any protection berms applied to the operational cumulative projects.

367. The results of the cumulative assessment in terms of the changes to the tidal and sediment transport regimes indicate no further impact to the tidal regime and as a result no anticipated change to the sediment transport regime. Based on the information presented here, it can be concluded that cumulative changes in physical processes from cable protection measures during operation will not lead to a significant risk of hindering the achievement of the conservation objectives for any feature of the firth of forth banks complex ncMPA (Table 5.18).

Table 5.18 CEA of the Firth of Forth Banks Complex ncMPA for changes to physical processes – Operation and maintenance phase.

Protected Feature	Potential impact
Subtidal sands and gravels	No further impact to hydrodynamic and sediment transport regimes are expected. The cumulative alteration of seabed habitat arising from changes to physical processes is predicted to affect a small proportion of the offshore subtidal sands and gravels feature during the operation and maintenance phase. Sediment composition and topography will be maintained and so too the habitat for the characteristic communities. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • recover structure and function; and • conserve supporting processes.
Ocean quahog aggregations	No further impact to hydrodynamic and sediment transport regimes are expected. As for sands and gravels, the cumulative alteration of seabed habitat arising from changes to physical processes is predicted to affect a small proportion of the offshore subtidal sands and gravels feature during the operation and maintenance phase. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structure and function; and • conserve supporting processes.
Shelf banks and mounds	Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structure and function; and • conserve supporting processes.
Shelf banks and mounds	No further impact to hydrodynamic and sediment transport regimes are expected. As for sands and gravels, the cumulative alteration of seabed arising from changes to physical processes is predicted to affect a small proportion of the feature during the operation and maintenance phase. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structure and function; and • conserve supporting processes.
Wee Bankie Geodiversity Area - moraines	No further impact to hydrodynamic and sediment transport regimes are expected. As for sands and gravels, the cumulative alteration of seabed arising from changes to physical processes is predicted to affect a small proportion of the feature during the operation and maintenance phase. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • recover structure and function; and • that the feature surface will remain sufficiently unobscured for the purposes of determining whether the above criteria are satisfied.

6. MCZ Assessment - Farnes East MCZ

6.1. Introduction

368. The Farnes East MCZ, which was designated in January 2016, is located in English territorial and offshore waters off the Northumberland coast, covering a total area of approximately 945 km^2. The site is designated for five broadscale marine habitats; moderate energy circalittoral rock, subtidal coarse sediment, subtidal sand, subtidal mud, subtidal mixed sediments, as well as seapen and burrowing megafauna communities and ocean quahog (*Arctica islandica*) (Figure 10).

369. At its closest point the MCZ is located 0.07 km west of the Marine Scheme.

6.2. Baseline

370. The seabed is predominantly composed of subtidal sediments with a scattering of small patches of moderate energy circalittoral rock. The shallower areas of the site, in the west, are dominated by subtidal coarse sediment and subtidal mixed sediments, while the eastern side is largely subtidal sand. A section of the Farnes Deep glacial trench occurs within the site boundary. The trench, which is the deepest part of the MCZ, contains subtidal mud.

371. The site specific surveys for the Marine Scheme recorded '*Paramphinome jeffreysii, Thyasira* spp. and *Amphiura filiformis* in offshore circalittoral sandy mud' (SS.SMu.OMu.PjefThyAfil) were recorded in the majority of stations adjacent to the Farnes East MCZ, with the exception of two stations recording 'Offshore circalittoral mixed sediment' SS.SMx.OMx in stations close to the south east corner of the MCZ (ES, Volume 3, Appendix 8:1: Benthic Survey Report (Phase 1 and 2)). This is in keeping with the sediments characteristic of the MCZ and the wider region.

372. The SS.SMu.OMu.PjefThyAfil biotope is typically found in deep, offshore cohesive sandy mud, but in areas of the North Sea, this biotope has been observed in sediments with a coarse material components. Communities are characterised by polychaete *Paramphinome jeffreysii*, bivalves such as *Parathyasira equalis* and *Thyasira gouldi* and the brittlestar *Amphiura filiformis*. Other taxa may include holothurians and polychaetes (JNCC, 2022)

373. The sedimentary habitats in the Farnes East MCZ also support ocean quahog. This species is a designating feature of the MCZ. The ocean quahog is also an OSPAR Threatened and/or Declining species and a species Feature of Conservation Importance listed on the Ecological Network Guidance (ENG). Previous surveys within the Farnes East MCZ have identified individuals of ocean quahog (mostly juveniles) predominately in the east and southwest of the site (Defra, 2015a). Singular ocean quahog were recorded at three sample locations within the Marine Scheme Offshore Export Cable Corridor (ES, Volume 3, Appendix 8:1: Benthic Survey Report (Phase 1 and 2)), noting that these sampling stations are located wholly outside of the Farnes East MCZ.

374. Two species of seapen; slender seapen (*Virgularia mirabilis*) and phosphorescent seapen (*Pennatula phosphorea*) have been observed living on the mud habitat in the MCZ. Norway lobster (*Nephrops norvegicus*) are also present within the deep mud habitat, constructing burrows and mainly emerging in the evening to feed. As a result, as well as being designated for the broad-scale habitat subtidal mud, the habitat feature of conservation importance; seapen and burrowing megafauna communities, is also protected in Farnes East MCZ. This habitat is also designated on the OSPAR List of Threatened and/or Declining Species and Habitats. Previous survey data within the Farnes East MCZ have recorded limited observations of this habitat predominantly located in patches of subtidal mud in the south east of the MCZ. An individual phosphorescent seapen was recorded from a single grab sample, and no Norway lobster were retrieved from this section of the Marine Scheme (ES, Volume 3, Appendix 8:1: Benthic Survey Report (Phase 1 and 2)). Potential Annex I stony reef was observed via DDV at one station close to the south-east corner of the MCZ, however it was composed of cobbles with relatively low percentage cover and was assessed as 'low' stony reef.

375. Within the Marine Scheme Offshore Export Cable Corridor in proximity to the Farnes East MCZ, no stations exceeded the thresholds for heavy metals for the relevant Cefas AL1 or AL2 thresholds or Canadian TEL thresholds. No stations exceeded the Canadian Interim Sediment Quality Guideline (ISQG) thresholds for all 13 PAHs and Total Hydrocarbon Content (THC) levels were generally low across the survey area (see Volume 3, Appendix 8.1: Phase 1 and Phase 2 Survey Reporting).

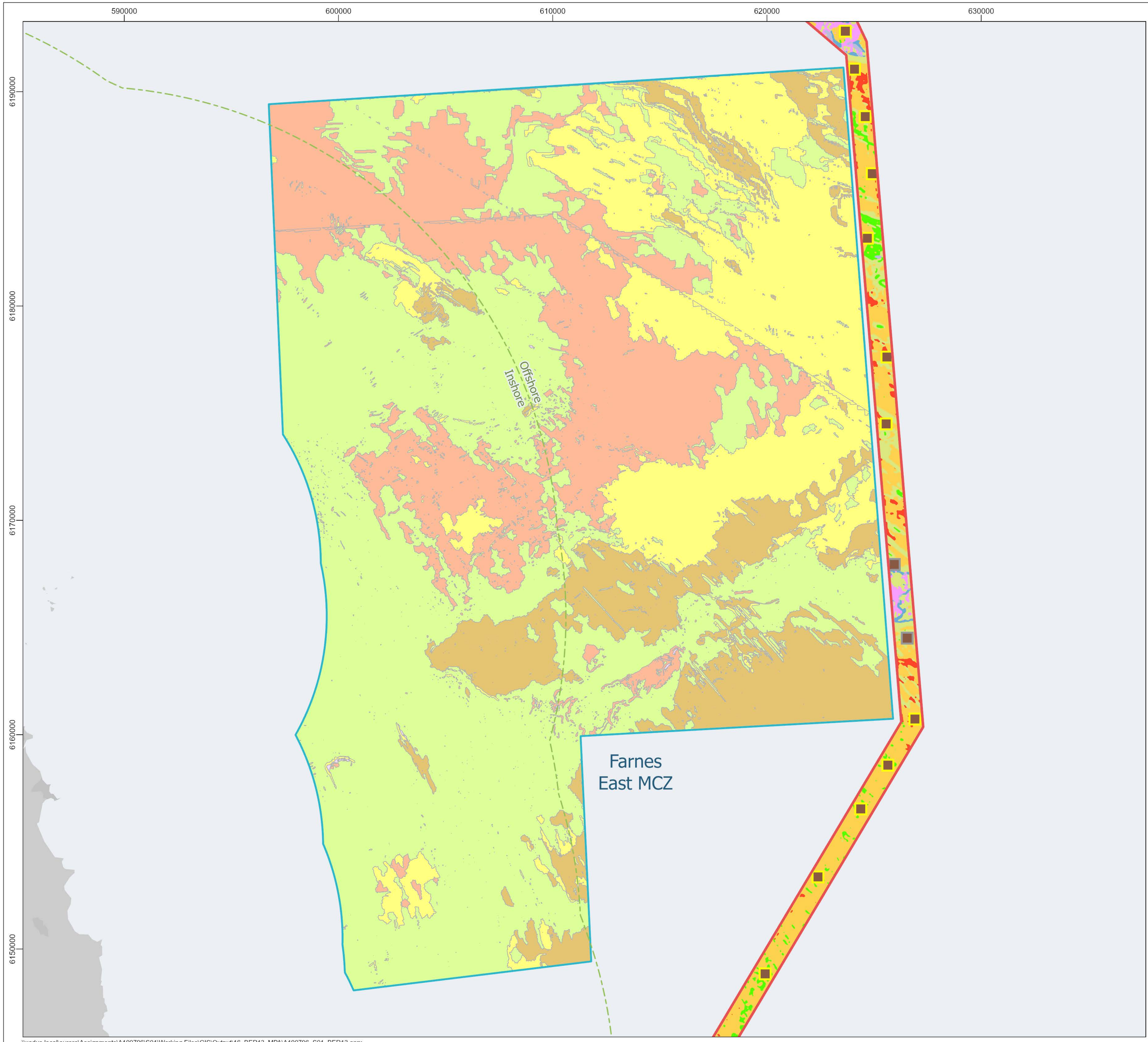
376. The baseline understanding associated with the Farnes East MCZ has significantly improved over the last decade. Surveys carried out by Cefas in 2012 (Hawes) and 2014 (McIlwaine, 2015) and JNCC (Defra, 2015a) advanced the understanding of the extent of broadscale habitats beyond the findings within the original Site Assessment Document (SAD) (NetGain, 2011).

377. Whilst the site was visited previously between 2012 and 2014, the aim of these surveys focussed on site verification. More recent surveys in 2018 (Wood *et al*, 2020) were focused on the acquisition of sentinel monitoring (Type 1 monitoring) data to contribute to the development of a monitoring time-series for the Farnes East MCZ.

378. Based on the nature of the protected features, there is considered to be no notable seasonal temporal change, as with the Firth of Forth Banks Complex ncMPA. Notwithstanding, a strong base of evidence indicates that long term changes in the benthic ecology may be related to long term changes in the climate or in nutrients, as explained above. Benthic communities are also predicted to be influenced by anthropogenic activities including contamination or seabed disturbing activities such as trawling, dredging and development (Krönke, 1995). Anthropogenic activity including fisheries has also been identified as a key pressure for the site which has led to an ongoing review of potential management measures associated with fisheries and licensable activities and also independent advice on the management of the site which has identified fisheries pressures (JNCC, 2011; JNCC, 2023).

379. Between 06 July 2022 and 28 September 2022, Defra carried out an open consultation regarding Highly Protected Marine Areas (HPMAs), which are defined as areas of the sea that allow the protection and recovery of marine ecosystems by prohibiting ‘extractive, destructive and depositional uses and allowing only non-damaging levels of other activities to the extent permitted by international law’ (Benyon Review, 2021; Defra, 2023). The candidates were two territorial sites, Allonby Bay (located in the Irish Sea) and Lindisfarne (located in the Northern North Sea), and three offshore sites, North East of Farnes Deep (also located in the Northern North Sea), Inner Silver Pit South (located in the Southern North Sea) and Dolphin Head (located in the Eastern Channel). North East of Farnes Deep (encompassing an area of approximately 492 km^2) was designated as a Highly Protected Marine Area (HPMA) on 14 June 2023 through the provisions of the Marine and Coastal Access Act 2009. HPMAs have the highest level of pretction in English waters. As such, all extractive, destructive and depositional uses are prohibited within the North Rast of Farnes HPMA. Through the designation of the North East of Farnes Deep HPMA, there may be a ‘squeeze’ effect whereby other users of the sea are required to use waters within the Farnes East MCZ. Farnes East HMPA is located approximately 14 km east of the Marine Scheme, outwith the study area for the MPA and MCZ assessment. As such, the HPMA is not considered further here.

380. The baseline described for the ncMPA and MCZ Assessment is a 'snapshot' of the present benthic ecosystem within a gradual yet continuously changing environment. Any changes that may occur during the design life span of the Marine Scheme should be considered in the context of both greater variability and sustained trends occurring on national and international scales in the marine environment.



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Legend

- Marine Scheme Boundary
- MCZ (Marine Conservation Zone)

MCZ Protected Features (Natural England, 2023)

- Moderate energy circalittoral rock (A4.2)
- Subtidal coarse sediment (A5.1)
- Subtidal sand (A5.2)
- Subtidal mud (A5.3)
- Subtidal mixed sediments (A5.4)

Folk Sediment Classification (Cambois)

- Muddy Sand
- Muddy Sandy Gravel

Cambois Survey Biotopes

- SS.SCS.OCS
- SS.SMu.CSaMu.ThyEten
- SS.SMu.OMu
- SS.SMu.OMu.PjefThyAfil
- SS.SMx.CMx
- SS.SMx.OMx
- SS.SSa.CFiSa.ApriBatPo
- UK 12 Nautical Mile Limit
- Scotland/England Territorial Waters

Rev	Date	Status	Drwn	Chkd	Appd
04	-	-	-	-	-
03	-	-	-	-	-
02	-	-	-	-	-
01	06/07/2023	Issued	TF	NL	EW

sse Renewables

Project

Cambois Connection

Title

Figure 10 Farnes East MCZ and Survey Biotopes

0 1 2 4 6 nm

0 1 2 4 6 8 10 km

N

Scale	Plot Size	Datum	Projection
1:170,000	A3	WGS84	UTM30N

Drawing Number	Sheet No.
A100796_S01_BER13_7	001 OF 001

6.3. Conservation Objectives

381. Key features of the Farnes East MCZ and conservation objectives of those features are summarised in Table 6.1 below.

Table 6.1 Conservation Objectives for the Farnes East MCZ

Protected Feature	Spatial Extent (km^2) and/or presence information	Condition	Conservation Objectives
Broadscale marine habitats			
Moderate energy circalittoral rock	~0.47	Favourable	Maintain in favourable condition
Subtidal coarse sediment	~191.33	Favourable	Maintain in favourable condition
Subtidal mixed sediments	~438.25 Muddy sand and Muddy sandy gravel dominate the Marine Scheme immediately adjacent to the MCZ (ES, Volume 3, Appendix 8:1: Benthic Survey Report (Phase 1 and 2)).	Favourable	Maintain in favourable condition
Subtidal sand	~192.73	Favourable	Maintain in favourable condition
Subtidal mud	~120.79	Unfavourable	Recover to favourable condition
Marine habitat			
Seapen and burrowing megafauna communities	Observed at nine video sampling locations in the south-eastern corner of the MCZ (JNCC, 2015). Observed at 2 stations in the offshore extent of the Marine Scheme site-specific survey, south of the MCZ (ES, Volume 3, Appendix 8:1: Benthic Survey Report (Phase 1 and 2)).	Unfavourable	Recover to favourable condition
Species of marine fauna			
Ocean quahog (*Arctica islandica*)	18 stations throughout the MCZ (JNCC, 2015); 3 stations in the English waters offshore extent of the site-specific survey (ES, Volume 3, Appendix 8:1: Benthic Survey Report (Phase 1 and 2)).	Unfavourable	Recover to favourable condition

382. Subject to natural change, the conservation objective for the he moderate energy circalittoral rock, subtidal coarse sediment, subtidal sand, subtidal mud, subtidal mixed sediments, and seapen and burrowing megafauna communities' features are to remain in or be brought into favourable condition, such that their:

- Extent is stable or increasing; and
- Structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.

383. Subject to natural change, the ocean quahog feature is to remain in or be brought into favourable condition, such that:

- The quality and extent of its habitat is stable or increasing; and
- The population structure allows numbers to be maintained or increased.

384. The Marine Scheme runs perpendicular to the eastern edge of the MCZ and as such there is no direct overlap. For this reason, several pathways for impact on the physical and ecological features have been screened out (see Table 4.3).

6.4. Assessment Information

6.4.1. Impacts Requiring Assessment

- Increased suspended sediment concentrations (SSC) and associated deposition (including mobilisation of potential contaminants) (C & D);
- Increased SSC and associated deposition from cable repairs and reburial (O&M); and
- Colonisation of hard structures (including potential introduction and spread of INNS) (O & M).

6.4.2. Maximum Design Scenario

385. The maximum design scenario(s) summarised here have been selected as those having the potential to result in the greatest effect on key features of the Farnes East MCZ. These scenarios have been selected from the details provided in the EIA Report - ES, Volume 2, Chapter 5: Project Description.

386. Site preparation works, in advance of construction, are predicted to commence in Q4 of 2026 and will continue until all installation activities have ceased. Export cable installation is expected to begin in Q3 2028 and is expected to last until Q4 of 2029. All activities associated with the Marine Scheme are predicted to conclude by the end of 2029. Until detailed design of the Marine Scheme is progressed and further refined pre-construction, this programme for the Marine Scheme as a whole is indicative and is subject to further refinement but is used to inform assessment of construction phase impacts for the Marine Scheme.

387. Given that the maximum design scenario is based on the design option (or combination of options) that represents the greatest potential for change, confidence can be had that development of any alternative options within the design parameters will not give rise to a greater potential of hindering the achievement of the MCZ's conservation objectives than assessed in this report. Table 6.2 presents the maximum design scenario for potential impacts on the Farnes East MCZ during construction, operation and maintenance and decommissioning.

Table 6.2 MDS for Assessment of Effects on the Farnes East MCZ

Potential Impact	Maximum Design Scenario (Marine Scheme whole)	Maximum Design Scenario (English waters)	Justification
Construction and decommissioning			
Increased suspended sediment concentration (SSC) and associated deposition (including mobilisation of potential contaminants)	Maximum duration of the construction phase of up to 39 months.	**English waters:** Seabed preparation: • Pre-lay grapnel run, boulder clearance, route preparation at sandwaves, sea trials (as required), pre-sweep, and pre-installation trenching through harder sediment; • Seabed levelling at sandwaves across a width of 25 m, average height 5 m and clearance along approximately 20% of the Marine Scheme length in English waters (2.8 km^2); Cable installation: • Four Offshore Export Cables, each up to 140 km in length (total 560 km); • Installation using any of the following methods: ploughs (displacement and/or non-displacement), jetting machines, mechanical trenchers, MFE. Of these, MFE has been assumed as the worst case with regards to SSC. Installation mobilises sediments from a 3 m deep and 2.5 m wide trench.	Greatest volume of sediment released into the water column (see ES, Volume 2, Chapter 7). Cable installation by MFE has the greatest potential to increase suspended sediments as this method fluidises the sediment. In some areas, a trench depth of 3 m may not be achieved and therefore the assessment provides the upper bound in terms of suspended sediment and dispersion potential.

Potential Impact	Maximum Design Scenario (Marine Scheme whole)	Maximum Design Scenario (English waters)	Justification
Operation and Maintenance			
Increased SSC and associated deposition		**English waters:** Repair / reburial activities; • Four cable repair events of up to 1 km each across the operation and maintenance phase; and • Four cable reburial events of up to 1 km each across the operation and maintenance phase.	Greatest volume of sediment released into the water column (see ES, Volume 2, Chapter 7). The maximum number of cable repair and reburial events result in the highest frequency of increased suspended sediment concentrations during the operation and maintenance stage.
Colonisation of hard structures (including potential introduction and spread of INNS).	Operation and maintenance phase of up 35 years.	**English waters:** Up to 1.23 km^2 of long term habitat creation due to: • Up to 1.18 km^2 of cable protection associated with 31.1 km per cable (124.4 km in total) at a width of up to 9.5 m. • Up to 0.05 km^2 of cable protection for five cable crossings at a width of up to 12.5 m.	Maximum footprint which would be affected during the operation and maintenance phase. While it is highly unlikely that all five crossings will be located within the zone of influence for the MCZ, the crossing footprint is included in full as a precautionary approach.

6.5. Assessment of Effects – Project Alone

6.5.1. Potential Effects During Construction

6.5.1.1. INCREASED SUSPENDED SEDIMENT CONCENTRATIONS (SSC) AND ASSOCIATED DEPOSITION (INCLUDING MOBILISATION OF POTENTIAL CONTAMINANTS)

388. Increases in SSC and associated deposition in subtidal habitats will occur as a result of site preparation activities (which includes boulder clearance and seabed levelling) and cable installation using cable protection methods, notably cable burial or remedial cable protection techniques.

389. The relevant MarESA pressures for this impact are:

- Water clarity changes;
- Siltation changes (high and low);
- Siltation changes (low);
- Hydrocarbon & PAH contamination.

390. The resuspension of sediment may result in the release of sediment-bound contaminants, which may have detrimental effects on ecological features of the MCZ.

6.5.1.1.1. MAGNITUDE OF IMPACT

391. Based on the sediment properties within the Marine Scheme, only a very small percentage of the sediment bulk will form a plume (on average and as informed by site-specific survey activity, this is anticipated to occur at less than 10% of the Marine Scheme) The majority of sediments (i.e. the remaining 90%) are anticipated to fall directly to the seabed outside of the MCZ, owing to their fraction. As a small proportion of sediments will enter into suspension in the first place, the high SSC concentrations would be only in the immediate vicinity of disturbance activities, affecting the eastern edge of the MCZ only, and would be very transient. Consequently, the contribution of sediment deposition from the plume is minimal.

392. In the case of seabed levelling activities, deposition within the MCZ would be minimal and would largely be indiscernible from the background and natural variation (ES, Volume 2, Chapter 7: Offshore Physical Environment and Seabed Conditions). Sedimentation from active deposition will be in relation to settling velocity of sediment within the Marine Scheme (i.e. predominantly fine sand), and once deposited will form part of the sediment transport regime. Deposition from the plumes from trenching could also result in deposition within the MCZ, however, this would be only millimetres of sediment deposition that would largely be indiscernible from the background and natural variation and be rapidly incorporated into the local sediment transport regime.

393. Therefore, the scale of impact although longer is still temporary, transient and localised, in that for the worst case, the plume lasts less than a day and just over a flood-ebb tidal cycle and only advects a maximum distance associated with the tidal ellipse. The fact that only a small proportion of sediments will enter into suspension to develop into a plume in the first place, with the seabed levelling and trenching activities, contributes to the short duration and relatively localised plume.

394. Sediment bound contaminants in the marine environment are most often associated with sediments that have a high fines content, especially clay and silt fractions. The potential dispersion of sediments is limited and sediment contaminant levels recorded within the offshore extents of the Marine Scheme are low (ES, Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology). A rapid dilution of suspended particular matter is also anticipated and in the context of natural disturbance of sediment during storm events that will also release sediment-bound contaminants, the potential

release of sediment-bound contaminants during the construction phase of the Marine Scheme are not expected to result in a significant exceedance beyond baseline levels.

6.5.1.1.2. SENSITIVITY OF RECEPTORS

395. The MarESA sensitivities to pressures associated with increased SSC and deposition are presented in Table 6.3.

Table 6.3 Sensitivities of the MCZ features to increased SSC and deposition according to MarESA

Receptor	Representative biotope(s)	Sensitivity to defined pressure			
		Changes in suspended solids (water clarity)	Smothering and siltation rate changes (light)	Smothering and siltation rate changes (heavy)	Hydrocarbon & PAH contamination
Broadscale marine habitats					
Moderate energy circalittoral rock	• CR.MCR • CR.MCR.EcCr.FaAlCr.Flu	Not sensitive	Not sensitive	Low	Not assessed
Subtidal coarse sediment	• SS.SCS.CCS • SS.SCS.OCS • SS.SCS.CCS.SpiB	Low	Low	Medium	Not assessed
Subtidal mixed sediments	• SS.SMx.CMx.KurThyMx / SS.SMx.CMx.MysThyMx • SS.SMx.OMx • SS.SMx.OMx.PoVen • SS.SMx.CMx	Not sensitive to low	Not sensitive to low	Low to medium	Not assessed
Subtidal sand	• SS.SSa.ImuSa.FfabMag • SS.SSa.IMuSa • SS.SSa.CfiSa.EpusOborApri • SS.SSa.OSa • SS.SSa.Osa.OfusAfil • SS.SSa.CfiSa.ApriBatPo	Low	Low	Medium	Not assessed
Subtidal mud	• SS.SMu.CsaMu • SS.SMu.CsaMu.AfilKurAnit / SS.SMu.CsaMu.AfilMysAnit • SS.SMu.CsaMu.AfilNten • SS.SMu.CSaMu.ThyEten • SS.SMu.OMu • SS.SMu.OMu.PjefThyAfil	Not sensitive	Not sensitive	Medium	Not assessed
Marine habitat					
Seapen and burrowing megafauna communities	• SS.SMu.CFiMu.SpnMeg	Not sensitive	Not sensitive	Not sensitive	High

Receptor	Representative biotope(s)	Sensitivity to defined pressure			
		Changes in suspended solids (water clarity)	Smothering and siltation rate changes (light)	Smothering and siltation rate changes (heavy)	Hydrocarbon & PAH contamination
Species of marine fauna					
Ocean quahog	• N/A	Not sensitive	Not sensitive	Not sensitive	Not assessed

6.5.1.1.2.1. Broadscale Marine Habitats

396. Each of the habitat features of the MCZ support diverse benthic communities which could be impacted by increased sediment loads. The habitats within the 5 km study area are primarily subtidal mud, subtidal sand, subtidal mixed sediments and subtidal mud. The biotopes associated with these habitats (see ES, Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology) have no to low sensitivity to light smothering. Given the negligible magnitude of sediment deposition expected within the MCZ, it is highly unlikely that heavy smothering would be experienced by the relevant biotopes.

397. There are no assessments available for the sensitivities of these biotopes to contamination by non-synthetic compounds such as heavy metals, hydrocarbons and produced water. The FeAST tool assesses continental shelf sands, continental mixed sediments and offshore deep sea muds, as being 'sensitive' to non-synthetic compound contamination. However, low contaminant levels were reported from the site specific survey (ES, Volume 3, Appendix 8:1: Benthic Survey Report (Phase 1 and 2)) and the extent of any sediment deposition will be highly localised. Deposited sediment will generally be in keeping with the surrounding area, and therefore, of a similar quality. Thus, it is anticipated that habitats and species will have some tolerance to small-scale changes in water and sediment quality as they experience natural disturbance of sediment during storm events or periods of strong wave action.

6.5.1.1.2.2. Seapen and burrowing megafauna communities

398. Seapen and burrowing megafauna communities are assessed as not being sensitive to increased suspended solids (water clarity) and light or heavy smothering or siltation rate changes according to the MarESA sensitivity assessment and so are not assessed further for this pressure.

399. No assessments are available for the MarESA pressures for contamination non-synthetic compounds such as heavy metals, hydrocarbons and produced water. In the absence of MarESA, the FeAST tool reports that the burrowed mud habitat is sensitive to contamination by hydrocarbon & PAH, and synthetic compound. A low confidence score has been assigned to this assessment and the provided explanation draws heavily on contamination due to oil spills, rather than low levels of sediment contamination. However, as previously described, the concentration of contaminants is not expected to exceed background levels and it is anticipated that habitats and species will have some tolerance to small-scale changes in water and sediment quality from natural disturbance of sediment during storm events or periods of strong wave action.

6.5.1.1.2.3. Ocean Quahog

400. The sedimentary habitats in Farnes East MCZ support ocean quahog. Previous surveys within the MCZ have identified individuals of ocean quahog, mostly juveniles (21 out of 25 individuals), predominately in the east and southwest of the site (Defra, 2015).

401. Ocean quahog are assessed as not being sensitive to increased suspended solids (water clarity) and light or heavy smothering or siltation rate changes according to the MarESA sensitivity assessment (Table 6.3) and so are not assessed further for this pressure.

402. No assessments are available for the MarESA pressures for contamination from non-synthetic compounds such as heavy metals, hydrocarbons and produced water. However, as described above, low contaminant levels were reported from the marine scheme and deposited sediment will in keeping with surrounding area. It is also anticipated that benthic species will have some tolerance to small-scale changes in water and sediment quality as they experience natural disturbance of sediment during storm events or periods of strong wave action.

403. Thus, the concentration of contaminants is not expected to exceed background levels and it is anticipated that habitats and species will have some tolerance to small-scale changes in water and sediment quality from natural disturbance of sediment during storm events or periods of strong wave action.

6.5.1.1.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

404. Based on the information presented above, the following can be concluded with respect to the attributes of the protected features of the Farnes East MCZ.

6.5.1.1.3.1. Broadscale marine habitats

405. The extent of the broadscale marine habitat features will be maintained following cable installation activities as the increase in SSC and associated deposition is predicted to be marginal and indiscernible from background conditions. The biotopes supported by these habitats have low sensitivity to the pressures of changes in water clarity and smothering.

406. The contaminant levels recorded within the marine scheme were low, and sediment quality is understood to be representative of the surrounding area, including the MCZ. Thus any deposition sediment would not be expected to present a risk of contamination exposure to the biological communities or a reduction in sediment quality within the MCZ.

407. It is concluded that potential effects on the broadscale marine habitat features of the MCZ, due to increased SSC and deposition would not hinder the conservation objective that features:

- **so far as already in favourable condition, remain in such condition; and**
- **so far as not already in favourable condition, be brought into such condition, and remain in such condition.**

6.5.1.1.3.2. Seapen and burrowing megafauna communities

408. Seapen and burrowing megafauna communities are not sensitive to increased SSC and associated deposition and there will be no increased risk of contamination exposure associated with the deposition of SSC.

409. It is concluded that potential effects on seapen and burrowing megafauna communities, due to increased SSC and deposition would not hinder the conservation objective that features:

- **so far as not already in favourable condition, be brought into such condition, and remain in such condition.**

6.5.1.1.3.3. Ocean quahog

410. Ocean quahog are not sensitive to increased SSC and associated deposition and there will be no increased risk of contamination exposure associated with the deposition of SSC.

411. It is concluded that potential effects ocean quahog, due to increased SSC and deposition would not hinder the conservation objective that features:

- **so far as not already in favourable condition, be brought into such condition, and remain in such condition.**

6.5.1.1.4. SECONDARY MITIGATION AND RESIDUAL EFFECT

412. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the MCZ.

6.5.2. Potential Effects During Operation and Maintenance

6.5.2.1. COLONISATION OF HARD STRUCTURES AND INCREASED RISK OF INVASIVE AND NON NATIVE SPECIES

413. The export cables will be buried wherever practicable however, where this is not possible due to the presence of hard substrate, up to 1.23 km^2 of cable protection material may be installed within the Marine Scheme Offshore Export Cable Corridor, within English waters. The Marine Scheme runs immediately adjacent to the eastern boundary of the Farnes East MCZ for approximately 31 km. The cable protection zones for this stretch of cable are English Waters 4 and English Waters 5, of which 25%-35% and 35%-45% of the cable is estimated to require cable protection (Figure 3).

414. The presence of cable protection materials has the potential to impact soft sediment features at the eastern edge of the MCZ. Provision of novel hard substrate can result in colonisation by epilithic species and increases the habitat complexity and biodiversity of the area, as protective materials act as *de facto* artificial reefs (Degraer *et al.,* 2020).

415. The novel habitat provided by offshore structures could also play a role in providing stepping-stones for INNS, by which geographical barriers to species dispersal might be passed (Adams *et al.,* 2014). INNS can have a detrimental effect on the benthic ecology through predation on existing wildlife or outcompeting for prey and habitat. To date, there has been mixed evidence from post-construction monitoring to suggest that hard structures provide new or unique opportunities for INNS which could facilitate their introduction (e.g. Linley *et al.,* 2007). Furthermore, no spread of INNS caused by submarine cabling has yet been documented (Taormina *et al*., 2018).

416. No INNS were identified in the Marine Scheme Offshore Export Cable Corridor surveys (ES, Volume 3, Appendix 8:1: Benthic Survey Report (Phase 1 and 2)) or previous surveys of the MCZ (Defra, 2015). Therefore, the risk of the spread of any existing INNS is considered to be low. Furthermore, the risk of spreading newly introduced INNS will be mitigated by reducing the use of cable protection as far as practicable and through the development and implementation of an INNS management plan.

417. The relevant MarESA pressures are:

- Physical change (to another seabed type); and
- Introduction or spread of invasive non-indigenous species.

6.5.2.1.1. MAGNITUDE OF IMPACT

418. As presented in Table 6.2, up to 1.23 km^2 of cable and crossing protection material may be installed in discrete areas within the Marine Scheme Offshore Export Cable Corridor, within English waters, providing colonisation potential for INNS. This will be outside of, but adjacent to the MCZ. The Marine Scheme is 0.07 km east of the Farnes East MCZ at its nearest point, and thus represents the closest possible placement of cable protection material.

419. Hard substrates are understood to primarily function as steppingstones for INNS by providing colonisation potential thus bypassing natural barriers to geographic spread. The sedimentary and high energy nature of the sediments characteristic of the MCZ are thought to be challenging for most INNS with very few species able to colonise mobile sands due to the high levels of sediment disturbance (Tillin, 2022). As such, any effects are likely to be limited to the immediate vicinity of the introduced hard substrate and will not result in changes to the species composition of communities associated with the offshore sediment features across the wider MCZ.

6.5.2.1.2. SENSITIVITY OF RECEPTORS

Table 6.4 Sensitivities of the MCZ features to increased INNS according to MarESA

Receptor	Representative biotope(s)	Sensitivity to introduction or spread of INNS
Broadscale marine habitats		
Moderate energy circalittoral rock	• CR.MCR • CR.MCR.EcCr.FaAlCr.Flu	No evidence
Subtidal coarse sediment	• SS.SCS.CCS • SS.SCS.OCS • SS.SCS.CCS.SpiB	High
Subtidal mixed sediments	• SS.SMx.CMx.KurThyMx / SS.SMx.CMx.MysThyMx • SS.SMx.OMx • SS.SMx.OMx.PoVen • SS.SMx.CMx	High
Subtidal sand	• SS.SSa.ImuSa.FfabMag • SS.SSa.IMuSa • SS.SSa.CfiSa.EpusOborApri • SS.SSa.OSa • SS.SSa.Osa.OfusAfil • SS.SSa.CfiSa.ApriBatPo	High
Subtidal mud	• SS.SMu.CsaMu • SS.SMu.CsaMu.AfilKurAnit / SS.SMu.CsaMu.AfilMysAnit • SS.SMu.CsaMu.AfilNten • SS.SMu.CSaMu.ThyEten • SS.SMu.OMu • SS.SMu.OMu.PjefThyAfil	Not relevant or no evidence
Marine habitat		
Seapen and burrowing megafauna communities	• SS.SMu.CFiMu.SpnMeg	No evidence
Species of marine fauna		
Ocean quahog	N/A	No evidence

6.5.2.1.2.1. Broadscale marine habitats

420. The MCZ broadscale habitat features subtidal coarse sediment, subtidal mixed sediment, and subtidal sand have high sensitivities to the introduction of INNS, however this is dependent on the biological communities present (Table 6.4). No evidence was available for moderate energy circalittoral rock or subtidal mud.

421. The identified characteristic biotopes (SS.SSa.CFiSa.ApriBatPo and SS.SSa.CFiSa.EpusOborApri) are considered to be most at risk from the slipper limpet, *Crepidula fornicata*, and potentially invasive colonial ascidians and predatory gastropods. However, the sedimentary and high energy nature of the environment is however thought to be challenging for most INNS with very few species able to colonise mobile sands due to the high levels of sediment disturbance (Tillin, 2022).

422. Colonisation of cable protection may have indirect adverse effects on the baseline communities and habitats in the immediate vicinity due to increased predation on and competition with the existing soft sediment species. However, the communities which will colonise the hard structures will be adapted to hard substrates and therefore unlikely to colonise the sedimentary habitat, which is occupied by the key and influential species, as supported by the research of De Backer *et al.*, 2021; APEM, 2021. There may be a higher risk of competition with communities inhabiting the moderate energy circalittoral rock feature of the MCZ, however moderate energy circalittoral rock is not expected to be present along the eastern boundary of the MCZ (JNCC, 2020) and the cable

protection will be at a minimum distance of 70 m from the MCZ boundary. This feature is therefore not considered at risk.

423. Studies have shown that there is potential for reef effects to occur in association with hard structures, however many of these studies consider large infrastructure such as wind turbine foundations and oil and gas platforms. The structural complexity of the hard substrate may provide refuge as well as increasing feeding opportunities for larger and more mobile species. The presence of mobile benthic organisms is thought to be dependent on sufficient food sources, cover of epibenthic communities, and appropriate habitat with shelter opportunities to hide from predators (Langhamer, and Wilhelmsson, 2009).

424. In conclusion, the sedimentary habitat and supported biotopes will not be continually degraded and will largely remain unchanged as a result of the introduction and colonisation of hard substrate, including extremely limited risk of INNS.

6.5.2.1.2.2. Seapen and burrowing megafauna

425. The sedimentary habitat at the eastern extent of the MCZ, which may support seapens and burrowing megafauna community will not be continually degraded by the presence of cable protection within the Marine Scheme, at least 70 m distance, and will largely remain unchanged as a result of the introduction and colonisation of hard substrate.

426. MarESA reports that there is no evidence to suggest that seapen and burrowing megafauna communities are particularly sensitive to the introduction of INNS (Table 6.4). As such, seapen and burrowing megafauna communities are considered to have a low sensitivity to INNS.

6.5.2.1.2.3. Ocean Quahog

427. The sedimentary habitat at the eastern extent of the MCZ, which may support ocean quahog will not be continually degraded by the presence of cable protection within the Marine Scheme and will largely remain unchanged as a result of the introduction and colonisation of hard substrate.

428. MarESA reports that there is no evidence to suggest that ocean quahog populations are particularly sensitive to the introduction of INNS (Table 6.4). As such, ocean quahog are considered to have a low sensitivity to INNS.

6.5.2.1.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

429. Based on the information presented above, the following can be concluded with respect to the attributes of the protected features of the Farnes East MCZ.

6.5.2.1.3.1. Broadscale marine habitats

430. The biological communities supported by the broadscale marine habitat features are unlikely to be affected by the biological communities which will colonise the cable protection material outside of the MCZ, including INNS.

431. It is concluded that potential effects on the broadscale marine habitat features of the MCZ, due to colonisation of hard structures and introduction of INNS, would not hinder the conservation objective that features:

- **so far as already in favourable condition, remain in such condition; and**
- **so far as not already in favourable condition, be brought into such condition, and remain in such condition.**

6.5.2.1.3.2. Seapen and Burrowing Megafauna communities

432. There is no evidence that seapen and burrowing megafauna communities are sensitive to increased risk of INNS. Novel hard substrate in soft sediment environments provides colonisation potential for species otherwise unsuited to soft-sediment environments. As such, there is no

opportunity for competition that could compromise the structure and function of seapen and burrowing megafauna communities.

433. It is concluded that potential effects to seapen and burrowing megafauna communities, due to colonisation of hard structures and introduction of INNS would not hinder the conservation objective that features:

- **so far as not already in favourable condition, be brought into such condition, and remain in such condition.**

6.5.2.1.3.3. Ocean Quahog

434. There is no evidence that ocean quahog are sensitive to increased risk of INNS. Novel hard substrate in soft sediment environments provides colonisation potential for species otherwise unsuited to that environment. As such, there is no opportunity for competition that could compromise the structure and function of ocean quahog aggregations.

435. It is concluded that potential effects ocean quahog, due to colonisation of hard structures and introduction of INNS, would not hinder the conservation objective that features:

- **so far as not already in favourable condition, be brought into such condition, and remain in such condition.**

6.5.2.1.4. SECONDARY MITIGATION AND RESIDUAL EFFECT

436. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the MCZ.

6.5.2.2. INCREASED SUSPENDED SEDIMENT CONCENTRATIONS (SSC) AND ASSOCIATED DEPOSITION

437. Cable repair and reburial events may result in short-term increases in suspended sediments during the operation and maintenance phase. As described in section 6.4.2, the maximum design scenario is for cable repair and reburial of up to 4 km (i.e. four cable repair and reburial events of up to 1 km each) over the operation and maintenance phase (35 years). It should be noted that this scenario covers the entire Marine Scheme, and though it cannot be predicted where in the Marine Scheme maintenance activities will be required, it presents a scenario in excess of what would be likely in close proximity to the Farnes East MCZ.

438. The temporary increases in suspended sediment may result in a sediment plume in the water column that is then deposited at a distance from the Marine Scheme and impact benthic receptors as described for potential effects during construction (section 6.5.1).

6.5.2.2.1. MAGNITUDE OF IMPACT

439. The length of cable requiring repair or reburial will be significantly less than the length of cable installed during the construction phase and the magnitude of impact is expected to be significantly lower than during construction. The resulting sediment plumes and sedimentation footprints would be dependent on which section of the cable is being repaired and thus the sediment type. Considering the far reduced scale, the impacts of the operation and maintenance activities (i.e. cable repair and reburial) are predicted to be no greater than those for construction, assessed in section 6.5.1.

6.5.2.2.2. SENSITIVITY OF THE RECEPTOR

440. The sensitivity of the protected features are as described for the assessment of increased SSC during the construction phase (section 6.5.1).

6.5.2.2.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

Based on the information presented above, the following can be concluded with respect to the attributes of the protected features of the Farnes East MCZ.

6.5.2.2.3.1. Broadscale marine habitats

441. The extent of the broadscale marine habitat features will be maintained following cable maintenance activities as the increase in SSC and associated deposition is predicted to be no greater than that assessed for construction, and thus marginal and indiscernible from background conditions. The biotopes supported by these habitats have low sensitivity to the pressures of changes in water clarity and smothering.

442. The contaminant levels recorded within the marine scheme were low, and sediment quality is understood to be representative of the surrounding area, including the MCZ. Thus, any deposition sediment would not be expected to present a risk of contamination exposure to the biological communities or a reduction in sediment quality within the MCZ.

443. It is concluded that potential effects on the broadscale marine habitat features of the MCZ, due to increased SSC and deposition would not hinder the conservation objective that features:

- **so far as already in favourable condition, remain in such condition; and**
- **so far as not already in favourable condition, be brought into such condition, and remain in such condition.**

6.5.2.2.3.2. Seapen and burrowing megafauna communities

444. Seapen and burrowing megafauna communities are not sensitive to increased SSC and associated deposition and there will be no increased risk of contamination exposure associated with the deposition of SSC.

445. It is concluded that potential effects on seapen and burrowing megafauna communities, due to increased SSC and deposition would not hinder the conservation objective that features:

- **so far as not already in favourable condition, be brought into such condition, and remain in such condition.**

6.5.2.2.3.3. Ocean quahog

446. Ocean quahog are not sensitive to increased SSC and associated deposition and there will be no increased risk of contamination exposure associated with the deposition of SSC.

447. It is concluded that potential effects ocean quahog, due to increased SSC and deposition would not hinder the conservation objective that features:

- **so far as not already in favourable condition, be brought into such condition, and remain in such condition.**

6.5.2.2.4. SECONDARY MITIGATION AND RESIDUAL EFFECT

448. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the MCZ.

6.5.3. Potential Effects During Decommissioning

449. Given the nature of the decommissioning activities, which will largely be a reversal of the installation process, the potential impacts of SSC during decommissioning are expected to be similar to, or less than those assessed for the construction phase. In the absence of detailed information regarding decommissioning works, the implications for the MCZ are considered analogous with or likely less than those identified and assessed for the construction phase. It is also assumed that

the designated feature sensitivities will not materially change over the life cycle of the Marine Scheme.

450. Offshore Export Cables and associated protection will be fully removed where it is practicable and appropriate to do so, noting this will depend on the type of protection used and condition of the protection at the time of removal.

451. Should complete removal of the Offshore Export Cables be required, the significance of effect is considered to result in similar impacts to those assessed as part of the construction phase of the Marine Scheme. Impacts are anticipated to be of similar or lower magnitude to the construction phase (depending on the decommissioning option selected). Complete removal of the Offshore Export Cables represents the most significant adverse effects, and therefore if the other decommissioning options were to be progressed, they would have no more significant adverse effects.

452. The maximum design scenario for the extent of habitat creation arising from the introduction of new hard structures adjacent to the Farnes East MCZ which will persist following the decommissioning phase, is therefore assumed to be same as for the operation and maintenance phase.

453. Based on the information presented across the assessment of effects resulting from installation and operation & maintenance activities, it can be concluded that the impacts of structures persisting post-decommissioning will not lead to a significant risk of hindering the achievement of the conservation objectives for the physical and biological features of the Farnes East MCZ.

6.5.3.1. SECONDARY MITIGATION AND RESIDUAL EFFECT

454. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the MCZ.

6.5.4. Assessment of Effects - Project Alone Conclusion

455. Based on the information presented for all features, conservation objectives and attributes set out above, there will be no significant risk of hindering the achievement of the conservation objectives for all features of the Farnes East MCZ.

6.6. Assessment of Effects – In-Combination

456. Table 6.5 lists details the Eastern Green Link 1 (EGL 1) and Eastern Green Link 2 (EGL 2) projects as having potential to have an effect on the Farnes East MCZ in combination with the Marine Scheme in English Waters.

Table 6.5 Other Plans and Projects with Potential for In-Combination Effects on the Farnes East MCZ

Development	Status	Distance from Marine Scheme (km)	Description of Development/ Plan	Dates of Construction (if Applicable)	Dates of Operation (if Applicable)	Phase Overlap with the Marine Scheme
Scotland to England Green Link 1 (SEGL1)	In planning	0 km	Transmission infrastructure	Construction anticipated to be 2024 to 2027	Operational from ~2027 for ~50 years	Construction, Operation and maintenance

Development	Status	Distance from Marine Scheme (km)	Description of Development/ Plan	Dates of Construction (if Applicable)	Dates of Operation (if Applicable)	Phase Overlap with the Marine Scheme
Eastern Green Link (EGL) 2	In planning	Approximately 3 km (English waters)	Transmission infrastructure	Construction anticipated to be 2025 to 2029	Operational from ~2029	Construction, Operation and maintenance

6.6.1. Potential Effects During Construction

6.6.1.1. INCREASED SSC AND ASSOCIATED DEPOSITION (INCLUDING MOBILISATION OF POTENTIAL CONTAMINANTS)

Table 6.6 Farnes East MCZ: Other plans and projects with potential for cumulative effects of increased SSC and associated deposition during construction of the Marine Scheme

Development	Development phase	Source
Marine Scheme	Construction	Section 5.4.2
Scotland to England Green Link 1 (SEGL1)	Construction	NGET & Scottish Power Transmission (2022)
Eastern Green Link 2 (EGL2)	Construction	NGET & SHET plc (2022)

457. The developments listed in Table 6.6 which met the CEA criteria may result in some temporary increases in SSC including the potential resuspension of contaminants and subsequent sediment deposition.

458. The planned construction period for the EGL2 cable overlaps with that of the Marine Scheme. At the nearest point (the north east corner of the MCZ, the cable corridor is located approximately 5 km to the east of the Farnes East MCZ and 4 km east of the Marine Scheme. The maximum distance travelled by fine sediments in suspension was assessed to be 1.5 km and thus would not reach the MCZ. As such, EGL2 is not considered further for cumulative impacts of SSC.

459. Construction of the EGL1 cable coincides with the construction of the Marine Scheme. EGL1 directly overlaps the Farnes East MCZ for 26 km along the western boundary of the MCZ, approximately 25 km west of the Marine Scheme. The maximum distance travelled by fine sediments in suspension was assessed to be 1.4 km. The shallower areas of the site, in the west, are dominated by subtidal coarse sediment and subtidal mixed sediments which will fall out of suspension quickly. Should trenching activities be undertaken simultaneously there is no evidence to suggest that SSC plumes would interact considering the limited plumes produced during construction activities for the Marine Scheme.

460. The MPA assessment undertaken for EGL1 concluded that any measurable change in suspended sediment concentrations will be temporary and localised, i.e. within the extent of the marine installation corridor. Moreover, the deposited sediment would be of native origin to the MCZ. The site specific surveys for EGL1 reported that seapens and burrowing megafauna, and ocean quahog were not found within the marine installation corridor and there were also no observations of individual seapens, Nephrops or its burrows though they may be present beyond the marine installation corridor. The predicted temporary increase to SSC levels and associated depositional

loads from the EGL1 construction operations in comparison to natural background levels were expected to be relatively minor.

461. Considering the cumulative effect of the Marine Scheme and EGL1, limited generation of SSC and associated deposition arising from both developments are unlikely to greatly increase in impact significance when considered together.

462. Based on the information presented here, it can be concluded that cumulative increases in SSC and associated deposition during the Marine Scheme construction phase will not lead to a significant risk of hindering the achievement of the conservation objectives for any feature of the Farnes East MCZ (Table 6.7).

Table 6.7 CEA of the Farnes East MCZ for increased SSC and associated deposition – Construction phase.

Protected Feature	Potential impact
Moderate energy circalittoral rock Subtidal coarse sediment Subtidal mixed sediments Subtidal sand Subtidal mud	The cumulative increases in SSC and subsequent deposition are predicted to temporarily affect a small proportion of the feature with no physical interaction of sediment plumes. Sediment composition will be maintained and characteristic biological communities will recover following construction activities. Cumulatively, the projects will not hinder the conservation objective that features: • so far as already in favourable condition, remain in such condition; and • so far as not already in favourable condition, be brought into such condition, and remain in such condition.
Ocean quahog aggregations	Ocean quahog are highly tolerant of increases in SSC and associated deposition. The small extent and temporary nature of SSC will not impact the population within the site. . Cumulatively, the projects will not hinder the conservation objective that features: • so far as not already in favourable condition, be brought into such condition, and remain in such condition.
Seapen and burrowing megafauna communities	Seapen and burrowing megafauna communities are highly tolerant of increases in SSC and associated deposition. The small extent and temporary nature of SSC will not impact the population within the site. Cumulatively, the projects will not hinder the conservation objective that features: • so far as not already in favourable condition, be brought into such condition, and remain in such condition.

6.6.2. Potential Effects During Operation

6.6.2.1. COLONISATION OF HARD STRUCTURES AND INTRODUCTION OF INNS

Table 6.8 Farnes East MCZ: Other plans and projects with potential for cumulative effects of colonisation of hard structures and increased risk of INNS during operation and maintenance of the Marine Scheme

Development	Development phase	Source
Marine Scheme	Construction	Section 5.4.2
Scotland to England Green Link 1 (SEGL1)	Construction	NGET & Scottish Power Transmission (2022)

463. The developments listed in Table 6.8 which met the CEA criteria may introduce additional hard substratum which may be colonised by benthic organisms.

464. The introduction of hard infrastructure, such as cable protection, alters previously soft sediment habitat areas. Provision of novel hard substrate can result in colonisation by epilithic species and increases the habitat complexity and biodiversity of the area, as protective materials act as *de facto* artificial reefs (Degraer *et al.,* 2020).

465. The operation and maintenance phase of the EGL1 cable temporally overlaps the operation and maintenance phase of the Marine Scheme. EGL1 directly overlaps the Farnes East MCZ for 26 km along the western boundary of the MCZ, approximately 25 km west of the Marine Scheme.

466. As discussed in section 6.5.2, up to 1.23 km^2 of cable and crossing protection material may be installed in discrete areas within the Marine Scheme Offshore Export Cable Corridor, within English waters, providing colonisation potential for INNS. This will be outside of, but adjacent to the MCZ. Whereas the EGL1 cable overlaps the MCZ, the Marine Scheme is 0.07 km east of the Farnes East MCZ at its nearest point, and thus represents the closest possible placement of cable protection material.

467. Colonisation of cable protection may have indirect adverse effects on the baseline communities and habitats in the immediate vicinity due to increased predation on and competition with the existing soft sediment species. However, the communities which will colonise the hard structures will be adapted to hard substrates and therefore unlikely to colonise the (minimum) 70 m distance of sedimentary habitat situated both between the Marine Scheme and the eastern boundary of the MCZ, and the soft sediment features present in the eastern extent of the MCZ.

468. EGL1 may install up to 0.266 km^2 of cable protection within the Farnes East MCZ. The environmental assessment for EGL1 concluded that given the small extent of rock placement, and the ability of the material to reflect some characteristics of the existing moderate energy circalittoral rock habitat, allowing similar communities to develop, the impact of rock placement in the Farnes East MCZ is considered to be minor and unlikely to affect the stated conservation objectives.

469. Considering both small magnitude of cable protection of the EGL1 cable project, the distance between the project and the Marine Scheme, and the distance between the Marine Scheme and the MCZ, there is considered to be no risk of hindrance to the conservation objectives of the MCZ through colonisation of hard structures and introduction of INNS (Table 6.9

Table 6.9 CEA of the Farnes East MCZ for colonisation of hard structures and introduction of INNS – Operation and maintenance phase.

Protected Feature	Potential impact
Moderate energy circalittoral rock Subtidal coarse sediment Subtidal mixed sediments Subtidal sand Subtidal mud	The cumulative colonisation of hard structures is predicted to have a negligible effect on habitat features of the MCZ. Cumulatively, the projects will not hinder the conservation objective that features: • so far as already in favourable condition, remain in such condition; and • so far as not already in favourable condition, be brought into such condition, and remain in such condition.
Ocean quahog aggregations	The cumulative colonisation of hard structures is predicted to have a negligible effect on the ocean quahog aggregations feature. Cumulatively, the projects will not hinder the conservation objective that features: • so far as not already in favourable condition, be brought into such condition, and remain in such condition.
Seapen and burrowing megafauna communities	The cumulative colonisation of hard structures is predicted to have a negligible effect on the seapen and burrowing megafauna communities feature. Cumulatively, the projects will not hinder the conservation objective that features: • so far as not already in favourable condition, be brought into such condition, and remain in such condition.

6.6.2.2. INCREASED SSC AND ASSOCIATED DEPOSITION (INCLUDING MOBILISATION OF POTENTIAL CONTAMINANTS)

470. The developments listed in Table 6.8 which met the CEA criteria may result in some temporary increases in SSC including the potential temporary resuspension of contaminants and subsequent sediment deposition.

471. The operation and maintenance phase of the EGL1 cable temporally overlaps the operation and maintenance phase of the Marine Scheme. EGL1 directly overlaps the Farnes East MCZ for 26 km along the western boundary of the MCZ, approximately 25 km west of the Marine Scheme. The shallower areas of the site, in the west, are dominated by subtidal coarse sediment and subtidal mixed sediments which will fall out of suspension quickly.

472. The projects in their operational phases will undertake periodic maintenance activities which may result in increased suspended sediment concentrations, however these activities would be of limited spatial extent and frequency and unlikely to interact with sediment plumes from the Marine Scheme.

473. The MPA assessment undertaken for EGL1 concluded that the maximum distance travelled by fine sediments in suspension would be to be 1.4 km and any measurable change in suspended sediment concentrations will be temporary and localised, i.e. within the extent of the marine installation corridor. Moreover, the deposited sediment would be of native origin to the MCZ. The predicted temporary increase to SSC levels and associated depositional loads from the EGL1 construction operations in comparison to natural background levels were expected to be relatively minor (NGET & Scottish Power Transmission, 2022).

474. Considering the cumulative effect of the Marine Scheme and EGL1, limited generation of SSC and associated deposition arising from maintenance and repair activities of both developments are unlikely to increase in impact significance when considered together.

475. Based on the information presented here, it can be concluded that cumulative increases in SSC and associated deposition during the Marine Scheme operation and maintenance phase will not lead to a significant risk of hindering the achievement of the conservation objectives for any feature of the Farnes East MCZ (Table 6.10).

Table 6.10 CEA of the Farnes East MCZ for increased SSC and associated deposition – Operation phase.

Protected Feature	Potential impact
Moderate energy circalittoral rock Subtidal coarse sediment Subtidal mixed sediments Subtidal sand Subtidal mud	The cumulative increases in SSC and subsequent deposition are predicted to temporarily affect a small proportion of the feature with no physical interaction of sediment plumes. Sediment composition will be maintained and characteristic biological communities will recover following operation and maintenance activities. Cumulatively, the projects will not hinder the conservation objective that features: • so far as already in favourable condition, remain in such condition; and • so far as not already in favourable condition, be brought into such condition, and remain in such condition.
Ocean quahog aggregations	Ocean quahog are highly tolerant of increases in SSC and associated deposition. The small extent and temporary nature of SSC will not impact the population within the site. . Cumulatively, the projects will not hinder the conservation objective that features: • so far as not already in favourable condition, be brought into such condition, and remain in such condition.
Seapen and burrowing megafauna communities	Ocean quahog are highly tolerant of increases in SSC and associated deposition. The small extent and temporary nature of SSC will not impact the population within the site. Cumulatively, the projects will not hinder the conservation objective that features: • so far as not already in favourable condition, be brought into such condition, and remain in such condition.

7. MCZ Assessment - Berwick to St Mary's MCZ

7.1. Introduction

476. The Berwick to St Mary's MCZ is located within territorial waters off the east coast of England (Figure 11). The Marine Scheme overlaps the Berwick to St Mary's MCZ; the last 4 km (approximately) of the territorial water section of the cable corridor passes through shallow waters of the MCZ on the approach to the Landfall site at Cambois beach. Common eider (*Somateria Mollissimal)* is the single designated feature of this MCZ.

477. Berwick to St Mary's MCZ provides protection to 634 km^2 of critical inshore marine habitat for nationally important numbers of breeding and non-breeding common eider, in particular the birds that breed on the Farne Islands and Coquet Island. In addition to breeding, the site protects areas on which common eiders are ecologically dependent, for instance, for foraging, preening and bathing. The MCZ holds 26.2% of the English and 5.7% of the GB non-breeding common eider population.

478. Those parts of the inshore section of the cable corridor where the seabed depth is less than approximately 20 m will be used by common eider as they forage on or close to the seabed. The eider utilising the area will be part of the common eider population that this MCZ is designed to safeguard.

479. The south end of marine cable route is approximately 19 km south of Coquet Island, (the closest eider breeding site), and as such is just within the reported maximum foraging range of breeding eider (Woodward et al. 2019). In practice, the nature of the habitat at Cambois (sea adjacent to an open beach with very high levels of activity by people and dogs) and distance from Coquet Island means that this part of the MCZ is unlikely to be used by actively breeding common eider, which prefer sheltered shallow coves and bays or islets, nor does it provide suitable habitat for rearing eider ducklings. The MCZ provides critical seaward maintenance and foraging extension surrounding the breeding colony at Coquet Island and Farne Islands.

7.2. Baseline

480. Common eider is a common nesting bird around the coasts of Scotland and northern England (including the notable populations on the Northumberland coast described above), the eider winters around various coastal locations in the UK. The male eider is a black-and-white duck, with a pale green patch at the back of the head, pinkish breast and pale yellow-grey bill. The female is greyish-brown with delicate barring. Eiders feed during the day by diving to the seabed in waters from approximately 3 to 20 m, preying on benthic invertebrates such as gastropod and bivalve molluscs, echinoderms, and decapod crustaceans.

481. Understanding of the breeding season abundance and distribution of eider ducks when the MCZ was designated was based on a variety of data sources described in Natural England Joint Publication JP026 (JNCC, 2018a). Based on five year mean counts from the Farne Islands, Coquet Island and Lindisfarne, the breeding population of eiders within the MCZ between 2011 and 2016 was estimated to be approximately 760 - 960 pairs. A recent evidence review (Percival, 2022) compiled data on common eider breeding populations from the annual Northumberland and Tyneside Bird Club reports and counts of the breeding populations at the two main colonies on the Farne Islands (monitored by the National Trust) and Coquet Island (monitored by Royal Society for the Protection of Birds wardens). Based on the data review, there is a marked difference in the population trends for the eider. At the Farne Islands, there has been a significant decline over time, equivalent to an approximate 61% decline over 20 years (comparing the initial five year mean of 1,350 reduced to the current level of approximately 530). In contrast, breeding numbers at Coquet Island have been shown to be more stable, with no statistically significant trend over time though a suggestion of a slight increase to the most recent populations of 250 – 400 pairs. On this basis, a more current estimate of nesting eider within the MCZ may be between 780 and 930 pairs.

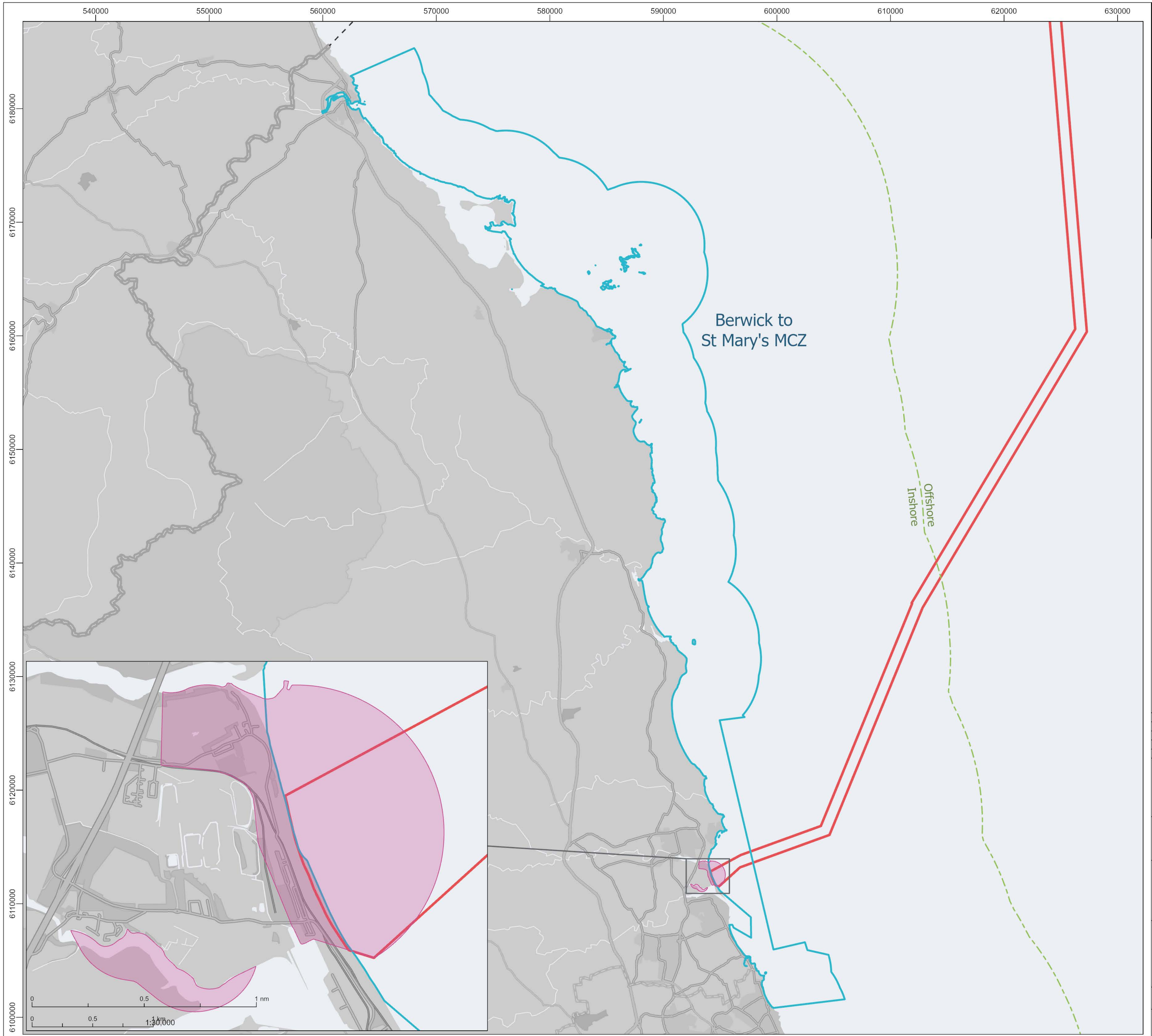
482. The 2022/23 baseline wintering bird survey conducted along the Cambois Coast (Figure 11; ES, Volume 3, Appendix 10.1: Non-Breeding / Over-Wintering Bird Survey Report) found that the inshore waters off Cambois are used by small numbers of common eider. The mean peak count in the survey area were 4 birds, and the peak single count was five birds. These numbers represent a very small proportion (<1%) of the total number of eider wintering in the MCZ.

483. The 2022/23 baseline wintering bird survey recorded large number of walkers and many with accompanying dogs using the Cambois beach on every survey visit. The near-shore waters are also subject to moderate levels of vessel disturbance. This arises from the activity of small-sized vessels used for inshore fisheries and recreation.

484. To help inform future conservation of the eider along the Northumberland coast, the Berwickshire and Northumberland Marine Nature Partnership launched the Eider Aware North East project in 2020 to help promote awareness and to encourage reporting of sightings (Northumberland County Council. 2019). In January 2023, Natural England commissioned a programme of aerial surveys to underpin a more robust estimate of the abundance and distribution of eider ducks in the MCZ (Natural England, 2023); results are not currently available.

485. There is regular seasonal temporal change for the eider, as can be expected based on the natural breeding cycle for this bird. In the breeding season, eiders are more likely to be present from the Northumberland coast northwards and off the west coast of Scotland. They are found in the same areas in winter and also further south on the Yorkshire coast and around the east and south coast, potentially extending to the south west as far as Cornwall. Outside the breeding season, the eider is typically found in sheltered coastal waters, sometimes in flocks of several hundred birds. Mating starts as early as December and the birds will continue to display and court until April or May when they gather round the islands within the MCZ in large numbers (Embleton, 1973). When eider ducklings are hatched out and dry, the duck takes them down to the sea for the next suitable tide which will assist in their passage to the mainland where they feed near the shore.

486. There are anticipated to be long-term changes for the eider population. Based on a historical review of available data, there have been significant changes in the population. During the years of WWII, estimates suggest that there were fewer than 100 nesting eider using the islands along the Northumberland coastline with egg collection for human consumption identified as primary causation (Waltho *et al*, 2015). Protection since this point helped restore numbers, with an estimate of 1,200 nesting eiders in 1972. Since this point, available data indicates that the population has fluctuated with the primary purpose of the MCZ being to help improve the population to recover to a favourable condition.



Legend

- Marine Scheme Boundary
- MCZ (Marine Conservation Zone)
- Wintering Bird Survey Study Area
- UK 12 Nautical Mile Limit
- Scotland/England Territorial Waters

Rev	Date	Status	Drwn	Chkd	Appd
04	-	-	-	-	-
03	-	-	-	-	-
02	-	-	-	-	-
01	12/07/2023	Issued	TF	NL	EW

Project

Cambois Connection

Title

Figure 11 Berwick to St Mary's MCZ and Wintering Bird Survey Study Area

0 2 4 8 12 nm
0 2 4 8 12 16 20 km
N

Scale	Plot Size	Datum	Projection
1:320,000	A3	WGS84	UTM30N

Drawing Number	Sheet No.
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7.3. Conservation Objectives

487. Conservation objectives for the common eider feature of the Berwick to St Mary's MCZ are summarised in Table 7.1 below.

Table 7.1 Conservation Objectives for the Berwick to St Mary's MCZ

Protected Feature	Spatial Extent (km^2) and/or presence information	Condition	Conservation Objectives
Common eider (*Somateria mollisima)*	~634 (an area which is understood to encompass approximately 26.2% of the English and 5.7% of the GB non-breeding population (Defra, 2018)[16].	Unfavourable	Recover to favourable condition

488. The conservation objectives of the MCZ are that, in relation to common eider,

- the supporting habitat
  - so far as already in favourable condition, remain in such condition, and
  - so far as not already in favourable condition, be brought into such condition and remain in such condition.
- the population of that species
  - so far as already in favourable condition, remain in such condition, and
  - so far as not already in favourable condition, be brought into such condition, and remain in such condition.

489. With respect to supporting habitat within the MCZ, this means that:

- The quality and extent of its habitat is stable or increasing, and
- The structures and functions, quality, and the composition of the habitat's characteristic biological communities are such as to ensure that it remains in a condition which is healthy and not deteriorating.

490. With respect to the population of common eider occurring within the MCZ (whether temporary or otherwise), this means that the distribution, size, age and sex ratios of the population are such as to ensure that it is maintained in numbers which enable it to thrive.

[16] The original understanding of the breeding season abundance and distribution of eider ducks within the MCZ was ~760 - 960 pairs, as described in the original MCZ designation and JNCC advice on highly-mobile species. More recent estimates of the number of nesting eider in the MCZ are between 780 and 930 pairs. In January 2023, Natural England commissioned a programme of aerial surveys to underpin a more robust estimate of the abundance and distribution of eider ducks in the MCZ (Natural England, 2023); results are not currently available.

7.4. Assessment Information

7.4.1. Impacts Requiring Assessment

- Disturbance and displacement as a result of construction and decommissioning activities (vessel presence and nearshore area construction activities) (C & D);
- Disturbance and displacement as a result of operation and maintenance activities (O & M) (vessel presence);
- Change in prey availability resulting from increased suspended sediment concentrations, reduced water quality/contamination, disturbance and temporary habitat loss/disturbance (C & D); and
- Change in prey availability resulting from permanent subtidal habitat loss/change (O & M)

7.4.2. Maximum Design Scenario

491. The maximum design scenario(s) summarised here have been selected as those having the potential to result in the greatest effect on key features of the Berwick to St Mary's MCZ. These scenarios have been selected from the details provided in the ES, Volume 2, Chapter 5: Project Description.

492. Site preparation works, in advance of construction, are predicted to commence in Q4 of 2026 and will continue until all installation activities have ceased. Export cable installation is expected to begin in Q3 2028 and is expected to last until Q4 of 2029. All activities associated with the Marine Scheme are predicted to conclude by the end of 2029. Until detailed design of the Marine Scheme is progressed and further refined pre-construction, this programme for the Marine Scheme as a whole is indicative and is subject to further refinement, but is used to inform assessment of construction phase impacts for the Marine Scheme.

493. Given that the maximum design scenario is based on the design option (or combination of options) that represents the greatest potential for change, confidence can be had that development of any alternative options within the design parameters will not give rise to a greater potential of hindering the achievement of the MCZ's conservation objectives than assessed in this report. Table 7.2 presents the maximum design scenario for potential impacts on ornithological receptors during construction, operation and maintenance and decommissioning.

Table 7.2: MDS for Assessment of Effects on the Berwick to St Mary's MCZ

Potential Impact	Maximum Design Scenario (Marine Scheme whole)	Maximum Design Scenario (English waters)	Justification
Construction and Decommissioning			
Disturbance and displacement as a result of construction and decommissioning activities (vessel presence and nearshore construction activity)	Presence of jack up barge and guard vessel in the nearshore area at Trenchless Technology punch out location for up to 15 months. Maximum duration of the construction phase of up to 39 months.	**English waters:** • Up to two pre-construction boulder removal / clearance vessels on site at any one time; • Up to two cable construction vessels on site at any one time; • Up to 10 guard vessels on site at any one time; • Up to two survey / Offshore Construction Vessel (OCV) vessels on site at any one time; • Up to two cable protection construction vessels on site at any one time; and • A jack up vessel may be used to support Landfall works.	Maximum number of vessels that could cause disturbance / displacement. Maximum duration of construction activities
Change in prey availability resulting from increased suspended sediment concentrations, reduced water quality/contamination disturbance and temporary habitat loss/disturbance	Maximum duration of the construction phase of up to 39 months.	**Habitat loss / disturbance in MCZ:** Up to 0.4 km^2 of temporary habitats loss / disturbance during cable installation (four x 25 m wide cable corridors x 4 km maximum cable length), five x trenchless technology exit pit locations in the nearshore area (four + one spare) and temporary placement of jack-up vessels in the nearshore area **Temporary increases in SSC, associated sediment deposition and potential release of contaminants:** Cable installation: • Maximum cable length ~4 km within the MCZ. • Cable installation methods include ploughs (displacement and/or non-displacement), jetting machines, mechanical trenchers, MFE. Of these, MFE	Maximum parameters for habitat loss and increased SSC affecting the availability of prey along the Marine Scheme during seabed preparation work and cable installation. Note, benthic prey items not sensitive to underwater noise. No morphological bedforms or boulders were identified within the MCZ during the site specific geophysical survey (XOcean, 2022) and thus sandwave clearance and boulder removal activities are not included. Further details on maximum volumes of sediment expected to be released during seabed preparation and cable installation and associated

Potential Impact	Maximum Design Scenario (Marine Scheme whole)	Maximum Design Scenario (English waters)	Justification
		has been assumed as the worst case with regards to SSC. • Installation mobilises sediments from a 3 m deep and 2.5 m wide trench. • Up to 5,000 m^2 of disturbance from the temporary placement of up to five jack-up vessel deployments in the nearshore area • Up to five exit pits, each 20 x 5 m, for up to four cable ducts (with one spare) due to trenchless cable installation at the Landfall.	dispersion / redeposition rates and distances are provided in the ES - ES, Volume 2, Chapter 7: Offshore Physical Environment and Seabed Conditions.
Operation and Maintenance			
Disturbance and displacement	Operation and maintenance phase of up 35 years.	**Whole Marine Scheme:** • Annual routine inspection survey • Annual geophysical survey • Up to four repair events and four reburial events of up to 1 km each over lifetime.	Greatest number of activities associated with the Marine Scheme resulting in the maximum number of vessel movements
Change in prey availability resulting from permanent habitat loss/change	Operation and maintenance phase of up 35 years,	**Habitat loss / disturbance in MCZ:** • Up to maximum cable length ~4 km within the MCZ. • Up to ~33% of cables in the MCZ may require external protection; • Up to 0.04 km^2 for four cable crossings and up to 200 m of cable requiring protection per crossing at a width of up to 12.5 m; and • Total footprint of cable protection in the MCZ is anticipatced to be 0.09 km^2 for 4 Offshore Export Cables each requiring ~2.1 km of external protection in the MCZ..	Maximum footprint which would be affected during the operation and maintenance phase.

7.5. Assessment of Effects – Project Alone

7.5.1. Potential Effects During Construction

7.5.1.1. DISTURBANCE AND DISPLACEMENT TO ORNITHOLOGICAL FEATURES

494. Construction phase activity has the potential to affect bird receptors through disturbance which in turn may lead to displacement of birds from the vicinity of construction activities (Furness *et al*., 2013). Displacement from areas that birds would otherwise use, for example for foraging, is akin to habitat loss.

495. Disturbance could arise from the operation of construction vessels and associated on board activities of construction personnel and machinery, noise and lighting. As described in section 7.4.2, landfall construction is scheduled to take place over a 15 month period during which vessel movements and other construction activity could occur at all times of day. The duration of construction activity visits at any one location (and at any one time) along the cable route will typically be relatively short (less than one day). However, longer periods of activity (up to a few weeks) are anticipated where work will be required at the Landfall, and thus within and in proximity to the Berwick to St Mary's MCZ.

496. Based on the maximum design scenario for the Marine Scheme, a trenchless technique such as HDD will be deployed to bring the cable from a point landward of MHWS exit point at least 250m seaward of MLWS, thus completely bypassing the intertidal zone. It is relevant to note that the intertidal habitat in the vicinity of the Landfall is subject to high baseline levels of disturbance (e.g. by recreational beach users and particularly dog walkers, the greatest source of anthropogenic disturbance by far, as reported in ES, Volume 2, Chapter 10: Offshore and Intertidal Ornithology).

497. Construction phase disturbance of birds could also occur due to project vessels (including supply and crew transfer vessels) operating within the Marine Scheme. Vessels travelling in the near vicinity of bird breeding areas during the breeding season (March to September) generally have greater potential for disturbing seabirds than when operating further from breeding areas. This is because many seabirds, especially auk species, tend to congregate on the sea near their colony. Project vessels will adhere to the Scottish Marine Wildlife Watching Code (NatureScot, 2017), and will avoid rafting birds where operationally safe and practicable to do so.

498. Disturbance to birds at would last only for the duration of construction work i.e., whilst project vessels are present, after which bird utilisation at the locality is expected to quickly return (within hours) to baseline conditions.

7.5.1.1.1. MAGNITUDE OF IMPACT

499. Common eider could be disturbed directly by the construction activity, with individual birds within the MCZ showing some form of behavioural response. This could be a very mild response such an increase in vigilance, or a stronger response such as moving away from the source of disturbance, resulting in displacement to a new location.

500. Disturbance to birds at a construction locality is a temporary and reversible effect that would last only for the duration of construction work, after which bird utilisation at the locality is expected to quickly return (within hours) to baseline conditions. The potential for cable laying activities to disturb seabirds is likely to extend no more than approximately 500 metres from the cable laying vessel, as discussed in Volume 2, Chapter 10: Offshore and Intertidal Ornithology). Although the location where such disturbance would occur will move as construction work proceeds, at any one time the area over which seabirds would potentially be affected is anticipated to be in the order of only 1 km^2. It is also noted that the presence of a limited number of construction vessels within the MCZ

is not a substantive change from baseline conditions, given the existing vessel activity in the area (ES, ES, Volume 2, Chapter 13: Shipping and Navigation).

501. A species' vulnerability to vessel disturbance and sensitivity to its effects may change seasonally due to changes in their food requirements and mobility. For example, breeding birds provisioning chicks have greater feeding requirements compared to non-breeding birds and therefore have greater sensitivity to disturbance. Common eider were considered in terms of a regional breeding population and occurrence in inshore and near-shore waters, regularly present in winter in low numbers (maximum 5). This was considered in combination with a medium disturbance susceptibility of common eider (Furness *et al*., 2012) to determine that the spatial magnitude of disturbance for common eider would be negligible (<1%) in the context of the size of the population (ES, Volume 2, Chapter 10: Offshore and Intertidal Ornithology).

7.5.1.1.2. SENSITIVITY OF THE RECEPTOR

502. The overall sensitivity of ornithology receptors to construction disturbance is judged by considered of three receptor characteristics:

- The susceptibility of individuals of a species to disturbance;
- The value of the receptor population; and
- The conservation status of the receptor population.

503. All eider likely to be present in the vicinity of construction works are presumed to be from the breeding population within the MCZ and as such are considered to be high value receptors. Common eider are also classified in the UK as Amber under the Birds of Conservation Concern 5: the Red List for Birds with an unfavourable conservation status (Stanbury *et al*., 2021) and areas of habitat on which eider are ecologically dependent are also protected within the MCZ. Eider have a medium susceptibility to disturbance and the population is considered to have a high recoverability to the effects of disturbance.

7.5.1.1.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

504. Based on the information presented above, the following can be concluded with respect to the attributes of the common eider feature of the Berwick to St Mary's MCZ.

505. The disturbance and displacement pressure is via a behavioural impact to the common eider and not relevant to the supporting habitat aspect of the feature.

506. Common eider may be temporarily disturbed and displaced from the nearshore waters during construction activities. This would equate to an approximate 1 km^2 disturbance area for a period of up to 15 months. The MCZ provides 634 km^2 of supporting habitat suitable for behaviours such as foraging, preening, bathing and displaying, of which the area of disturbance equates to 0.16% of the available area within the MCZ.

507. Disturbance to birds at the construction locality would last only for the duration of construction work i.e., whilst project vessels are present, after which bird utilisation at the locality is expected to quickly return (within hours) to baseline conditions.

508. The population of common eider is defined by the distribution, size, age and sex ratios of the population. The temporary disturbance and displacement of common eider within a small area of available habitat would not be expected to have a population level effect.

509. It is concluded that potential effects to the common eider population, due to disturbance and displacement, would not hinder the conservation objective to:

- **recover the population.**

510. It is concluded that potential effects to the common eider supporting habitat, due to disturbance and displacement, would not hinder the conservation objective to:

- **recover quality and extent; and**
- **recover structure and function.**

7.5.1.1.4. SECONDARY MITIGATION AND RESIDUAL EFFECT

511. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the MCZ.

7.5.1.2. CHANGE IN PREY AVAILABILITY RESULTING FROM INCREASED SSC, REDUCED WATER QUALITY / CONTAMINATION, AND TEMPORARY HABITAT LOSS/DISTURBANCE

512. Reduced benthic prey availability as a result increased SSC generation and direct disturbance to the sediment by construction activity has potential to give rise to impact the regional receptor population of common eider.

513. The spatial extent of critical marine habitat for this population has been determined by Natural England and is defined by the boundary of the Berwick to St Mary's MCZ. This MCZ covers an area of 634 km^2 and roughly corresponds to the extent of territorial waters off the Northumberland coast that are less than 20 m deep.

514. This species specialises in feeding on non-mobile benthos, in particular bivalve molluscs. Non-mobile benthos prey densities in the areas of seabed affected by physical disturbance could take up to several years to recover to baseline levels and thus reductions in prey availability for common eider could persist over the medium term.

515. Increases in SSC may occur during the construction phase as a result of cable trenching and burial. No morphological bedforms were identified within the MCZ during the site specific geophysical survey (XOcean, 2022) and thus seabed levelling is not considered further. The increases in suspended sediment may result in a sediment plume in the water column that is then deposited at a distance from the Marine Scheme. As discussed in ES, Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology, increases in SSC can impact benthic invertebrates through reductions in water quality and smothering.

516. The resuspension of sediment may result in the release of sediment-bound contaminants, which could have detrimental effects on benthic receptors. Elevated levels of contaminants were recorded at a small number of sampling station in the nearshore area (ES, Volume 3, Appendix 8:1: Benthic Survey Report (Phase 1 and 2)), likely due to the area's proximity to the Port of Blyth. However, as discussed in ES, Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology, in the context of natural disturbance of sediment during storm events that will also release sediment-bound contaminants, the potential mobilisation of sediment-bound contaminants during the construction phase of the Marine Scheme are not expected to result in a significant exceedance beyond baseline levels. As such, this pressure is not assessed further here.

7.5.1.3. MAGNITUDE OF IMPACT

517. Where cable burial is achieved, the effects on low-mobility benthic prey caused by construction activity would be reversible, with populations likely to gradually recover through natural recolonisation from surrounding habitat to baseline conditions over the medium-term (up to approximately two years after construction work ends). The potential for reduced benthic prey availability would persist from the initial physical disturbance of seabed habitat by construction activity, until recovery occurs.

518. The potential for permanent habitat loss, in the case of cable installation presence, is discussed in section 7.5.2.

519. As described in section 7.4.2, up to 0.4 km^2 of temporary benthic habitat loss and disturbance may occur within the MCZ during the construction phase. The construction phase for the Marine Scheme

will last up to 39 months, however, works within the MCZ can be expected to be significantly less, including landfall works lasting up to 15 months.

520. As discussed in ES, Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology, this temporary benthic habitat loss and disturbance will result in a loss of baseline levels of prey items within this area for up to two years following construction. This equates to a negligible temporary loss of eider foraging habitat within the MCZ of 0.06%.

521. The greatest instantaneous increases in SSC will occur in the immediate vicinity of the construction activities. In Chapter 7: Offshore Physical Environment and Seabed Conditions, it was determined that the majority of sediment disturbed (on average over 90%) would settle out in the immediate vicinity of the disturbance within the order of seconds and thus the highest smothering potential is immediately adjacent to the construction works.

522. No significant effects on benthic or fish and shellfish receptors were identified by the ES (ES, Volume 2, Chapters 8 and 9 respectively. As such, adverse effects on common eider prey species availability are not anticipated.

523. Common eider is a mobile species and therefore any individuals that were to experience a localised reduction in benthic prey availability would be able to relocate to nearby alternative habitat. It is concluded that the spatial magnitude of benthic prey availability impact on the common eider receptor would be negligible.

7.5.1.4. SENSITIVITY OF RECEPTOR

524. The impacts to benthic prey availability following direct disturbance would be a temporary and localised reduction in density and species richness within the footprint of construction activities. Soft sediments, such as those present in the overlap between the Marine Scheme and the MCZ, would be expected to recover from these activities within one to two years, following recolonisation of the disturbed sediments from nearby unaffected areas (see ES, Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology).

525. The prey items of common eider have low to medium sensitivity to increased suspended solids (water quality) and light or heavy level smothering and siltation according to the MarESA sensitivity assessments (see ES, ES, Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology). The communities associated with these biotopes, by their very nature, have a degree of tolerance to short-term increases in suspended solids and low-level sediment deposition (Tillin, 2022).

526. Common eider are dependent on benthic prey (especially bivalve molluscs) and the area of foraging habitat available to the receptor population is relatively restricted. The common eider regional receptor population is deemed to be of high susceptibility to benthic prey availability but have high recoverability potential.

7.5.1.5. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

527. Based on the information presented above, the following can be concluded with respect to the attributes of the common eider feature of the Berwick to St Mary's MCZ.

528. There will be a temporary and spatially negligible reduction in supporting habitat of 0.06%. The habitat will be expected to recover to baseline conditions within two years. Any individuals that were to experience a localised reduction in benthic prey availability would be able to relocate to nearby alternative habitat. There is no potential for population level impacts.

529. It is concluded that potential effects to the common eider population, due to disturbance and displacement, would not hinder the conservation objective to:

- **recover the population.**

530. It is concluded that potential effects to the common eider supporting habitat, due to disturbance and displacement, would not hinder the conservation objective to:

- **recover quality and extent; and**
- **recover structure and function.**

7.5.2. Potential Effects During Operation and Maintenance

7.5.2.1. DISTURBANCE AND DISPLACEMENT TO ORNITHOLOGICAL FEATURES

531. The potential for bird disturbance the during the operation and maintenance phase arises from vessel activity required to check the condition of the Marine Scheme and affect any necessary maintenance and repairs, as explained in ES, Volume 2, Chapter 5: Project Description. It is anticipated that ordinarily, cable monitoring and maintenance would involve the use of a single vessel operating at relatively slow speeds. Cable maintenance will be undertaken in response to information gathered during condition surveys. Based on industry experience of operating similar subsea transmission assets in the North Sea, it is likely that cable maintenance activities will be relatively infrequent (less than annual) and be required only for short stretches of the cable route.

532. It is anticipated that the vessel activity required in the O&M phase would mainly involve a relatively slow moving vessel working gradually along the cable route, together with associated transit journeys from/to local ports, and would generally involve the use of vessel smaller than the cable laying vessel and/or craft used during construction. It is also anticipated that O&M activities would, on average, require considerably fewer vessel days per year than the during the construction phase. Common eider would be expected to show similar levels of vessel proximity tolerance and behavioural responses to vessel activity as that in the construction phase, including localised displacement.

7.5.2.1.1. MAGNITUDE OF IMPACT

533. The nature of disturbance due to vessel activities during operation and maintenance would be similar to the construction phase but of a smaller magnitude due to the anticipated lower numbers of vessels used and the lower number of vessel days per year. However, the operation and maintenance phase would persist over the operational life of the cable (35 years). Therefore, during this phase, vessel disturbance would comprise localised, infrequent and short duration events (i.e., limited to the time when a project vessel is present at a location) and occurring over a long-term time scale.

7.5.2.1.2. SENSITIVITY OF THE RECEPTOR

534. The sensitivity of the common eider feature to vessel disturbance during the O&M phase is the same as during the construction phase.

7.5.2.1.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

535. Based on the information presented above, it is concluded that potential effects to the common eider population, due to disturbance and displacement, would not hinder the conservation objective to:

- **recover the population.**

536. It is concluded that potential effects to the common eider supporting habitat, due to disturbance and displacement, would not hinder the conservation objective to:

- **recover quality and extent; and**
- **recover structure and function.**

7.5.2.1.4. SECONDARY MITIGATION AND RESIDUAL EFFECT

537. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the MCZ.

7.5.2.2. CHANGE IN PREY AVAILABILITY RESULTING FROM INCREASED SSC, EMF AND THERMAL EMISSIONS, AND LONG TERM HABITAT LOSS/ DISTURBANCE

538. During the operation and maintenance phase, there is the potential for ornithological prey species to be indirectly impacted.

539. Potential effects include those resulting from permanent loss of subtidal soft sediment to hard substrate associated with cable protection, increased SSC during maintenance and repair activities and both thermal emissions and EMF effects associated with the operation of the Offshore Export Cables. Such activities and impacts may change the behaviour or availability of prey species for seabirds.

540. Permanent habitat changes resulting from cable protection (approximately 0.09 km^2) will not represent a habitat loss for the prey species of common eider (gastropod and bivalve molluscs, echinoderms, and decapod crustaceans) as these faunae can inhabit both subtidal soft sediments and hard substrates such as rocky outcrops and stones and boulders. This pressure is not considered further.

7.5.2.2.1. MAGNITUDE OF IMPACT

541. As described above for temporary habitat / species loss and disturbance during the operation and maintenance phase, the length of cable requiring repair or reburial in each case will be significantly less than the length of cable installed during the construction phase and the magnitude of SSC generation is expected to be significantly lower than during construction. The sediment plumes and sedimentation footprints would be dependent on which section of the cable is being repaired and thus the sediment type. Considering the far reduced scale the impacts of the operation and maintenance activities (i.e. cable repair and reburial) are predicted to be no greater than those for construction.

542. High level modelling has been completed for the Marine Scheme on the level and attenuation of the EMF emissions (B-fields only) for both a paired symmetrical monopole configuration rated at 320 kV (comprising 4 HVDC cables) and a bipole configuration rated at 525 kV (2 HVDC cables), as detailed in ES, Volume 2, Chapter 5: Project Description.

543. As detailed in ES, Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology, the maximum EMF strengths are associated with a bipole cable configuration rated at 525 kV. For the 525 kV bipole configuration, including a pair of cables separated by 25 m and buried to a minimum depth of 0.5 m, the resulting EMF strength is approximately 658 µT. This is shown to decay with distance to the natural GMF strengths for the Marine Scheme (50 µT) at a distance of between 10-20 m from the cable, both vertically and horizontally and falls below the MarESA tool benchmark within 10 m of the cables. In reality, it is likely that the cables will be buried to a greater depth than this in areas with favourable ground conditions, where EMF strengths will dissipate to the GMF even more rapidly. The extent of any increases in EMF associated with the Marine Scheme therefore is very spatially limited and is not expected to result in a widespread effect on baseline conditions.

544. As discussed in ES, Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology, thermal emissions can modify physical and chemical properties of the seabed, result in a development of microorganism communities and/or result in displacement of demersal mobile organisms (Taormina *et al*., 2018). It is expected that the zone of influence from any thermal radiation will be limited to the immediate vicinity of each cable and that heat will dissipate relatively rapidly. The prey species potentially impacted are considered to be fairly common, and therefore, the localised effects from thermal emissions will only impact a small proportion of the available prey species in the wider area.

7.5.2.2.2. SENSITIVITY OF RECEPTORS

545. The sensitivity of the benthic prey items to increased SSC is as described previously for the construction phase in section 7.5.1.

546. Summaries of the current evidence of EMF effects on the marine environment is provided in Gill and Desender (2020) and Hutchison et al (2020). Overall, the effects of EMFs on benthic communities are considered to be not well understood and based on a limited number of studies. Recent studies suggest that benthic communities growing along cable routes are similar to those in nearby baseline areas, and where there are differences in species abundance, this is considered to be likely due to the physical presence of the cable and surface properties, rather than an EMF effect (Gill and Desender, 2020). Similarly, a recent review of the effects of EMF on invertebrates reported that no direct impact on individual survival has been identified in the literature (Hervé, 2021). The relevant MarESA pressure for EMF is electromagnetic changes, however no evidence is available in relation to this pressure for any of the benthic communities within the Marine Scheme.

547. Similar to EMF, there is also a paucity of evidence on the potential effects of thermal emissions on invertebrates. The potential impact on the benthic fauna of the ncMPA is therefore largely unknown (Boehlert & Gill, 2010; Taormina et al. 2018). The relevant MarESA tool pressure and benchmark for thermal emissions from operational cables is temperature increase (local). The benchmark for this pressure is a 5°C increase in temperature for one month period, or 2°C for one year. According to MarESA, the biotopes recorded within the MCZ have low sensitivity to the thermal emissions pressure (see ES, Volume 2, Chapter 8: Benthic and Subtidal and Intertidal Ecology).

548. As detailed in section 7.5.1, common eider are deemed to be highly sensitive to reductions in prey availability.

7.5.2.2.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

549. Based on the information presented above, the following can be concluded with respect to the attributes of the common eider feature of the Berwick to St Mary's MCZ.

550. The extent and distribution of prey availability will be maintained in the long term following cable maintenance activities as the increase in SSC and associated deposition is predicted to affect only a small proportion of the MCZ, intermittently during the operation and maintenance phase. The effects will be temporary and reversible with recovery of sediments occurring following completion of maintenance activities.

551. The extent of any increases in EMF or thermal emissions associated with the Marine Scheme is spatially limited and emissions would not be expected to materially impact the availability of prey features in relation to their distribution across the MCZ supporting habitat.

552. The foraging habitat will be expected to recover to baseline conditions within two years. Any individuals that were to experience a localised reduction in benthic prey availability would be able to relocate to nearby alternative habitat. There is no potential for population level impacts.

553. It is concluded that potential effects to the common eider population, due to disturbance and displacement, would not hinder the conservation objective to:

- **recover the population.**

554. It is concluded that potential effects to the common eider supporting habitat, due to disturbance and displacement, would not hinder the conservation objective to:

- **recover quality and extent; and**
- **recover structure and function.**

7.5.2.2.4. SECONDARY MITIGATION AND RESIDUAL EFFECT

555. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the ncMPA.

7.5.3. Potential Effects During Decommissioning

556. Given the nature of the decommissioning activities, which will largely be a reversal of the installation process, the impacts during decommissioning due to disturbance and benthic prey availability are expected to be similar, and of no greater magnitude, to those assessed for the construction phase. Therefore, the assessment conclusions for the construction phase also apply equally to the decommissioning phase. It is therefore concluded that that there is no significant risk of the decommissioning of the Marine Scheme hindering the achievement of the conservation objectives stated for the MCZ.

7.5.3.1. SECONDARY MITIGATION AND RESIDUAL EFFECT

557. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the MCZ.

7.5.4. Assessment of Effects - Project Alone Conclusion

558. Based on the information presented for all features, conservation objectives and attributes set out above, there will be no significant risk of hindering the achievement of the conservation objectives for all features of the Berwick to St Mary's MCZ.

7.6. Assessment of Effects – In-Combination

7.6.1. Other Plans and Projects Included in the In-Combination Assessment

559. Table 7.3 lists the other plans and project that have been identified as having potential to have an effect on the Berwick to St Mary's MCZ in combination with the Marine Scheme.

Table 7.3 Other Plans and Projects with potential for in-combination effects on the Berwick to St Mary's MCZ

Development	Status	Distance from Marine Scheme (km)	Description of Development/ Plan	Dates of Construction (if applicable)	Dates of Operation (if applicable)	Phase Overlap with the Marine Scheme
Cambois Connection Onshore Scheme	In planning	0 km	Onshore cables, converter station and associated works to connect into the National Grid substation at Blyth	Construction anticipated to be 2026 to 2030	Anticipated to be operational from 2030 for 35 years	Construction, Operation and Maintenance
Blyth Demonstrator Offshore Wind Farm – Phase 2	Consented	1	Offshore wind farm	Completed by 2025	Current lease secured until 2050	Operation and maintenance
Blyth Demonstration	Consented	0	Transmission infrastructure	Completed by 2025	Assumed to be consistent with Blyth	Operation and maintenance

Development	Status	Distance from Marine Scheme (km)	Description of Development/ Plan	Dates of Construction (if applicable)	Dates of Operation (if applicable)	Phase Overlap with the Marine Scheme
Phase 2 (&3) Cable Corridor					Demonstrator Offshore Wind Farm – Phase 2	

7.6.2. Potential Effects During Construction

7.6.2.1. DISTURBANCE AND DISPLACEMENT TO ORNITHOLOGICAL FEATURES

560. The developments listed in Table 7.3 which met the CEA criteria may result in some temporary increases disturbance and displacement of common eider.

561. It is also appropriate to consider the Landfall area in further detail in the context of the Cambois Connection Onshore Scheme including owing to the populations of eider protected by the Berwick to St Mary's MCZ.

562. Based on the maximum design scenario for the Marine Scheme, a trenchless technique such as HDD will be deployed to bring the Offshore Export Cables ashore via ducts that will be installed from a point landward of MHWS to an exit point 250m seaward of MLWS, thus completely bypassing the intertidal zone.

563. Given that there will be no construction works within the intertidal area, there is no potential for any direct effects on common eider ducks in terms of direct disturbance. However, there is limited potential for birds in the intertidal area to be disturbed by construction works in the nearshore area and from construction activities associated with the Onshore Scheme (located landward of MHWS) associated with the trenchless technology construction compounds required to install the ducts and bring the Offshore Export Cables to shore where they will be connected to the Onshore HVDC Cables.

564. Any disturbance from both offshore and onshore construction activities would last only for the duration of construction work i.e., whilst project vessels are present offshore and works are being undertaken in the onshore trenchless technology construction compounds, after which bird utilisation at the locality is expected to quickly return (within hours) to baseline conditions. The disturbance will also not occur within the intertidal zone (will occur offshore or onshore).

565. The Onshore Scheme is located wholly outside of the Berwick to St Mary's MCZ, and whilst some populations of common eider may wander onto land in-use by the Onshore Scheme, the common eider is a large sea-duck, and is anticipated to favour the coastal waters as opposed to regularly frequenting the dune structure at Cambois. This is validated by the findings from the non-breeding survey carried out by the Applicant at the Landfall which observed 3.1 and 5 common eider (mean peak count and maximum peak count respectively), none of which were observed on the beach / intertidal area or fields and flood water. It was also noted that Cambois beach does not provide suitable habitat for common eider, given the extensive recreational activities, specifically dog walking (ES, Volume 3, Appendix 10.1: Non-Breeding / Over-Wintering Bird Survey Report).

566. The planned construction period for the Marine Scheme overlaps with the operation and maintenance periods for the Blyth Demonstrator Offshore Wind Farm – Phase 2. The Blyth Demonstrator Phase 2 (&3) export cable project has consent to be constructed, however, EDF have confirmed there is no indicative construction timescale. Due to consent timeline requirements, it is not considered likely that the construction period would overlap with the construction period of the Marine Scheme.

567. The vessel disturbance to common eider predicted to occur as a result of the Marine Scheme will be additional to disturbance and displacement caused by the operation and maintenance of the

Blyth Demonstrator Offshore Wind Farm – Phase 2. It will also be additional to the baseline levels of vessel disturbance from long established shipping and fishing activities in the region.

568. Disturbance to birds would last only for the duration of the works i.e., whilst project vessels are present, after which bird utilisation at the locality is expected to quickly return (within hours) to baseline conditions.

569. Disturbance to birds at a construction locality would last only for the duration of construction work i.e., whilst project vessels are present, after which bird utilisation at the locality is expected to quickly return (within hours) to baseline conditions. Based on the low levels of anticipated disturbance associated with the Marine Scheme and the low levels of vessel activity typically expected for maintenance and repair activities for the Blyth Demonstrator Offshore Wind Farm – Phase 2, the conclusions of the MCZ assessment for the Marine Scheme alone also apply for the in-combination assessment.

570. Based on the information presented here, it can be concluded that cumulative risk of disturbance and displacement during the Marine Scheme construction phase will not lead to a significant risk of hindering the achievement of the conservation objectives common eider of the Berwick to St Mary's MCZ (Table 6.7).

Table 7.4 CEA of the Berwick to St Mary's MCZ for increased disturbance and displacement – Construction phase.

Protected Feature	Potential impact
Common eider	The cumulative increases in disturbance and displacement effects are predicted to temporarily affect birds using the Cambois region of the MCZ, after which bird utilisation at the locality is expected to quickly return (within hours) to baseline conditions. It is concluded that cumulative effects to the common eider population, due to disturbance and displacement, would not hinder the conservation objective to: • recover the population. It is concluded that potential effects to the common eider supporting habitat, due to disturbance and displacement, would not hinder the conservation objective to: • recover quality and extent; and • recover structure and function.

7.6.2.2. CHANGE IN PREY AVAILABILITY RESULTING FROM INCREASED SSC, REDUCED WATER QUALITY / CONTAMINATION, AND TEMPORARY HABITAT LOSS/DISTURBANCE

571. The developments listed in Table 7.3 which met the CEA criteria may result in some temporary increases disturbance and displacement of common eider, excluding the Onshore Scheme as this project is wholly located above MHWS, and therefore there is no pathway for changes in prey availability as a result of the project.

572. The planned construction period for the Marine Scheme overlaps with the operation and maintenance periods for the Blyth Demonstrator Offshore Wind Farm – Phase 2 offshore wind farm and export cable.

573. Increases in SSC will occur during the Marine Scheme construction phase as a result of cable trenching and burial. The increases in suspended sediment may result in a sediment plume in the water column that is then deposited to the seabed.

574. The construction activities for the Marine Scheme may coincide with repair and maintenance activities for the other projects that may also generate SSC plumes. However, any increase in SSC as a result of the repair and maintenance activities of the would be temporary and expected to be significantly less that plumes expected from construction activities of the Blyth Demonstrator Offshore Wind Farm – Phase 2 and Blyth Demonstrator Phase 2 (&3) export cable projects. As for the Marine Scheme, the majority of the sediment would be expected to fall out of suspension rapidly and thus remain highly localised.

575. As discussed in ES, Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology, increases in SSC can impact benthic invertebrates through reductions in water quality and smothering, however, the benthic fauna on which common eider prey are highly tolerant of changes to water clarity and smothering and there would be no risk of material reduction in the availability of these prey items.

576. Where cable burial is achieved, the effects on low-mobility benthic prey within the footprint of the construction activity would be highly localised (0.4 km^2) and reversible, with populations likely to gradually recover through natural recolonisation from surrounding habitat to baseline conditions over the medium-term (up to approximately two years after construction work ends). The footprint of additional habitat disturbance arising from the Blyth Demonstrator Phase 2 (&3) export cable construction activities will be small in extent, localised to within the Array 2 cable corridor.

577. Based on the information presented here, it can be concluded that cumulative risk of SS, reduced water quality/contamination, and temporary habitat loss/disturbance will not result in a material reduction in prey availability during the Marine Scheme construction phase, and thus will not lead to a significant risk of hindering the achievement of the conservation objectives common eider of the Berwick to St Mary's MCZ (Table 7.5).

Table 7.5 CEA of the Berwick to St Mary's MCZ for change in prey availability – Construction phase.

Protected Feature	Potential impact
Common eider	The cumulative effects of temporary SSC, contamination and habitat loss/disturbance during the construction period of the MS are not predicted to materially reduce the availability of prey items. It is concluded that cumulative effects to the common eider population, due to reduced prey availability, would not hinder the conservation objective to: • recover the population. It is concluded that potential effects to the common eider supporting habitat, due to reduced prey availability, would not hinder the conservation objective to: • recover quality and extent; and • recover structure and function.

7.6.3. Potential Effects During Operation and Maintenance

7.6.3.1. DISTURBANCE AND DISPLACEMENT TO ORNITHOLOGICAL FEATURES

578. There are not anticipated to be any ongoing activities at the trenchless technology construction compounds during the Operation and Maintenance phase of the Onshore Scheme. As such there is no pathway for cumulative disturbance resulting from the Onshore Scheme, and this development is not considered further.

579. The Blyth Phase 2 (&3) export cable overlaps with the Berwick to St Mary's MCZ and the Marine Scheme. The planned operation and maintenance period for the Marine Scheme overlaps with the operation and maintenance period for the Blyth Demonstrator Phase 2 (&3) export cable and Blyth Demonstrator Offshore Wind Farm – Phase 2.

580. It is anticipated that the vessel activity required in the O&M phase would mainly involve a relatively slow moving vessel working gradually along the cable route, and would generally involve the use of fewer vessels and/or craft used during construction. The disturbance generated from cumulative vessel activity related to operation and maintenance activities for these projects, including transit, would be no greater, and likely less than that generated during the construction phase of the project.

581. The risk of hindering the conservation objectives of the MCZ disturbance and displacement to ornithological features during the operation and maintenance phase, in combination with the other project considered, would be expected to be less that that assessed for the construction phase (Table 7.6).

Table 7.6 CEA of the Berwick to St Mary's MCZ for disturbance and displacement to ornithological features – operation and maintenance phase.

Protected Feature	Potential impact
Common eider	The cumulative increases in disturbance and displacement effects are predicted to temporarily affect birds using the Cambois region of the MCZ, after which bird utilisation at the locality is expected to quickly return (within hours) to baseline conditions. It is concluded that cumulative effects to the common eider population, due to disturbance and displacement, would not hinder the conservation objective to: • recover the population. It is concluded that potential effects to the common eider supporting habitat, due to disturbance and displacement, would not hinder the conservation objective to: • recover quality and extent; and • recover structure and function.

7.6.3.2. CHANGE IN PREY AVAILABILITY RESULTING FROM INCREASED SSC, EMF AND THERMAL EMISSIONS, AND PERMANENT HABITAT LOSS/DISTURBANCE

582. Table 7.3 lists the other plans and project that have been identified as having potential to have an effect on the Berwick to St Mary's MCZ in combination with the Marine Scheme in English Waters. The Onshore Scheme is wholly located above MHWS, and therefore there is no pathway for changes in prey availability as a result of the project, as such it is not considered further.

583. The planned operation and maintenance period for the Marine Scheme overlaps with the operation and maintenance periods for the Blyth Demonstrator Offshore Wind Farm – Phase 2 and the construction of the Blyth Demonstrator Phase 2 (&3) export cable.

584. As discussed in section 7.6.2, there was no risk of hindrance to the conservation objectives of the MCZ in the construction period when considered cumulatively with the operation and maintenance activities of the Blyth Demonstrator Offshore Wind Farm – Phase 2. The combined SSC generation during the operation and maintenance phase of the Marine Scheme will be less than that during the construction phase. SSC generated through construction of the Blyth Demonstrator Phase 2 (&3) cable would not be expected to be any greater than that produced during the Marine Scheme construction phase. Any SSC generated by the Marine Scheme during this period would be marginal in comparison the construction activities underway.

585. Indirect effects on birds may occur during the operation and maintenance phase if there are impacts on prey species and/or the habitats of prey species. These indirect effects include those resulting from permanent habitat loss associated with cable protection, increased SSC during maintenance and repair activities and both thermal emissions and EMF effects associated with the operation of Offshore Export Cables. Such activities and impacts may change the behaviour or availability of

prey species for seabirds. The project alone assessment for the Marine Scheme concluded no risk of hindrance of the conservation objectives for the site for the above pressures.

586. The consented Blyth 2 & 3 cable corridor extends for approximately 4 km through the MCZ on approach to landfall. The Blyth Demonstrator Phase 2 (&3) export cable project plans to install 0.0013 km^2 of cable protection along the export cable corridor (EDF Energy Renewables, 2017). Should the full extent of cumulative worst case cable protection (0.0913 km^2) be present within the MCZ, this would equate to 0.014% of the available habitat within the MCZ. However, cable protection will not represent a habitat loss for the prey species of common eider (as gastropod and bivalve molluscs, echinoderms, and decapod crustaceans) as these fauna can inhabit both subtidal soft sediments and hard substrates such as rocky outcrops and stones and boulders. As such, there is no risk to hindering the conservation objectives of the site relating to the supporting habitat for common eider.

587. The only potential for cumulative EMF and thermal emissions would arise at the point of a cable crossing. However, the extent of EMF effects will be within close proximity of the source, likely within 10-20 m prior to decaying to natural GMF (as is the case for the Marine Scheme; section 7.5.2). Therefore, even when other development cables are in close proximity to the Marine Scheme the extent of impact is limited. Consequently, the magnitude of impact to benthic prey receptors is considered to be the same as for the Marine Scheme assessment alone.

588. Similarly, sediment heating will remain as highly localised at the point of a cable crossing, reducing to ambient levels rapidly with distance from the cables of the Marine Scheme and the BBWF array area. Consequently, the magnitude of impact to benthic prey receptors is considered to be the same as for the Marine Scheme assessment alone.

589. Based on the information presented here, it can be concluded that cumulative risk of change in prey availability during the Marine Scheme operation phase will not lead to a significant risk of hindering the achievement of the conservation objectives common eider of the Berwick to St Mary's MCZ (Table 7.7).

Table 7.7 CEA of the Berwick to St Mary's MCZ for change in prey availability – Construction phase.

Protected Feature	Potential impact
Common eider	The cumulative effects of temporary SSC, contamination and habitat loss/disturbance during the construction period of the MS are not predicted to materially reduce the availability of prey items. It is concluded that cumulative effects to the common eider population, due to reduced prey availability, would not hinder the conservation objective to: • recover the population. It is concluded that potential effects to the common eider supporting habitat, due to reduced prey availability, would not hinder the conservation objective to: • recover quality and extent; and • recover structure and function.

8. MCZ Assessment - Coquet to St Mary's MCZ

8.1. Introduction

590. Coquet to St Mary's MCZ covers 192 km² of intertidal and territorial English waters from near Whitley Bay in the south to near Alnwick in the north (Figure 12). It includes areas around St Mary's Island and Coquet Island. Thirteen Broadscale marine habitats (BSHs) and two habitat Features of Conservation Importance (FOCI) are designated for protection at the site. The depth at the site ranges from 10 m above the mean low water mark to 30 m below at its seaward extent. The Marine Scheme overlaps the Coquet to St Mary's MCZ for the final approximately 4 km of the offshore export cable corridor approach to the Landfall at Cambois Beach

8.2. Baseline

591. The seabed protected by this site is made up of rock, sand, mud and sediment as detailed above. This range of habitats provides a home for a large variety of marine life. The coarse sediment found within the MCZ is home to animals such as bristleworms, sand mason worms, small shrimp-like animals, burrowing anemones, and cockles. Rocks in shallow water (infralittoral rocks) are a key habitat for kelp and red seaweed, whilst the deep water (circalittoral) rock is a habitat for cup coral, sea-fans, and anemones, and sponges. These animals thrive in this deeper water where there is not enough sunlight for algal life to grow.

592. These complex habitats and communities also support mobile species such as starfish, sea urchins, crabs, and lobsters. When this site was surveyed, amongst the species recorded, is the first ever Arctic cushion star, a starfish, on the English coast. The site also supports a range of intertidal habitats, which are above water at low tide and underwater at high tide. One of these habitats is intertidal underboulder communities. Boulders create shaded areas that provide a refuge to sea squirts, sea mats, and sponges. The undersides of the boulder provide a habitat for animals like sea slugs, long-clawed porcelain crabs and brittlestars, which shelter and feed in the damp shaded conditions. Crabs, fish and young lobsters also scavenge for food and seek shelter amongst the boulders (Defra, 2015a)

593. Multibeam echosounder (MBES) bathymetry and backscatter data was collected within the MCZ between January and March 2014, followed by a ground truth survey between July and September 2014 in support of the recommendation to designate the MCZ at the time (Defra, 2015b). Ninety-five target sampling stations were identified for the collection of ground truth data within the MCZ. This selection of stations was deemed to give the best possible representation of the MCZ and potential broadscale habitats.

594. There are some significant differences between the original Site Assessment Document (NetGain, 2011) and the site specific survey results (ES, Volume 3, Appendix 8.1: Benthic Survey Report (Phase 1 and 2). High energy infralittoral rock, moderate energy infralittoral rock, subtidal course sediment, subtidal mud and subtidal mixed sediments were not found to be present within the MCZ. However, results from the ground truth survey indicated significantly higher than predicted levels of habitats; this included subtidal sand with an approximate extent of 51.76 km² (~51.63 km² more than the previous estimate) and subtidal mud with an approximate extent of 47.00 km² (~46.84 km² than the previous estimate). Further analysis of the 2014 data was carried out by Natural England as part of a review of the MCZ to confirm the potential presence of an undesignated habitat feature of conservation interest – sea-pen and burrowing megafauna communities' – within the MCZ (Natural England, 2022).

595. In the datasets analysed, the slender sea-pen *Virgularia mirabilis*, the Norway lobster *Nephrops norvegicus*, the mud shrimps *Callianassa subterranea* and *Upogebia stellata* and the angular crab *Goneplax rhomboides* were identified however, at this stage, the habitat feature of conservation interest sea-pen and burrowing megafauna communities is not a designated feature of the MCZ.

596. The Marine Scheme Offshore Export Cable Corridor survey (Figure 12) (ES, Volume 3, Appendix 8.1: Benthic Survey Report (Phase 1 and 2)), recorded the sandy biotopes 'Circalittoral muddy sand' (SS.SSa.CMuSa) and '*Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand' (SS.SSa.IMuSa.FfabMag) within the MCZ. This biotope is found in stable, fine, compacted sands and slightly muddy sands in the infralittoral and littoral fringe and communities are dominated by venerid bivalves such as *Chamelea gallina*. This biotope may be characterised by a prevalence of *Fabulina fabula* and *Magelona mirabilis* or other species of Magelona (e.g. *M. filiformis*). Other taxa, including the amphipod *Bathyporeia* spp. and polychaetes such as *Chaetozone setosa, Spiophanes bombyx* and *Nephtys* spp. are also commonly recorded (JNCC, 2022)

597. Moderate energy circalittoral rock with soft rock communities (CR.MCR) was identified within the MCZ, including annex I stony reef and Annex I rocky reef (Figure 12). '*Flustra foliacea* on slightly scoured silty circalittoral rock' (CR.MCR.EcCr.FaAlCr.Flu) was recorded just seaward of the Coquet to St Mary's MCZ. This biotope is typically found on the upper faces of moderately wave-exposed circalittoral bedrock or boulders subjected to moderately strong tidal streams. These rocky patches may be interspersed with gravelly sand patches, causing a scouring effect. (JNCC, 2022).

598. A site specific intertidal survey was conducted at two intertidal sites north and south of Cambois Beach, Northumberland (ES, Volume 3, Appendix 8.2: Intertidal Survey Report). Due to the homogenous nature of the intertidal habitats within the intertidal zone at Cambois Beach, these two survey locations were selected as being both representative of the habitats and features along the beachfront and to also allow for a sufficient spatial extent of potential landfall locations along Cambois Beach. The south survey area overlaps with the Landfall. The EUNIS habitats identified during the survey are listed in Table 8.7.

Table 8.1 EUNIS habitats identified during the 2022 intertidal surveys

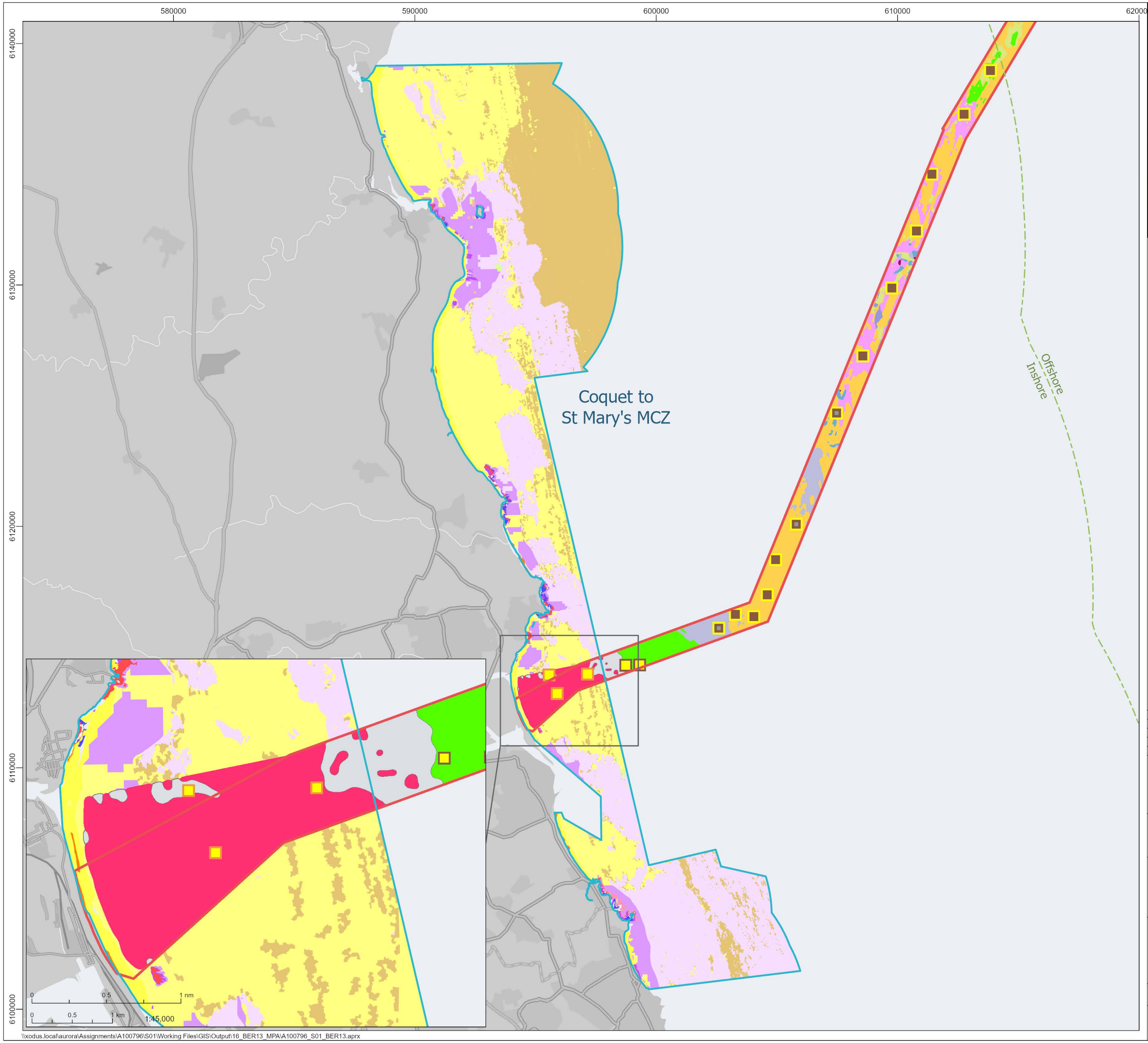
EUNIS habitat	South survey area	North survey area
A1.2 – Moderate Energy Littoral Rock	✓	✓
A2.1 – Littoral Coarse Sediment	✓	✓
A2.2 – Littoral Sand and Muddy Sand	✓	✓
B1.3 – Coastal dunes and sandy shores	✓	×

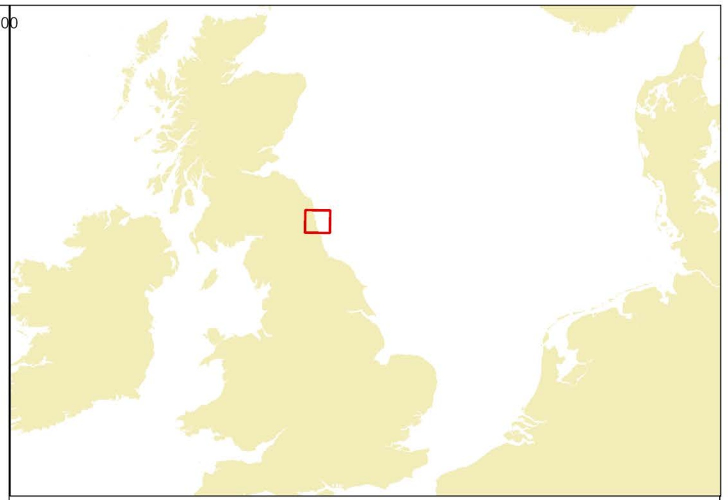
599. Based on the nature of the protected features, there is considered to be no notable seasonal temporal change, as with the Firth of Forth Banks Complex ncMPA and Farnes East MCZ. Based on the nature of the designated features, there is anticipated to be limited long-term changes to many of the features within the MCZ, particularly rock-based habitats which are considered likely to be stable.

600. Anthropogenic activity is anticipated to be a cause of some change to the Northumberland coastline as a result of, for example, coastal development such as that which has been observed along the Blyth Estuary and Cambois coastline over the last century. The Site Improvement Plan for the Northumberland Coastal region acknowledges these sources of pressure and potential impact on coastal habitats but encourages proactive regulation, mitigation and research / monitoring to help minimise change (Natural England, 2015). Coastal and clifftop and coastal surveys to the north of the River Wansbeck and along the Cambois coastline indicate a gradual retreat; when considering changes between the first survey carried out as part of the Cell 1 regional monitoring programme in September 2007 and the September 2009 survey, a large length of this frontage has been actively eroding over the two years of monitoring often by small amounts (e.g. 0.1 to 0.3 m), but in localised individual events by up to 2.5 or 3.5m (NCC, 2010). Overall, these factors are anticipated to be a limited source of change for the lifetime of the Marine Scheme.

601. The baseline described for the MCZ Assessment is a 'snapshot' of the present benthic ecosystem within a gradual yet continuously changing environment. Any changes that may occur during the

design life span of the Marine Scheme should be considered in the context of both greater variability and sustained trends occurring on national and international scales in the marine environment.





Legend

- Marine Scheme Boundary
- MCZ (Marine Conservation Zone)

MCZ Protected Features (Natural England, 2023)

- High energy intertidal rock (A1.1)
- Moderate energy intertidal rock (A1.2)
- Low energy intertidal rock (A1.3)
- Intertidal coarse sediment (A2.1)
- Intertidal sand and muddy sand (A2.2)
- Intertidal mud (A2.3)
- Intertidal mixed sediments (A2.4)
- High energy infralittoral rock (A3.1)
- Moderate energy infralittoral rock (A3.2)
- Moderate energy circalittoral rock (A4.2)
- Subtidal coarse sediment (A5.1)
- Subtidal sand (A5.2)
- Subtidal mud (A5.3)
- Subtidal mixed sediments (A5.4)

Folk Sediment Classification (Cambois)

- Gravelly Muddy Sand; (Gravelly) Muddy Sand
- Muddy Sand
- Sand; (Gravelly) Sand
- Sandy Mud; (Gravelly) Sandy Mud

Cambois Survey Biotopes

- SS.SCS.OCS
- SS.SMu.CSaMu.ThyEten
- SS.SMu.OMu
- SS.SMu.OMu.PjefThyAfil
- SS.SMx.CMx
- SS.SMx.CMx.KurThyMx
- SS.SMx.OMx
- SS.SSa.CFiSa.ApriBatPo
- SS.SSa.IMuSa.FfabMag
- SS.SSa.OSa.OfusAfil
- CR.MCR
- UK 12 Nautical Mile Limit
- Scotland/England Territorial Waters

Rev	Date	Status	Drwn	Chkd	Appd
04	-	-	-	-	-
03	-	-	-	-	-
02	-	-	-	-	-
01	12/07/2023	Issued	TF	NL	EW

Project

Cambois Connection

Title

Figure 12 Coquet to St Mary's MCZ with Survey Biotopes

Scale	Plot Size	Datum	Projection
1:150,000	A3	WGS84	UTM30N

Drawing Number	Sheet No.
A100796_S01_BER13_9	001 OF 001

8.3. Conservation Objectives

602. Key features of the Coquet to St Mary's MCZ and associated Conservation Objectives are listed in Table 8.2 below.

Table 8.2 Conservation Objectives for the Coquet to St Mary's MCZ

Protected Feature	Spatial Extent (km^2) and/or presence information	Recorded in site specific surveys	Within 5km of Marine Scheme[17]	Condition	Conservation Objectives
Broadscale marine habitat					
Low energy intertidal rock (A1.3)	0.05 km^2	×	✓	Favourable	Maintain in favourable condition
Moderate energy intertidal rock (A1.2)	0.33 km^2	✓	✓	Favourable	Maintain in favourable condition
High energy intertidal rock (A1.1)	Extent Unknown	×	✓	Favourable	Maintain in favourable condition
Intertidal mixed sediments (A2.4)	0.29 km^2	×	×	Favourable	Maintain in favourable condition
Intertidal coarse sediment (A2.1)	0.15 km^2	✓	✓	Favourable	Maintain in favourable condition
Intertidal sand and muddy sand (A2.2)	0.03 km^2	✓	✓	Favourable	Maintain in favourable condition
Intertidal mud (A2.3)	0.03 km^2	×	×	Favourable	Maintain in favourable condition
Moderate energy infralittoral rock (A3.2)	Extent Unknown (and not present in latest habitat mapping)	×	✓	Favourable	Maintain in favourable condition
High energy infralittoral rock (A3.1)	Extent Unknown (and not present in latest habitat mapping)	×	×	Favourable	Maintain in favourable condition
Moderate energy circalittoral rock (A4.2)	64.13 km^2	✓	✓	Favourable	Maintain in favourable condition
Subtidal coarse sediment (A5.1)	Extent Unknown (and not present in latest habitat mapping)	×	×	Favourable	Maintain in favourable condition
Subtidal sand (A5.2)	51.76 km^2	✓	✓	Favourable	Maintain in favourable condition
Subtidal mixed sediments (A5.4)	Extent Unknown (and not present in latest habitat mapping)	×	×	Favourable	Maintain in favourable condition
Subtidal mud (A5.4)	47.00 km^2	×	×	Favourable	Maintain in favourable condition
Marine habitat FOCI					
Intertidal underboulder communities	6 point records	×	✓	Favourable	Maintain in favourable condition
Peat and clay exposures	Extent Unknown	×	NA	Favourable	Maintain in favourable condition

[17] Natural England, 2022a.

603. The conservation objective of the MCZ is that the protected features, so far as already in favourable condition, remain in such condition, such that their:

- Extent is stable or increasing; and
- Structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.

8.4. Assessment Information

8.4.1. Impacts Requiring Assessment

- Temporary benthic habitat / species loss or disturbance (C & D)
- Increased suspended sediment concentrations (SSC) and associated deposition (including mobilisation of potential contaminants) (C & D);
- Permanent habitat/ species loss or disturbance (O & M);
- Increased SSC and associated deposition from cable repairs and reburial (O&M)
- EMF effects (O&M); and
- Colonisation of hard structures (including potential introduction and spread of INNS) (O&M).
- Changes in physical processes from cable protection measures (O&M).

8.4.2. Features Requiring Assessment

604. As described in section 8.2, 14 broadscale habitats and two marine FOCI are designated as protected features within the Coquet to St Mary's MCZ. Based on a study area of 5 km around the Marine Scheme (section 1.3), according to the available protected features information (Natural England, 2022a), and the results of the site specific surveys (section 3.7.2) the following features are not present within 5 km of the Marine Scheme (Table 8.2). Due to the distance between these features and the planned works, there is not potential impact pathway and so are scoped out of further assessment:

- Intertidal mixed sediment (A2.4)
- Intertidal mud (A2.3)
- High energy infralittoral rock (A3.1)
- Subtidal coarse sediment (A5.1)
- Peat and clay exposures

605. The presence of the following features were identified within the offshore Marine Scheme boundary during site-specific surveys and so are scoped in for direct effects (direct disturbance, habitat loss, colonisation of hard structures, EMF and thermal emissions):

- Moderate energy intertidal rock (A1.2)
- Intertidal coarse sediment (A2.1)
- Intertidal sand and muddy sand (A2.2)
- Moderate energy circalittoral rock (A4.2)
- Subtidal sand (A5.2)

606. The following features are scoped in for assessment of indirect effects (increased SSC and physical processes), as understood to be present within 5 km of the Marine Scheme (Natural England, 2022a), are:

- Low energy intertidal rock (A1.3)
- Moderate energy intertidal rock (A1.2)
- High energy intertidal rock (A1.1)
- Intertidal coarse sediment (A2.1)
- Intertidal sand and muddy sand (A2.2)
- Moderate energy infralittoral rock (A3.2)
- Moderate energy circalittoral rock (A4.2)
- Subtidal sand (A5.2)
- Subtidal mud (A5.3)
- Intertidal underboulder communities.

8.4.3. Maximum Design Scenario

607. The maximum design scenario(s) summarised here have been selected as those having the potential to result in the greatest effect on key features of the Coquet to St Mary's MCZ. These scenarios have been selected from the details provided in the EIA Report - ES, Volume 2, Chapter 5: Project Description.

608. Site preparation works, in advance of construction, are predicted to commence in Q4 of 2026 and will continue until all installation activities have ceased. Export cable installation is expected to begin in Q3 2028 and is expected to last until Q4 of 2029. All activities associated with the Marine Scheme are predicted to conclude by the end of 2029. Until detailed design of the Marine Scheme is progressed and further refined pre-construction, this programme for the Marine Scheme as a whole is indicative and is subject to further refinement, but is used to inform assessment of construction phase impacts for the Marine Scheme.

609. Given that the maximum design scenario is based on the design option (or combination of options) that represents the greatest potential for change, confidence can be had that development of any alternative options within the design parameters will not give rise to a greater potential of hindering the achievement of the MCZ's conservation objectives than assessed in this impact assessment. Table 8.3 presents the maximum design scenario for potential impacts on marine habitat receptors during construction, operation and maintenance and decommissioning.

Table 8.3 MDS for Assessment of Effects on the Coquet to St Mary's MCZ

Potential Impact	Maximum Design Scenario (Marine Scheme whole)	Maximum Design Scenario (English waters)	Justification
Construction & Decommissioning			
Temporary benthic habitat / species loss or disturbance	Maximum duration of the construction phase of up to 39 months.	**MCZ:** Up to 0.4 km^2 of temporary habitats loss / disturbance due to: • Up 0.4 km^2 of disturbance from installation of up to four cables with seabed disturbance width of 25 m for cable installation and seabed preparation activities including PLGR, sea trials, pre-sweep and pre-installation trenching through harder sediment; • Up to 5,000 m^2 of disturbance from the temporary placement of jack-up vessels in the nearshore area; and • Up to five exit pits, each 20 x 5 m, for up to four cable ducts (with one spare) due to trenchless cable installation at the Landfall	Maximum footprint which would be affected during the construction phases. No morphological bedforms were identified within the MCZ during the site specific geophysical survey (XOcean, 2022) and thus seabed levelling activities are not included.
Increased suspended sediment concentration (SSC) and associated deposition (including mobilisation of potential contaminants)	Maximum duration of the construction phase of up to 39 months.	**English waters:** Seabed preparation: • Pre-lay grapnel run, sea trials (as required), and pre-installation trenching through harder sediment. Cable installation: • Offshore export cables length up to 4 km within the MCZ; • Installation using any of the following methods: ploughs (displacement and/or non-displacement), jetting machines, mechanical trenchers, MFE. Of these, MFE has been assumed as the worst case with regards to SSC. • Installation mobilises sediments from a 3 m deep and 2.5 m wide trench. Landfall: • Trenchless technology such as HDD; • Up to five exit pits, each 20 x 5 m, for up to four cable ducts (with one spare) due to trenchless cable installation at the Landfall Minimum exit pit water depth (offshore): 10 m LAT;	Greatest volume of sediment released into the water column (see ES, Volume 2, Chapter 7). Cable installation by MFE has the greatest potential to increase suspended sediments as this method fluidises the sediment. In some areas, a trench depth of 3 m may not be achieved and therefore the assessment provides the upper bound in terms of suspended sediment and dispersion potential. No morphological bedforms were identified within the MCZ during the site specific geophysical survey (XOcean, 2022) and thus seabed levelling activities are not included.

Potential Impact	Maximum Design Scenario (Marine Scheme whole)	Maximum Design Scenario (English waters)	Justification
		• Maximum footprint per exit pit: 100 m^2 and 500 m^2 for all pits; • Maximum volume of excavated material per exit pit 300 m^3 and 1,500 m^3 for all pits; and • Cable installation at the Landfall via trenchless technique with potential for drilling releases associated with trenchless techniques (e.g., HDD), up to 2,000 m3 per HDD of which 1,900 m3 is water and 100 m3 is drilling mud / solids (e.g. bentonite), totalling 10,000 m3 (9,500 m3 water and 500 m3 drilling mud / solids) for 5 drilling HDD bores (4 used and 1 contingency). HDDs will be drilled sequentially, so the fluids will be released in 5 separate releases of up to 2,000 m3 i.e. the 10,000 m3 will not be released in a single event.	
Operation and Maintenance			
EMF effects	Operation and maintenance phase of up 35 years.	**MCZ:** • Presence of up to four 4 km long HVDC cables in a 320 kV symmetrical monopole arrangement or two 4 km long HVDC cables as a bipole arrangement at 525 kV; • Minimum target burial depth of 0.5 m; • Operation and maintenance phase of up 35 years.	Modelling completed for the Marine Scheme provides data on the level and attenuation of EMF for a symmetrical monopole configuration at 320 kV and a bi-pole configuration at 525 kV, assuming a horizontal separation distance of 25 m (further details are provided in ES, Volume 2, Chapter 5). The worst-case EMF level and attenuation is calculated for each cable as a worst-case under the assumption that a bundled arrangement will not be used. Based on this modelling, the maximum design scenario is associated with a bi-pole arrangement at 525 kV

Potential Impact	Maximum Design Scenario (Marine Scheme whole)	Maximum Design Scenario (English waters)	Justification
Permanent benthic habitat / species loss or disturbance and permanent change/alteration to substrata and habitats	Operation and maintenance phase of up 35 years,	**MCZ:** • Up to maximum cable length ~4 km within the MCZ. • Up to ~33% of cables in the MCZ may require external protection; • Up to 0.04 km^2 for four cable crossings and up to 200 m of cable requiring protection per crossing at a width of up to 12.5 m; and • Total footprint of cable protection in the MCZ is anticipated to be 0.09 km^2 for 4 Offshore Export Cables each requiring ~2.1 km of external protection in the MCZ.	Maximum footprint which would be affected during the operation and maintenance phase.
Increased SSC and associated deposition		**English waters:** Repair / reburial activities; • Four cable repair events of up to 1 km each across the operation and maintenance phase	Greatest volume of sediment released into the water column (see ES, Volume 2, Chapter 7). The maximum number of cable repair and reburial events result in the highest frequency of increased suspended sediment concentrations during the operation and maintenance stage.
Colonisation of hard structures (including potential introduction and spread of INNS).	Operation and maintenance phase of up 35 years.	**MCZ:** • Up to maximum cable length ~4 km within the MCZ. • Up to ~33% of cables in the MCZ may require external protection; • Up to 0.04 km^2 for four cable crossings and up to 200 m of cable requiring protection per crossing at a width of up to 12.5 m; and • Total footprint of cable protection in the MCZ is anticipatced to be 0.09 km^2 for 4 Offshore Export Cables each requiring ~2.1 km of external protection in the MCZ.	Maximum footprint which would be affected during the operation and maintenance phase.

Potential Impact	Maximum Design Scenario (Marine Scheme whole)	Maximum Design Scenario (English waters)	Justification
Changes in physical processes from cable protection measures	Operation and maintenance phase of up to 35 years.	**MCZ:** • Cable protection along ~1.3 km of each Offshore Export Cable of up to 1.5 m height and 9.5 m width; • Cable protection at crossings along 800 m of cable up to 2 m height and 12.5 m width.	Maximum cable protection height, with and area would result in the largest obstruction to flow (see ES, Volume 2, Chapter 7).

8.5. Assessment of Effects – Project Alone

8.5.1. Potential Effects During Construction

8.5.1.1. TEMPORARY HABITAT / SPECIES LOSS OR DISTURBANCE

610. There will be direct temporary disturbance of the protected features within the Coquet to St Mary's MCZ during the construction phase, as a result of the route preparation, installation of offshore export cables and cable protection measures and cable landfall construction.

611. Works associated with the Landfall, including the use of jack up barges and the excavation of exit pits, will also result in temporary seabed disturbance. However, as detailed in section 8.4.3, these activities will be located within the 25 m wide zone of disturbance for the route preparation and cable installation activities, so the overall area of disturbance will not be increased.

612. No morphological bedforms were identified within the MCZ during the site specific geophysical survey (XOcean, 2022) and thus seabed levelling is not considered further in this assessment.

613. The relevant MarESA pressures are therefore:

- Surface abrasion;
- Sub-surface abrasion/ penetration; and
- Removal of substratum (extraction).

614. For the purposes of this assessment, temporary habitat disturbance refers to the impact of activities and events which will produce effects in the short term. In the case of buried cables, following the cessation of the activities associated with this impact a shift toward the original baseline of the environment will occur via the recovery of the sediments themselves and subsequently the associated communities.

615. The Offshore Export Cables will be installed at the landfall using a trenchless technology such as HDD and as such the intertidal area will be entirely avoided. Therefore, there is no impact pathway to intertidal receptors for temporary habitat loss. The protected features expected within the zone of influence for direct disturbance are limited to:

- Moderate energy circalittoral rock (A4.2); and
- Sublittoral sand (A5.2).

8.5.1.1.1. MAGNITUDE OF IMPACT

616. The Offshore Export Cables will be installed at the landfall using a trenchless technology such as HDD. The HDD exit may also require the excavation of HDD exit pits (section 2.8).

617. As part of HDD and cable trenching activities, material will be removed from the seabed, via MFE as worst case, and redeposited in the immediate vicinity. In the case of cable installation, this sediment will be side-cast, and then utilised in the burial of the cable. In regard to the HDD, excavated material would be temporarily stored alongside the excavated pits as sediment berms, with a temporary but maximum height of up to 1.5 m. The sediment berms would be used to backfill the pits on completion of drilling. Therefore, the excavated pits and sediment berms are only likely to be present for a period of up to 3 months, before the seabed is reinstated. Side-casting of material will take place within the 0.4 km^2 area of disturbance.

618. Please note that the impact of smothering of biotopes is assessed under increased suspended sediment concentrations (SSC) and associated deposition.

619. The effects of cable installation on subtidal sediments and habitats, particularly sandy sediments, recover quickly, with little or no evidence of disturbance in the years following cable installation, and that benthic communities readily recover into areas when the sediment type is reflective of the baseline environment. There is a total extent of approximately 64 km^2 of the subtidal sand feature within the MCZ (Defra, 2016), 4.8 km^2 of which is within the marine scheme boundary (7.4% of the site feature extent). If the full 0.4 km^2 of the temporary habitat loss was within this feature, it would equate to 0.6% of the subtidal sand feature. The total extent of the moderate energy circalittoral rock feature within the MCZ is approximately 61 km^2 (Defra, 2016), of which the full area of temporary disturbance would equate to a 0.7%.

620. This assessment of temporary habitat disturbance primarily considers the impacts associated with abrasion of rock habitat during cable installation with the impact associated with presence of cable protection materials assessed as a permanent impact within the operation and maintenance phase (see Section 8.5.2).

621. Seabed disturbance from export cable and landfall installation activities would be limited to the duration of installation activities, considered to be of short term and of a limited spatial extent.

8.5.1.1.2. SENSITIVITY OF THE RECEPTOR

622. There are no MarESA assessments for penetration or disturbance of the physical moderate energy rock feature. The benchmark for removal of substratum (extraction) excludes hard bedrock and so an assessment is not provided. The pressure of physical change (to another seabed type) is benchmarked as a permanent change, including to artificial substrate, and is assessed in section 8.5.2).

623. The MarESA assessment reports that the CR.MCR.EcCr.FaAlCr.Flu biotope, associated with the moderate energy circalittoral rock feature, has low sensitivity to surface abrasion. It is characteristic of the large bedrock terraces along the Northumberland coast which are generally fairly species-poor compared to similar habitats on the west coasts which have more sponges, hydroids and bryozoans (JNCC, 2022). This biotope characterized by the silt/scour-tolerant species *Flustra foliacea. F. foliacea* is flexible, however physical disturbance would be expected to cause physical damage. In cases where the holdfast remains intact, *F. folicea* would be expected to survive and grow back, and in cases where the colony did not survive, recruitment from adjacent colonies would be expected to allow recovery in 2-10 years. Bryozoans tend to be fast growing fauna that are capable of self-regeneration. Dispersal of the larvae is limited and it is likely that *Flustra foliacea* would recover rapidly, within 2 years (resilience of 'High') from abrasion of limited spatial extent (i,e, no more than 75% of the bryozoan population or habitat is removed) (Readman, 2016). Overall, the epifauna associated with this habitat would be expected to recolonise quickly following abrasion as they are characterised by rapid growth and early reproduction as well as multiple reproductive phases which would allow the biotope to recover quickly (Readman, 2016).

624. The subtidal sand feature supports the identified biotope SS.SSa.IMuSa.FfabMag, dominated by venerid bivalves and characterised by a prevalence of *Magelona* sp. burrowing worms. According to MarESA, this biotope has a low sensitivity to penetration and surface abrasion. Abrasion is likely to damage epifauna and flora and may damage a proportion of the characterising species, however opportunistic species are likely to recruit rapidly, and some damaged characterizing species may recover or recolonize (Tillin & Rayment, 2002).

625. A number of trawling studies and data comparative studies suggest that the biological assemblage present in this biotope is characterised by species that are relatively tolerant of penetration and disturbance of the sediments. Species are either robust or buried within sediments or are adapted to habitats with frequent disturbance (natural or anthropogenic) and recover quickly. Some species will be displaced and may be predated or injured and killed, but will recover rapidly and the biotope is likely to still be classified as the same type following disturbance. MarESA thus reports a low sensitivity to subsurface abrasion (Tillin & Rayment, 2002).

626. Cable trenching and HDD activities have the potential to displace sediments, with relocation of sediments in the immediate vicinity, including burial of the cable. Changes to seabed levels and

changes to seabed properties identified will be localised and composed of native material which may be deposited through sedimentation, therefore the structure and function of the seabed is of low vulnerability and recoverable.

627. Associated biological communities will need to re-establish. The majority of infauna will be expected to burrow back into the sediment following displacement with only a small degree of mortality resulting from predation when exposed at the sediment surface. Larger fragile, surface and epibenthic species are more likely to be damaged and therefore unable to borrow back into the sediment. MarESA reports that recovery from loss of substrate is expected in the short to medium term as the activity is temporary and of limited spatial extent, local habitat conditions will recover and processes such as larval-supply and recruitment between populations will not be affected (Tillin & Rayment, 2022).

8.5.1.1.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

628. Based on the information presented above, the following can be concluded with respect to the attributes of the protected features of the Coquet to St Mary's MCZ.

8.5.1.1.3.1. Moderate energy circalittoral rock

629. The extent and distribution of the moderate energy circalittoral rock feature will be maintained in the long term following cable installation activities, as there is no potential for removal or relocation of the rock substrate.

630. The epifauna associated with the rocky reef habitat will be minimally impacted in terms of spatial extent within the MCZ, and would be expected to recolonise quickly following abrasion as they are characterised by rapid growth and early reproduction as well as multiple reproductive phases. With respect to the associated biological communities, the structure and functions, quality, and the composition of these biotopes will be therefore maintained.

631. It is concluded that potential effects on the moderate energy circalittoral rock feature, due to temporary habitat loss / disturbance, would not hinder the conservation objective to:

- **conserve extent and distribution; and**
- **conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.**

8.5.1.1.3.2. Sublittoral Sand

632. The extent and distribution of the sublittoral sand feature will be maintained in the long term following cable installation activities, with only a small proportion of the total extent of this feature within the MCZ affected. The temporary disturbance effects on the sublittoral sand feature resulting from the installation activities will be temporary and reversible with recovery of sediments occurring following completion of installation.

633. The sediment composition of the sublittoral sand protected feature is unlikely to be affected by temporary habitat disturbance resulting from cable installation and preparation activities. Whilst trenching and HDD activities will temporarily remove sediment, it will be deposited locally, and the high rate of sedimentation in this moderate energy environment will ensure rapid redistribution of material. Since no sediment is being removed from the area, this is considered unlikely to represent a significant shift from the baseline conditions.

634. With respect to the biological communities that have a core role in determining the structure and function of the sublittoral sand feature, it is considered that they will be minimally affected, with only a small proportion (7% within the Marine Scheme) of the total extent of this feature within the MCZ potentially affected, enabling the maintenance of characteristic communities in this feature. Following temporary habitat disturbance, a full recovery of these communities into the affected areas would be expected within a few years following disturbance. These processes ensure that

the key and influential species and characteristic communities of protected feature will be maintained in the long term across the Coquet to St Mary's MCZ.

635. It is concluded that potential effects on the subtidal sand feature, due to temporary habitat loss / disturbance would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.**

8.5.1.1.4. SECONDARY MITIGATION AND RESIDUAL EFFECT

636. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the MCZ.

8.5.1.2. INCREASED SUSPENDED SEDIMENT CONCENTRATIONS (SSC) AND ASSOCIATED DEPOSITION

637. As detailed in section 2.4 , the preferred method of cable protection is to bury the cable along the majority of the Offshore Export Cable Corridor. Where cable burial is conduced, MFE is determined to be the worst-case scenario for SSC generation. This is due to MFE having the potential to displace relatively large volumes of sediment near the seabed.

638. Seabed disturbance associated with construction activities could lead to the remobilisation of sediment-bound contaminants that may reduce marine water quality with subsequent indirect effects on benthic species.

639. The features scoped in for assessment of increase SSC and associated deposition, having been identified within the Marine Scheme or mapped within 5 km of the Marine Scheme (Natural England, 2022a), are:

- Low energy intertidal rock;
- Moderate energy intertidal rock;
- High energy intertidal rock;
- Intertidal coarse sediment;
- Intertidal sand and muddy sand;
- Moderate energy infralittoral rock;
- Moderate energy circalittoral rock;
- Subtidal sand; and
- Intertidal underboulder communities.

640. The relevant MarESA pressures for this impact are:

- Smothering and siltation changes (high);
- Smothering and siltation changes (low); and
- Hydrocarbon & PAH contamination.

641. As assessed in the EIA, for both activities, the maximum distance the plume has the potential to travel is the extent of the tidal ellipse in the direction of the tidal flow which is approximately 5 km. This means that although SSC may increase by several orders of magnitude locally, the effect will be very short-lived on the order of minutes as sediment is immediately deposited to the seabed.

8.5.1.2.1. MAGNITUDE OF IMPACT

642. During trenching activities, an instantaneous increase in SSC could result in a plume which would only occur in the immediate vicinity of the trenching activity, with much smaller and reduced

sediment concentrations transported over larger distances. It is estimated that SSC could locally increase by tens of thousands of mg/l, in very close proximity to the trench, with the SSC again reducing with increasing distance from the disturbance. It is estimated that by the widest extent of the plume, the SSC would generally be less than 10 mg/l, the finest sediment fractions could remain in suspension for only a short duration at nearly 3-hours before settling back to the seabed, and based on a flow speed of 0.2 m/s sediment could be moved up to a total distance of 2 km (ES, Volume 2, Chapter 7: Offshore Physical Environment and Seabed Conditions). This means that for trenching operations, any plume as a result of the cable installation would largely return to background levels during the same phase of the tide, only moving a relative short distance in relation to the flow direction. Therefore, any sediment disturbed as a result of MFE that has the potential to form a plume would be extremely transient, and due to the current flow regime within the Marine Scheme, sediment would settle out, returning the SSC back to ambient concentrations after a short duration.

643. To aid HDD exit, temporary HDD exit pits and associated sediment storage berms will be created at a minimum water depth of 10 mLAT. Based on the sediment disturbance mechanism, it is assumed that the sediment release associated with the HDD pit excavation and sediment side-casting would be similar or less than that associated with trenching. Therefore, the same characterisation of the potential plume described for cable installation via MFE is also applicable here.

644. The highest concentrations of SSC will mostly be parallel to the coast due to the orientation of the flow axis. However, a small proportion may extend to the coast at the plume extents. SSC magnitudes at the plume extents are only expected to be on the order of tens of mg/l based on the dissipation and dilution in the flow. Therefore, it is assumed that low levels of SSC could reach any of the designated habitat features across the intertidal and subtidal. However, the concentrations of SSC predicted to be advected by a plume, resulting in only millimetres of deposition, does not exceed background levels of SSC for this area and thus would not represent a significant impact pathway.

645. The maximum design scenario for the installation of the cables assumes installation by MFE with a 2.5 m wide and 3 m deep trench for each cable. Under an assumed 5 m ejection height and current speed of 0.4 m/s, the deposition of fine sand in thicknesses of approximately 0.03 m may occur for extents of up to 200 m in the wake of the installation activity. Deposition of coarser grained sediments (fine gravel) of 0.07 m thickness may occur over comparatively smaller extents of approximately 6.9 m (

646. Table 8.4, and discussed further in ES, Volume 2, Chapter 7: Physical Environment and Seabed Conditions).

Table 8.4 Deposition extent and thickness associated with cable installation (undertaken by MFE)

Sediment type	Current speed (m/s)	Ejection height (m)	Distance travelled (m)	Deposition thickness (m)
Fine gravel	0.4	5	6.9	0.07
Coarse sand			14.3	0.05
Medium sand			40	0.04
Fine sand			200	0.03

647. Generally, the thickness of fine sand deposits are always less than 0.2 m. For larger sediments, like fine gravel, the deposition thickness ranges from 0.02 m to 0.65 m varying in relation to the flow speed and disturbance height (ES, Volume 2, Chapter 7: Offshore Physical Environment and Seabed Conditions). The deposited material would be of native sediment composition to the sublittoral sand feature. This is not considered to ultimately lead to a change in sediment properties

or characteristics of the sublittoral sediments and would be incorporated into the sediment transport regime over the course of months, under the flow conditions at the site, or sooner if under storm conditions.

648. At the Landfall in English waters, up to 10,000 m^3 of drilling fluids may be released for five bores (four used and one spare), resulting in increases of SSC of hundreds of thousands of mg/l at the release site. As outlined in ES, Volume 2, Chapter 7: Physical Environment and Seabed Conditions, the SSC at the release site will disperse rapidly in the form of a plume with decreasing SSC with distance from the source and solids settling completely within 1.4 hours. The deposition of released drilling fluids will be up to 0.05 m thick in slower current speeds (0.1 m/s) with a plume extent of 500 m. At faster current speeds, associated with the fastest spring flow speeds, the deposition thickness reduces to 0.2 m with a plume that extends over a larger area of 3 km.

649. Two stations within the MCZ were tested for sediment contaminants, stations 5 and 9. No heavy metals exceeded the relevant Cefas AL1 or AL2 thresholds. with individual thresholds in both stations exceeded individual Canadian Interim Sediment Quality Guideline (ISQG) thresholds for acenapthelene, naphthalene, flourene and phenanthrene. Total Hydrocarbon Content (THC) levels were low and did not exceed Cefas AL1 thresholds (see ES, Volume 3, Appendix 8.1: Benthic Survey Report (Phase 1 and 2).

8.5.1.2.2. SENSITIVITY OF THE RECEPTORS

Table 8.5 MarESA sensitivity assessments for the pressures of SSC

Receptor	Representative biotope(s)	Smothering and siltation rate changes (light)	Smothering and siltation rate changes (heavy)	Hydrocarbon & PAH contamination
Low energy intertidal rock	• LR.LLR.F.Asc • LR.LLR.F.Fves • LR.LLR.F.Fserr	Low to Medium	Medium to High	Not assessed
Moderate energy intertidal rock	• LR.MLR.BF • LR.MLR.MusF.MytFR	Low to Medium	Medium to High	Not assessed
High energy intertidal rock	• LR.HLR.MusB.MytB • LR.HLR.FR.Mas	Low	Low	Not assessed
Intertidal coarse sediment	• LS.LCS.Sh.BarSh • LS.LCS.Sh.Ech	Not sensitive to Medium	Not sensitive to Medium	Not assessed
Intertidal sand and muddy sand	• LS.LSa.MoSa • LS.LSa.FiSA.Po	Not sensitive	Low	Not assessed
Moderate energy infralittoral rock	• IR.MIR.KR.Ldig	Not sensitive	Low	Not assessed
Moderate energy circalittoral rock	• CR.MCR • CR.MCR.EcCr.FaAlCr.Flu	Not sensitive	Low	Not assessed
Subtidal sand	• SS.SSa.ImuSa.FfabMag • SS.SSa.IMuSa	Low	Low	Not assessed
Subtidal mud	• SS.SMu.CsaMu • SS.SMu.CSaMu.AfilEten • SS.SMu.CFiMu.SpnMeg	Not sensitive	Medium	Not assessed
Underboulder communities	• LR.MLR.BF.Fser.Bo	Low	Medium	Not assessed

650. MarESA assessments for the protected features are shown in Table 8.5. The high energy intertidal rock, intertidal sand and muddy sand, moderate energy infralittoral rock, moderate energy

circalittoral rock, subtidal mud and subtidal sands and gravels feature all have no, to low sensitivity to light smothering and siltation. This is due to a combination of the energy levels to which they are subjected, which would rapidly disperse any deposited sediment, and the characteristic communities of these features including burrowing organisms. A detailed assessment of communities recorded within the site specific surveys is provided in ES, ES, Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology.

651. The greatest thickest deposition would be localised deposition of excavated material over the biological communities associated with the sublittoral sand and subtidal mud features which would equate to the heavy siltation and smothering impact assessed under MarESA. Sand and mud biotopes have a medium sensitivity to heavy smothering. The maximal overburden through which small bivalves could migrate has been reported as 20 cm in sand for Donax and approximately 40 cm in mud for *Tellina* sp. and approximately 50 cm in sand. No further information was available on the rates of survivorship or the time taken to reach the surface (Tillin & Rayment, 2002). The maximum potential deposition exceeds this range, and so it can be assumed that there would be a level of mortality experienced by at least some taxa within the buried community. The sensitivity would therefore be high, given the maximum estimated overburden.

652. MarESA reports low to medium sensitivities for low energy intertidal rock and moderate energy intertidal rock and underboulder communities to light smothering and siltation. Smothering could cause direct mortalities in the associated communities, notably of the filter-feeding sessile organisms unable to clear their feeding appendages or relocate and some algal species intolerant of sediment movement. Very low levels of siltation would be expected in the intertidal as the highest levels of deposition will be in the immediate vicinity of the trenching and HDD activities in the subtidal area. The benchmark for the light smothering pressure is 5 cm, which as described above is greater than would be expected in the intertidal.

653. There is no MarESA assessment of sensitivity of the sand and mud sediment biotopes to exposure to transitional elements and heavy metals, or hydrocarbon and PAH contaminants. Low levels of contaminants were recorded in the sediment within the MCZ, to which the native communities would already be exposed. Sediments will be deposited locally, resulting in no change to existing sediment composition, and SSC will be quickly dispersed. As such, the subtidal sand feature is not considered to be sensitive to this pressure.

654. Deposition of SSC may occur over the moderate energy circalittoral rock feature if trenching activities occurred in immediate proximity. The depositional layer may remain for a period of months due to the relatively low flow speeds in the area (0.2 to 0.6 m/s), before being fully mobilised and redistributed. A heavy deposition would smother sessile species which would be unlikely to recover until the sediment was redistributed. However, following mobilisation of the sediment, the biotope would be expected to recover via recruitment from nearby unaffected habitats, over the course of 2-10 years (Readman, 2016).

655. However, in the case of light deposition from the sediment plume, likely to be millimetres of deposition, indiscernible from natural variation in SSC at this site. The bryozoan dominated communities associated with the rock substrate have low sensitivity to light smothering and siltation rate changes and medium sensitivity to heavy smothering and siltation rate changes. Communities dominated by *Flustra foliacea* have been described on tide swept seabed, exposed to high levels of suspended sediment and sediment scour in the English Channel subject to sediment transport (mainly sand) and periodic, temporary, submergence by thin layers of sand ca <5 cm. The identified biotope would therefore not be considered sensitive to temporary smothering in the region of millimetres to a few centimetres of deposition.

656. As described above, *F. folicia* are largely tolerant of low levels of naturally occurring suspended sediment, and encrusting sponge species have been recorded in high sedimentation conditions and are also reported to show a preference for such habitats. As such, this biotope is assessed as not sensitive to changes in water clarity (Readman, 2016).

657. There are no MarESA assessments available regarding the sensitivity of the biotopes to exposure to sediment bound contaminants. Filter feeders are highly sensitive to oil pollution, particularly those inhabiting the tidal zones which can experience high exposure and show correspondingly

high mortality, as are bottom dwelling organisms in areas where oil components are deposited by sedimentation. There is little information on the effects of hydrocarbons on bryozoans and one study reported no adverse effects of oil contamination on the bryozoan *Alcyonidium* spp. in Milford Haven or St. Catherine's Island, south Pembrokeshire although it did alter the breeding period (Readman, 2016, and references therein). Given the low levels of sediment contamination recorded within the MCZ, and the natural levels of sediment resuspension owing to the moderate energy environment, the biological communities associated with these features are considered to be of low sensitivity.

8.5.1.2.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

658. Based on the information presented above, the following can be concluded with respect to the attributes of the protected features of the Coquet to St Mary's MCZ.

8.5.1.2.3.1. Intertidal features

659. SSC plumes generated by trenching and HDD drilling activities may reach the intertidal via plume advection. However, the concentrations of the SSC are expected be very low and would not meet the MarESA benchmark for light smothering and siltation. Any exposure to contaminated sediments, either through mobilisation of contaminated sediments or HDD drilling fluids, would likewise be minimal and would not be expected to exceed baseline conditions experienced during storm events. As such, no impact on the extent and distribution of these features, or their characteristic communities and thus function and quality, would be expected.

660. It is concluded that potential effects on the low energy intertidal rock, moderate energy intertidal rock, high energy intertidal rock, intertidal coarse sediment, intertidal sand and muddy sand, and intertidal underboulder communities features, due to increased SSC and associated deposition, would not hinder the conservation objective to:

- **conserve extent and distribution; and**
- **conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.**

8.5.1.2.3.2. Subtidal Rock

661. The extent and distribution of the moderate energy infralittoral rock and moderate energy circalittoral rock features will be maintained in the long term following cable installation activities. The characteristic communities of these features are not sensitive to light siltation and have low sensitivity to heavy siltation. The energy that these environments are subject to would be expected to disperse any deposited material relatively quickly, and the species characteristic of these habitat are tolerant to scour. As discussed above, there is no evidence to suggest that these habitats and the associated communities are sensitive to contaminants and any exposure is not expected to exceed baseline levels for this area.

662. It is concluded that potential effects on the moderate energy infralittoral rock and moderate energy circalittoral rock features, due to increased SSC and associated deposition, would not hinder the conservation objective to:

- **conserve extent and distribution; and**
- **conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.**

8.5.1.2.3.3. Subtidal sand and subtidal mud

663. The extent and distribution of the subtidal sand feature will be maintained in the long term following cable installation activities, as any immediate deposition from trenching and HDD drilling activities is expected to be highly localised, will constitute native material and be quickly incorporated into

the sediment transport system. Further deposition of sediment from plumes is expected to be in the order of millimetres of deposition and will not impact the extent or distribution of the feature.

664. The structure and function of the feature including the composition of characteristic communities, will remain in (or recover to) a condition which is healthy and not deteriorating. Recovery of the seabed sediment will occur within a few tidal cycles following with completion of construction activities. The key and influential species are tolerant of the effects of SSC, with full recovery of characteristic communities expected.

665. It is concluded that potential effects on the subtidal sand and subtidal mud features, due to increased SSC and associated deposition, would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.**

8.5.1.2.4. SECONDARY MITIGATION AND RESIDUAL EFFECT

666. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the MCZ.

8.5.2. Potential Effects During Operation and Maintenance

8.5.2.1. PERMANENT BENTHIC HABITAT / SPECIES LOSS OR DISTURBANCE

667. Permanent habitat loss and habitat alteration will arise as a result of the placement of cable protection, as described within the maximum design scenario (section 8.4.3). Cables will be buried wherever practicable across the Marine Scheme, however, where the target burial depth is not achieved cable protection will be required. This represents a localised habitat alteration and physical change to another seabed type away from the subtidal sand and circalittoral rock features that dominate the overlapping area between the Marine Scheme and the MCZ. Successful burial within the MCZ has been previously demonstrated for the North Sea Link project which makes landfall at Cambois beach (NSL, 2019). It should be noted that this habitat loss will initially occur during the construction phase and the effects will continue to be realised through to the operation and maintenance phase. At the point of decommissioning, some cable protection may be left *in situ* as it may not be practical to remove, and so permanent habitat loss is assessed here as a worst case.

668. The relevant MarESA pressure is therefore:

- Physical change (to another seabed type).

669. The Offshore Export Cables will be installed at the landfall using a trenchless technology such as HDD and as such the intertidal will be entirely avoided. As such there is no impact pathway to intertidal receptors for the impact of permanent benthic habitat/ species loss or disturbance. The protected features within the zone of influence for direct disturbance are limited to:

- Moderate energy circalittoral rock ; and
- Sublittoral sand.

8.5.2.1.1. MAGNITUDE OF IMPACT

670. As described in Section 8.4.3, up to 0.09 km^2 of cable protection material may be installed within the MCZ. This equates to approximately 0.05% of the MCZ as a whole (192 km^2).

671. There is a total extent of approximately 64 km^2 of the subtidal sand feature within the MCZ (Defra, 2016), 4.8 km^2 of which is within the marine scheme boundary (7.4% of the site feature extent).

Permanent habitat loss of 0.09 km^2 would equate to 0.14 % of this feature. The total extent of the moderate energy circalittoral rock feature within the MCZ is approximately 61 km^2 (Defra, 2016), 0.4 km^2 of which is within the marine scheme boundary (0.7% of the site feature extent). Likewise, this would equate to a permanent habitat change of 0.15 %.

672. As far as practicable, all cable protection will be removed during decommissioning. However, as there is a possibility that cable protection may remain in situ, benthic habitat and species loss is assessed as a permanent impact.

8.5.2.1.2. SENSITIVITY OF THE RECEPTOR

673. The subtidal sand feature is characterised by a sedimentary habitat so a change to an artificial or rock substratum would alter the character of the biotope, leading to reclassification and the loss of the sedimentary community including the characterising bivalves, polychaetes and echinoderms that live buried within the sediment.

674. As described above, the moderate energy circalittoral rock feature supports a biotope characterized by the silt/scour-tolerant species *Flustra foliacea*. It is characteristic of the large bedrock terraces along the Northumberland coast which are generally fairly species-poor compared to similar habitats on the west coasts which have more sponges, hydroids and bryozoans (JNCC, 2022).

675. The direct placement of infrastructure and protective material on the rocky habitats will replace the existing habitat in the immediate vicinity, with direct mortality of all affected surfaces and replace the rocky substrate with anthropogenic artificial substrate. According to Langhamer (2012), new benthic habitats resulting from the introduction of renewable structures including scour protection, can compensate for habitat loss. The epifaunal communities inhabiting the circalittoral rock are expected to be well adapted to the dynamic, energetic environmental conditions present. *F. folicia* would be expected to recover via recruitment over 2-10 years (Readman, 2016). Therefore, it is predicted that recolonisation of the introduced substrate by a similar epifaunal community, with recruitment supported by adjacent undisturbed habitat will occur throughout the operation & maintenance phase of the Project. Therefore, the introduced rock could therefore be considered to provide surrogate substrate and ecosystem complexity.

8.5.2.1.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

676. Based on the information presented above, the following can be concluded with respect to the attributes of the subtidal sand and moderate energy circalittoral rock features.

8.5.2.1.3.1. Moderate Energy Circalittoral Rock

677. Given the relatively low proportion of moderate energy circalittoral rock affected compared with its distribution within the MCZ, it is predicted that there would be no significant impact to the ecological function of this habitat type as a result of the long-term disturbance. Overall, the long-term impacts will be minimised as far as practicable and thus localised and limited in spatial extent. Furthermore, there will be new habitat created by the new infrastructure and introduced rock, allowing colonisation via recruitment from adjacent, unaffected habitat. Where possible, rock protection will match up as much as possible with the existing hard substrate, in terms of size, shape and type of rock/materials used in order to reduce habitat alteration. The extent and distribution, and quality and function of this feature across the MCZ will therefore be maintained.

678. It is concluded that potential effects on the subtidal sand feature, due to permanent benthic habitat/ species loss, would not hinder the conservation objective to:

- **conserve extent and distribution; and**
- **conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.**

8.5.2.1.3.2. Sublittoral Sand

679. The presence of cable protection in the sublittoral sand feature will represent a highly localised, but permanent loss of 0.14% of this habitat type within the MCZ. However, the installation of cable protection will only be required in areas of harder substrate that prevents successful cable burial, and is would be expected to be minimal within this feature. Should cable protection be required in discrete areas, the magnitude of this impact is considered negligible in comparison with the wider distribution of this feature within the MCZ and as such the extent and distribution of this feature will be maintained in the long term.

680. The cable protection will likewise cause a permanent habitat loss impact on the biotopes associated with this feature, to which the representative species are highly sensitive. However, given the highly localised loss of habitat, the structure and function of the unaffected feature (>99%) as a habitat for associated soft sediment communities will be maintained.

681. It is concluded that potential effects on the subtidal sand feature, due to permanent benthic habitat/ species loss, would not hinder the conservation objective to:

- **conserve extent and distribution; and**
- **conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.**

8.5.2.1.4. SECONDARY MITIGATION AND RESIDUAL EFFECT

682. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the Coquet to St Mary's MCZ.

8.5.2.2. COLONISATION OF HARD STRUCTURES AND INTRODUCTION OF INNS

683. As described above, up to 0.09 km^2 of cable protection is estimated within the MCZ, equating to 0.05% of the MCZ as a whole and 0.15% of the moderate energy circalittoral rock and subtidal sand features.

684. The introduction of hard infrastructure, such as cable protection, alters previously soft sediment habitat areas. Provision of novel hard substrate can result in colonisation by epilithic species and increases the habitat complexity and biodiversity of the area, as protective materials act as *de facto* artificial reefs (Degraer *et al.,* 2020).

685. The novel habitat provided by offshore structures could also play a role in providing so-called 'stepping-stones' for INNS, by which geographical barriers to species dispersal might be passed (Adams *et al.,* 2014). INNS can have a detrimental effect on the benthic ecology through predation on existing wildlife or outcompeting for prey and habitat. To date, there has been mixed evidence from post-construction monitoring to suggest that hard structures provide new or unique opportunities for INNS which could facilitate their introduction (e.g. Linley *et al.,* 2007). Furthermore, no spread of INNS caused by submarine cabling has yet been documented (Taormina *et al*., 2018).

686. No INNS were identified in the Marine Scheme Offshore Export Cable Corridor survey (ES, Volume 3, Appendix 8:1: Benthic Survey Report (Phase 1 and 2)). Therefore, the risk of the spread of any existing INNS is considered to be low. Furthermore, the risk of spreading newly introduced INNS will be mitigated by reducing the use of cable protection as far as practicable and through the development and implementation of an INNS management plan.

687. The environmental pressures associated with this impact are the same as those associated with long term subtidal habitat loss as the physical change (to another substratum type) pressure involves the permanent loss of one marine habitat type with an equal creation of a different marine habitat type (Tillin and Tyler-Walters, 2015; 2014a,b).

688. The relevant MarESA pressures are therefore:

- Physical change (to another seabed type); and
- Introduction or spread of invasive non-indigenous species.

689. The Offshore Export Cables will be installed at the landfall using a trenchless technology such as HDD and as such the intertidal will be entirely avoided. As such there is no impact pathway to intertidal receptors for the impact of permanent benthic habitat/ species loss or disturbance. The protected features within the zone of influence for colonisation of hard structures and introduction of INNS are limited to:

- Moderate energy circalittoral rock; and
- Sublittoral sand.

8.5.2.2.1. MAGNITUDE OF IMPACT

690. The Marine Scheme within the Coquet to St mary's MCZ is characterised by subtidal sand interspersed with moderate energy circalittoral rock. Therefore, the magnitude of impact of provision of hard substrate providing potential for colonisation by epilithic species, including INNS, is negligible.

8.5.2.2.2. SENSITIVITY OF THE RECEPTOR

691. Subtidal sands have a low to high sensitivity to the introduction of INNS, dependent on the biological communities present. The characteristic biotopes are considered to be most at risk from the slipper limpet, *Crepidula fornicata*, and potentially invasive colonial ascidians and predatory gastropods. However, the sedimentary and high energy nature of the environment is however thought to be challenging for most INNS with very few species able to colonise mobile sands due to the high levels of sediment disturbance (Tillin, 2022).

692. Colonisation of cable protection may have indirect adverse effects on the baseline communities and habitats due to increased predation on and competition with the existing soft sediment species. However, the communities which will colonise the hard structures will be adapted to hard substrates and therefore unlikely to colonise the sedimentary habitat which is occupied by the key and influential species, as supported by the research of De Backer *et al*., 2021; APEM, 2021.

693. The installation of cable protection over the moderate energy rock feature would not constitute a provision of novel hard substrate. The impact of this is considered in permanent benthic habitat/ species loss.

8.5.2.2.2.1. Moderate Energy Circalittoral Rock

694. The installation of cable protection over the moderate energy rock feature would not constitute a provision of novel hard substrate. The moderate energy circalittoral rock feature is already characterised by epilithic fauna that would be expected to colonise cable protection materials.

695. It is concluded that potential effects on the moderate energy circalittoral rock feature, due to colonisation of hard structures and introduction of INNS, would not hinder the conservation objective to:

- **conserve extent and distribution; and**
- **conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.**

8.5.2.2.2.2. Sublittoral Sand

696. The subtidal sand feature is interspersed by areas of circalittoral rock and associated communities, and as such has limited capacity to be further changed by the highly localised presence of hard substrate in the form of cable protection.

697. It is concluded that potential effects on the subtidal sand feature, due to colonisation of hard substrate and introduction of INNS would not hinder the conservation objective to:

- **conserve extent and distribution; and**
- **conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.**

8.5.2.2.3. SECONDARY MITIGATION AND RESIDUAL EFFECT

698. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the MCZ.

8.5.2.3. INCREASED SUSPENDED SEDIMENT CONCENTRATIONS (SSC) AND ASSOCIATED DEPOSITION

699. Cable repair and reburial events may result in short-term increases in suspended sediments during the operation and maintenance phase. As described in section 8.4.3, the maximum design scenario is for cable repair and reburial of up to 4 km (i.e. four cable repair and reburial events of up to 1 km each) over the operation and maintenance phase (35 years). It should be noted that this scenario covers the entire Marine Scheme and would not be feasibly required in its entirety within the 4 km of cable corridor in the MCZ.

700. The increases in suspended sediment may result in a sediment plume in the water column that is then deposited at a distance from the Marine Scheme and impact benthic receptors as described for potential effects during construction (section 8.5.1).

8.5.2.3.1. MAGNITUDE OF IMPACT

701. The length of cable requiring repair or reburial will be significantly less than the length of cable installed during the construction phase and the magnitude of impact is expected to be significantly lower than during construction. The resulting sediment plumes and sedimentation footprints would be dependent on which section of the cable is being repaired and thus the sediment type. Considering the far reduced scale, the impacts of the operation and maintenance activities (i.e. cable repair and reburial) are predicted to be no greater than those for construction, assessed in section 8.5.1.

8.5.2.3.2. SENSITIVITY OF THE RECEPTOR

702. The sensitivity of the protected features are as described for the assessment of increased SSC during the construction phase (section 8.5.1).

8.5.2.3.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

703. Based on the information presented above, the following can be concluded with respect to the attributes of the protected features of the Coquet to St Mary's MCZ.

8.5.2.3.3.1. Intertidal features

704. SSC plumes generated by maintenance activities would be expected to be no greater than those produced during construction.

705. It is concluded that potential effects on the low energy intertidal rock, moderate energy intertidal rock, high energy intertidal rock, intertidal coarse sediment, intertidal sand and muddy sand, and intertidal underboulder communities features, due to increased SSC and associated deposition, would not hinder the conservation objective to:

- conserve extent and distribution; and

- conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.

8.5.2.3.3.2. Subtidal Rock

706. SSC plumes generated by maintenance activities would be expected to be no greater than those produced during construction.

707. It is concluded that potential effects on the moderate energy infralittoral rock and moderate energy circalittoral rock features, due to increased SSC and associated deposition, would not hinder the conservation objective to:

- **conserve extent and distribution; and**
- **conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.**

8.5.2.3.3.3. Subtidal sand and subtidal mud

708. SSC plumes generated by maintenance activities would be expected to be no greater than those produced during construction.

709. It is concluded that potential effects on the subtidal sand and subtidal mud feature, due to increased SSC and associated deposition, would not hinder the conservation objective to:

- **conserve extent and distribution; and**
- **conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.**

8.5.2.3.4. SECONDARY MITIGATION AND RESIDUAL EFFECT

710. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the Coquet to St Mary's MCZ.

8.5.2.4. EMF EFFECTS

711. The operation of the Offshore Export Cables will result in emission of localised EMFs. EMFs have the potential to alter the behaviour of marine organisms that are able to detect electric (E-fields, measured in volts per metre (V/m)) or magnetic (B-field, measured in micro Tesla, (µT)) components of the fields. The B-field penetrates most materials, and therefore, is emitted into the marine environment, thus resulting in an associated induced electric (iE)-field. The direct E-fields are blocked by the use of conductive sheathing within the cable, and hence are not considered further. When relative motion is present between B-fields and a conductive medium (e.g. sea water), iE-fields are produced. Earth has its own natural geomagnetic field (GMF) with associated B and iE-fields which species rely on for navigation (Gill and Desender, 2020; Winklhofer, 2009). The natural iE-fields result from sea water interacting with the natural GMF, due to relative motion caused by the Earth's rotation, and tidal currents (Gill and Desender, 2020).

712. The exposure of benthic organisms to EMF will vary with distance from the cables and will be influenced by current flow, distance between cables, cable insulation, and burial depth / cable protection height. The project is committed to achieving burial as far as practicable along the route in any areas where ground conditions prevents burial being achieved, cable protection will be installed.

713. The strength of B-fields (and iE-fields) decreases rapidly in all directions with distance from the source due to field decay. Consequently, burying a cable results a reduced B-field at the seabed

as a result of field decay with distance from the cable (Nordmandeau et al., 2011; CSA, 2019; Hutchison *et al*., 2021). While cable burial and use of measures such as cable protection are not thought to be effective means of mitigating against B-fields (Hutchison *et al*., 2021), the separation does reduce the maximum field strength likely to be encountered by marine species on or near the seabed (Copping *et al*., 2020).

714. Modelling has been completed for the Marine Scheme on the level and attenuation of the EMF emissions (B-fields only) for both a symmetrical monopole configuration rated at 320 kV and a bipole configuration rated at 525 kV, as detailed in ES, Volume 2, Chapter 5: Project Description. As iE fields are dependent on the B-field strength, B-fields are generally the main focus of potential impacts on the marine environment (Gill and Desender, 2020).

715. The effects of EMFs on benthic communities are not well understood, however, recent studies suggest that benthic communities growing along cable routes are similar to those in nearby baseline areas, and where species are not found this is likely due to the physical presence of the cable and surface properties, rather than an EMF effect (Copping and Hemery, 2020).

716. This impact only relates to potential impacts to the fauna associated with the subtidal sand and moderate energy circalittoral rock features.

717. The relevant MarESA pressure is therefore:

- Electromagnetic changes.

718. The MarESA tool benchmark for EMF changes is set as a change in the local E-field of 1 V/m or local B-field of 10 µT, due to anthropogenic means.

8.5.2.4.1. MAGNITUDE OF IMPACT

719. There will be up to 4 cables buried to a minimum depth of 0.5 m situated within the MCZ (Section 8.4.3). In any areas where burial cannot be achieved, remedial cable protection will be installed. As detailed in ES, Volume 2, Chapter 8: Benthic Subtidal and Intertidal Ecology, the maximum EMF strengths are associated with a bipole cable configuration rated at 525 kV, and as such, this configuration has been assessed as the worst-case. The modelling estimates indicate that EMF from a 25 m separated bipole configuration, buried to a depth of 0.5 m, is equal to the approximate GMF at the Marine Scheme (50 µT) at a distance of around 10 m from the cable, both vertically and horizontally. In reality, it is likely that offshore export cables will be buried to a greater depth than this in some areas with favourable ground conditions, and in such circumstances, the EMF strengths will dissipate to the GMF even more rapidly.

720. High level modelling has been completed for the Marine Scheme on the level and attenuation of the EMF emissions (B-fields only) for both a paired symmetrical monopole configuration rated at 320 kV (comprising 4 HVDC cables) and a bipole configuration rated at 525 kV (2 HVDC cables), as detailed in ES, Volume 2, Chapter 5: Project Description.

721. As detailed in Table 5.3, the maximum EMF strengths are associated with a bipole cable configuration rated at 525 kV. The four cable 320 kV symmetrical monopole configuration resulted in lower EMF strengths, but a wider footprint of elevated EMF levels given the additional two HVDC cables. The modelling estimates that:

- For the 525 kV bipole configuration including a pair of HVDC cables separated by 25 m and buried to a minimum depth of 0.5 m, the resulting EMF strength is approximately 658 µT. This is shown to decay with distance to the natural GMF strengths for the Marine Scheme (50 µT) at a distance of between 10-20 m from the cable, both vertically and horizontally and falls below the MarESA tool benchmark within 10 m of the cables. In reality, it is likely that the cables will be buried to a greater depth than this in some areas with favourable ground conditions, where EMF strengths will dissipate to the GMF even more rapidly.
- For the 320 kV bipole configuration including four HVDC cables, separated by 25 m and buried to a minimum depth of 0.5 m, the resulting EMF strength is approximately 541 µT. This is

shown to decay with distance to the natural GMF strength at a distance of between 10-20 m from the cable, both vertically and horizontally and falls below the MarESA benchmark within 5-10 m of the cables. In reality, it is likely that the cables will be buried to a greater depth than this in some areas with favourable ground conditions, where EMF strengths will dissipate to the GMF even more rapidly.

722. Although the burial of cables and other protective measures such as placement of remedial protection are not considered to be effective ways to mitigate magnetic emissions into the marine environment entirely, burial and cable protection separate the most sensitive species from the source of the emissions (Copping *et al*., 2020).

723. EMF will be continuously emitted throughout the lifetime of the Marine Scheme (35 years). Current through the export cables and subsequently the strength of resulting EMF, will be dependent on the generation output from the BBWF. However, the modelling undertaken assumes the maximum capacity of the cables is utilised so the actual filed strengths will not exceed those outlined above.

724. As noted above, the extent of any increases in EMF associated with the Marine Scheme is very spatially limited and is not expected to result in a widespread effect on the characteristic communities of the subtidal sand or moderate energy circalittoral rock features.

8.5.2.4.2. SENSITIVITY OF THE RECEPTORS

725. The relevant MarESA pressure for EMF is electromagnetic changes. However, no evidence is available in relation to this pressure for any of the biotopes associated with the subtidal sands or moderate energy circalittoral rock features.

726. The effects of EMFs on benthic communities are considered to be not well understood and based on a limited number of studies. Recent studies suggest that benthic communities growing along cable routes are similar to those in nearby baseline areas, and where there are differences in species abundance, this is considered to be likely due to the physical presence of the cable and surface properties, rather than an EMF effect (Gill and Desender, 2020). Similarly, a recent review of the effects of EMF on invertebrates reported that no direct impact on individual survival has been identified in the literature (Hervé, 2021). These communities however are not exposed to the maximum EMF emissions due to cable burial creating a physical distance between the cable and the seabed surface, although the EMF which reaches the surface is measurable at biologically relevant scales at the seabed and in the water column (Hutchinson *et al*., 2020).

8.5.2.4.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

727. Based on the information presented above, the following can be concluded with respect to the attributes of the subtidal sand and moderate energy circalittoral rock features.

8.5.2.4.3.1. Subtidal sand

728. The extent and distribution of the offshore subtidal sand feature will be maintained in the long term following cable installation activities, with only a small proportion of the biotopes characteristic of this feature affected by EMF.

729. With respect to the key influential species that have a core role in determining the structure and function of the offshore subtidal sand feature, and the characteristic communities that make up the habitat and reflect the habitat's overall character and conservation interest, it is considered that they will be minimally affected by EMF, with only a small proportion of the total extent of this feature within the MCZ affected, enabling the maintenance of the diverse composition of communities in this feature.

730. It is concluded that potential effects on the subtidal sand feature, due to EMF, would not hinder the conservation objective to:

- conserve extent and distribution; and

- conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.

8.5.2.4.3.2. Moderate energy circalittoral rock

731. The extent and distribution of the moderate energy circalittoral rock feature will be maintained in the long term following cable installation activities, with only a small proportion of the biotopes characteristic of this feature affected by EMF.

732. As for the subtidal sand feature, with respect to the key influential species that have a core role in determining the structure and function of the offshore subtidal sand feature, and the characteristic communities that make up the habitat and reflect the habitat's overall character and conservation interest, it is considered that they will be minimally affected by EMF, with only a small proportion of the total extent of this feature within the MCZ affected, enabling the maintenance of the diverse composition of communities in this feature.

733. It is concluded that potential effects on the subtidal sand feature, due to EMF, would not hinder the conservation objective to:

- **conserve extent and distribution; and**
- **conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.**

8.5.2.4.4. SECONDARY MITIGATION AND RESIDUAL EFFECT

734. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the Coquet to St Mary's MCZ.

8.5.2.5. THERMAL EMISSIONS FROM OPERATIONAL CABLES

735. Power cables in the marine environment generate and dissipate heat. Heat emitted into the sediment from the buried Offshore Export Cables has the potential to directly affect benthic ecology receptors. Water has a high heat capacity, therefore thermal emissions from the Offshore Export Cables will not be able to heat the overlying seawater. Consequently, only sediments along the proposed cable route may be subject to potential heating. For this reason, this assessment only considers fauna associated with the subtidal sand and moderate energy circalittoral rock features.

736. The relevant MarESA pressure is therefore:

- Temperature changes – local.

8.5.2.5.1. MAGNITUDE OF IMPACT

737. When electricity is transported, a certain amount dissipates as heat energy, potentially increasing the temperature at the cable surface and in the surrounding sediment. There is evidence that this heat (also known as thermal emissions) can occur from high voltage subsea cables and is detectable within the surrounding sediments (Meißner 2006; Taormina *et al.,* 2018). However, Taormina *et al.* (2018) found that a maximum increase of 2.5°C occurs 50 cm directly below the cable whereas sediment temperature increases above the cables were reduced, due to the increasing influence of the seawater towards the seabed.

738. Thermal emissions can modify physical and chemical properties of the seabed, resulting in a development of microorganism communities and/or result in displacement of demersal mobile organism (Taormina *et al*., 2018). It is expected that the zone of influence from any thermal emissions will be limited to the immediate vicinity of each cable and that heat will dissipate relatively rapidly.

739. Emeana *et al*. (2016) found that heat transfer within sediments was dependent on sediment type, with coarse silts experiencing the greatest temperature change. However, this greatest difference was more localised to the source. In comparison, very coarse sediments had a lower temperature change but were affected over a greater distance. This is due to the increased interstitial space between coarser sediment particles. Considering the nature of the offshore sands and gravels, including that of the shelf banks and mounds feature, it is likely that the increase in temperature within the sediments will be highly localised to the source, only impacting a small proportion of the available biotopes across the ncMPA, but for the duration of the operational lifetime of the project.

8.5.2.5.2. SENSITIVITY OF THE RECEPTOR

740. Similar to EMF, there is also a paucity of evidence on the potential effects of thermal emissions on invertebrates. The potential impact on the benthic fauna of the ncMPA is therefore largely unknown (Boehlert & Gill, 2010; Taormina et al. 2018).

741. The relevant MarESA tool benchmark for thermal emissions from operational cables is temperature increase (local). The benchmark for this pressure is a 5°C increase in temperature for one month period, or 2°C for one year.

742. According to MarESA, the biotopes of the subtidal sand and moderate energy circalittoral rock features have low sensitivity to this pressure (see ES, Volume 2, Chapter 8: Benthic and Subtidal and Intertidal Ecology).

8.5.2.5.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

743. Based on the information presented above, the following can be concluded with respect to the attributes of the protected features of the Coquet to St Mary's MCZ.

8.5.2.5.3.1. Subtidal sand

744. The extent and distribution of the subtidal sand feature will be maintained in the long term following cable installation activities, with only a small proportion of the biotopes characteristic of this feature affected by thermal emissions.

745. With respect to the key biotopes that have a core role in determining the structure and function of the subtidal sand feature, and the characteristic communities that make up the habitat and reflect the habitat's overall character and conservation interest will be minimally affected by thermal emissions, with only a small proportion of the total extent of this feature within the MCZ affected. This will enable the maintenance of the diverse composition of communities in this feature.

746. It is concluded that potential effects on the subtidal sand feature, due to thermal emissions, would not hinder the conservation objective to:

- conserve extent and distribution; and
- conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.

8.5.2.5.3.2. Moderate energy circalittoral rock

747. The extent and distribution of the moderate energy circalittoral rock feature will be maintained in the long term following cable installation activities, with only a small proportion of the biotopes characteristic of this feature affected by thermal emissions.

748. As for the subtidal sand feature, the characteristic communities that make up the habitat and reflect the habitat's overall character and conservation interest, it is considered that they will be minimally affected by thermal emissions, with only a small proportion of the total extent of this feature within the MCZ affected, enabling the maintenance of the diverse composition of communities in this feature.

749. It is concluded that potential effects on the circalittoral rock feature, due to thermal emissions, would not hinder the conservation objective to:

- **conserve extent and distribution; and**
- **conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.**

8.5.2.5.4. SECONDARY MITIGATION AND RESIDUAL EFFECT

750. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the Coquet to St Mary's MCZ.

8.5.2.6. CHANGES IN PHYSICAL PROCESSES FROM CABLE PROTECTION MEASURES

751. Alteration of seabed habitat arising from effects on physical processes during the operation and maintenance phase of the Marine Scheme in the Coquet to St Mary's MCZ may occur as a result of the presence of cable protection for cables. However, as described above, cable burial will be achieved wherever practicable.

752. Full detail on the project envelope assumptions and maximum design for cable installation and seabed levelling is provided in Section 8.4.3 and ES, Volume 2, Chapter 7: Offshore Physical Environment.

753. Potential changes to the tide and wave regime will occur when the cable protection on the seabed has the capacity to locally block the incident flows and waves. These changes can have associated consequences on the water column, seabed and coast, due to blockage effects. The scale of any blockage relates to the cross-sectional area of the infrastructure on the seabed and its protruding heights.

754. The relevant MarESA tool pressures for changes in physical processes from cable protection measures include:

- Changes in local water flow (tidal current) / wave exposure (tidal current) changes – local; and
- Local wave exposure changes.

8.5.2.6.1. MAGNITUDE OF IMPACT

755. As described in Section 8.4.3, up to 0.09 km^2 of cable protection material may be installed within the MCZ, assuming up to 1.3 km of cable protection is required for each of the four Offshore Export Cables, with a further 0.8 km allowance for four cable crossings. This equates to 0.05% of the MCZ area as a whole.

756. Protection will have a maximum height of 1.5 m and width of 9.5 m and will protrude into the water column with a submerged cross-sectional profile. For crossings the maximum berm height will be 2 m, with a 12.5 m width.

757. Results of the completed analyses, described in ES, Volume 2, Chapter 7: Offshore Physical Environment and Seabed Conditions, indicate that there will be no discernible change to water levels upstream or downstream of the cable protection berm and thus no alteration to flow speeds.

758. Changes to waves are limited by the actual profile of the protection berm at 9.5 m at its widest and 1.5 m (12.5 m wide and up to 2 m high for crossings) at its highest, being very small and largely indiscernible in the context of a progressing wave train that is on a much larger scale at tens to hundreds of metres. Furthermore, any protection will be placed in distinct areas. Therefore, the presence of any protection within the water depths associated with the transitional wave is not considered to cause any changes to wave or increase shoaling. The small and intermittent footprint

of the protection in locations where required within the Marine Scheme, would also not lead to wave energy dissipation for the same reason that waves would recover in the lee of the protection berms and continue to travel to eventually completely break at the coast.

759. The presence of cable and crossing protection on the seabed does not ultimately impact the local wave and tidal regime. With no change to waves and tides, there is not anticipated to be onward changes to the sediment transport regime as a result of the Marine Scheme. However, it is noted that in the short-term the protection berm could act as a localised sink, with disruption to sediment transport processes, but in the medium to long-term, sediment would bypass the protection berm. This process could occur at all depths, but would be more pronounced in the shallowest water depths at which HDD protection may be installed (i.e. 10 m LAT) where the shallow water breaking wave regime is considered to occur and waves contribute to sediment transport processes. Therefore, the impact is predicted to be of local spatial extent and short-term duration (until sediment by-passing begins) but continuous, with sediment by-passing occurring in the medium to long-term in line with the protection being present.

760. As discussed in detail in ES, Volume 2, Chapter 7: Offshore Physical Environment and Seabed Conditions, the changes to tidal currents, wave climate, littoral currents, and sediment transport are insignificant in terms of the hydrodynamic regime. Given the negligible magnitude of impact, highly localised to the any discrete areas of cable protection, and that the Offshore Export Cables will be installed at the Landfall via trenchless techniques, there will be no impact on any intertidal receptors.

8.5.2.6.2. SENSITIVITY OF THE RECEPTOR

761. The sedimentological features of the habitats designated for the MCZ are considered to have a low capacity to accommodate and moderate ability to recover from changes to physical processes. However, the changes to physical processes will be insignificant in terms of the hydrodynamic regime and thus have no impact of change on the protected habitats of the MCZ.

8.5.2.6.3. POTENTIAL TO HINDER CONSERVATION OBJECTIVES

762. Based on the information presented above, the following can be concluded with respect to the attributes of the protected features of the Coquet to St Mary's MCZ.

763. Based on the completed analyses (see ES, Volume 2, Chapter 7: Offshore Physical Environment and Seabed Conditions), the impacts to the habitat features of the MCZ as a result of changes to the tidal, wave and sediment transport regimes due to blockage effects from cable protection measures is negligible. The impact is predicted to be highly localised to the any discrete areas of cable protection. The extent and distribution, and thus quality and function of the designated features will be maintained in the long term.

8.5.2.6.3.1. Intertidal features

764. It is concluded that potential effects on the low energy intertidal rock, moderate energy intertidal rock, high energy intertidal rock, intertidal coarse sediment, intertidal sand and muddy sand, and intertidal underboulder communities features, due to changes in physical processes would not hinder the conservation objective to:

- **conserve extent and distribution; and**
- **conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.**

8.5.2.6.3.2. Subtidal Rock

765. Subtidal rock biotopes are considered to be not sensitive to the pressures of changes in local water flow and wave exposure.

766. It is concluded that potential effects on the moderate energy infralittoral rock and moderate energy circalittoral rock features, due to changes in physical processes, would not hinder the conservation objective to:

- **conserve extent and distribution; and**
- **conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.**

8.5.2.6.3.3. Subtidal sands

767. Subtidal sand biotopes are not sensitive to the pressures of changes in local water flow and wave exposure. The magnitude of any potential impact on this feature would be highly localised to the immediate vicinity of the discrete areas of cable protection.

768. It is concluded that potential effects on the subtidal sand feature, due to changes in physical processes, would not hinder the conservation objective to:

- **conserve extent and distribution;**
- **conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.**

8.5.2.6.4. SECONDARY MITIGATION AND RESIDUAL EFFECT

769. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the Coquet to St Mary's MCZ.

8.5.3. Potential Effects During Decommissioning

770. Given the nature of the decommissioning activities, which will largely be a reversal of the installation process, the impacts during decommissioning are expected to be similar to, or less than those assessed for the construction phase. In the absence of detailed information regarding decommissioning works, the implications for the MCZ are considered analogous with or likely less than those identified and assessed for the construction phase. It is also assumed that the designated feature sensitivities will not materially change over the life cycle of the Marine Scheme.

771. The Offshore Export Cables, associated protection and HDD exit pits will be fully removed where it is possible and appropriate to do so noting this will depend on the type of protection used and condition of the protection at the time of removal.

772. Should complete removal of the Offshore Export Cables be required, the activities are expected to result in similar impacts to those assessed as part of the construction phase of the Marine Scheme. Impacts are anticipated to be of similar or lower magnitude to the construction phase (depending on the decommissioning option selected). Complete removal of the Offshore Export Cables represents the most significant adverse effects, and therefore if the other decommissioning options were to be progressed, they would have no more significant adverse effects.

773. The maximum design scenario for the extent of habitat creation arising from the introduction of new hard substrate within the Coquet to St Mary's MCZ which will persist following the decommissioning phase is assumed to be same as for the operation and maintenance phase.

774. Based on the information presented across the assessment of effects resulting from installation and operation & maintenance activities, it can be concluded that the impacts of resulting from decommissioning will not lead to a significant risk of hindering the achievement of the conservation objectives for the habitat features of the Coquet to St Mary's MCZ.

8.5.3.1. SECONDARY MITIGATION AND RESIDUAL EFFECT

775. No secondary mitigation is considered necessary because the Marine Scheme will not lead to a significant risk of hindering the achievement of the conservation objectives of the MCZ.

8.5.4. Assessment of Effects - Project Alone Conclusion

776. Based on the information presented for all features, conservation objectives and attributes set out above, there will be no significant risk of hindering the achievement of the conservation objectives for all features of the Coquet to St Mary's MCZ

8.6. Assessment of Effects – In-Combination

8.6.1. Other Plans and Projects Included in the In-Combination Assessment

777. Table 8.6 lists the other plans and developments that have been identified as having potential to have an effect on the Coquet to St Mary's MCZ in combination with the Marine Scheme.

Table 8.6 Other Plans and Projects with potential for in-combination effects on the Coquet to St Mary's MCZ

Development	Status	Distance from Marine Scheme (km)	Description of Development / Plan	Dates of Construction (if applicable)	Dates of Operation (if applicable)	Phase Overlap with the Marine Scheme
Blyth Demonstrator Offshore Wind Farm – Phase 2	Consented	1	Offshore wind farm	Completed by 2025	Current lease secured until 2050	Operation and maintenance
Blyth Demonstration Phase 2 (&3) Cable Corridor	Consented	0	Transmission infrastructure	Completed by 2025	Assumed to be consistent with Blyth Demonstrator Offshore Wind Farm – Phase 2	Operation and maintenance

8.6.2. Potential Effects During Construction

8.6.2.1. TEMPORARY BENTHIC HABITAT / SPECIES LOSS OR DISTURBANCE

778. The planned construction period for the Marine Scheme overlaps with the operation and maintenance periods for the Blyth Demonstrator Phase 2 (&3) export cable. The project has consent to be constructed, however, EDF have confirmed there is no indicative construction timescale. Due to consent timeline requirements, it is not considered possible that the construction period would overlap with the construction period of the Marine Scheme and thus the operation and maintenance period is assessed here.

779. Alone, disturbance from seabed preparation and export cable installation activities associated with the Marine Scheme are considered to be of short term and of a limited spatial extent (0.4 km^2) equating to 0.2% of the subtidal sand and moderate energy circalittoral rock features of the MCZ. The Blyth Phase 2 & 3 cable corridor reaches landfall in the southern extent of the Marine Scheme landfall corridor (Figure 8). A quantitative assessment cannot be made, however the habitat disturbance resulting from any operation and maintenance activities associated with Blyth Phase 2 & 3 cable would be expected to be short term and localised, and no more than the habitat disturbance resulting from construction of the Marine Scheme, given the scale of the offshore wind

farm project and the similar cable length within the MCZ. Considering the location of the Blyth Phase 2 cable corridor (Figure 8) the corridor is unlikely to overlap any moderate energy circalittoral rock (Figure 12).

780. The limited extent of cumulative disturbance is unlikely to have a material impact on the habitat features of the MCZ owing to the widespread undisturbed habitat and communities within the MCZ which will act as a source for recolonisation once construction activities cease.

781. Based on the information presented here, it can be concluded that cumulative increases temporary habitat / species loss or disturbance during the Marine Scheme construction phase will not lead to a significant risk of hindering the achievement of the conservation objectives for any feature of the Coquet to St Mary's MCZ (Table 8.7).

Table 8.7 CEA of the Coquet to St Mary's MCZ for temporary benthic habitat / species loss

Protected Feature	Conclusion
Subtidal sand	The cumulative disturbance to this feature is expected to be temporary and highly localised. Sediment composition will be maintained and biological communities within the footprint of activities will recover. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.
Moderate energy circalittoral rock	Any cumulative disturbance to the characteristic communities of this feature is expected to be temporary and highly localised. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.

8.6.2.1.1. INCREASED SUSPENDED SEDIMENT CONCENTRATIONS (SSC) AND ASSOCIATED DEPOSITION

782. The developments listed in Table 7.3 which met the CEA criteria may result in some temporary increases in SSC and associated deposition, including mobilisation of potential sediments.

783. As described above, the planned construction period for the Marine Scheme overlaps with the operation and maintenance periods for the Blyth Demonstrator Offshore Wind Farm – Phase 2 and the Blyth Demonstrator Phase 2 (&3) export cable project.

784. The Blyth Demonstrator Phase 2 (&3) export cable corridor overlaps with the MCZ for approximately 4 km and overlaps with the Marine Scheme at the southern landfall approach. The Demonstrator Offshore Wind Farm – Phase 2 is located approximately 1 km from the Marine Scheme (Figure 8).

785. The deposition of sediment is expected to be transient associated with the Marine Scheme and along with the nearby projects, with the thickest areas of sedimentation located closest to the area of disturbance activity, decreasing in thickness with increasing distance. Sedimentation will occur in relation to the natural settling velocity of the sediment present and once deposited will form part of the sediment transport regime and be reworked in line with transport processes. As determined for the Marine Scheme, there is not expected to be any changes to sediment properties, as the same deposition mechanisms are expected to apply to all projects. As such, it can be reasonably

expected that SSC generated by the Blyth 2 & 3 cable corridor works would fall out of suspension quickly, depositing in close proximity to the maintenance activities and thus within an area of similar sediment composition. Likewise, any plume created would be similarly localised and temporary to that of the Marine Scheme.

786. There was no risk identified to any of the intertidal or subtidal habitat features of the MCZ. Any SSC generated by maintenance works to the Blyth Phase 2 & 3 cable or offshore wind farm would be expected to be of no greater extent to that of the Marine Scheme construction works.

787. As discussed for the project alone assessment, any exposure of benthic fauna to contaminated sediments would be expected to be no greater than that experienced during storm events, and thus not above the baseline.

788. The project alone assessment for the Marine Scheme concluded that SSC generation and deposition posed no risk to the conservation objectives. The impacts likely to arise from the maintenance activities of the Blyth 2 & 3 cable would not be expected to be sufficient to increase the assessment of risk.

789. Based on the information presented here, it can be concluded that cumulative increases in SSC and associated deposition during the Marine Scheme construction phase will not lead to a significant risk of hindering the achievement of the conservation objectives for any feature of the Coquet to St Mary's MCZ (Table 8.8).

Table 8.8 CEA of the Coquet to St Mary's MCZ for increased SSC and associated deposition during construction

Protected Feature	Conclusion
Low energy intertidal rock Moderate energy intertidal rock High energy intertidal rock Intertidal coarse sediment Intertidal sand and muddy sand Moderate energy infralittoral rock Moderate energy circalittoral rock Subtidal sand Subtidal mud Intertidal underboulder communities	The cumulative impact of SSC and associated deposition to this feature is expected to be temporary and highly localised. Sediment composition will be maintained and biological communities within the footprint of activities will recover. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.

8.6.3. Potential Effects During Operation

8.6.3.1. PERMANENT BENTHIC HABITAT / SPECIES LOSS OR DISTURBANCE

790. The planned construction period for the Marine Scheme overlaps with the operation and maintenance period for the Blyth Demonstrator Phase 2 (&3) export cable.

791. The consented cable corridor extends for approximately 4 km through the MCZ on approach to landfall. The cable protection requirements for the Marine Scheme would mean that up to 0.09 km^2

of cable protection may be required (section 8.5.2). The Blyth Demonstrator Phase 2 (&3) export cable project plans to install 0.0013 km^2 of cable protection along the export cable corridor (EDF Energy Renewables, 2017). Should the full extent of cumulative worst case cable protection (0.0913 km^2) be present within the MCZ, this would equate to 0.14 % of the subtidal sand feature within the MCZ or 0.15 % of the moderate energy circalittoral rock feature.

792. As discussed for the project alone assessment, the presence of cable protection on the moderate energy circalittoral feature of the MCZ would equate to a change to an artificial substratum (approximately 0.15% cumulatively), but similar epifaunal communities to that of the moderate energy circalittoral rock feature would be expected to colonise the cable protection over time.

793. Given the negligible proportions of habitat loss described here, the extent and distribution of subtidal sands and moderate energy circalittoral rock will be largely maintained within the MCZ. The wider extent of these features within the MCZ will be unaffected during the operation and maintenance phase and provide suitable habitat for the associated soft-sediment and rock biotopes.

794. Based on the information presented here, it can be concluded that permanent habitat/ species loss during the Marine Scheme operation phase will not lead to a significant risk of hindering the achievement of the conservation objectives for any feature of the Coquet to St Mary's MCZ (Table 8.9).

Table 8.9 CEA of the Coquet to St Mary's MCZ for permanent benthic habitat / species loss

Protected Feature	Conclusion
Subtidal sand	The cumulative disturbance to this feature is expected to be highly localised. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.
Moderate energy circalittoral rock	The cumulative disturbance to this feature is expected to be highly localised. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.

8.6.3.2. COLONISATION OF HARD STRUCTURES AND INTRODUCTION OF INNS

795. The planned construction period for the Marine Scheme overlaps with the operation and maintenance period for the Blyth Demonstrator Phase 2 (&3) export cable.

796. As described for the effect of permanent habitat loss above, up to 0.0913 km^2 of cumulative cable protection could be present within the MCZ, this would equate to 0.14% of the subtidal sand feature within the MCZ or 0.15% of the moderate energy circalittoral rock feature.

797. As discussed for the project alone assessment, the cumulative magnitude of this pressure is negligible as the presence of hard structures is not a substantive change from existing seabed conditions of subtidal sand interspersed with moderate energy circalittoral rock.

798. As such there is considered to be no risk of hindrance to the conservation objectives of the MCZ through colonisation of hard structures and introduction of INNS (Table 8.10).

Table 8.10 CEA of the Coquet to St Mary's MCZ for colonisation of hard structures and introduction of INNS

Protected Feature	Conclusion
Subtidal sand	The cumulative disturbance to this feature is expected to be highly localised. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.
Moderate energy circalittoral rock	The cumulative disturbance to this feature is expected to be highly localised. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.

8.6.3.3. INCREASED SUSPENDED SEDIMENT CONCENTRATIONS (SSC) AND ASSOCIATED DEPOSITION

799. The developments listed in Table 7.3 which met the CEA criteria may result in some temporary increases in SSC and associated deposition, including mobilisation of potential sediments.

800. As described above, the planned construction period for the Marine Scheme overlaps with the operation and maintenance periods for the Blyth Demonstrator Offshore Wind Farm – Phase 2 and the Blyth Demonstrator Phase 2 (&3) export cable project.

801. The Blyth Demonstrator Phase 2 (&3) export cable corridor overlaps with the MCZ for approximately 4 km, and overlaps with the Marine Scheme at the southern landfall approach. The Demonstrator Offshore Wind Farm – Phase 2 is located approximately 1 km from the Marine Scheme (Figure 8).

802. The project alone assessment for the Marine Scheme concluded no risk of hindrance of the conservation objectives for the site for the increased SSC and associated deposition during the construction phase.

803. The cumulative SSC generated by these projects during their respective operation and maintenance phases would be expected to be less than that produced during the Marine Scheme operation phase, for which no risk was identified to hindering the conservation objectives of the MCZ.

804. Based on the information presented here, it can be concluded that cumulative increases in SSC and associated deposition during the Marine Scheme operation and maintenance phase will not lead to a significant risk of hindering the achievement of the conservation objectives for any feature of the Coquet to St Mary's MCZ (Table 8.11).

Table 8.11 CEA of the Coquet to St Mary's MCZ for increased SSC and associated deposition during construction

Protected Feature	Conclusion
Low energy intertidal rock Moderate energy intertidal rock High energy intertidal rock Intertidal coarse sediment Intertidal sand and muddy sand Moderate energy infralittoral rock Moderate energy circalittoral rock Subtidal sand Subtidal mud Intertidal underboulder communities	The cumulative impact of SSC and associated deposition to this feature is expected to be temporary and highly localised. Sediment composition will be maintained and biological communities within the footprint of activities will recover. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.

8.6.3.4. EMF EFFECTS

805. Based on the information provided in the project alone assessment (section 8.5.2) the spatial extent of thermal and EMF impacts are highly localised to the immediate proximity of the operational cables. Given this similarity in magnitude, both pressures are assessed here together.

806. The planned construction period for the Marine Scheme overlaps with the operation and maintenance period for the Blyth Demonstrator Phase 2 (&3) export cable.

807. The effects of EMFs on benthic communities are not well understood, however, recent studies suggest that benthic communities growing along cable routes are similar to those in nearby baseline areas, and where species are not found this is likely due to the physical presence of the cable and surface properties, rather than an EMF effect (Copping and Hemery, 2020).

808. Thermal radiation can modify physical and chemical properties of the seabed, resulting in a development of microorganism communities and/or result in displacement of demersal mobile organism (Taormina et al., 2018). It is expected that the zone of influence from any thermal radiation will be limited to the immediate vicinity of each cable and that heat will dissipate relatively rapidly. Indeed, considering the composition of the offshore sands and gravels, including that of the shelf banks and mounds feature, it is likely that the increase in temperature within the sediments will be highly localised to the source, only impacting a small proportion of the available infaunal biotopes across the ncMPA, but for the duration of the operational lifetime of the project.

809. The potential for cumulative EMF and thermal emissions will be limited to the location of cable crossings. The consented cable corridor extends for approximately 4 km through the MCZ on approach to landfall and overlaps with the Marine Scheme at the southern approach to landfall.

810. Thermal emissions from operational cables are expected to be highly localised (section 8.5.2). It is assumed that the Blyth Demonstrator Phase 2 (&3) export cable will be buried as far as practicable or adequately protected. Considering the high heat capacity of water and the depth of burial proposed, the potential for heat to be emitted beyond the immediate seabed is low.

811. The emissions will remain highly localised, reducing to ambient levels rapidly with distance from the cables of the Marine Scheme and the Blyth Demonstrator Phase 2 (&3) export cable. Consequently, the magnitude of impact is considered to be the same as for the Marine Scheme assessment alone.

812. Due to the localised effects of EMF and thermal emissions, the sensitivities of the subtidal sand and moderate energy circalittoral rock features described for the project alone assessment (section 8.5.2) also apply for the cumulative assessment. The extent of any increases in EMF and thermal emission associated with the Marine Scheme is very spatially limited and is not expected to result in a widespread effect on the characteristic communities of the subtidal sand or moderate energy circalittoral rock features. Based on the information presented here, it can be concluded that cumulative increases in EMF and thermal emissions during operation will not lead to a significant risk of hindering the achievement of the conservation objectives for any feature of the Coquet to St Mary's MCZ (Table 8.12).

Table 8.12 CEA of the Coquet to St Mary's MCZ for EMF and thermal emissions

Protected Feature	Conclusion
Subtidal sand	The cumulative impact of EMF and thermal emissions is expected to be highly localised and is not expected to result in a widespread effect on the characteristic communities. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.
Moderate energy circalittoral rock	The cumulative impact of EMF and thermal emissions is expected to be highly localised and is not expected to result in a widespread effect on the characteristic communities. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.

8.6.3.5. CHANGES IN PHYSICAL PROCESSES FROM CABLE PROTECTION MEASURES DURING OPERATION.

813. The planned construction period for the Marine Scheme overlaps with the operation and maintenance period for the Blyth Demonstrator Phase 2 (&3) export cable.

814. The consented cable corridor extends for approximately 4 km through the MCZ on approach to landfall. Cumulatively for the two projects, up to 0.0913 km^2 of cable protection could be present within the MCZ. The profile of the Blyth Demonstrator Phase 2 (&3) export cable protection will be no more than 3 m wide and 0.6 m high depending on the type of cable protection deployed. The Environmental Assessment for the project notes that this level of vertical change is within the scale of natural variability of the local seabed topography at the site and the changes to the sediment transport and hydrodynamic regime is likely to be of negligible to low magnitude and highly localised (EDF Energy Renewables, 2017).

815. Assessment of the changes to the tidal, wave and sediment transport regimes in relation to the Marine Scheme in isolation (section 8.5.2), is considered to be negligible as a result of the Marine Scheme with no risk of hindering the conservation objectives of the site.

816. The cable protection measures for the Blyth Demonstrator Phase 2 (&3) export cable can be expected to be of a similar extent and low profile to that of the Marine Scheme. As such there is little potential for this project to act cumulatively with the Marine Scheme during shared operational periods with respect to changes to tide, wave and sediment transport regime from blockage resultant from nearby cables, floating or seabed structures and associated protection measures.

817. The sensitivities of the subtidal sand and moderate energy circalittoral rock features are discussed in section 8.5.2.

818. Considering the negligible magnitude of potential changes to the physical processes of the site resulting from highly localised and low profile cable protection measures, it can be concluded that cumulative changes to physical processes within the MCZ during the operation and maintenance period will not lead to a significant risk of hindering the achievement of the conservation objectives for any feature of the Coquet to St Mary's MCZ (Table 8.13).

Table 8.13 CEA of the Coquet to St Mary's MCZ for change in physical processes.

Protected Feature	Conclusion
Subtidal sand	The cumulative impact of changes to physical processes as a result of cable protection materials is expected to be negligible. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.
Moderate energy circalittoral rock	The cumulative impact of changes to physical processes as a result of cable protection materials is expected to be negligible. Cumulatively, the projects will not hinder the conservation objective to: • conserve extent and distribution; • conserve structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.

9. Summary of Conclusions from the ncMPA / MCZ Assessments

819. Table 9.1 below provides a summary of the outcomes from the Full Assessment (MPAs) and Stage 1 Assessment (MCZs).

820. Given the nature of the decommissioning activities, which will largely be a reversal of the installation process, the impacts during decommissioning are expected to be similar, and of no greater magnitude, to those assessed for the construction phase. Therefore, the assessment conclusions for the construction phase also apply equally to the decommissioning phase.

821. Based on the information presented in the preceding sections, it can be concluded that there is no potential for the Marine Scheme to hinder the achievement of the conservation objectives (other than insignificantly) for the Firth of Forth banks Complex ncMPA, Farnes East MCZ, Berwick to St Mary's MCZ and Coquet to St Mary's MCZ (in accordance with section 126 of the Marine and Coastal Access Act 2009).

822. Furthermore, it can be concluded that there is no potential for Marine Scheme in combination with the relevant cumulative projects, to hinder the achievement of the conservation objectives (other than insignificantly) for the Firth of Forth banks Complex ncMPA, Farnes East MCZ, Berwick to St Mary's MCZ and Coquet to St Mary's MCZ (in accordance with section 126 of the Marine and Coastal Access Act 2009).

Table 9.1 Summary of Full Assessment/ Stage 1 Assessment

Site Name	Feature(s) and overall conservation objectives	Pathways Assessed - Construction	Pathways Assessed – Operation and Maintenance	Assessment Conclusion
Scottish waters				
Firth of Forth Banks Complex ncMPA	Recover to favourable condition: • Offshore subtidal sands and gravels • Ocean quahog (*Arctica islandica*) aggregations Maintain in favourable condition: • Shelf banks and mounds • Moraines representative of the Wee Bankie key geodiversity area	• Temporary benthic habitat / species loss or disturbance • Increased SSC and associated deposition (including mobilisation of potential contaminants)	• Permanent benthic habitat / species loss or disturbance • Colonisation of hard structures and introduction of INNS • Increased SSC and associated deposition (including mobilisation of potential contaminants) • EMF effects • Thermal emissions from operational cables • Changes in physical processes from cable protection measures	A full assessment of the ncMPA has been carried out, as reported within section 5 above. **Project alone conclusion:** The impact pathways assessed for the construction and operation and maintenance phase will not lead to a significant risk of hindering the achievement of the overall conservation objective of “recover to favourable condition” for the offshore subtidal sands and gravels, and Ocean quahog aggregations features. The impact pathways assessed for the construction and operation and maintenance phase will not lead to a significant risk of hindering the achievement of the overall conservation objective of “maintain in favourable condition” for the shelf banks and mounds, and moraines representative of the Wee Banke key geodiversity area features. **In-combination conclusion:** The cumulative impact pathways assessed for both construction and operation and maintenance phases will not lead to a significant risk of hindering the achievement of the overall conservation objectives as set out above. **Assessment Outcome:** No significant risk of hindering the achievement of the conservation objectives stated for the ncMPA. There is no requirement for additional mitigation over and above the pre-defined designed in measures.

Site Name	Feature(s) and overall conservation objectives	Pathways Assessed - Construction	Pathways Assessed – Operation and Maintenance	Assessment Conclusion
English waters				
Farnes East MCZ	Recover to favourable condition: • Subtidal mud • Seapen and burrowing megafauna communities Ocean quahog (*Arctica islandica*) Maintain in favourable condition: • Moderate energy circalittoral rock • Subtidal coarse sediment • Subtidal mixed sediments • Subtidal sand	• Increased SSC and associated deposition (including mobilisation of potential contaminants)	• Colonisation of hard structures and increased risk of INNS	A Stage 1 assessment of the MCZ has been carried out, as reported within section 6 above. **Project alone conclusion:** The impact pathways assessed for the construction and operation and maintenance phase will not lead to a significant risk of hindering the achievement of the overall conservation objective of “recover to favourable condition” for the subtidal mud, and seapen and burrowing megafauna communities features. The impact pathways assessed for the construction and operation and maintenance phase will not lead to a significant risk of hindering the achievement of the overall conservation objective of “maintain in favourable condition” for the moderate energy circalittoral rock, subtidal coarse sediment, subtidal mixed sediments, subtidal sand features. **In-combination conclusion:** The cumulative impact pathways assessed for both construction and operation and maintenance phases will not lead to a significant risk of hindering the achievement of the overall conservation objectives as set out above. **Assessment Outcome:** No significant risk of hindering the achievement of the conservation objectives stated for the MCZ; a Stage 2 assessment is not required. There is no requirement for additional mitigation over and above the pre-defined designed in measures.

Site Name	Feature(s) and overall conservation objectives	Pathways Assessed - Construction	Pathways Assessed – Operation and Maintenance	Assessment Conclusion
Berwick to St Mary's MCZ	Recover to favourable condition: • Common eider (*Somateria mollisima)*	• Disturbance and displacement to ornithological features • Change in prey availability resulting from increased SSC, reduced water quality/ contamination, and temporary habitat loss/ disturbance	• Disturbance and displacement to ornithological features • Change in prey availability resulting from increased SSC, reduced water quality/ contamination, and long term habitat loss/ disturbance	A Stage 1 assessment of the MCZ has been carried out, as reported within section 7 above. **Project alone conclusion:** The impact pathways assessed for the construction and operation and maintenance phase will not lead to a significant risk of hindering the achievement of the overall conservation objective of "recover to favourable condition" for the common eider feature. **In-combination conclusion:** The cumulative impact pathways assessed for both construction and operation and maintenance phases will not lead to a significant risk of hindering the achievement of the overall conservation objective as set out above. **Assessment Outcome:** No significant risk of hindering the achievement of the conservation objectives stated for the MCZ; a Stage 2 assessment is not required. There is no requirement for additional mitigation over and above the pre-defined designed in measures.

Site Name	Feature(s) and overall conservation objectives	Pathways Assessed - Construction	Pathways Assessed – Operation and Maintenance	Assessment Conclusion
Coquet to St Mary's MCZ	Maintain in favourable condition: • Low energy intertidal rock • Moderate energy intertidal rock • High energy intertidal rock • Intertidal mixed sediments • Intertidal coarse sediment • Intertidal sand and muddy sand • Intertidal mud • Intertidal underboulder communities • Peat and clay exposures • Moderate energy infralittoral rock • High energy circalittoral rock • Subtidal coarse sediment • Subtidal sand • Subtidal mixed sediments • Subtidal mud	• Temporary benthic habitat / species loss or disturbance • Increased SSC and associated deposition (including mobilisation of potential contaminants)	• Permanent benthic habitat / species loss or disturbance • Colonisation of hard structures and introduction of INNS • Increased SSC and associated deposition (including mobilisation of potential contaminants) • EMF effects • Thermal emissions from operational cables • Changes in physical processes from cable operations	A Stage 1 assessment of the MCZ has been carried out, as reported within section 0 above. **Project alone conclusion:** The impact pathways assessed for the construction and operation and maintenance phase will not lead to a significant risk of hindering the achievement of the overall conservation objective of "maintain in favourable condition" for all broadscale marine habitat, and marine habitat features. **In-combination conclusion:** The cumulative impact pathways assessed for both construction and operation and maintenance phases will not lead to a significant risk of hindering the achievement of the overall conservation objective as set out above. **Assessment Outcome:** No significant risk of hindering the achievement of the conservation objectives stated for the MCZ; a Stage 2 assessment is not required. There is no requirement for additional mitigation over and above the pre-defined designed in measures.

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