Morven North Offshore Wind Array Project

Additional Application Information

Chapter 6: Marine Protected Area Assessment: Morven North

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9.1 Introduction

9.1.1 Overview

9.1.1.1 This report addresses specific consideration of Nature Conservation Marine Protected Areas (ncMPAs; henceforth referred to as Marine Protected Areas (MPAs)) which is required for consent applications in United Kingdom (UK) waters. This report presents the assessment of the likely significant effects on relevant MPAs that may occur as a result of the Morven North Offshore Wind Array Project (hereafter, "Morven North") during the construction, operation and maintenance (O&M) and decommissioning phases. This report sits alongside the Offshore Environmental Impact Assessment (EIA) Report; however, it is a standalone assessment to address provisions for MPAs in the Marine (Scotland) Act 2010 and the Marine Coastal Access Act 2009.

9.1.2 ScotWind leasing round

9.1.2.1 In 2020, Crown Estate Scotland (CES) launched the ScotWind leasing process to facilitate the increase in offshore wind capacity to support the Scottish Government's 2045 Net Zero target. The Climate Change Committee estimates that around 100GW of offshore wind by 2050 will be needed to deliver Net Zero, with the combined capacity of the ScotWind leasing round (27.6GW) covering a significant portion of this (CES, 2022). On top of the progression towards the 2045 Net Zero and 2050 offshore wind capacity targets, the ScotWind leasing round also has wider benefits such as creating Scottish jobs and investment, supporting the supply chain and providing additional revenue for the Scottish Government. Morven Offshore Wind Limited (MvOWL), a joint venture between JERA Nex bp Limited (JNBP), and EnBW Energie Baden-Württemberg AG (EnBW) (hereafter "the Applicant"), has been awarded a seabed option under the 2021/22 ScotWind Leasing Round for the Morven Option Lease Agreement Site (hereafter 'Morven Site'), located wholly within Plan Option Area E1, identified in the Scottish Government's Sectoral Marine Plan for Offshore Wind Energy (the SMP) (Scottish Government, 2020). This was subsequently divided into Morven North and the Morven South Offshore Wind Array Project (hereafter "Morven South"), with this report covering the MPA Assessment for Morven North.

9.1.3 Morven North

9.1.3.1 Morven North will be located approximately 61km from the Aberdeenshire coast at the closest point to the mainland. The Morven Site will be progressed as two separate developments: Morven North and Morven South. This separation is primarily driven by the identification of two distinct grid connection Points of Connection (POC), Branxton in East Lothian and Hawthorn Pit in County Durham. To align with the respective grid connection arrangements, Hawthorn Pit in County Durham will be consented through a Development Consent Order and a marine licence as required in Scottish waters, while Branxton in East Lothian will proceed via an offshore marine licence application. Separate assessments will be produced for these applications, and therefore this assessment focuses only on the offshore generation assets, which are all located within the Morven North Boundary, as shown in Figure 9.1 and Figure 9.2. A more detailed description of the Morven North offshore infrastructure is provided in Section 9.6. The full project description is provided in Volume 1, Chapter 3: Project Description, of the EIA Report.

9.1.4 Supporting information

9.1.4.1 This assessment is informed by the following Morven North EIA Report chapters and technical reports:

- Volume 2, Chapter 7: Physical Processes;
- Volume 3, Annex 7.1: Physical Processes Shared Technical Report;
- Volume 2, Chapter 8: Benthic Subtidal Ecology;

- Volume 3, Annex 8.1: Benthic Subtidal Ecology Shared Technical Report;
- Volume 2, Chapter 10: Marine Mammals;
- Volume 3, Annex 10.2: Underwater Sound Shared Technical Report;
- Scoping Report for the Morven Option Lease Agreement Site (hereafter ”the Morven Site Scoping Report”);
- Morven Option Lease Agreement Site Scoping Opinion (hereafter “Morven Site Scoping Opinion”).

9.2 Purpose of this assessment

9.2.1.1 Specific consideration of MPAs is required for offshore wind consent applications in UK waters to address provisions for MPAs in the Marine (Scotland) Act 2010 and the Marine Coastal Access Act 2009. In Scotland, MPAs designed to conserve marine biodiversity species, habitats, and geodiversity (the variety of landforms and natural processes that underpin the marine landscapes) are referred to as nature conservation MPAs (hereafter referred to as an MPA). Under section 126 of the Marine and Coastal Access Act 2009 and under section 83 of the Marine (Scotland) Act 2010, public authorities who are responsible for granting authorisation for a licensable activity (in Scotland the Marine Directorate – Licensing Operations Team (MD-LOT) on behalf of Scottish Ministers) are required to consider whether the activity, which is subject to the application (i.e. the marine licensable activities subject to a marine licence application) is capable of affecting (other than insignificantly) a protected feature in an MPA or any ecological or geomorphological process which the conservation of any protected feature in an MPA is (wholly or in part) dependant. To grant consent MD-LOT must be satisfied that there is no significant risk of the licensable activity hindering the achievement of the conservation objectives for the MPA. If MD-LOT is not satisfied that there is no significant risk of the licensable activity hindering the achievement of the conservation objectives, there are other criteria which must be met for the licence to be granted (Scottish Government, 2025).

9.2.1.2 This report provides evidence to assess whether Morven North could significantly hinder the conservation objects of any screened in MPAs, with the criteria for this screening process outlined in Section 9.5.2.

9.2.1.3 It should be noted that other designated sites, such as Special Areas of Conservation (SAC), Special Protection Areas (SPAs), and Ramsar sites, designated under the Habitats Directive, will be addressed in Chapter 2.1: Report to Inform Appropriate Assessment Part 2: SAC Assessments and Chapter 2.2: Report to Inform Appropriate Assessment Part 3: SPA and Ramsar Site Assessments.

9.3 Legislative and policy context

9.3.1.1 The MPA screening and Stage 1 Assessment process (all stages are explained in Section 9.5) have been undertaken to address provisions for MPAs in the Marine (Scotland) Act 2010 and the Marine Coastal Access Act 2009 with the aim of:

- conserving marine flora or fauna;
- conserving marine habitats or types of such habitat;
- conserving features of geological or geomorphological interest;
- undertaking a Cumulative Effects Assessment (CEA) of this project alongside other nearby projects and plans which could together result in a cumulative impact.

9.3.1.2 This document is informed by guidance published by the Scottish Government (2025) and Marine Scotland’s Nature Conservation Marine Protected Areas: Draft Management Handbook (Marine Scotland, 2014). This guidance covers how these MPA Assessments should be undertaken, with consideration of advice from the Statutory Nature Conservation Bodies during consultation in the pre-application phase (as outlined in Section 9.4). This MPA Assessment has been undertaken based on the Morven North information details within Volume 1, Chapter 3: Project Description, of the EIA Report.

9.4 Consultation

9.4.1.1 The approach to consultation for Morven North presents the issues raised during consultation activities undertaken to date and specific to the MPA Assessment. These are presented in Table 9.1, together with how these issues have been considered in the production of this assessment.

Table 9.1: Summary of key consultation issues raised during consultation activities undertaken for Morven North of relevance to the Marine Protected Area assessment

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
18 April 2023	MD-LOT, NatureScot, Marine Scotland: Morven Site Scoping Workshop	The Applicant outlined that the indirect benthic effects on the ocean quahogs and subtidal sands and gravels features of the Firth of Forth Banks Complex MPA would be screened in.	No comments were raised on the inclusion of this MPA, and therefore it has been screened in (Section 9.7).
30 November 2023	MD-LOT: Scoping Opinion	The Scottish Ministers agreed that increased suspended sediment concentrations (SSCs) and associated deposition and changes in physical processes should be screened in for the ocean quahog aggregations and offshore subtidal sands and gravels features of the Firth of Forth Banks Complex MPA.	These impacts were screened in for the Firth of Forth Banks Complex MPA (Section 9.7) and assessed in Section 9.9.
30 November 2023	MD-LOT: Scoping Opinion	The Scottish Ministers advised that Morven North would not affect any marine mammal features (paragraph 5.7.9 of the Scoping Opinion) or ornithological features (paragraph 5.8.9 of the Scoping Opinion) of MPAs (other than insignificantly) and therefore MPAs based on these receptors could be screened out.	These features and all associated MPAs were screened out in Section 9.7.
30 November 2023	MD-LOT: Scoping Opinion	The Scottish Ministers advised that it is acceptable to screen out the two physical (geomorphological and large scale) features of the MPA.	The MPA Assessment has screened out the physical geomorphological and large scale features of the Firth of Forth Banks Complex MPA.
03 March 2025	MD-LOT: Targeted Consultation on Morven North and Morven South approach to MPA screening	An MPA Assessment for the subtidal sands and gravels and ocean quahog aggregations features of the Firth of Forth Banks Complex MPA should be submitted to determine the	Consents for Morven North and Morven South are now being applied for separately by MvOWL. The MPA Screening Assessment for Morven North

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
		potential for significant effects.	remains relevant and appropriate. The subtidal sands and gravels and ocean quahog aggregations features of the Firth of Forth Banks Complex MPA were identified in Section 9.7.2 and assessed in Section 9.10 for Morven North. Due to the location of Morven South, it does not have any connectivity with the Firth of Forth Banks Complex MPA and there are no pathways for Morven South to affect (other than insignificantly) the protected features of the MPA. Therefore, Morven South is screened out from further MPA assessment.

9.5 Methodology

9.5.1 Overview

9.5.1.1 The Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 introduced provisions to support the management of MPAs. Marine Scotland's Nature Conservation Marine Protected Areas: Draft Management Handbook (Marine Scotland, 2014) recommends a staged approach to the MPA Assessment, starting with a preliminary screening process which should identify whether the impacts associated with a project can reasonably be predicted to be 'capable of affecting (other than insignificantly)' the protected features of an MPA.

9.5.1.2 If the MPA screening identifies an MPA with protected features which may be affected (other than insignificantly), the relevant licensable activities, sites and impacts are screened into the MPA Assessment process, these are then considered within the Stage 1 assessment.

9.5.1.3 The Stage 1 assessment focuses on determining whether the impacts identified in the screening would or might significantly hinder, or there is or may be a significant risk of the impacts hindering, the achievement of the conservation objectives. Full details of each of these stages of the approach have been provided in the sections below.

9.5.1.4 If the Stage 1 assessment concludes that the conservation objectives of the MPA are hindered, a Stage 2 assessment is undertaken to determine if there is no other means of proceeding with the development which would create a substantially lower risk of hindering the achievement of the MPA feature conservation objectives. Full details of each of these stages have been provided in the sections below.

9.5.2 Marine Protected Area screening

9.5.2.1 In the first instance, a screening stage will be undertaken to identify impacts that can reasonably be predicted to occur as a result of Morven North. This can be determined by considering whether the activity will exert pressures to which the protected feature(s) is sensitive. This information is

provided in the Advice on Operations document for each MPA or from the Feature Activity Sensitivity Tool (FeAST) where MPA specific advice is not available.

9.5.2.2 Secondly, if it is concluded that there is a 'capability of affecting' an MPA, the focus will then be on considering whether the activity will affect the protected features of an MPA (other than insignificantly). Where it is concluded that the impacts of a project are capable of affecting (other than insignificantly) the protected features of an MPA, then a Stage 1 assessment is required to consider the potential impact of the project on the conservation objectives of the relevant MPA.

Morven North Marine Protected Area screening criteria

9.5.2.3 To determine the capability of the activities associated with Morven North to affect the features of any MPA, it is proposed that MPAs which satisfy the following criteria are screened in:

- MPAs with physical overlap with Morven North.
- MPAs within the Zone of Influence (ZoI) for individual topics.
  - Benthic ecology: the ZoI was defined in paragraph 8.2.1.2 of Volume 2, Chapter 8: Benthic Subtidal Ecology as a 5km to 14km tidal ellipse over a large spring tide around the Morven North Boundary, to account for potential indirect benthic impacts including increases in SSCs and associated deposition and changes in physical processes.
  - Fish and shellfish: the ZoI was defined as a 5km to 14km buffer surrounding the Morven North Boundary, to encompass the area in which physical processes impacts could impact mobile fish species.
  - Marine mammals: the ZoI was defined as the UK waters within the Morven North and Morven South Regional Marine Mammal Study Area (as described in section 10.2 of Volume 2, Chapter 10: Marine Mammals, of the EIA Report).
  - Ornithology: the ZoI was defined as a wide area generally coinciding with the northern and southern North Sea as defined by the regional seas identified by the Joint Nature Conservation Committee (JNCC, 2024) (and as further described in section 11.2 of Volume 2, Chapter 11: Offshore Ornithology, of the EIA Report).

9.5.2.4 The above definitions have been revised where necessary for Morven North to take into account updates to modelling (physical processes modelling from Volume 2, Chapter 7: Physical Processes, of the EIA Report, and underwater sound modelling from Volume 3, Annex 10.2: Underwater Sound Shared Technical Report, of the EIA Report). Based on the evidence provided in the Morven North EIA Report, it is concluded that the individual ZoIs applied are sufficient to ensure all of the potentially affected MPA features can be captured.

9.5.2.5 The MPA screening has been presented in section 9.7.

9.5.3 Stage 1 assessment

9.5.3.1 The Stage 1 assessment for Morven North is presented in this document which has been submitted alongside the Morven North EIA Report and considers the extent of the potential impact of Morven North, in all phases (construction, O&M, and decommissioning) on the MPAs screened into the assessment in more detail. The Stage 1 assessment focuses on determining whether there is, or may be, a significant risk of Morven North hindering the achievement of the conservation objectives of the screened in MPA(s).

9.5.3.2 As with the screening process described in paragraphs 9.5.2.1 to 9.5.2.5, aspects such as scale, timing, and duration of the proposed activities are considered. However, while the screening focuses on the protected features, this Stage 1 assessment will focus on the potential impact on achieving the conservation objects of the MPA protected features. Consideration of cumulative effects with other projects, plans, and activities will also be undertaken.

9.5.3.3 The conservation objectives for MPA protected features are high level criteria describing the desired condition of the MPA protected feature. The conservation objectives of an MPA should ensure that its protected features:

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

9.5.3.4 The MPA Stage 1 assessment will, therefore, consider whether Morven North could potentially affect these conservation objectives for each MPA screened into the assessment.

9.5.3.5 This assessment has been undertaken by identifying the attributes associated with the relevant protected features. These attributes are identified in conservation and management advice for an MPA. For benthic ecology receptors, the magnitude of the impacts is therefore considered in relation to the physical attributes to determine if the processes, extent and structure of the protected features will be affected. The sensitivity, based on data from the Marine Evidence-based Sensitivity Assessment (MarESA) and FeAST tools are used to determine if the ecological attributes of the feature could be affected. Specifically, these tools identify pressures arising from impacts on the receptors and provide evidence-based benchmarks and thresholds against which potential changes to the receptors are measured. This assessment then determines if the impacts are likely to hinder the conservation objectives of an MPA. Although this assessment is undertaken independent to the Morven North EIA Report, it is supported by assessments undertaken in the Morven North EIA Report, particularly in Volume 2, Chapter 7: Physical Processes and Volume 2, Chapter 8: Benthic ecology, of the EIA Report.

9.5.3.6 When considering whether an activity may hinder the conservation objectives of a site, consideration should be given to the direct impact of an activity upon a protected feature as well as any applicable indirect impacts. Such an indirect impact could include changing the effectiveness of a management measure put in place to further the conservation objectives (section 9.10).

9.5.4 Stage 2 assessment

9.5.4.1 The Stage 2 assessment, only required if the Stage 1 assessment concludes hindrance of the conservation objectives of the MPA, considers whether the conditions in section 83(4)(b) of the Marine (Scotland) Act 2010 and sections 126(7)(a), (b) and (c) of the Marine and Coastal Access Act 2009 can be met. Marine Scotland advises that if an act is capable of affecting (other than insignificantly) conservation objectives, Scottish Ministers must not grant authorisation unless it either:

- satisfies Scottish Ministers that there is no other means of proceeding with the act which would create a substantially lower risk of hindering the achievement of those objectives or (as the case may be) that purpose;
- satisfies Scottish Ministers that the benefit to the public of proceeding with the act clearly outweighs the risk of damage to the environment (or the marine historic asset) that will be created by proceeding with it;
- satisfies Scottish Ministers that the person will undertake, or make arrangements for the undertaking of, measures of equivalent environmental benefit to the damage which the act will or is likely to have in or on the MPA concerned.

9.5.4.2 In determining 'public benefit', the decision maker should consider benefits at a national, regional or local level.

9.6 Project description

9.6.1 Offshore infrastructure

9.6.1.1 All relevant information from Volume 1, Chapter 3: Project Description, of the EIA Report has been provided in this section. The information presented is relevant to the MPA screening in Section 9.7.

9.6.1.2 The offshore infrastructure key components will consist of:

- Up to 96 wind turbines (each comprising a tower section, nacelle, hub and three rotor blades) and associated support structures and foundations;
- Up to five Offshore Substation Platforms (OSPs) and associated support structures and foundations, including:
  - up to four High Voltage Alternating Current (HVAC) collector substation platforms;
  - up to one High Voltage Direct Current (HVDC) convertor substation (this could be a single platform or two platforms linked by a bridge);
  - scour protection for wind turbine and OSP foundations (to reduce sediment scour and associated impacts on the seabed environment as per MM-1 as outlined in Table 9.8);
  - a network of inter-array cabling linking the individual wind turbines to each other and to the OSPs, plus interconnector cables connecting OSPs to each other (approximately 424km of inter-array cabling and 484km of interconnector cabling).

9.6.2 Site preparation activities

9.6.2.1 Prior to the installation of the offshore infrastructure, it is likely that seabed preparation will be required, including boulder clearance, sandwave clearance, removal of disused and out of service cables, and removal of debris and Unexploded Ordnance (UXO). These activities will occur before construction but are assessed alongside the construction phase. These activities have the potential to cause increased SSCs and associated deposition, which could impact the benthic features and possibly hinder the achievement of the conservation objectives of nearby MPAs due to the spread of sediment plumes.

Clearance of unexploded ordnance

9.6.2.2 UXO originating from World War I, World War II, or military training exercises, may be present within Morven North. Due to the health and safety risks posed by UXO, and potential interactions with planned locations of installed infrastructure and vessel activities, it is necessary for UXO to be surveyed and managed carefully before the construction phase and installation of offshore infrastructure commences. UXOs have been given consideration in this assessment as the detonations could be sources of underwater sound which could potentially hinder the conservation objectives of fish and shellfish and marine mammal MPA features.

9.6.2.3 The Maximum Design Scenario (MDS) assumes clearance of up to 15 UXOs within the Morven North Boundary, ranging from 25kg to 554kg, with 132kg being the most likely (common) maximum within the Morven North Boundary (section 3.3.3 of Volume 1, Chapter 3: Project Description, of the EIA Report). Methodologies considered for the avoidance or clearance of UXO are as follows:

- avoid or microsite or leave *in-situ*;
- relocation of UXO to avoid detonation;
- low order clearance method (e.g. deflagration);
- high order clearance method (e.g. detonation, with associated mitigation measures).

9.6.2.4 Given the health and safety risks posed by UXOs, the Applicant aims to avoid UXOs through micrositing or relocating them where feasible. If avoidance methods are not viable, a specialist contractor will clear UXOs before further site preparation and construction commence. The preferred clearance method involves using a low order technique (subsonic combustion) with a single donor charge of 0.25kg Net Explosive Quantity for each clearance event. The MDS accounts for the clearance of a maximum of up to 15 UXOs. Table 9.2 presents the MDS for UXO clearance.

Table 9.2: Maximum Design Scenario for unexploded ordnance parameters

Parameter	Maximum Design
Maximum weight anticipated to be encountered (kg)	554
Maximum realistic number of UXO to be cleared	15
Maximum duration of UXO clearance activities (days)	15
Maximum number of detonation activities during 24 hours	1

Boulder clearance

9.6.2.5 Boulder clearance will be required in some areas of Morven North prior to installation of offshore infrastructure, particularly along inter-array and interconnector cable routes. A boulder is typically defined as being over 256mm in diameter or length (Wentworth, 1922).

9.6.2.6 Boulder clearance is required to reduce the risk of shallow cable burial resulting in the need for further cable burial works or cable protection, as well minimising risk of damage to cables during installation. Boulders would pose the risk of damage and exposure to the cable as well as an obstruction risk to the foundation and cable installation equipment. The MDS for boulder clearance is presented in Table 9.3.

9.6.2.7 Boulders may be cleared using boulder grabbers or remotely operated vehicles, a displacement plough, or pre-lay grapnels, depending on geophysical and pre-construction surveys and the parameters of the boulders present. The removal of boulders could cause short-term increases in SSCs in the vicinity of the clearance activities. Specific information about boulder clearance and assessment of these activities, where relevant, is presented in Table 9.10.

Table 9.3: Maximum Design Scenario for boulder clearance

Parameter	Maximum Design Parameter
Maximum width of boulder clearance along inter-array and interconnector cables (m) (per cable)	20
Maximum proportion of inter-array and interconnector cables requiring boulder clearance (%)	15% inter-array cables 85% interconnector cables
Maximum total area of boulder clearance for wind turbines and OSPs (m^2)	8,480,000

Sandwave clearance

9.6.2.8 Prior to offshore infrastructure installation, existing sandwaves and similar bedforms may need to be removed. This is carried out mainly for two reasons:

- Many of the cable installation tools require a relatively flat seabed surface in order to work effectively. Installing cables on a slope over a certain angle, or where the installation tool is working on a camber, may reduce the ability to meet target burial depths.
- Cables must be installed to a depth where it may be expected to stay buried for the duration of the Morven North operational lifetime. Sandwaves are generally mobile in nature therefore the cable must be buried beneath the level where natural sandwave movement could result in the

cable becoming un-covered. Sometimes this can only be achieved by removing the mobile sediments before installation takes place.

9.6.2.9 Site specific geophysical and bathymetry data from the Morven North Boundary were utilised to identify sandwaves, revealing that up to 15% of inter-array cables and up to 15% of interconnector cables may require sandwave clearance. Additionally, based on the preliminary site investigation data, it was determined that up to 80% of foundation locations may require sandwave clearance, with an overall anticipated area of 52,875,000m^2 requiring removal (Table 8.17 of Volume 2, Chapter 8: Benthic Subtidal Ecology, of the EIA Report).

9.6.2.10 A maximum depth of 75m was recorded close to the southwestern edge of the Morven North Boundary, with the shallowest depths located towards the centre in a region of megaripples. There were gentle undulations in the seabed, with a general gradient of <1° throughout the Morven North Boundary. Shoals, influenced by seabed currents, were present across the Morven North Boundary. These typically had gradients of <1° and are thought to be both accumulations of surficial sediments and associated with the underlying geology. The seabed across much of the Morven North Boundary was dominated by megaripples. The megaripples were typically 0.5m above the seabed and had wavelengths of 15m to 50m, generally orientated from west to east.

9.6.2.11 Sandwave clearance is likely to be required in specific discrete areas of Morven North and could occur throughout the construction phase. Sandwave clearance could include pre-installation ploughing controlled flow excavation, or jet trenching. Excavated material will be deposited within the Morven North Boundary, close to the excavation location. This is so that a broadly similar composition of sediment is retained within the disposal location. The clearance of sandwaves will cause potentially large increases in SSCs and sediment deposition which could potentially impact the benthic features of any nearby MPAs.

9.6.2.12 Table 9.4 presents the MDS for sandwave clearance.

Table 9.4: Maximum Design Scenario for sandwave clearance

Parameter	Maximum Design Parameter
Inter-array and interconnector cables	
Maximum sandwave clearance width along inter-array and interconnector cables (m)	20
Maximum percentage of inter-array and interconnector cables requiring clearance (%)	15
Maximum sandwave clearance volume for inter-array and interconnector cables collectively (m^3)	13,071,600
Wind turbine and OSP foundations	
Maximum total area of sandwave clearance for wind turbine foundations (for scour protection) (m^2)	4,455,300
Maximum total volume of sandwave clearance for wind turbine foundations (including scour protection) (m^3)	13,365,900

Removal of disused and out of service cables

9.6.2.13 The construction of Morven North could include the removal of up to 5,000m of disused cables with a disturbance width of 20m, resulting in up to 100,000m^2 of sediment disturbance which could increase SSCs and associated sediment deposition that could potentially hinder the conservation objectives of any nearby benthic features of MPAs. Any cable removal will be undertaken in consultation with the asset owner and in accordance with the International Cable Protection Committee guidelines (ICPC, 2011). Where feasible, cables will be retrieved to a vessel deck, where one end will be cut, the cable will be pulled past the crossing point and then cut again before being pulled to the surface where it will be removed from site by the vessel.

9.6.3 Construction phase

Methodology

9.6.3.1 Construction of Morven North is expected to occur over a period of up to five years, aligning with the following indicative construction series:

- Step 1: Pre-construction site investigation surveys (Section 9.6);
- Step 2: seabed preparation activities (Sections 9.6.2-9.6.5);
- Step 3: foundations installation (paragraphs 9.6.3.3 to 9.6.3.5 and Table 9.5);
- Step 4: OSP installation and commissioning (paragraphs 9.6.3.6 to 9.6.3.7);
- Step 5: interconnector cables installation (paragraphs 9.6.3.8 to 9.6.3.10);
- Step 6: inter-array cables installation (paragraphs 9.6.3.8 to 9.6.3.10);
- Step 7: wind turbine installation and commissioning (paragraphs 9.6.3.11 to 9.6.3.12);
- Step 8: post-construction as-built surveys (paragraph 9.6.3.12).

9.6.3.2 To provide the full context for the MPA Assessment, all activities associated with the construction phase have been listed, as they all have the potential to cause impacts which could hinder the conservation objectives of MPAs. The relevant impacts have been highlighted in relation to the potential impacts they could cause on the MPA.

Step 3: Foundations installation

9.6.3.3 Three options for foundation installation have been considered. These include monopiles, pin piles, and suction bucket jacket foundations. The pin piles could be piled and/or drilled into the seabed by up to two vessels simultaneously, or the suction bucket jacket foundations could be lowered by crane to the seabed. The greatest impacts would likely derive from the monopile foundations, which would cause increased underwater sound from the piling required for their installation, and increased SSCs and associated deposition from installation into the seabed. All other foundation options caused lower levels of increased SSCs and changes in physical processes. Therefore, the monopile option is further discussed as part of the MDS. Further detail is provided on each option in Volume 1, Chapter 3: Project Description, of the EIA Report.

9.6.3.4 It is proposed that monopile foundations will be installed by piling using hydraulic hammers or blue piling hammers. In areas of rough seabed, drilling may aid the piling process, with drilling spoil disposed of at the drill site. The installation will be carried out from jack-up or floating vessels/barges. These activities for foundation installation will cause increased SSCs and associated deposition, and the presence of the installed foundations will cause changes in physical processes. Up to two monopiles may be installed in a 24-hour period, assuming concurrent piling operations. A “soft start” procedure will be employed whereby the hammer strikes will commence at 15% of the maximum hammer energy up to 100% of the maximum hammer energy (if required). There will be four HVAC OSPs which will involve piling of monopiles, and a bridge-linked HVDC OSP which may use two six-legged jacket foundations (with each leg requiring four piles), for a total of 48 piles on the 12 foundations. The MDS for all foundation types requiring piling for installation is presented in Table 9.5.

9.6.3.5 The HVDC OSP may also use gravity bases and therefore not require piling. The gravity base installation has been given consideration based on physical processes modelling (Volume 2, Chapter 7: Physical Processes) which concluded this type of foundation would result in the greatest increase in SSCs and associated deposition.

Table 9.5: Maximum Design Scenario for foundation installation by piling

Parameter	Maximum design parameter for wind turbines (monopiles)	Maximum design parameter for HVAC OSPs (monopiles)	Maximum design parameter for HVDC OSP (pin piles)
Maximum piling scenario	96	4	48
Maximum hammer energy (kJ)	6,600		4,000
Soft Start Energy (% of Maximum Hammer Energy)	15		
Duration			
Maximum soft start duration (minutes)	20		
Maximum duration of piling (per pile) (hours)	24		
Minimum number of piles installed over 24 hours	1		
Maximum total number of days when piling may occur over construction phase	96	4	12
Concurrent piling			
Maximum number of concurrent piling events	2		
Maximum distance between concurrent piling events (m)	1,000		
Maximum distance between concurrent piling events (km)	37.10		

Step 4: Offshore Substation Platform installation and commissioning

9.6.3.6 The OSP topsides will be transported to Morven North via vessel from the fabrication yard or pre-assembly harbour, following installation of foundations for OSPs. It is assumed that the OSP topsides will be transported by the installation vessel or on a barge towed by a tug. Once on site, the OSP topside will be rigged up, sea fastening cut, lifted and installed onto the foundation. The topside and foundation will then be welded or bolted together. Rigging, welding and bolting equipment will be available on board the installation vessel. The installation of these OSPs by piling will cause increased underwater sound and local increases in SSCs and associated deposition, and the presence of the structures will cause changes in physical processes which is assessed for the O&M phase (Section 9.10.1). These impacts could potentially hinder the conservation objectives of marine mammal, fish and shellfish, and benthic features of MPAs.

9.6.3.7 Commissioning works are expected to be carried out using a jack-up or dynamic positioning vessel. Assisting support and supply vessels will be used as required and crew transfer vessels will be used for transfer of personnel installation and commissioning of the OSPs.

Steps 5 and 6: interconnector and inter-array cables installation

9.6.3.8 Installation (or lay) of inter-array cables and interconnector cables will be undertaken using a cable lay vessel, using various equipment such as a carousel or reels, tensioners and cable lay spread. Inter-array cables and interconnector cables are typically surface laid prior to cable burial or installation of external cable protection post lay. Cable lay and cable burial can also be performed simultaneously.

9.6.3.9 Potential installation methods for inter-array and interconnector cables include ploughing, trenching and jetting whereby the seabed is opened and the cable laid within the trench. The installation method will be defined post-consent with a detailed Cable Plan, incorporating a Cable Burial Risk Assessment (as defined in Section 3.4.4 of Volume 1, Chapter 3: Project Description, of the EIA Report, and against MM-2 in Table 9.8) which will take into account environmental and human considerations that could affect cable burial such as trawling and vessel anchors.

9.6.3.10 The inter-array cables will be buried where possible and protected with a hard protective layer (such as rock or concrete mattresses) where minimum burial depth is not achievable. The installation and burial of cables will cause short-term increased SSCs, and the presence of the protective layer will cause a change in physical processes which is assessed in the O&M phase, both of which could potentially hinder the conservation objectives for benthic features of nearby MPAs.

Step 7: Wind turbine installation and commissioning

9.6.3.11 Wind turbines are typically installed using the following process:

- Step 1: Wind turbine components collected from a port in the UK, Europe or elsewhere and loaded onto barges or dedicated transport vessels at port and transported to the array area. Generally, blades, nacelles, and towers for a number of wind turbines are loaded separately onto the vessel.
- Step 2: Wind turbine components will be installed onto the existing foundations by an installation vessel. Each wind turbine will be assembled on site. The exact methodology for the assembly is dependent on the wind turbine type and installation contractor and will be defined in the pre-construction phase. Jack-up vessels are often used to ensure a stable platform for installing the wind turbine components, with the potential for these to cause increases in SSCs and associated deposition which could hinder the conservation objectives for benthic features of MPAs.

9.6.3.12 Following installation, commissioning activities will then take place.

9.6.4 Operation and maintenance phase

9.6.4.1 The Morven North operational lifetime is up to 35 years. The overall O&M strategy will be confirmed once the final design and technical specifications of Morven North are confirmed. Routine and non-routine O&M works will be undertaken. Routine maintenance activities may include inspections, removal of marine growth build up, minor repairs, cleaning activities, and the replacement of consumables and corrosion protection systems. Non-routine major maintenance activities may include but are not limited to component exchanges and replacement of infrastructure and equipment (e.g. wind turbine blades, gearboxes and interconnector and inter-array cables), scour protection and cable protection replenishment or replacement (as per MM-32 in Table 9.8), cable reburial and cable repair activities, painting and other coating works, replacement of access ladders, and geophysical surveys. These activities may cause increases in SSCs and changes in physical processes which have the potential to hinder the conservation objectives of benthic features of nearby MPAs.

9.6.5 Decommissioning phase

9.6.5.1 In line with the requirements under Section 105 of the Energy Act 2004 (as amended), the Applicant will prepare a Decommissioning Programme for approval by the Scottish Ministers which will include

anticipated costs and financial securities, and consider good industry practice, guidance and legislation relating to decommissioning at the time. The use of this good industry practice will help to reduce any impacts of decommissioning activities on the MPA. A draft of the Decommissioning Programme will be submitted to MD-LOT prior to construction of Morven North. The Decommissioning Programme will be updated during the lifetime of Morven North to take account of changing good practice, new technologies, and any changes to legislation.

9.6.5.2 At the end of the operational lifetime of Morven North, it is currently anticipated that all structures above the seabed or ground level (with the exception of monopiles/pin piles (depending on foundation option chosen for wind turbines and OSPs), scour protection and cable protection will be completely removed where this be feasible and practicable. Monopiles/pin piles, scour protection and cable protection are either expected to remain fully or partly in-situ depending on the most up to date legislation and guidance, best practice, and consideration of environmental conditions and sensitivities at the time of decommissioning (as per MM-32 in Table 9.8).

9.6.5.3 The decommissioning sequence will generally be the reverse of the construction sequence and involve similar types and numbers of vessels and equipment. These activities may cause increases in SSCs that may be of similar magnitude or less than the construction phase and therefore would have the potential to hinder the conservation objectives for benthic features of nearby MPAs.

9.7 Marine Protected Area screening

9.7.1 Marine Protected Areas which could potentially be impacted

9.7.1.1 Based on the methodology described above in Section 9.5, the MPA screening exercise is presented below. The screening considers all MPAs located within the relevant ZoIs, with these MPAs listed in Table 9.6 and Figure 9.1 and Figure 9.2. All offshore ornithology designated sites were SPAs and therefore were screened out.

Table 9.6: Marine Protected Areas considered within the screening

Designated site	Closest Distance to Morven North (km)	Relevant qualifying interest features
Firth of Forth Banks Complex MPA	0.04	Ocean quahog (*Arctica islandica*); Offshore subtidal sands and gravels; Shelf banks and mounds; Quaternary of Scotland: Moraines.
Turbot Bank MPA	46.6	Sandeel (Raitt's sandeel (*Ammodytes marinus*) and lesser sandeel (*Ammodytes tobianus*))
Southern Trench MPA	57.2	Minke whale; Burrowed mud; Shelf deeps; Quaternary of Scotland: Moraines; Quaternary of Scotland: Sub-glacial tunnel valleys; Submarine Mass Movement: Slide scars.

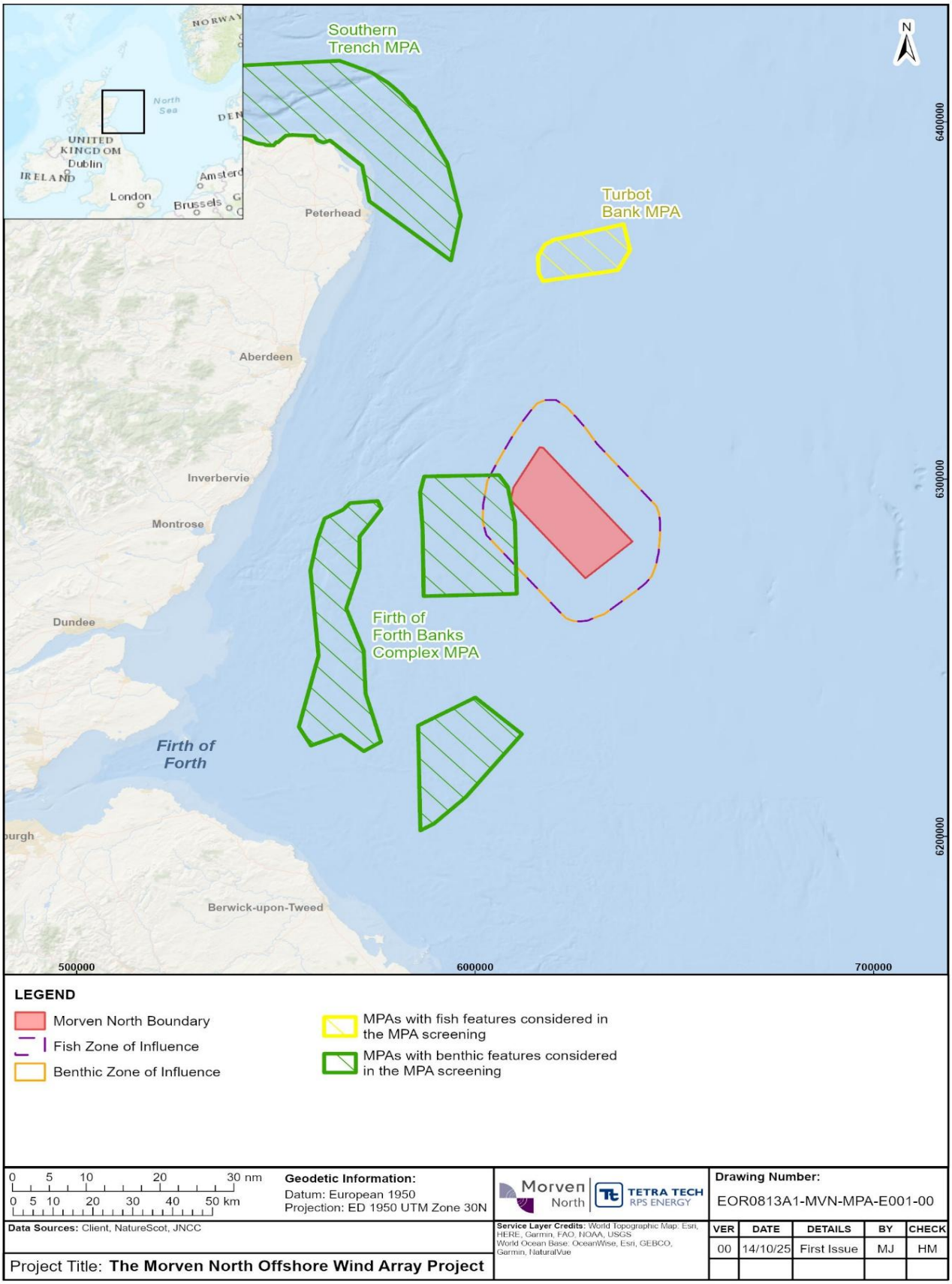

Figure 9.1: Distribution of Marine Protected Areas with benthic ecology and fish and shellfish features within their Respective Zones of Influence

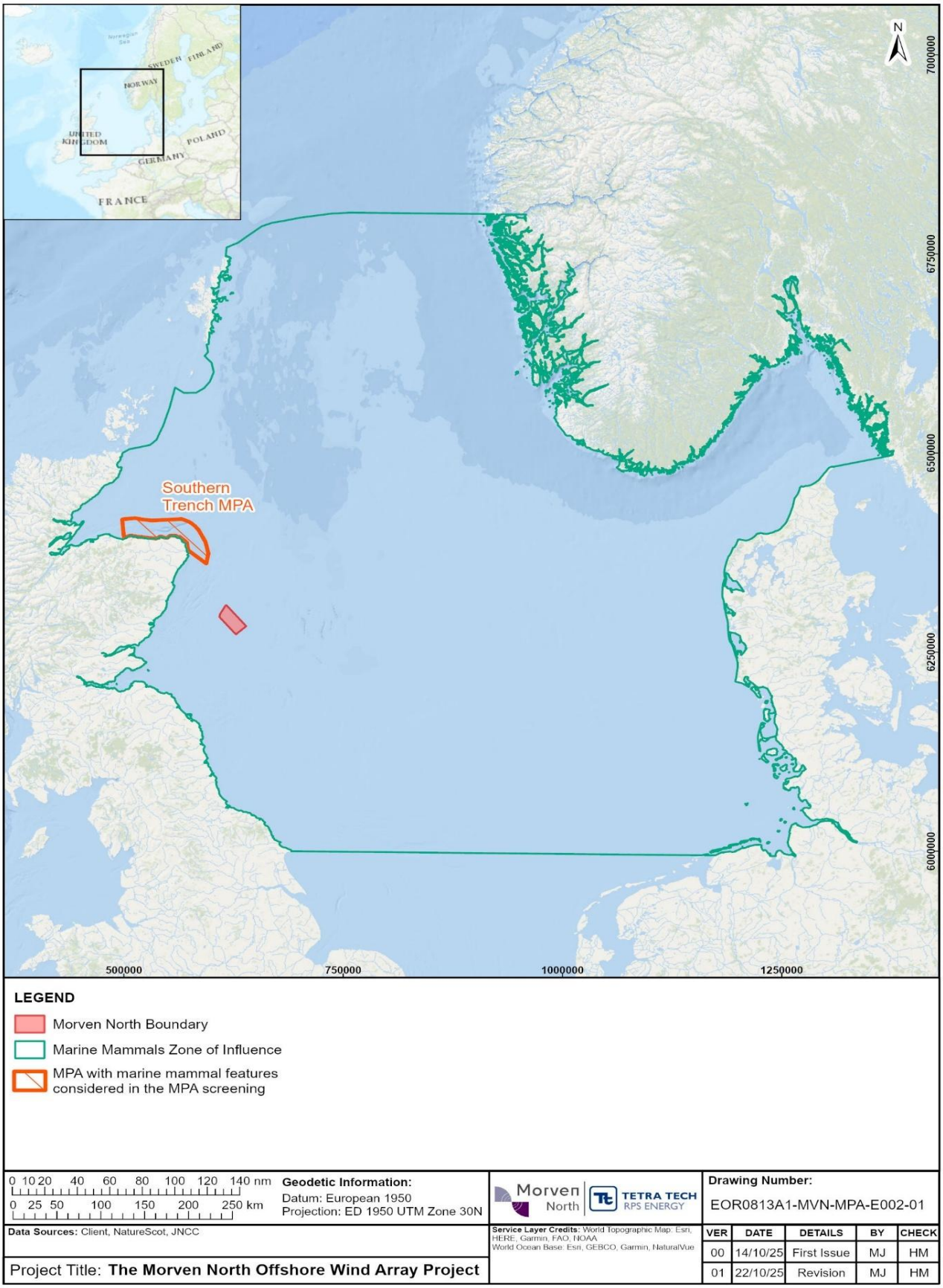

Figure 9.2: Distribution of Marine Protected Areas with marine mammal features within the marine mammal Zones of Influence

9.7.2 Screening results

Screening for Marine Protected Areas with benthic habitats/species and geodiversity features

9.7.2.1 Direct impacts to benthic habitats and species, such as the impacts arising from temporary habitat disturbance, long-term habitat loss, colonisation of hard structures, and Electromagnetic Fields (EMF) will be confined to being within the Morven North Boundary. There is no physical overlap between Morven North and any MPA designated for benthic or geodiversity features. As such, no MPAs are screened in for this physical overlap criterion.

9.7.2.2 There is the potential for indirect effects to MPAs designated for benthic features and geodiversity features within the 5km to 14km ZoI. Indirect impacts on benthic features may be associated with increased SSCs arising from construction activities, or changes to the hydrodynamic regime due to the presence of offshore infrastructure associated with Morven North. One MPA, the Firth of Forth Banks Complex MPA, has been identified within the 5km to 14km screening buffer for benthic receptors.

Firth of Forth Banks Complex Marine Protected Area

9.7.2.3 The Firth of Forth Banks Complex MPA covers 2,130km^2 and is split into the three sections of Berwick Bank, Scalp and Wee Bankie, and Montrose Bank. The MPA is located to the southwest of Morven North, and Montrose Bank is located 0.04km from the Morven North Boundary (Figure 9.3). The Morven North Boundary has no direct overlap with the Firth of Forth Banks Complex MPA, and therefore it may only be impacted by indirect impacts from Morven North within the Benthic ZoI. The Firth of Forth Banks Complex MPA is designated for ocean quahog aggregations, offshore subtidal sands and gravels, shelf banks and mounds, and moraines (JNCC, 2018a). Indirect impacts may occur on these ocean quahog aggregations within the Firth of Forth Banks Complex MPA, due to increases in SSCs and associated deposition from the installation of foundation and wind turbine structures and burial of cables, and changes in physical processes from the presence of foundations, wind turbines, and cable protection. Therefore, it is screened in for further assessment.

9.7.2.4 All other impacts, such as temporary habitat loss, long-term habitat loss, or the risk of introduction and spread of invasive non-native species, are considered to be direct impacts limited to within the Morven North Boundary. The risk of invasive non-native species being introduced to the MPA from vessel traffic travelling to and from the Morven North Boundary is minimal due to the relatively small number of vessels required on site at any one time, and will also be mitigated by the designed-in measures outlined in Table 9.8.

Screening for Marine Protected Area with fish features

9.7.2.5 Direct impacts to fish features of MPAs, such as the impact of temporary habitat loss, long-term habitat loss, colonisation of hard structures and EMFs will be confined to the area within the Morven North Boundary. There is no physical overlap between Morven North and any MPA designated for fish features. As such, no MPAs are screened in for this physical overlap criterion.

9.7.2.6 A direct impact to fish features of MPAs may, however, occur due to increased underwater sound (i.e. from piling), with effects potentially extending beyond Morven North. The 100km radius ZoI for fish MPA features has been defined as the ZoI for fish as described in Section 9.5.2. A single MPA, the Turbot Bank MPA, which is designated for sandeel (Raitt's sandeel and lesser sandeel), has been identified within this screening.

Turbot Bank Marine Protected Area

9.7.2.7 The Turbot Bank MPA is located approximately 47km to the north of Morven North. This MPA may be directly affected only by the impact of increased underwater sound, which has the potential to affect fish receptors in a variety of ways including particle motion, injury and mortality, and behavioural effects.

9.7.2.8 Regarding particle motion, the upper ranges for distances over which adverse effect on fish without swim bladders, such as sandeels, from particle motion may be detected are hypothesised to be less than 1km (Miller *et al.*, 2016, Thomsen *et al.*, 2015). As the Turbot Bank MPA is located approximately 47km from Morven North, it is therefore unlikely to be affected by particle motion.

9.7.2.9 The Turbot Bank MPA is also considered likely to be beyond the zone within which Temporary Threshold Shift (TTS) (i.e. a temporary reduction in hearing sensitivity) from piling activities for wind turbine installation may be experienced by sandeels, which is likely to be within less than 37km for unmitigated concurrent monopiles installation (this modelling is presented in Table 9.25 of Volume 2, Chapter 9: Fish and Shellfish Ecology, of the EIA Report). Recoverable injury for sandeel is expected to occur out to approximately 4km from piling activities, with the underwater sound impacts therefore having no overlap with the Turbot Bank MPA.

9.7.2.10 Regarding behavioural effects, at a distance of approximately 47km, the risk to sandeels from behavioural effects including startle responses, changes in schooling patterns, or avoidance (Popper *et al.*, 2014) is considered to be low. The extent of underwater sound contours associated with sound pressure levels above 150 dB re 1 µPa Root Mean Squared (RMS), the criterion typically used for indicating the extent of onset of potential behavioural effects due to impulsive piling, is considered unlikely to extend to the Turbot Bank MPA.

9.7.2.11 In summary, it is concluded that underwater sound will not be capable of affecting (other than insignificantly) the protected sandeel feature of the Turbot Bank MPA. On this basis, no MPAs with fish as a protected feature are screened in for underwater sound impact pathways, and overall, no MPAs with fish as a protected feature are screened in. All direct impacts will not affect the MPA due to the lack of physical overlap with the Morven North Boundary.

Screening for Marine Protected Areas with ornithological features

9.7.2.12 No MPAs with relevant ornithological features either have physical overlap with Morven North or are present within the ornithology ZoI. As such, no MPAs are screened in for this physical overlap criterion for any impacts assessed for ornithological features (direct temporary habitat loss, collision with rotating blades, displacement, combined collision and displacement, barrier effects, or attraction to light, which are all direct impacts, or the indirect impact of changes in prey availability due to temporary habitat loss). This approach was confirmed by MD-LOT in the Scoping Opinion (Table 9.1).

Screening for Marine Protected Areas with marine mammal features

9.7.2.13 Some direct impacts to marine mammal features of MPAs, such as the impacts of temporary habitat disturbance and long-term habitat loss will be confined to the area within the Morven North Boundary. There is no physical overlap between Morven North and any MPA designated for marine mammal features. As such, no MPAs are screened in for these criteria.

9.7.2.14 A direct impact on marine mammal features of MPAs may, however, occur due to increased underwater sound, with effects potentially extending beyond the boundaries of Morven North. The ZoI for the potential effect has been defined as the UK waters within the Morven North and Morven South Regional Marine Mammal Study Area (Section 9.5.2). One MPA, the Southern Trench MPA, designated for minke whale, lies within this area.

9.7.2.15 Indirect impacts on marine mammal features of MPAs may occur as a result of changes in prey availability. The indirect effect of impacts such as SSC and sediment deposition on fish and shellfish prey species has been considered in paragraphs 9.7.2.5 to 9.7.2.11. No MPAs with fish and shellfish features were screened in, and therefore no MPAs with marine mammal features have been screened in for this impact.

Southern Trench Marine Protected Area

9.7.2.16 The Southern Trench MPA is approximately 57km from Morven North. At this distance, the MPA will be located outside the area within which injury to minke whale could potentially occur (Volume 3, Annex 10.2: Underwater Sound Shared Technical Report, of the EIA Report). Minke whale are most often spotted around Scotland between July and September (NatureScot, 2023) when they migrate north to feed (Evans and Stirling, 2001). Minke whale have variable spatial and temporal distribution around the Moray Firth (Robinson *et al.*, 2009), with the Southern Trench MPA being located along the southern coast of the outer Moray Firth. In aerial surveys, minke whales were encountered throughout the survey area, with slightly more sightings, usually as single animals, in the north of the survey area (Grellier and Lacey, 2011). Marine mammal noise impacts are measured by modelling Permanent Threshold Shift (PTS), TTS, and behavioural effects, and these are given consideration below on whether sound may affect minke whales within the Southern Trench MPA

9.7.2.17 The potential marine mammal TTS range (from first strike to highest energy) for conservative unmitigated single 3.7m diameter pin pile installation using multiple strikes for low frequency marine mammals, such as minke whale, is up to 56.6km, based on the National Marine Fisheries Service (NMFS (2024)) cumulative Sound Exposure Level threshold (see Table 5.23 in Section 5.4 of Volume 3, Annex 10.2: Underwater Sound Shared Technical Report, of the EIA Report). The PTS for low frequency marine mammals may occur up to approximately 19km from the site of installation (in the conservative unmitigated concurrent installation of two widely separated 16m diameter monopiles). At a distance of approximately 57.2km from Morven North, it can be concluded that potential effects of TTS or PTS would, therefore, not be capable of affecting (other than insignificantly) the protected minke whale feature of the Southern Trench MPA. Other sources of underwater sound, such as UXO clearance or vessel noise, caused lower ranges of impacts than piling (Sections 5.7-5.9 of Volume 3, Annex 10.2: Underwater Sound Shared Technical Report, of the EIA Report), and therefore were not considered further.

9.7.2.18 Regarding behavioural effects, with the Southern Trench MPA at a distance of approximately 57km, the risk to minke whales is considered low due to their site fidelity meaning they tend to remain in or around their associated MPAs, thereby reducing the potential for overlap with the Morven North Boundary. The impact pathway most likely to affect marine mammals such as minke whale at such a distance would be increased underwater sound, with all other potential impacts unlikely to reach this MPA due to being mostly contained to the vicinity of the Morven North Boundary. The extent of underwater sound contours associated with sound pressure levels above 140dB re 1µPa RMS, the criterion typically used for indicating the extent of onset of potential low-level marine mammal disturbance effects from impulsive sound, will not extend to the Southern Trench MPA, with a maximum range of 41.8km for piling of a 16m diameter monopile.

9.7.2.19 In summary, it is concluded that underwater sound will not be capable of affecting (other than insignificantly) the protected minke whale feature of the Southern Trench MPA. Therefore, no MPAs with marine mammal protected features are screened in. All direct impacts will not affect the MPA due to the lack of physical overlap with the Morven North Boundary.

Summary of screening results

9.7.2.20 From the screening of protected features within MPAs, the only MPA taken forward for further assessment is the Firth of Forth Banks Complex MPA for benthic receptors.

9.8 Marine Protected Area background information

9.8.1 Firth of Forth Banks Complex Marine Protected Area

9.8.1.1 The Firth of Forth Banks Complex MPA, the designation of which came into effect on 7 August 2014, is located off the east coast of Scotland. The MPA extends over an area of 2,130km^2 and is split into three sections of Berwick Bank, Scalp and Wee Bankie, and Montrose Bank, with a site depth range

of 30m to 110m below sea level (JNCC, 2018b). The location of the Firth of Forth Banks Complex MPA in relation to Morven North is shown in Figure 9.3.

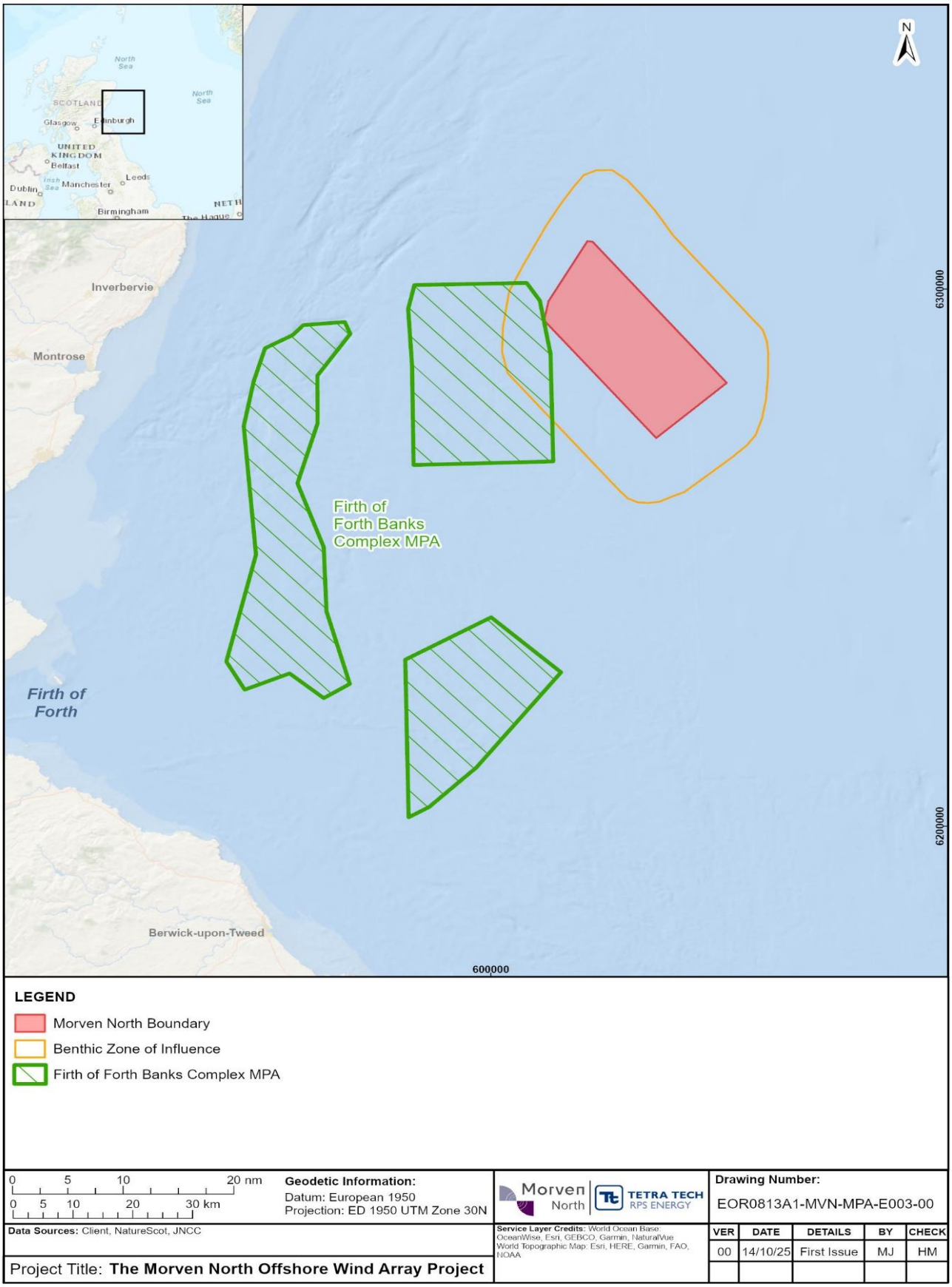

Figure 9.3: Location of Firth of Forth Banks Complex Marine Protected Area

9.8.1.2 The Firth of Forth Banks Complex MPA is designated for ocean quahog aggregations, offshore subtidal sands and gravels, shelf banks and mounds, and moraines (JNCC, 2018b). The offshore subtidal sands and gravels and ocean quahog features of the Firth of Forth Banks Complex MPA, specifically within the Montrose Bank, occur inside the Morven North Benthic Subtidal ZoI and are screened in.

9.8.1.3 The shelf banks and mounds, and the moraines, which are also features of this MPA, occur outside the Benthic ZoI and are therefore screened out of this MPA Assessment (Figure 9.4).

9.8.1.4 Table 9.7 presents the screened in protected features of the Firth of Forth Banks Complex MPA and the condition of the features as detailed in JNCC (2014b).

Table 9.7: Protected features of the Firth of Forth Banks Complex Marine Protected Area and feature conditions

Protected Features	Feature Condition	Assessment Date	Broader Conservation Status
Ocean quahog aggregations	Unfavourable	2014	Oslo-Paris Conventions (OSPAR) Threatened and declining
Offshore subtidal sands and gravels	Unfavourable	2014	N/A

Conservation objectives

9.8.1.5 The conservation objectives set out the desired quality of the protected features within the Firth of Forth Banks Complex MPA. The biodiversity features have no direct evidence of their condition in the Firth of Forth Banks Complex MPA JNCC (2014b), but have the conservation objectives of:

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

Conservation and management advice

9.8.1.6 As evidenced in Table 9.7, both the ocean quahog aggregations and offshore subtidal sands and gravels features have no direct evidence of their condition JNCC (2014b). The Management Options Paper for the Firth of Forth Banks Complex ncMPA (JNCC, 2014a) indicates the current activities which could cause impacts on these features include otter trawling, scallop dredging, and creeling and potting. It was advised that reduction or removal of scallop dredging activity could potentially help to meet the conservation objects for the ocean quahog aggregations and offshore subtidal sands and gravels features, and that no additional management was required for the creeling and potting as these were unlikely to impact these features. For offshore renewable energy activity development, the current management strategy is to assess the impact of each project on the protected features within the MPA on a case by case basis, with dialogue between developers and the Marine Directorate and the JNCC, where relevant.

Protected features

9.8.1.7 A map (Figure 9.4) produced with NatureScot data (JNCC, 2021) was used to support the designation of this MPA. This map shows the distribution of ocean quahog aggregations and offshore subtidal sands and gravel features throughout the three MPA areas. The Montrose Bank, which overlaps with the Morven North Benthic Subtidal ZoI but not directly with Morven North, was comprised primarily of circalittoral coarse sediments and had (*Flustra foliacea*) and (*Hydrallmania falcata*) on tide-swept circalittoral mixed sediment (SS.SMx.CMx.FluHyd) present to the north east

and south (Axelsson *et al.*, 2014). The offshore circalittoral sand (SS.SSa.OSa) biotope was also present to the east (Goudge and Morris, 2014). The ocean quahog aggregations were more sparsely located throughout Montrose Bank (Figure 9.4), with vessel monitoring system data from 2009-2011 indicating that at least half of the surveyed ocean quahog aggregations within the MPA are exposed to fishing activities which could cause pressure on the extent, structure, and supporting features of this feature, which may have a medium to high sensitivity to direct impacts JNCC (2014b).

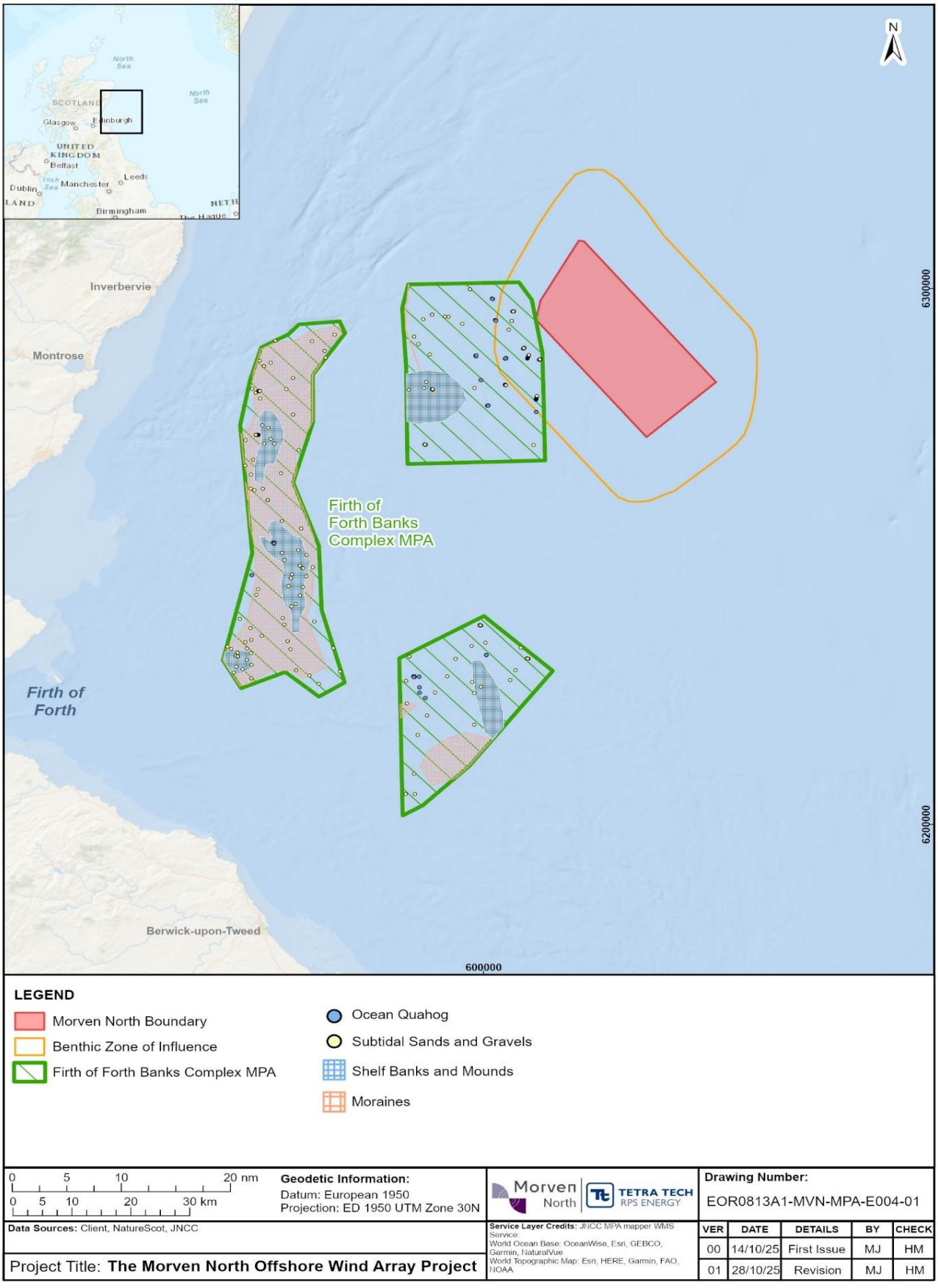

Figure 9.4: Distribution of Designated Features within the Firth of Forth Banks Complex Marine Protected Area

9.9 Designed-in measures

9.9.1.1 Table 9.8 details the Designed -in measures adopted as part of Morven North to reduce the potential for impacts. As Morven North has committed to implementing these measures, they have been considered in this MPA Assessment. The use of scour protection (MM-1) will reduce potential changes in physical processes impacts on the MPA throughout the duration of Morven North's operational lifespan by reducing scouring of the seabed around the infrastructure. The implementation of a cable plan (MM-2) and environmental management plan (EMP) (MM-32) will reduce the overall volume of increased SSCs and associated deposition through controls on construction activities, thereby reducing the potential for the spread of sediment plumes to the MPA. The burial of the cables (MM-2) will also reduce changes in physical processes that could potentially impact the MPA, as this measure will reduce the amount of infrastructure present on the surface of the seabed.

Table 9.8: Designed-in measures as part of Morven North which will reduce the impacts on the Firth of Forth Banks Complex Marine Protected Area

Commitment ID Number	Designed-in Measures	Justification
MM-1	Development of and adherence to a Scour Protection Management Plan.	There is the potential for scouring of seabed sediments to occur due to interactions between the metocean regime (waves and currents) and foundations or other seabed structures. This scouring can develop into depressions around the structure. The use of scour protection around offshore structures and foundations will be employed, as described in Volume 1, Chapter 3: Project Description. It is therefore likely that any secondary scour effects associated with scour protection would be confined to within a few metres of the direct footprint of that scour protection material, as design criteria for cable protection will ensure this is the case. The presence of scour protection has been included in the modelled scenarios used within the assessment of effects to protect foundations from the effects of scour. The SPMP will set out the approach to scour protection installation and monitoring. This will maximise protection of offshore infrastructure as far as possible during the project lifecycle.
MM-2	Development of and adherence to a Cable Plan which will include a Cable Burial Risk Assessment (CBRA) and cable burial and protection monitoring throughout the operational phase.	There is potential for cable exposure to occur due to interactions between the metocean regime (wave, sand and currents) and the foundations. Sediment transportation can lead to exposure of cables and infrastructure, although the use of a target cable burial depth alongside the cable installation strategy should provide sufficient depth to avoid exposure. A Cable Plan will set out the approach to protection

Commitment ID Number	Designed-in Measures	Justification
		of cables during the project life cycle. It will minimise the risks of vessel underwater allision with cable protection, anchor or fishing gear interaction with subsea cables and interference with magnetic position fixing equipment. The Cable plan will implement management and monitoring of cable protection (via burial or external protection where adequate burial depth, as identified via risk assessment, is not feasible) with any damage, destruction or decay of cables notified to Maritime and Coastguard Agency, Northern Lighthouse Board, Kingfisher and UK Hydrographic Office no later than 24 hours after discovered. This will reduce the probability of cables becoming unburied and impacting other sea users and marine ecology receptors Cable burial and protection monitoring will be undertaken throughout the operational phase to assess the status of cable burial and any deployed protection. It will include the requirement of minimum burial depths of 0.5m or the use of cable protection around inter-array and interconnector cables and will include a Cable Burial Risk Assessment
MM-32	Development of, and adherence to an Environmental Management Plan.	The EMP will ensure appropriate environmental controls are in place for Morven North, and the agreed procedures to mitigation and potential risk to the receiving environment. Measures will cover a wide range of management measures including environmental awareness training, auditing, reporting procedures and waste management. It is expected that the EMP will include a Marine Pollution Contingency Plan (MPCP) and an Invasive Non-Native Species Management Plan (INNSMP). The EMP is also expected to limit potential environmental damage from small quantities of drill fluids which may be released and as regulated by the UK Registration, Evaluation, Authorisation and Restriction of Chemicals REACH Regulations.

9.10 Marine Protected Area Stage 1 Assessment

9.10.1 Firth of Forth Banks Complex Marine Protected Area

9.10.1.1 This section presents the Stage 1 assessment of the effects of the construction, O&M, and decommissioning of Morven North on the Firth of Forth Banks Complex MPA and its conservation objectives. Each of the relevant indirect impacts are discussed in the following sections and within each assessment, the effects on attributes of the relevant protected features, and subsequently on the conservation objectives, are considered, using the best available scientific evidence to support the conclusions made.

9.10.1.2 The attributes for the ocean quahog aggregations and the offshore subtidal sands and gravels protected features are listed in Table 9.9.

Table 9.9: Impacts assessed in relation to the relevant attributes during the Firth of Forth Banks Complex Marine Protected Area Assessment

MPA Attribute		Impacts			
Attribute Type	**Attribute**	**Construction**	**O&M**		**Decommissioning**
		Increased SSC and associated deposition	Increased SSC and associated deposition	Changes in physical processes	Increased SSC and associated deposition
MPA feature: Ocean quahog aggregations					
Physical	Extent and distribution	paragraph 9.10.1.11 to 9.10.1.17	paragraph 9.10.1.20 to 9.10.1.23	paragraph 9.10.1.35 to 9.10.1.38	paragraph 9.10.1.26 to 9.10.1.29
Physical	Structure and function	paragraph 9.10.1.11 to 9.10.1.17	paragraph 9.10.1.20 to 9.10.1.23	paragraph 9.10.1.35 to 9.10.1.38	paragraph 9.10.1.26 to 9.10.1.29
Physical	Supporting processes	paragraph 9.10.1.11 to 9.10.1.17	paragraph 9.10.1.20 to 9.10.1.23	paragraph 9.10.1.35 to 9.10.1.38	paragraph 9.10.1.26 to 9.10.1.29
MPA feature: Offshore subtidal sands and gravels					
Physical	Extent and distribution	paragraph 9.10.1.11 to 9.10.1.17	paragraph 9.10.1.20 to 9.10.1.23	paragraph 9.10.1.35 to 9.10.1.38	paragraph 9.10.1.26 to 9.10.1.29
Physical	Structure and function	paragraph 9.10.1.11 to 9.10.1.17	paragraph 9.10.1.20 to 9.10.1.23	paragraph 9.10.1.35 to 9.10.1.38	paragraph 9.10.1.26 to 9.10.1.29
Physical	Supporting processes	paragraph 9.10.1.11 to 9.10.1.17	paragraph 9.10.1.20 to 9.10.1.23	paragraph 9.10.1.35 to 9.10.1.38	paragraph 9.10.1.26 to 9.10.1.29

Maximum Design Scenario

9.10.1.3 The MDS in Table 9.10 presents the parameters with the potential to result in the greatest effect on the respective features of the Firth of Forth Banks Complex MPA. Any other development scenario within the MDS will result in the same, or a reduced, level of environmental effect. The scenario has been selected from the details provided in Section 9.6, which is based on the information presented in Volume 1, Chapter 3: Project Description, of the EIA Report, and covers a range of different scenarios based on what would cause the greatest impact for each activity.

9.10.1.4 The project parameters and assessment of the impacts and associated with Morven North for the Firth of Forth Banks Complex MPA has been informed by the Morven North EIA Report including Volume 2, Chapter 7: Physical Processes, of the EIA Report, and Volume 2, Chapter 8: Benthic Ecology, of the EIA Report.

9.10.1.5 Only the indirect impacts are considered due to the lack of direct overlap with the Firth of Forth Banks Complex MPA, as noted in Section 9.7. The impacts were confirmed to be indirect by the physical processes modelling for increased SSCs and associated deposition in Volume 2, Chapter 7: Physical Processes, of the EIA Report. This modelling showed that plume concentrations and sedimentation would not persist at significant levels during construction activities, due to the orientation of the tides, even after remobilisation of the suspended sediment. The changes in physical processes impact is only scoped in for the O&M phase as the changes depend on the presence of infrastructure in the water column, which is not present during construction, and which will be mostly removed during decommissioning.

Table 9.10: Maximum Design Scenario considered for each potential impact that could hinder the conservation objectives of the Firth of Forth Banks Complex Marine Protected Area

Potential Impact	C	O&M	D	Maximum Design Scenario	Justification
Increased SSCs and associated deposition	✓	✓	✓	**Construction phase** Site Preparation Foundations: • Sandwave clearance activities undertaken over an approximate fifteen month duration within the wider five year construction programme. • Wind turbines and OSP foundations: sandwave clearance has been calculated based on the assumption of clearance at up to 80% of locations using a suction hopper dredge. Spoil volume per location has been calculated on the basis of 58 locations supporting the three-legged suction bucket wind turbine foundations and five locations supporting gravity base OSP foundations. This equates to a total sandwave clearance area for Morven North of 3,753,226m^2 or volume of 11,259,679m^3 based on sandwaves 3m in height. The single greatest sandwave clearance area may occur due to the bridge-linked HVDC converter substation OSP with gravity base foundations, with a clearance area up to 597,800m^2 or volume of up to 1,793,400m^3. Site Preparation Cabling: • Inter-array cables: sandwave clearance along 63.6km of cable length, with a base width of 20m, to an average depth of 3m. Total spoil volume of 6,102,000m^3. • Interconnector cables: sandwave clearance along 72.6km of cable length, with a base width	**Seabed Preparation** The volume of material to be cleared from individual sandwaves will vary according to the local dimensions of the sandwave (height, length, and shape) and the level to which the sandwave must be reduced. These details are not fully known at this stage, however based on the available data, it is anticipated that the sandwaves requiring clearance in Morven North are likely to be circa 3m in height. The MDS for sandwave clearance to allow the installation of wind turbines and OSPs and their associated scour protection has been selected in line with standard practice (as per MM-1 in Table 9.8) and based on the greatest potential volume of suspended sediments at an individual location, rather than over the Morven North Boundary. This is because for suspended sediments, it is the maximum concentrations of suspended sediments within the water column at a particular location at a particular time during a tidal cycle that are considered critical with regards to the maximum potential deposition on the seabed. Note that although sediment plumes from a sandwave clearance operation at an individual foundation may extend and interact with sediment plumes resulting from similar works at an adjacent wind turbine location, if these operations are undertaken simultaneously, sediment plumes will align with the tidal currents, with concentration rapidly diminishing with increasing distance from the works. Thus, selection of the MDS is based upon maximum concentrations and the maximum

Potential Impact	C	O&M	D	Maximum Design Scenario	Justification
				of 20m, to an average depth of 3m. Total spoil volume of 6,969,600m^3. • Total Cabling spoil volume of 13,071,600m^3, which assumes that 15% of total length of inter-array and interconnector cables will require sandwave clearance. • Removal of up to 5km of disused cables.	potential seabed deposition at any one location. Note, there is a greater proportional difference between scenario areas when considering individual locations than over the Morven North Boundary, which has also been used to select the most critical MDS. Similarly, the MDS for sandwave clearance to allow for the installation of cables and associated cable protection has been selected in line with standard practice, based on the greatest potential volume of suspended sediments at an individual location. However, as sandwave clearance width, proportion of cables requiring clearance and sandwave heights remain the same for all scenarios considered, and the selected MDS is also capable of producing the largest sandwave clearance areas and volumes over the site as a whole. Site clearance activities may be undertaken using a range of techniques - the suction hopper dredger will result in the greatest increase in suspended sediment and largest plume extent as material is released near the water surface during the disposal of material. Boulder clearance activities will result in minimal increases in SSCs and have therefore not been considered in the assessment.
				Foundation installation • Undertaken over an approximate 21 month duration. • Wind turbines: installation of up to 68 monopiles, of which 34 monopiles of 16m diameter could be drilled which could cause increased SSCs. These 34 monopile foundations could be drilled to a depth of 64m at a rate of up to 1.5m/h. Three	**Foundation Installation** Installation of foundations via augured (drilled) operations results in the release of the largest volume of sediment. The greatest volume of sediment disturbance by drilling at individual foundation locations and across the site as a whole is associated with monopiles for wind turbines. The selected OSP scenario represents the greatest volume of sediment to be released for a drilling event.

Potential Impact	C	O&M	D	Maximum Design Scenario	Justification
				monopiles installed concurrently. Spoil volume of 14,358m^3 per pile. • OSPs: installation of four HVAC collector substation OSPs with foundations consisting of 16m diameter monopiles, drilled to a depth of 64m at a rate of up to 1.5m/h. Two monopiles installed concurrently. Spoil volume of 14,357m^3 per pile. • OSPs: installation of one bridge-linked HVDC converter substation OSP with two six-legged jacket foundations (with each leg requiring 4 piles), each with a pile diameter of 5m, drilled to a depth of 80m at a rate of up to 1.45m/h. Three piles installed concurrently. Spoil volume of 1,888m^3 per pile.	The greatest drilling rate represents the maximum level of increase in SSC. Maximum drilling rates are similar for all scenarios. Selected scenario includes allowance for up to half of the wind turbine monopiles to be installed via drilling, based on the scenario of the 68 larger wind turbines (rather than the 96 smaller turbine option in the PDE), which may yield the greatest spoil volumes per pile and thus represents the MDS for this activity.
				Cable installation • Inter-array cables: Installation via trenching of up to 424km of cable, with a trench width of up to 3m and a depth of up to 3m. Total spoil volume of 1,908,000m^3 assuming triangular cross section of the trench. Installed over a period of one year. • Interconnector cables: installation via trenching of up to 484km of cable, with a trench width of up to 3m and a depth of up to 3m. Total spoil volume of 2,178,000m^3 assuming triangular cross section of the trench. Installed over a period of one year.	**Cable Installation** Cable routes inevitably include a variety of seabed material and in some areas 3m depth may not be achieved or may be of a coarser nature which settles in the vicinity of the cable route. The assessment therefore considers the upper bound in terms of suspended sediment and dispersion potential. Cables may be buried by ploughing, trenching or jetting with trenching or jetting mobilising the greatest volume of material to increase SSCs. O&M phase - the greatest foreseeable number of cable reburial and repair events is considered to the MDS for sediment dispersion, with this ongoing management to reduce impacts required as per MM-32 in Table 9.8.

Potential Impact	C	O&M	D	Maximum Design Scenario	Justification
				O&M phase Project lifetime of 35 years. • Inter-array cables: repair of up 10km of cable in two events every five years. Reburial of up to 17km of cable in a maximum of one event every five years. • Interconnector cables: repair of up to 2km of cable in each of 10 events in 25 years. Reburial of up to 19km of cable in a maximum of one event every five years. **Decommissioning phase** Inter-array and interconnector cables will be removed where it is possible and appropriate to do so. The MDS is the removal of all cables.	**Decommissioning phase** It is assumed the removal of cables will be undertaken using similar techniques to those employed during installation, therefore the potential increases in SSCs and deposition would be in line with the construction phase. Scour and cable protection are anticipated to remain in-situ.
Changes in physical processes	×	✓	×	**O&M phase** Foundations • Wind turbines: 96 installations with monopile foundations, each with a 15m diameter with scour protection to a height of 2.5m. Total footprint of 3,578m^2 per wind turbine. • OSPs: four HVAC collector substation installations with circular footprint gravity base foundations, each with a diameter of 17m at the surface and 67m at the bed, with a caisson diameter of 51m and with scour protection to a height of 4.0m. Total footprint of 40,471m^2 per OSP. • OSPs: one bridge-linked HVDC converter substation installation with two rectangular footprint gravity base foundations, each with	Physical processes are comprised of tides, waves and sediment transport and these aspects are integrated (i.e. without the influence of tides and waves there would be no sediment transport) as outlined below: The tidal regime is influenced by changes in bathymetry due to the placement of scour protection (as per MM-1 in Table 9.8) and the obstruction of tidal flow due to foundation structures within the water column: • The wave climate is influenced by obstruction within the water column however changes in bathymetry would only cause effects in shallow water • The sediment transport regime is affected by obstructions in the sediment transport pathways and also potential changes to the littoral currents

Potential Impact	C	O&M	D	Maximum Design Scenario	Justification
				dimensions of 180x240m at the surface and 195x255m at the bed and with scour protection to a height of 4.0m. Total footprint of 74,725m^2 per foundation. Cabling • Inter-array cables: cable protection along 42.4km of the cable, with a height of up to 3m and up to 10m width. Up to five cable crossings, each crossing has a height of up to 4m, a width of up to 36m and a length of up to 80m. • Interconnector cables: cable protection along 48.4km of the cable, with a height of up to 3m and up to 10m width. Up to five cable crossings, each crossing has a height of up to 4m, a width of up to 36m and a length of up to 80m. The inclusion of five cable crossings within the MDS is a conservative assumption, as it is unlikely there will be any crossings in reality.	which drive this process (i.e. those factors which also affect tide and wave climate). A holistic approach has therefore been applied to assessing the MDS. The greatest surface blockage to influence wave climate is generally from the wind turbines with the four-legged suction bucket or jacket foundations. However the monopile foundations, which also provide a much larger obstruction to tidal flows over Morven North. Three-legged suction bucket foundations have the largest footprint at each wind turbine and over the site as a whole in terms of scour protection and provide the greatest influence on bathymetry. Monopiles have been selected as the MDS due to the magnitude of the water column obstruction over the site as a whole, compounded with the largest surface obstruction not much less than that of the four-legged suction bucket or jacket foundations over Morven North. The greatest in-water column blockage to influence tidal flow and wave climate from the OSP foundations are the gravity base foundations, which also present the largest footprints to affect changes in bathymetry and sediment transport pathways. The gravity base foundations also result in the greatest surface blockage which will predominantly affect wave climate. This six-legged suction bucket or jacket foundations may have similar levels of impact, but the larger scale of the in-water column blockage and footprint of the gravity bases means these have been selected for the MDS.

Increased Suspended Sediment Concentration and associated deposition

Construction phase

9.10.1.6 Increased SSCs and associated deposition in subtidal habitats during the construction of Morven North will occur as a result of the installation of foundations, sandwave clearance seabed preparation activities, the installation of inter-array and interconnector cables in the construction area, and the removal of existing disused and out of service cables prior to the construction activities.

9.10.1.7 The benchmarks for the relevant MarESA and FeAST pressures which have been used to inform this impact assessment are described below:

- Habitat structure changes: removal of substratum (extraction): the benchmark for which is the extraction of substratum to 30cm. This pressure is considered to be analogous to the impacts associated with sandwave clearance and pre-lay preparation (e.g. boulder and debris clearance), and UXO clearance.
- Abrasion/disturbance at the surface of the substratum or seabed: the benchmark for which is damage to surface structures (e.g. species and physical structures within the habitat). This pressure corresponds to the impacts associated with anchor placement and jack-up vessel operation.
- Penetration and/or disturbance of the substratum subsurface: the benchmark for which is damage to subsurface features (e.g. species and physical structures within the habitat). This pressure corresponds to the impacts associated with cable installation, jack-up vessel operation, and the removal of existing cables.
- Smothering and siltation rate changes (heavy): the benchmark for which is heavy deposition of up to 30cm of fine material added to the habitat in a single discrete event. This pressure corresponds to impacts associated with the deposition of sandwave clearance material and site preparation activities prior to cable installation.

9.10.1.8 Increased SSCs and associated deposition resulting from construction activities could affect the ocean quahog aggregations and offshore subtidal sands and gravels features of the Firth of Forth Banks Complex MPA.

9.10.1.9 Sediment plume modelling, presented in full from physical processes modelling in Volume 3, Annex 7.1: Physical Processes Technical Report, of the EIA Report, has been used to inform the assessment of potential increased SSCs and associated deposition.

9.10.1.10 Installation of the wind turbines and OSPs may disturb a sandwave clearance volume of up to 11,259,679m^3, and cable installation may result in up to 13,071,600m^3 of sediment spoil using a suction hopper dredger. Up to 58 three-legged suction bucket wind turbine foundations and six gravity base OSP foundations may be installed. Up to approximately 64km of inter-array cable may require sandwave clearance, and up to approximately 73km of interconnector cables may require sandwave clearance, with a clearance width of 20m and average depth of 3m in each case.

Physical attributes

9.10.1.11 The following physical attributes of both the ocean quahog aggregations and offshore subtidal sands and gravels features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the increased SSC and associated deposition during the construction phase:

- extent;
- structure;
- supporting processes.

9.10.1.12 The modelling for Morven North was undertaken for a suction hopper dredger for both sandwave clearance and cable installation.

9.10.1.13 Seabed preparation using a suction hopper dredger will be required prior to the installation of foundations. The release of the sediment back to the seabed will take place at a nearby location. During releases of sediment, the full volume of material is released into the water column from the vessels hull near to the water surface in a relatively short time. At a representative higher current speed of 0.66m/s to 0.7m/s, average sedimentation is focused within circa 200m of the site of release with a maximum depth of 0.5m to 2.0m, while the finer sediment fractions are distributed in the vicinity at much smaller depths, circa 5mm to 50mm (Section 7.11.2 of Volume 2, Chapter 7: Physical Processes, of the EIA Report). This distance will be proportionally shorter during periods of lower current speed, such as outside peak flow times and generally around neap tides. Fine sand and silt sized sediments persist in suspension for longer than relatively coarser sediment grain sizes.

9.10.1.14 Drilling action for pile installation was also modelled, with this anticipated to generate plumes with average SSCs <0.2mg/l over the campaign at the discharge locations within the Morven North Boundary, rapidly decreasing a short distance from the discharge location to 0.01mg/l within 500m.

9.10.1.15 For the inter-array and interconnector cable installation, the SSCs reached are larger than for the pile installation, due to the larger volume of sediment mobilised, with resuspension giving rise to concentrations up to 0.6mg/l in an amalgamated plume. SSCs of up to 750mg/l were found in the vicinity of the releases, with narrow plumes (with width circa 200m) of up to 40mg/l extending up to 8km in a north northeasterly direction within the Morven North Boundary. Plume widths increased with distance from the activity due to dispersion. The greatest area of increased SSC, extending circa 9km from the releases within the Morven North Boundary is also associated with remobilisation of the deposited material on the subsequent tide with concentrations of up to 800mg/l, but typically in the order of 20mg/l to 50mg/l over greater areas. Average SSC over the campaign were typically <100mg/l. The average sedimentation during the modelled trenching operation is <0.003mm and is greatest at the location of the trenching, reducing rapidly following cessation of the activity. Due to the low magnitude of sedimentation, the impact is not expected to be detectible.

9.10.1.16 Based on the information presented above, the following can be concluded with respect to impacts to the physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels features of the Firth of Forth Banks Complex MPA.

- **Extent**: the modelling undertaken (Section 6 of Volume 3, Annex 7.1: Physical Processes Shared Technical Report, of the EIA Report) found that Morven North may result in increases in SSCs and associated deposition, however, it highlighted that any sediment plumes that may reach the MPA will be of low concentration and will likely only affect a small proportion of the MPA for a short duration. Furthermore, the ocean quahog aggregations only have negligible sensitivity to this impact due to being adapted for deposit feeding in sedimentary environments (Morton, 2011) and naturally inhabiting a range of sheltered to wave exposed conditions (Tyler-Walters and Sabatini, 2017). The offshore subtidal sands and gravels feature has a medium sensitivity to this impact, due to the potential of heavy smothering potentially causing mortality to constituent polychaete species (Essink, 1999, Powilleit *et al.*, 2009). However, the offshore subtidal sands and gravels feature is widespread throughout the Firth of Forth Banks Complex MPA, and any impact from increased SSCs and associated deposition are likely to be minimal overall, and the physical extents of the feature are therefore unlikely to be impacted other than insignificantly.
- **Structure**: the structure of ocean quahog aggregations are unlikely to be significantly impacted by increased SSCs and associated deposition, due to their relative sparsity throughout the Montrose Bank limiting the potential for smothering or siltation impacts on this feature. The offshore subtidal sands and gravels feature structure is also unlikely to be significantly impacted, due to all deposited sediment being from the local area and having a similar composition to that located within the Firth of Forth Banks Complex MPA (Section 8.7 of Volume 2, Chapter 8: Benthic Subtidal Ecology, of the EIA Report). Therefore, the structure of both features are unlikely to be impacted other than insignificantly.
- **Supporting processes**: the hydrological supporting processes for the ocean quahog aggregations and the offshore sands and gravels features are unlikely to be changed by increased SSCs and associated deposition, as modelling indicated that SSCs would likely

return to baseline conditions within a few tidal cycles (Section 7.11.2 of Volume 2, Chapter 7: Physical Processes, of the EIA Report). This would lead to the supporting processes returning to normal conditions shortly following the cessation of construction activities, and therefore increased SSCs and associated deposition are unlikely to have any impact (other than insignificantly) on the conservation objective to recover this feature to favourable condition.

Conclusion of attribute assessment

9.10.1.17 Based on the information presented in paragraphs 9.10.1.11 to 9.10.1.16, it can be concluded that increased SSCs and associated deposition during the Morven North construction phase **will not, and cannot reasonably be expected to, result in a significant risk of hindering the achievement of the conservation objective** of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons:

- The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and offshore subtidal sands and gravels features will not be significantly negatively impacted by the construction activities of Morven North. This is due to only small increases in SSCs and associated deposition anticipated to reach the Firth of Forth Banks Complex MPA, with conditions returning to the baseline within a few tidal cycles.

Operations and maintenance phase

9.10.1.18 Increased SSCs and associated deposition may occur during the O&M phase as a result of cable repair and reburial events for the inter-array and interconnector cables. Volume 2, Chapter 8: Benthic Subtidal Ecology, of the EIA Report, and Volume 2, Chapter 7: Physical Processes, of the EIA Report provide full detail on the magnitude of impact and MDS assumptions with respect to increased SSCs and associated deposition arising from cable installation as a whole throughout Morven North.

9.10.1.19 O&M activities associated with cable repair events may cause increased SSCs and associated deposition, from the undertaking of up to two repair events along 10km of inter-array cables once every five years and up to 10 repair events in 25 years along 2km of interconnector cables. Reburial will also occur along up to 17km of inter-array cables in a maximum of one event every five years, and along up to 19km of interconnector cables in a maximum of one event every five years. The adherence to the Cable Plan and EMP (Section 9.9) is likely to mitigate any large increases in SSCs and associated deposition during the O&M phase. These activities are likely to be reduced in magnitude compared to the construction phase, and therefore sediment plumes and sedimentation footprints will be smaller and will return to baseline conditions more quickly.

Physical attributes

9.10.1.20 The following physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the increased SSCs and associated deposition during the O&M phase:

- extent;
- structure;
- supporting processes.

9.10.1.21 Repairs and reburial would be undertaken using similar methods as those for cable installation activities, however, over a much smaller length of cable. Therefore, the magnitude of the impact would be smaller than what is described for the construction phase. The sediment plumes and sedimentation footprints would be dependent on the section of cable being repaired or reburied, and even if repairs occur at the closest point to the Firth of Forth Banks Complex MPA (0.04km), the increased SSCs and associated deposition will be reduced due to coarse sediment re-settlement before reaching the Firth of Forth Banks Complex MPA.

9.10.1.22 Based on the information above, the following can be concluded with respect to the physical attributes of the ocean quahog and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA.

- The impact on the physical attributes of the Firth of Forth Banks Complex MPA (extent, structure, and supporting processes) will be similar to the construction phase but is likely to be slightly smaller overall. The impact in the O&M phase, however, will be reduced in area as well as in time scale due to the nature of the repair activities which will not include sandwave clearance. The disturbances will also be spread over a time period of 35 years and will therefore have limited impact at any one time.

Conclusion of attribute assessment

9.10.1.23 Based on the information presented in paragraphs 9.10.1.18 to 9.10.1.22, it can be concluded that increased SSCs and associated deposition during the Morven North O&M phase **will not, and cannot reasonably be expected to, lead to a significant risk of hindering the achievement of the conservation objective** of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons:

- The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and offshore subtidal sands and gravels features will not be significantly negatively impacted by the O&M activities of Morven North. This is due to only small increases in SSCs and associated deposition anticipated to reach the Firth of Forth Banks Complex MPA, with conditions returning to the baseline within a few tidal cycles.

<u>Decommissioning phase</u>

9.10.1.24 Increased SSCs and associated deposition may occur during the decommissioning phase as a result of the removal of offshore infrastructure, with the exact programme to be submitted to MD-LOT for consultation and approval. The decommissioning methods are assumed to be similar to those used during construction due to fewer activities required for decommissioning, but the overall decommissioning programme will be specified closer to the time and therefore a precautionary approach has been used at this time. The magnitude of increased SSCs and associated deposition are expected to not be greater than that set out for the assessment of the construction phase of Morven North.

9.10.1.25 The benchmarks for the relevant MarESA and FeAST pressures for the Firth of Forth Banks Complex MPA are as listed for the construction phase.

Physical attributes

9.10.1.26 The following physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the increased SSC and associated deposition during the decommissioning phase:

- extent;
- structure;
- supporting processes.

9.10.1.27 As a result of decommissioning, increases in SSC and associated deposition would be of a similar magnitude to those described for the construction phase but slightly reduced with the reduction in seabed preparation activities. The removal of the Morven North cabling would lead to an increase in SSC through similar trenching techniques as implemented during installation. The expected magnitude of impact is, therefore, assumed as equal to that of the construction phase.

9.10.1.28 Based on the information presented above, the following can be concluded with respect to the physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels protected feature of the Firth of Forth Banks Complex MPA:

- The impact on the physical attributes of the Firth of Forth Banks Complex MPA (extent, structure, and supporting processes) will be similar to the construction phase but is likely to be slightly smaller overall. The impacts during the decommissioning phase however will be reduced in area and in time scale due to the nature of the activities which will not include sandwave clearance.

Conclusion of attribute assessment

9.10.1.29 Based on the information presented in paragraphs 9.10.1.24 to 9.10.1.28, it can be concluded that increased SSCs and associated deposition during the Morven North decommissioning phase **will not, and cannot reasonably be expected to, lead to a significant risk of hindering the achievement of the conservation objective** of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons:

- The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and offshore subtidal sands and gravels features will not be significantly negatively impacted by the decommissioning activities of Morven North. This is due to only small increases in SSCs and associated deposition anticipated to reach the Firth of Forth Banks Complex MPA, with conditions returning to the baseline within a few tidal cycles.

Changes in physical processes

Operations and maintenance phase

9.10.1.30 Changes in physical processes may arise from the installation of infrastructure into the water column (e.g. foundations of wind turbines and OSPs, and cable protection, as per MM-1 in Table 9.8), including scour effects and changes in the sediment transport and wave regimes resulting in potential effects on both the ocean quahog aggregations and offshore subtidal sands and gravels features.

9.10.1.31 Volume 2, Chapter 7: Physical Processes, of the EIA Report, provides a full description of the analysis used to inform this assessment.

9.10.1.32 The relevant MarESA pressures and benchmarks used to inform this impact assessment are:

- changes in local water flow (tidal current): change in peak mean spring bed flow velocity between 0.1m/s to 0.2m/s for more than one year. The pressure is associated with activities that have the potential to modify hydrological energy flows. This pressure corresponds to the impacts associated with the presence of cable protection;
- local wave exposure changes: change in nearshore significant wave height >3% but <5% for one year. This pressure corresponds to the impacts associated with the presence of cable protection.

9.10.1.33 The relevant FeAST pressures and benchmarks used to inform this impact assessment were:

- water flow (tidal current) changes – local: the benchmark for this pressure is the peak mean spring tide flow change of greater than 0.1m/s over an area >1km^2 or 50% of the width of the water body for >1 year;
- wave exposure changes – local: the benchmark for this pressure is a change in nearshore significant wave height >3% for one year.

9.10.1.34 The MDS for Morven North will include up to 96 wind turbine monopile foundations, up to four HVAC OSP foundations, one bridge-linked HVDC OSP, and cable protection along approximately 42km of inter-array cables and approximately 48km of interconnector cables.

Physical attributes

9.10.1.35 The following physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the changes in physical processes during the O&M phase:

- extent;
- structure;
- supporting processes.

9.10.1.36 In terms of tidal currents and water levels, the potential for localised changes in current speed is spatially limited to narrow wakes of slightly reduced current speed extending downstream of individual foundations, cable protection, and cable crossings, with proportionally increased turbulence expected in these areas. Changes to current speed at the resolution of the physical processes modelling found a maximum variation of 0.4m/s in the immediate vicinity of infrastructure, which constitutes approximately 60% of the peak baseline flow. However, this reduced to <0.01m/s within 5km, representing <2% of the baseline current speeds, indicating that changes would be imperceptible beyond the Morven North Boundary.

9.10.1.37 In terms of changes to wave regimes, Morven North infrastructure has the potential to impact wave height, period, and direction. Modelling indicated that waves in a yearly southerly storm event would be deflected around the structures, and wave height could increase by up to 0.35m or decrease by 0.8m around an OSP gravity base foundation, equating to <10% of the baseline significant wave height. For a once in 20 year southerly storm event, wave height could increase by up to 0.4m or decrease by up to 0.9m in the immediate vicinity of infrastructure, although this represents a small impact within the benthic subtidal ecology ZoI.

9.10.1.38 The Firth of Forth Banks Complex MPA is 0.04km from Morven North. As changes in physical processes impacts are expected to be contained within the Morven North Boundary, there is no potential impact pathway, and this impact is not considered further for the Firth of Forth Banks Complex MPA.

Conclusion of attribute assessment

9.10.1.39 It can be concluded that changes in physical processes during the Morven North O&M phase will not, and cannot reasonably be expected to, lead to a significant risk of hindering the achievement of the conservation objective of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons:

- The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and subtidal sands and gravels features will not be significantly negatively impacted by the O&M activities of Morven North. This is due to the O&M activities and associated changes in physical processes being contained fully within the Morven North Boundary and therefore having no physical overlap with the Firth of Forth Banks Complex MPA.

Future monitoring commitments

9.10.1.40 No significant risk of hindering the achievement of the conservation objectives of maintaining the ocean quahog aggregations or the offshore subtidal sands and gravels features of the Firth of Forth Banks Complex MPA have been identified within this MPA Assessment. Therefore, future monitoring to test the predictions made within the impact assessment is not considered necessary.

9.11 Whole project assessment and Cumulative Effects Assessment

9.11.1 Methodology

9.11.1.1 The CEA assesses the impact associated with Morven North together with other relevant projects and activities. Cumulative effects are defined as the effect of Morven North in combination with the effects from a number of different projects, on the same receptor or resource.

9.11.1.2 The projects, plans and activities selected as relevant to the CEA presented within this assessment are based upon the results of a screening exercise, accounting for the Benthic ZoI (as only the benthic ocean quahog aggregations and subtidal sands and gravels features in the Firth of Forth Banks Complex MPA are screened in for assessment). Each project, plan and activity 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 and temporal scales involved.

9.11.1.3 The following assessment scenarios have been considered to identify the potential effects of Morven North in combination with other projects, plans and activities on the same receptor, as follows (and summarised in Table 9.11):

- Whole project assessment: to identify the potential impacts associated with Morven North together with each grid connection option in turn, (Scenario 1: Morven Hawthorn Pit Grid Connection (MHPGC) Project and Scenario 2: Morven Branxton Area Grid Connection (MBAGC) Project), each of which would comprise a "Whole Project";
- Morven Programme assessment: to identify impacts associated with all four components: Morven North, Morven South, MHPGC Project, and MBAGC Project (together the "Morven Programme") (Scenario 3);
- CEA: to identify the potential impacts associated with the Morven Programme (Morven North, Morven South, MHPGC Project, and MBAGC Project) together with other relevant projects, plans and activities, (Scenario 4).

9.11.1.4 The Whole Project assessment and CEA have been undertaken in accordance with the legal requirement to consider the potential cumulative impact of developments alongside other nearby projects and plans as detailed in the Marine and Coastal Access Act 2009 (Section 9.3).

Table 9.11: Scenarios to be considered within the Morven North Whole Project assessment and Cumulative Effects Assessment for benthic subtidal ecology

Whole Project assessment		Morven Programme assessment (Offshore Ornithology and Shipping & Navigation only)	Cumulative Effects Assessment
Scenario 1	**Scenario 2**	**Scenario 3**	**Scenario 4**
Morven North + MHPGC Project	Morven North + MBAGC Project	Morven North + Morven South + MHPGC Project + MBAGC Project	Morven North + Tier 1, Tier 2 and Tier 3 Plans/Projects screened in

9.11.1.5 For the purposes of this MPA Assessment, Scenarios 1, 2, and 4 have been taken forward for assessment; Scenario 3 has not been included as it is not applicable to this MPA Assessment. As discussed in Volume 1, Chapter 6: EIA Methodology, the Morven Programme assessment (Scenario 3) is only required for specific receptors to provide further context to, and to support, the conclusions of the CEA scenario (Scenario 4), in agreement with the relevant stakeholders for these topics. As Scenario 3 does not form the basis of the CEA conclusions, it is considered a supplementary

assessment to the CEA scenario (Scenario 4) for these specific topics. The approach to Cumulative Effects Assessment presented in this MPA Assessment complies with the requirements under the Marine (Scotland) Act 2010 and the Marine Coastal Access Act 2009 to assess whether the development is capable of affecting (other than insignificantly) a protected feature in an MPA cumulatively with other relevant plans, projects and activities, and no supplementary assessment of the Morven Programme (Scenario 3) is required or has been requested by relevant stakeholders with regard to the MPA Assessment.

9.11.1.6 In undertaking the CEA for Morven North, it is important to bear in mind that other projects under consideration will have differing potential for proceeding to an operational stage and hence a differing potential to ultimately contribute to a cumulative impact alongside Morven North.

9.11.1.7 Therefore, a tiered approach has been adopted. This provides a framework for placing relative weight upon the potential for each project to be included in the CEA to ultimately be realised, based upon the project's current stage of maturity and certainty in the projects' parameters. The tiered approach which will be utilised within the Morven North CEA employs the following tiers:

- Tier 1 assessment – Existing developments either built (operational) or under construction[1]; approved developments awaiting implementation; and permitted/submitted application(s) but not yet determined.
- Tier 2 assessment – All plans/projects assessed under Tier 1, and plans/projects where a scoping report has been submitted and is in the public domain.
- Tier 3 assessment – All plans/projects assessed under Tier 1 and 2, plus plans/projects that are reasonably foreseeable (e.g., projects identified in development plans, projects in other plans and programmes, offshore renewable energy projects that have a CES Lease Option Agreement).

9.11.1.8 The specific projects scoped into the CEA for the Firth of Forth Banks Complex MPA Assessment are shown in Figure 9.5 and outlined in Table 9.12 and Table 9.13.

9.11.1.9 Two tier 1 projects were identified within the Benthic ZoI which could result in cumulative impacts on the Firth of Forth Banks Complex MPA. This included two wind farms. Four tier 2 projects were identified, with this including one wind farm and three wind cable agreements and Carbon Capture System (CCS) projects. One tier 3 project was identified, including one wind cable agreement and CCS project.

9.11.1.10 The potential cumulative impact that was identified and included in Table 9.12 and Table 9.13 below, is a subset of those impacts considered for the Morven North alone assessment. This is because some of the potential impacts identified and assessed for Morven North alone are localised and temporary in nature. It is considered, therefore, that these potential impacts have negligible or no potential to interact with similar changes associated with other plans or projects. These have, therefore, been scoped out of the CEA.

9.11.1.11 Similarly, some of the potential impacts considered within the Morven North alone assessment are specific to a particular phase of development (e.g. construction, O&M or decommissioning). Where the potential for cumulative effects with other projects only have potential to occur where there is

[1] Note that existing developments are included in the Tier 1 CEA long list but are generally screened out of the CEA assessments, aside from the following exceptions:

1) Existing developments which were not present at the time of baseline characterisation, where a potential cumulative impact-receptor pathway has been identified; or

2) For specific topics where there is a large conceptual, temporal and spatial overlap between project impacts. In these instances, the potential for ongoing effects through cumulative impact-receptor pathways throughout project lifetime, across the development phases, means that they are considered within quantitative assessment for these topic CEAs (e.g., offshore ornithology assessments consider the cumulative effects of operational offshore wind farms).

spatial or temporal overlap with Morven North during certain phases of development, impacts associated with a certain phase may be omitted from further consideration where no projects have been identified as having the potential for cumulative effects during this period.

9.11.1.12 As a result, the only impact that has been included in the cumulative assessment is the increases in SSC and associated deposition impact as it was identified in the project alone assessment that there would be a potential effect on the Firth of Forth Banks Complex MPA due to this impact. Changes in physical processes has not been brought forward to the cumulative assessment as it was identified in the project alone assessment that effects would be highly localised within the Morven Boundary, and that there would be no effect on the Firth of Forth Banks Complex MPA. It is therefore not possible for a cumulative effect to arise in relation to this impact as there is no spatial overlap with another project. As increased SSCs and associated deposition is the only impact assessed within the CEA, the most appropriate cumulative study area is the Benthic ZoI, as this represents the greatest potential extent of this impact that could interact cumulatively with the impacts from other nearby projects and plans.

Table 9.12: List of other projects considered within the Cumulative Effects Assessment for the Firth of Forth Banks Complex Marine Protected Area assessment

Project	Status	Distance from Morven North (km)	Description of project/plan	Estimated dates of construction (if applicable)	Estimated dates of operation (if applicable)	Project phases that overlap with each phase of Morven North
Morven North	Pre-application	N/A	See Section 9.6	2033-2042	2038-2073	N/A
Tier 1						
Wind Farms						
Morven South Offshore Wind Array Project	Application submitted, awaiting decision	0	The Morven South Offshore Wind Array Project is proposed for up to 1500MW capacity.	2033-2042	2038-2073 or 2043-2078	All phases of Morven South overlap temporally with all phases of Morven North.
Ossian OWF	Consenting/Pre-Construction	9	The Ossian Floating Wind project is proposed for up to 3,610MW capacity.	2029-2038	2039-2078	Construction and O&M of Ossian OWF overlap temporally with construction of Morven North. O&M of Ossian OWF overlaps temporally with construction and O&M of Morven North.
Tier 2						
Wind Farms						
Bowdun Offshore Wind Farm	Consenting/Pre-Construction	10	Bowdun Offshore Wind Farm is proposed for up to 60 wind turbines at a capacity of 1,008MW.	2029-2033	2032-2064	Construction and O&M of Bowdun OWF overlap temporally with

Project	Status	Distance from Morven North (km)	Description of project/plan	Estimated dates of construction (if applicable)	Estimated dates of operation (if applicable)	Project phases that overlap with each phase of Morven North
						construction of Morven North. O&M and decommissioning of Bowdun OWF overlap temporally with construction and O&M of Morven North.
Wind cable agreements and CCS						
Morven Hawthorn Pit Grid Connection Project	Consenting/Pre-Construction	0	N/A	Unknown	Unknown	Unknown. Construction and O&M phases of MHPGC Project may overlap temporally with construction and O&M of Morven North. Decommissioning of MHPGC Project may overlap temporally with the decommissioning of Morven North.
Eastern Green Link 3	Consenting/Pre-Construction	5	Scotland to England Green Link 3	2028 - 2033	2034 onwards	Construction and O&M of Eastern Green Link 3 overlap temporally

Project	Status	Distance from Morven North (km)	Description of project/plan	Estimated dates of construction (if applicable)	Estimated dates of operation (if applicable)	Project phases that overlap with each phase of Morven North
						with Morven North.
Ossian – OWF Export Cable	Consenting/Pre-Construction	9	Maximum six offshore export cables, no indicative construction start date or transmission capacity mentioned.	N/A	N/A	N/A
Tier 3						
Wind cable agreements and CCS						
Morven Branxton Area Grid Connection Project	Pre-Planning	0	Potential transmission for the Morven North/ Morven South.	Unknown	Unknown	Unknown. Construction phase, O&M and decommissioning phases of MBAGC Project may overlap with Morven North construction, O&M and decommissioning phases

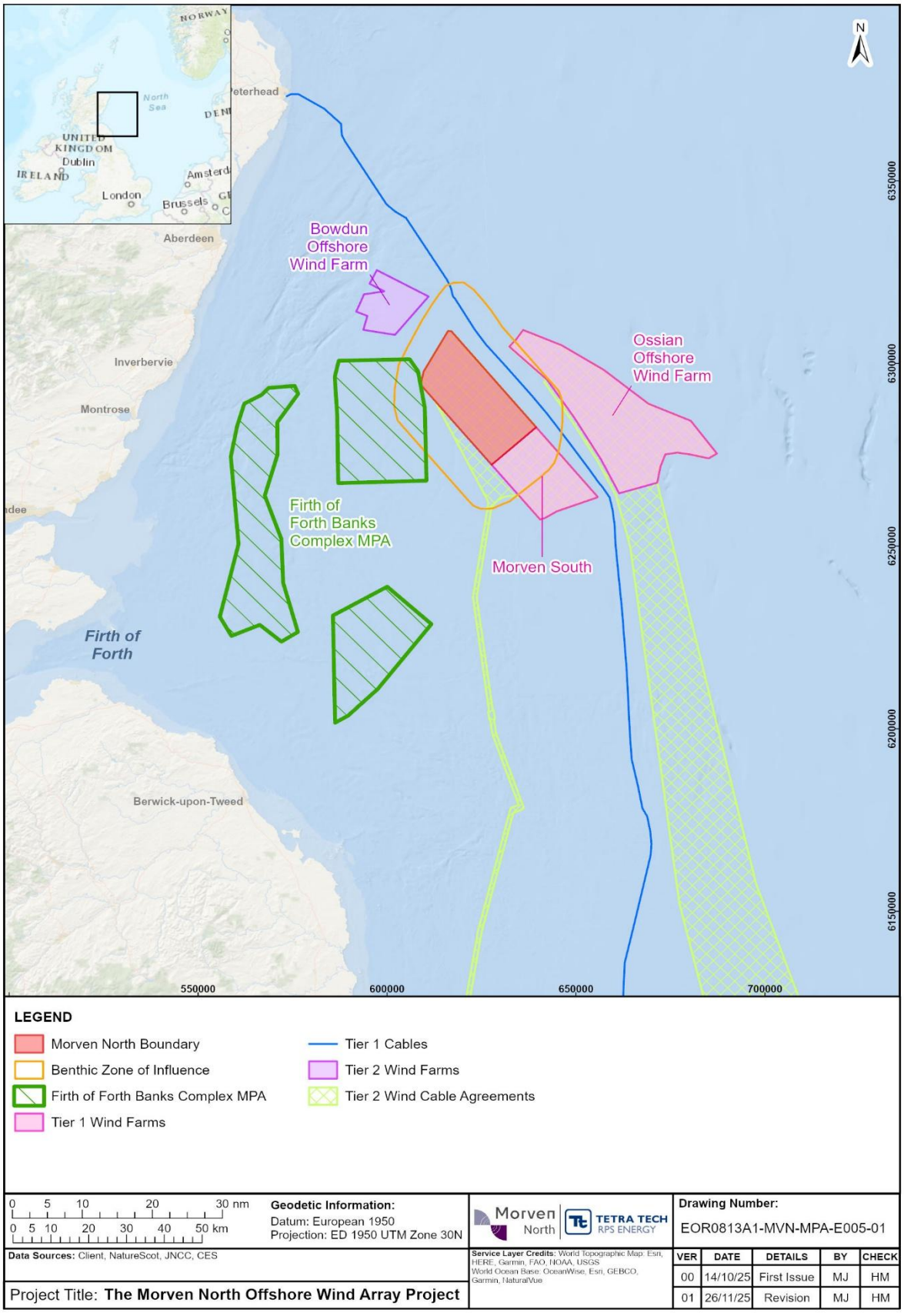

Figure 9.5: Other Projects Screened into the Cumulative Effects Assessment for the Firth of Forth Banks Complex Marine Protected Area

9.11.1.13 To ensure the potential cumulative impacts on the Firth of Forth Banks Complex MPA from increased SSCs and associated deposition were fully assessed, the MPA Assessment conclusions of projects overlapping with the Firth of Forth Banks Complex MPA were also considered. Specifically, these projects included the following tier 1 projects, as shown in Figure 9.6:

- Berwick Bank Wind Farm;
- Cambois Connection;
- Seagreen 1 Offshore Windfarm;
- Seagreen 1A Offshore Wind Farm.

9.11.1.14 These projects overlap with the Firth of Forth Banks Complex MPA and therefore may have a cumulative impact on the conservation objectives at the same time as the potential impacts from Morven North. Any cumulative impact would not be direct, as these projects do not overlap with the Benthic ZoI for Morven North. However, the potential exists for the construction and O&M activities, which result in increased SSCs and associated deposition, from these projects to have temporal overlap with Morven North activities, and to be close enough to Morven North for sediment plumes to potentially overlap, based on project-specific physical processes modelling. This could result in cumulative impacts on the static benthic offshore sands and gravels and ocean quahog aggregations receptors of the Firth of Forth Banks Complex MPA.

9.11.1.15 These projects are considered in Section 9.11.3, but are not included in the MDS as they do not overlap with the Benthic ZoI.

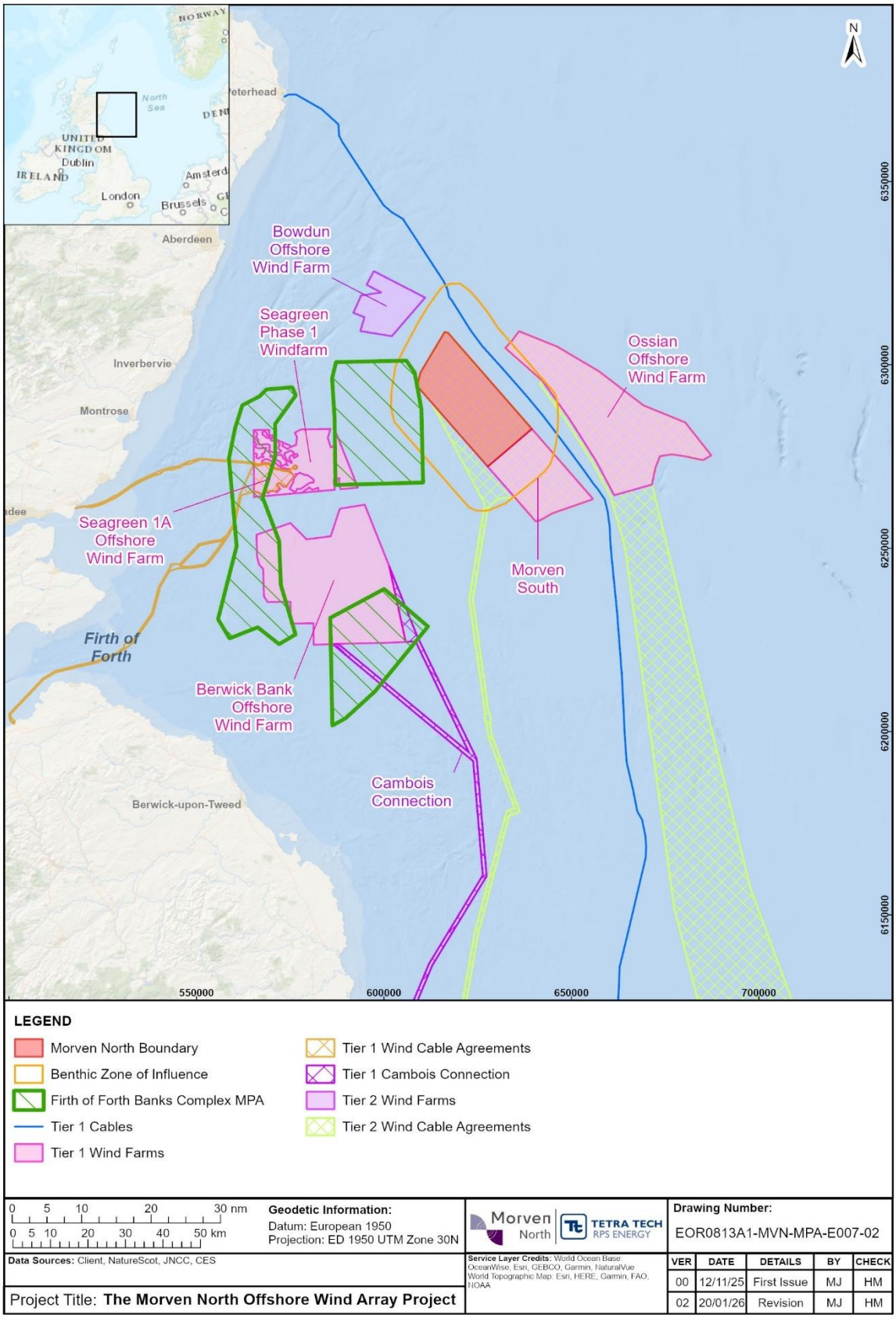

Figure 9.6: Projects Overlapping with the Firth of Forth Banks Complex Marine Protected Area (but not overlapping with the Benthic ZoI) which could cause Potential Cumulative Effects alongside Morven North

9.11.2 Maximum Design Scenario

9.11.2.1 The MDS identified in Table 9.13 has been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. The cumulative effects presented and assessed in this section have been selected from the details provided in Volume 1, Chapter 3: Project Description, of the EIA Report as well as the information available on other projects to inform an MDS accounting for temporal overlaps with Morven North. Any other development scenario within the MDS will result in the same level of, or less, environmental effect.

Table 9.13: Maximum Design Scenario considered for each impact

Potential cumulative effect	C	O&M	D	MDS	Justification
Increased SSCs and associated deposition	✓	×	×	**Scenario 1** MDS as described for Morven North (Table 9.10), assessed cumulatively with MHPGC Project. **Scenario 2** MDS as described for Morven North (Table 9.10), assessed cumulatively with MBAGC Project. **Scenario 4** MDS as described for Morven North (Table 9.10), assessed cumulatively with the following other projects and plans: **Tier 1** • OWF Projects: – Ossian OWF – Morven South **Tier 2** • OWF Projects: – Bowdun Offshore Wind Farm • Wind Cable Agreements: – Ossian OWF Export Cable – Eastern Green Link 3 – MHPGC Project **Tier 3** • Wind Cable Agreements: – MBAGC Project	These projects have temporal overlap with the construction phase of Morven North.
	×	✓	×	**Scenario 1** MDS as described for Morven North (Table 9.10), assessed cumulatively with MHPGC Project. **Scenario 2** MDS as described for Morven North (Table 9.10), assessed cumulatively with MBAGC Project. **Scenario 4** MDS as described for Morven North (Table 9.10), assessed cumulatively with the following other projects and plans:	These projects have temporal overlap with the O&M phase of Morven North.

Potential cumulative effect	C	O&M	D	MDS	Justification
				Tier 1 • OWF Projects: – Ossian OWF – Morven South **Tier 2** • OWF Project: – Bowdun Offshore Wind Farm • Wind Cable Agreements: – Ossian OWF Export Cable – Eastern Green Link 3 – MHPGC Project **Tier 3** • Wind Cable Agreements: – MBAGC Project	
	×	×	✓	**Scenario 1** MDS as described for Morven North (Table 9.10), assessed cumulatively with MHPGC Project. **Scenario 2** MDS as described for Morven North (Table 9.10), assessed cumulatively with MBAGC Project. **Scenario 4** MDS as described for Morven North (Table 9.10), assessed cumulatively with the following other projects and plans: **Tier 1** • OWF Projects: – Ossian OWF – Morven South **Tier 2** • OWF Project: – Bowdun Offshore Wind Farm • Wind Cable Agreements: – Ossian OWF Export Cable – MHPGC Project **Tier 3** • Wind Cable Agreements: – MBAGC Project	These projects have temporal overlap with the decommissioning phase of Morven North.

9.11.3 Cumulative Effects Assessment: Firth of Forth Banks Complex MPA

9.11.3.1 An assessment of the likely significance of the cumulative effects of Morven North upon the protected features of the Firth of Forth Banks Complex MPA arising from the identified impact is provided below.

Increased SSC and associated deposition

9.11.3.2 The cumulative assessment of increased SSC and associated deposition in terms of the potential impacts on the Firth of Forth Banks Complex MPA features is presented in Table 9.14 for Scenario 1 and 2, and in Table 9.15 for Scenario 4.

Table 9.14: Morven North Whole Project assessment for increased Suspended Sediment Concentrations and associated deposition

	Whole Project assessment	
	Scenario 1: Morven North + MHPGC Project	**Scenario 2: Morven North + MBAGC Project**
Construction phase		
Magnitude of impact	The Whole Project assessment for Scenario 1 considers Morven North together with MHPGC Project. The construction and O&M phases of the MHPGC Project may occur simultaneously with the construction phase of Morven North and includes cable installation and burial events, and repair and reburial activities. The MHPGC Project export cable installation, repair and reburial activities will be undertaken in close proximity to Morven North, using similar parameters and techniques to those associated with the inter-array and interconnector cable installation activities for Morven North (as presented in Table 9.10). The impacts are expected to be minimal, with much smaller areas of disturbance and therefore smaller increases in SSCs and associated deposition than during the construction of Morven North due to there being no installation of foundations or wind turbines. Also, the schedule of construction and O&M activities are not currently known and, therefore, the potential for direct temporal overlap with all Morven North construction activities is low. Therefore, the cumulative impact with Morven North is expected to be minimal.	The Whole Project assessment for Scenario 2 considers Morven North together with MBAGC Project. The construction of the MBAGC Project may occur simultaneously with the construction phase of Morven North (as presented in Table 9.10). Currently no scoping report has been published for the MBAGC Project, however the MBAGC Project site preparation and offshore cable installation will be undertaken in close proximity to Morven North, likely using similar parameters and techniques to those associated with the inter-array and interconnector cable installation for Morven North. The O&M phase of the MBAGC Project may also occur simultaneously with the construction phase of Morven North, and will include repair and reburial events, similar to the MHPGC Project, and with a reduced impact compared to the construction phase.
Physical attributes	The following physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the increased SSCs and associated deposition during the construction phase: • extent; • structure; • supporting processes.	The following physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the increased SSCs and associated deposition during the construction phase: • extent; • structure; • supporting processes.

	Whole Project assessment	
	The following can be concluded with respect to the physical attributes of the ocean quahog and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA, based on the physical attributes assessment in Section 9.10.1: • The cumulative impact on the physical attributes of the Firth of Forth Banks Complex MPA (extent, structure, and supporting processes) will be similar to that described for the Morven North project alone assessment, as the MHPGC Project does not cause any significant increase in impact. This is due to the MHPGC Project being smaller in magnitude than Morven North and there being only a small chance of temporal or spatial overlap of any activities at the same time.	The following can be concluded with respect to the physical attributes of the ocean quahog and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA, based on the physical attributes assessment in Section 9.10.1: • The impact on the physical attributes of the Firth of Forth Banks Complex MPA (extent, structure, and supporting processes) will be similar to that described for the alone assessment, as the MBAGC Project does not cause any significant increase in impact. This is due to the MBAGC Project being smaller in magnitude than Morven North, and not including any foundation installation activities, as well as there being only a small chance of temporal or spatial of any activities at the same time.
Conclusion of attribute assessment	It can be concluded that increased SSCs and associated deposition during the Scenario 1 construction phase **will not, and cannot reasonably be expected to, lead to a significant risk of hindering the achievement of the conservation objective** of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons: • The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and offshore subtidal sands and gravels features will not be significantly negatively impacted by the construction activities of Morven North and the construction and O&M activities of the MHPGC Project. This is due to only small increases in SSCs, and associated deposition anticipated to reach the Firth of Forth Banks Complex MPA, with conditions returning to the baseline within a few tidal cycles.	It can be concluded that increased SSCs and associated deposition during the Scenario 2 construction phase **will not, and cannot reasonably be expected to, lead to a significant risk of hindering the achievement of the conservation objective** of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons: • The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and offshore subtidal sands and gravels features will not be significantly negatively impacted by the construction activities of Morven North and the construction and O&M activities of MBAGC Project. This is due to only small increases in SSCs, and associated deposition anticipated to reach the Firth of Forth Banks Complex MPA, with conditions returning to the baseline within a few tidal cycles.
O&M phase		
Magnitude of impact	The Whole Project assessment for Scenario 1 considers Morven North together with MHPGC Project.	The Whole Project assessment for Scenario 2 considers Morven North together with MBAGC Project.

	Whole Project assessment	
	The construction and O&M phases of the MHPGC Project may occur simultaneously with the O&M phases of Morven North and includes cable installation, repair and reburial events. The MHPGC Project export cable installation, repair and reburial activities will be undertaken in close proximity to Morven North, using similar parameters and techniques to those associated with the inter-array and interconnector cable installation activities for Morven North (as presented in Table 9.10). The construction and maintenance activities, therefore, are likely to result in a similar level of increased SSCs and associated deposition, with a limited and localised spatial extent, with the impact only occurring intermittently across the operational lifetime of Morven North and therefore also having low levels of potential temporal overlap.	The construction and O&M phase of the MBAGC Project may occur simultaneously with the O&M phase of Morven North and includes cable installation, cable repair, and reburial events. The MBAGC Project export cable installation, repair and reburial activities will be undertaken in close proximity to Morven North, using similar parameters and techniques to those associated with the inter-array and interconnector cable installation activities for Morven North (as presented in Table 9.10). The maintenance activities, therefore, are likely to result in a similar level of increased SSCs and associated deposition, with a limited and localised spatial extent, with the impact only occurring intermittently across the operational lifetime of Morven North and therefore also having low levels of potential temporal overlap.
Physical attributes	The following physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the increased SSCs and associated deposition during the O&M phase: • extent; • structure; • supporting processes. The following can be concluded with respect to the physical attributes of the ocean quahog and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA, based on the physical attributes assessment in Section 9.10.1: • The impact on the physical attributes of the Firth of Forth Banks Complex MPA (extent, structure, and supporting processes) will be similar to that described for the alone assessment. This is due to the MHPGC Project being smaller in magnitude than Morven North and there being only a small chance of temporal or spatial overlap of any activities at the same time.	The following physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the increased SSCs and associated deposition during the O&M phase: • extent; • structure; • supporting processes. The following can be concluded with respect to the physical attributes of the ocean quahog and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA, based on the physical attributes assessment in Section 9.10.1: • The impact on the physical attributes of the Firth of Forth Banks Complex MPA (extent, structure, and supporting processes) will be similar to that described for the alone assessment. This is due to the MBAGC Project being smaller in magnitude than Morven North, and not including any foundation installation activities, as well as there being only

	Whole Project assessment	
		a small chance of temporal or spatial of any activities at the same time.
Conclusion of attribute assessment	It can be concluded that increased SSCs and associated deposition during the Scenario 1 O&M phase **will not, and cannot reasonably be expected to, lead to a significant risk of hindering the achievement of the conservation objective** of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons: • The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and offshore subtidal sands and gravels features will not be significantly negatively impacted by the O&M activities of Morven North, and the construction and O&M activities of MHPGC Project. This is due to only small increases in SSCs, and associated deposition anticipated to reach the Firth of Forth Banks Complex MPA, with conditions returning to the baseline within a few tidal cycles.	It can be concluded that increased SSCs and associated deposition during the Scenario 2 O&M phase **will not, and cannot reasonably be expected to, lead to a significant risk of hindering the achievement of the conservation objective** of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons: • The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and offshore subtidal sands and gravels features will not be significantly negatively impacted by the O&M activities of Morven North and the construction and O&M activities of MBAGC Project. This is due to only small increases in SSCs, and associated deposition anticipated to reach the Firth of Forth Banks Complex MPA, with conditions returning to the baseline within a few tidal cycles.
Decommissioning phase		
Magnitude of impact	The Whole Project assessment for Scenario 1 considers Morven North together with MHPGC Project. The decommissioning phase of the MHPGC Project may occur simultaneously with the decommissioning phase of Morven North. Due to the relationship of the projects, it is assumed the construction and O&M phase of the MHPGC Project will not occur during the decommissioning phase of Morven North. There is the potential for the MHPGC Project decommissioning activities to include cable removal, although it is anticipated that offshore cables will be removed where possible and appropriate to do so, with the approach reviewed at the time of decommissioning following the most up to date and good practice industry guidance, and also that any offshore cable protection may be left in-situ (as presented in Table 9.10). For the purpose of this MPA Assessment, it is assumed that all cables	The Whole Project assessment for Scenario 2 considers Morven North together with MBAGC Project. The decommissioning phase of the MBAGC Project may occur simultaneously with the decommissioning phase of Morven North. Due to the relationship of the projects, it is assumed the O&M phase of the MBAGC Project will not occur during the decommissioning phase of Morven North. There is the potential for the MBAGC Project decommissioning activities to include cable removal, although it is anticipated that offshore cables will be removed where possible and appropriate to do so and any offshore cable protection may be left in-situ (as presented in Table 9.10). For the purpose of this MPA Assessment, it is assumed that all cables and cable protection will be removed, as this will cause the greatest increased in SSC and associated deposition. Any direct impacts from jack-up vessels and

	Whole Project assessment	
	and cable protection will be removed, as this will cause the greatest increased in SSC and associated deposition. Any direct impacts from jack-up vessels and anchor placements will be similar to the construction phase, with similar recovery periods. Therefore, the cumulative impact with Morven North is expected to be minimal.	anchor placements will be similar to the construction phase, with similar recovery periods. Therefore, the cumulative impact with Morven North is expected to be minimal.
Physical attributes	The following physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the increased SSCs and associated deposition during the decommissioning phase: • extent; • structure; • supporting processes. The following can be concluded with respect to the physical attributes of the ocean quahog and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA, based on the physical attributes assessment in Section 9.10.1: • The impact on the physical attributes of the Firth of Forth Banks Complex MPA (extent, structure, and supporting processes) will be similar to that described for the alone assessment. This is due to the MHPGC Project being smaller in magnitude than Morven North and there being only a small chance of temporal or spatial overlap of any activities at the same time.	The following physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the increased SSCs and associated deposition during the decommissioning phase: • extent; • structure; • supporting processes. The following can be concluded with respect to the physical attributes of the ocean quahog and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA, based on the physical attributes assessment in Section 9.10.1: • The impact on the physical attributes of the Firth of Forth Banks Complex MPA (extent, structure, and supporting processes) will be similar to that described for the alone assessment. This is due to the MBAGC Project being smaller in magnitude than Morven North, and not including any foundation installation activities, as well as there being only a small chance of temporal or spatial of any activities at the same time.
Conclusion of attribute assessment	It can be concluded that increased SSCs and associated deposition during the Scenario 1 decommissioning phase **will not, and cannot reasonably be expected to, lead to a significant risk of hindering the achievement of the conservation objective** of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons:	It can be concluded that increased SSCs and associated deposition during the Scenario 2 decommissioning phase **will not, and cannot reasonably be expected to, lead to a significant risk of hindering the achievement of the conservation objective** of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons:

	Whole Project assessment	
	• The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and offshore subtidal sands and gravels features will not be significantly negatively impacted by the decommissioning activities of Morven North and the MHPGC Project. This is due to only small increases in SSCs, and associated deposition anticipated to reach the Firth of Forth Banks Complex MPA, with conditions returning to the baseline within a few tidal cycles.	• The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and offshore subtidal sands and gravels features will not be significantly negatively impacted by the decommissioning activities of Morven North and the MBAGC Project. This is due to only small increases in SSCs, and associated deposition anticipated to reach the Firth of Forth Banks Complex MPA, with conditions returning to the baseline within a few tidal cycles.

Table 9.15: Morven North cumulative effects assessment for increased Suspended Sediment Concentrations and associated deposition

	Cumulative effects assessment
	Scenario 4: Morven North and Tier 1, Tier 2 and Tier 3 Projects
Construction phase	
Magnitude of impact	The cumulative effects assessment for Scenario 4 considers Morven North together with the Tier 1, Tier 2 and Tier 3 projects below. **Tier 1** Tier 1 includes the Ossian OWF and Morven South, alongside Morven North (as presented in Table 9.10). The construction phase of Ossian OWF may also occur simultaneously with the construction phase of Morven North and includes activities such as site preparation/sandwave clearance, and export cable trenching, which will give rise to increased SSCs. The O&M phase of Ossian OWF and Morven South may occur simultaneously with the construction phase of Morven North and includes cable repair and reburial events. Ossian OWF is located 9km from the Morven North Boundary directly to the east and southeast and is proposed for up to 265 wind turbines. There will be limited opportunity for the amalgamation of sediment plumes from these projects, given the orientation of the tides in a predominantly north northeast to south southwest direction which would carry the sediment away from the sediment plumes produced by Morven North. Collectively the impact is not anticipated to be significantly greater than for the alone assessment. The potential exists for the tier 1 projects Berwick Bank Wind Farm, the Cambois Connection, Seagreen 1 OWF, and Seagreen 1A OWF construction activities to have potential cumulative impacts on the Firth of Forth Banks Complex MPA static benthic receptors alongside Morven North construction activities (with the justification for inclusion explained in paragraphs 9.11.1.13 to 9.11.1.15). The MPA Assessments for Berwick Bank Wind Farm (SSE Renewables, 2022), the Cambois Connection (SSE Renewables, 2023), Seagreen 1 OWF

	Cumulative effects assessment
	(Seagreen Wind Energy Limited, 2014), and Seagreen 1A OWF (Seagreen Wind Energy Limited, 2021) concluded there would be no hindrance or risk of a significant impact to the conservation objectives alone or cumulatively on the Firth of Forth Banks Complex MPA receptors. In combination with the lack of hindrance of conservation objectives caused by the increased SSCs and associated deposition from activities for Morven North, and the distance between the projects as well as the time between construction programmes for all projects, the likelihood of a significant cumulative impact is minimal. Therefore, for increased SSCs and associated deposition, there would be no overall cumulative impact on the ocean quahog aggregations and offshore subtidal sands and gravels receptors alongside Morven North during the construction phase. **Tier 2** Tier 2 includes Bowdun Offshore Wind Project, Ossian OWF Export Cable, the Eastern Green Link 3 cable and the MHPGC Project, alongside all tier 1 projects. The construction phase of Bowdun, Ossian OWF Export Cable, the Eastern Green Link 3 cable, and the MHPGC Project may also occur simultaneously with the construction phase of Morven North (as presented in Table 9.10) and includes activities such as site preparation/sandwave clearance, foundation installation, and export cable trenching, which will give rise to increased SSCs. The O&M phase of Bowdun Offshore Wind Project, the Ossian OWF Export Cable, the Eastern Green Link 3 cable, and the MHPGC Project may occur simultaneously with the construction phase of Morven North and includes cable repair and reburial events. Bowdun Offshore Wind Project (60 wind turbines and an associated export cable corridor) is located 10km to the north west of the Morven North Boundary (but within the maximum 14km defined for the Benthic ZoI) and is unlikely to have potential for the amalgamation of plumes from Morven North construction activities for either the installation of wind turbines and associated foundations or the burial of the export cable corridor, both of which could increase SSCs and associated deposition, due to the orientation of the tides reducing the potential for sediment plume overlap with the plumes from Morven North. Construction or O&M activities from the Ossian OWF Export Cable may be undertaken in close proximity to Morven North and should they be undertaken concurrently, there is potential for the amalgamation of plumes, increased deposition and a negligible amount of remobilised and redistributed material. These activities would be of limited spatial extent and frequency and plume interactions likely of a low magnitude and short duration. The majority of sedimentation would occur within close proximity to each activity due to the low sediment transport rates in the area. Tier 3 Tier 3 includes the MBAGC Project alongside Morven North and all tier 1 and 2 projects. The construction of the MBAGC Project may occur simultaneously with the construction phase of Morven North (as presented in Table 9.10). Currently no scoping report has been published for the MBAGC Project, however the MBAGC Project site preparation and offshore cable installation will be undertaken in close proximity to Morven North, likely using similar parameters and techniques to those associated with the inter-array and interconnector cable installation for Morven North. The O&M phase of the MBAGC Project may also occur simultaneously with the construction phase of Morven North, and will include repair and reburial events, similar to the MHPGC Project, and with a reduced impact compared to the construction phase.

	Cumulative effects assessment
Physical attributes	Tier 1 The following physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the increased SSCs and associated deposition during the construction phase: • extent; • structure; • supporting processes. The following can be concluded with respect to the physical attributes of the ocean quahog and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA, based on the physical attributes assessment in Section 9.10.1: • The impact on the physical attributes of the Firth of Forth Banks Complex MPA (extent, structure, and supporting processes) will be similar to that described for the alone assessment, as the additional projects do not cause an overall significant cumulative impact when assessed cumulatively with Morven North. Tier 2 The following physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the increased SSCs and associated deposition during the construction phase: • extent; • structure; • supporting processes. The following can be concluded with respect to the physical attributes of the ocean quahog and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA, based on the physical attributes assessment in Section 9.10.1: • The impact on the physical attributes of the Firth of Forth Banks Complex MPA (extent, structure, and supporting processes) will be similar to that described for the alone assessment, as the additional projects do not cause an overall significant cumulative impact when assessed cumulatively with Morven North. Tier 3 The following physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the increased SSCs and associated deposition during the construction phase: • extent;

	Cumulative effects assessment
	• structure; • supporting processes. The following can be concluded with respect to the physical attributes of the ocean quahog and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA, based on the physical attributes assessment in Section 9.10.1: • The impact on the physical attributes of the Firth of Forth Banks Complex MPA (extent, structure, and supporting processes) will be similar to that described for the alone assessment, as the additional projects do not cause an overall significant cumulative impact when assessed cumulatively with Morven North.
Conclusion of attribute assessment	Tier 1 It can be concluded that increased SSCs and associated deposition during the Scenario 4 construction phase **will not, and cannot reasonably be expected to, lead to a significant risk of hindering the achievement of the conservation objective** of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons: • The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and offshore subtidal sands and gravels features will not be significantly negatively impacted by the construction activities of Morven North and the tier 1 projects. This is due to only small increases in SSCs and associated deposition anticipated to reach the Firth of Forth Banks Complex MPA, with conditions returning to the baseline within a few tidal cycles. Tier 2 It can be concluded that increased SSCs and associated deposition during the Scenario 4 construction phase **will not, and cannot reasonably be expected to, lead to a significant risk of hindering the achievement of the conservation objective** of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons: • The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and offshore subtidal sands and gravels features will not be significantly negatively impacted by the construction and O&M activities of Morven North and the tier 2 and tier 1 projects. This is due to only small increases in SSCs and associated deposition anticipated to reach the Firth of Forth Banks Complex MPA, with conditions returning to the baseline within a few tidal cycles. Tier 3 It can be concluded that increased SSCs and associated deposition during the Scenario 4 construction phase **will not, and cannot reasonably be expected to, lead to a significant risk of hindering the achievement of the conservation objective** of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons: • The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and offshore subtidal sands and gravels features will not be significantly negatively impacted by the construction and O&M activities of Morven North and the tier 3, tier 2, and tier 1 projects. This is due to only small increases in SSCs and associated deposition anticipated to reach the Firth of Forth Banks Complex MPA, with conditions returning to the baseline within a few tidal cycles.

	Cumulative effects assessment
O&M phase	
Magnitude of impact	The cumulative effects assessment for Scenario 4 considers Morven North together with the Tier 1, Tier 2 and Tier 3 projects below. Tier 1 Tier 1 includes Ossian OWF and Morven South alongside Morven North. The O&M phase of Ossian OWF, and Morven South may occur simultaneously with the O&M phase of Morven North (as presented in Table 9.10) and includes cable repair and reburial events. The construction phase of Morven South may also occur simultaneously with the O&M phase of Morven North and will include activities such as site preparation/sandwave clearance, foundation installation (for Morven South) and export cable trenching, which will give rise to increased SSCs. The decommissioning phases of Morven South and Ossian OWF also may align with the O&M phase of Morven North and may include cable removal. Ossian OWF is located 9km from the Morven North Boundary directly to the east and southeast. There will be limited opportunity for the amalgamation of sediment plumes from these projects, given the orientation of the tides in a predominantly north northeast to south southwest direction which would carry the sediment away from the sediment plumes produced by Morven North. It is noted that a limited increases in SSCs may occur due to the mooring lines interacting with the seabed as part of the Ossian OWF, however, plumes are not expected to amalgamate with Morven North. The magnitude of the impact is not anticipated to be significantly greater than the project alone for this impact with the addition of this tier 1 project, with the construction phase of Morven South the most critical to the potential increase in SSCs and associated deposition. The potential exists for the tier 1 projects Berwick Bank Wind Farm, the Cambois Connection, Seagreen 1 OWF, and Seagreen 1A OWF O&M activities to have potential cumulative impacts on the Firth of Forth Banks Complex MPA static benthic receptors alongside Morven North O&M activities (with the justification for inclusion explained in paragraphs 9.11.1.13 to 9.11.1.15). The MPA Assessments for Berwick Bank Wind Farm (SSE Renewables, 2022), the Cambois Connection (SSE Renewables, 2023), Seagreen 1 OWF (Seagreen Wind Energy Limited, 2014), and Seagreen 1A OWF (Seagreen Wind Energy Limited, 2021) concluded there would be no hindrance or risk of a significant impact to the conservation objectives alone or cumulatively on the Firth of Forth Banks Complex MPA receptors. In combination with the lack of hindrance of conservation objectives caused by the increased SSCs and associated deposition from activities for Morven North, and the distance between the projects as well as the time between construction programmes for all projects, the likelihood of a significant cumulative impact is minimal. Therefore, for increased SSCs and associated deposition, there would be no overall cumulative impact on the ocean quahog aggregations and offshore subtidal sands and gravels receptors alongside Morven North during the construction phase. Tier 2 Tier 2 includes Bowdun OWF, the Ossian OWF Export Cable, the Eastern Green Link 3 cable, and MHPGC Project alongside Morven North and all tier 1 projects. Bowdun Offshore Wind Project (60 wind turbines and an associated export cable corridor) is located 10km to the north west of the Morven North Boundary and is unlikely to have potential for the amalgamation of plumes from Morven North O&M activities for either the installation of wind turbines and associated foundations or the burial of the export cable corridor, both of which could increase SSCs and associated

	Cumulative effects assessment
	deposition, due to the orientation of the tides reducing the potential for sediment plume overlap with the plumes from Morven North. The O&M phase of the Ossian OWF Export Cable and Eastern Green Link 3 cable, and the construction and O&M phases of the MHPGC Project may occur simultaneously with the O&M phase of Morven North (as presented in Table 9.10) and includes cable installation, repair and reburial events. The construction phase of the Ossian OWF Export Cable and Eastern Green Link 3 cable may also occur simultaneously with the O&M phase of Morven North and includes activities such as site preparation/sandwave clearance, foundation installation, and export cable trenching, which will give rise to increased SSCs. The decommissioning phase of the Ossian OWF Export Cable also may align with the O&M phase of Morven North and may include cable and foundation removal. Activities from Ossian OWF Export Cable may be undertaken in close proximity to Morven North and should they be undertaken concurrently, there is potential for the amalgamation of plumes, increased deposition and a negligible amount of remobilised and redistributed material. These activities would be of limited spatial extent and frequency and plume interactions likely of a low magnitude and short duration due to the orientation of the tides in this area likely causing plumes to be carried away from those produced by Morven North. The majority of sedimentation would occur within close proximity to each activity due to the low sediment transport rates in the area, and therefore the overall magnitude is unlikely to significantly increase. Tier 3 Tier 3 includes the MBAGC Project alongside Morven North and all tier 1 and 2 projects. Currently no scoping report has been published for the MBAGC Project, therefore the scale and specific impact of the construction and O&M activities involved in this project are unknown but are likely to be similar, if not much smaller than Morven North.
Physical attributes	Tier 1 The following physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the increased SSCs and associated deposition during the O&M phase: • extent; • structure; • supporting processes. The following can be concluded with respect to the physical attributes of the ocean quahog and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA, based on the physical attributes assessment in Section 9.10.1: • The impact on the physical attributes of the Firth of Forth Banks Complex MPA (extent, structure, and supporting processes) will be similar to that described for the alone assessment, and the additional projects do not cause an overall significant cumulative impact when assessed cumulatively with Morven North. Tier 2 The following physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the increased SSCs and associated deposition during the O&M phase:

	Cumulative effects assessment
	• extent; • structure; • supporting processes. The following can be concluded with respect to the physical attributes of the ocean quahog and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA, based on the physical attributes assessment in Section 9.10.1: • The impact on the physical attributes of the Firth of Forth Banks Complex MPA (extent, structure, and supporting processes) will be similar to that described for the alone assessment, and the additional projects do not cause an overall significant cumulative impact when assessed cumulatively with Morven North. Tier 3 The following physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the increased SSCs and associated deposition during the O&M phase: • extent; • structure; • supporting processes. The following can be concluded with respect to the physical attributes of the ocean quahog and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA, based on the physical attributes assessment in Section 9.10.1: • The impact on the physical attributes of the Firth of Forth Banks Complex MPA (extent, structure, and supporting processes) will be similar to that described for the alone assessment, and the additional projects do not cause an overall significant cumulative impact when assessed cumulatively with Morven North.
Conclusion of attribute assessment	Tier 1 It can be concluded that increased SSCs and associated deposition during the Scenario 4 O&M phase **will not, and cannot reasonably be expected to, lead to a significant risk of hindering the achievement of the conservation objective** of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons: • The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and offshore subtidal sands and gravels features will not be significantly negatively impacted by the O&M activities of Morven North and the tier 1 projects. This is due to only small increases in SSCs and associated deposition anticipated to reach the Firth of Forth Banks Complex MPA, with conditions returning to the baseline within a few tidal cycles. Tier 2

	Cumulative effects assessment
	It can be concluded that increased SSCs and associated deposition during the Scenario 4 O&M phase **will not, and cannot reasonably be expected to, lead to a significant risk of hindering the achievement of the conservation objective** of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons: • The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and offshore subtidal sands and gravels features will not be significantly negatively impacted by the construction and O&M activities of Morven North and the tier 2 and tier 1 projects. This is due to only small increases in SSCs and associated deposition anticipated to reach the Firth of Forth Banks Complex MPA, with conditions returning to the baseline within a few tidal cycles. Tier 3 It can be concluded that increased SSCs and associated deposition during the Scenario 4 O&M phase **will not, and cannot reasonably be expected to, lead to a significant risk of hindering the achievement of the conservation objective** of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons: • The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and offshore subtidal sands and gravels features will not be significantly negatively impacted by the construction and O&M activities of Morven North and the tier 3, tier 2, and tier 1 projects. This is due to only small increases in SSCs and associated deposition anticipated to reach the Firth of Forth Banks Complex MPA, with conditions returning to the baseline within a few tidal cycles.
Decommissioning phase	
Magnitude of impact	The cumulative effects assessment for Scenario 4 considers Morven North together with the Tier 1, Tier 2 and Tier 3 projects below. Tier 1 Tier 1 includes Ossian OWF and Morven South alongside Morven North. The O&M phase of Ossian OWF and Morven South may occur simultaneously with the decommissioning phase of Morven North and includes cable repair and reburial events. The decommissioning phase of Ossian OWF and Morven South may also occur simultaneously with the decommissioning phase of Morven North and includes cable and foundation removal. Ossian OWF is located 9km from the Morven North Boundary directly to the east and southeast. There will be limited opportunity for the amalgamation of sediment plumes from these projects, given the orientation of the tides in a predominantly north northeast to south southwest direction, which would carry the sediment away from the sediment plumes produced by Morven North. It is noted that a limited increases in SSCs may occur due to the mooring lines interacting with the seabed as part of the Ossian OWF, however, plumes are not expected to amalgamate with Morven North. The magnitude of the impact is not anticipated to be significantly greater than the project alone for this impact as it is unlikely concurrent activities will be undertaken in the same location. Tier 2 Tier 2 includes Bowdun OWF, the Ossian OWF Export Cable, and the MHPGC Project alongside Morven North, as well as the tier 1 projects.

	Cumulative effects assessment
	Bowdun Offshore Wind Project (60 wind turbines and an associated export cable corridor) is located 10km to the north west of the Morven North Boundary and is unlikely to have potential for the amalgamation of plumes from Morven North decommissioning activities for either the installation of wind turbines and associated foundations or the burial of the export cable corridor, both of which could increase SSCs and associated deposition, due to the orientation of the tides reducing the potential for overlap of sediment plumes with plumes from Morven North. The O&M phase of the Ossian OWF Export Cable may occur simultaneously with the decommissioning phase of Morven North and includes cable repair and reburial events. The decommissioning phase of the Ossian OWF Export Cable and the MHPGC Project may also occur simultaneously with the decommissioning phase of Morven North and includes cable and foundation removal. Activities from Ossian OWF Export Cable may be undertaken in close proximity to Morven North and should they be undertaken concurrently, there is potential for the amalgamation of plumes, increased deposition and a negligible amount of remobilised and redistributed material. These activities would be of limited spatial extent and frequency and plume interactions likely of a low magnitude and short duration. The majority of sedimentation would occur within close proximity to each activity due to the low sediment transport rates in the area. With no construction activities to consider under this phase, the additional cumulative magnitude of the impact during decommissioning is likely to be less than during the Morven North construction or O&M phases. Tier 3 Tier 3 includes the MBAGC Project alongside Morven North and all tier 1 and 2 projects. Currently no scoping report has been published for the MBAGC Project, therefore the scale and specific impact of the decommissioning phase of this project is unknown but is likely to be similar, if not much smaller than Morven North.
Physical attributes	Tier 1 The following physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the increased SSCs and associated deposition during the decommissioning phase: • extent; • structure; • supporting processes. The following can be concluded with respect to the physical attributes of the ocean quahog and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA, based on the physical attributes assessment in Section 9.10.1: • The impact on the physical attributes of the Firth of Forth Banks Complex MPA (extent, structure, and supporting processes) will be similar to that described for the alone assessment and the additional projects do not cause an overall significant cumulative impact when assessed cumulatively with Morven North.

	Cumulative effects assessment
	Tier 2 The following physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the increased SSCs and associated deposition during the decommissioning phase: • extent; • structure; • supporting processes. The following can be concluded with respect to the physical attributes of the ocean quahog and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA, based on the physical attributes assessment in Section 9.10.1: • The impact on the physical attributes of the Firth of Forth Banks Complex MPA (extent, structure, and supporting processes) will be similar to that described for the alone assessment and the additional projects do not cause an overall significant cumulative impact when assessed cumulatively with Morven North. Tier 3 The following physical attributes of the ocean quahog aggregations and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA are relevant as they may be affected by the increased SSCs and associated deposition during the decommissioning phase: • extent; • structure; • supporting processes. The following can be concluded with respect to the physical attributes of the ocean quahog and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA, based on the physical attributes assessment in Section 9.10.1: • The impact on the physical attributes of the Firth of Forth Banks Complex MPA (extent, structure, and supporting processes) will be similar to that described for the alone assessment, and the additional projects do not cause an overall significant cumulative impact when assessed cumulatively with Morven North.
Conclusion of attribute assessment	Tier 1 It can be concluded that increased SSCs and associated deposition during the Scenario 4 decommissioning phase **will not, and cannot reasonably be expected to, lead to a significant risk of hindering the achievement of the conservation objective** of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons: • The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and offshore subtidal sands and gravels features will not be significantly negatively impacted by the decommissioning activities of Morven North and the tier 1 projects. This

	Cumulative effects assessment
	is due to only small increases in SSCs and associated deposition anticipated to reach the Firth of Forth Banks Complex MPA, with conditions returning to the baseline within a few tidal cycles. Tier 2 It can be concluded that increased SSCs and associated deposition during the Scenario 4 decommissioning phase **will not, and cannot reasonably be expected to, lead to a significant risk of hindering the achievement of the conservation objective** of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons: • The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and offshore subtidal sands and gravels features will not be significantly negatively impacted by the decommissioning activities of Morven North and the tier 2 and tier 1 projects. This is due to only small increases in SSCs and associated deposition anticipated to reach the Firth of Forth Banks Complex MPA, with conditions returning to the baseline within a few tidal cycles. Tier 3 It can be concluded that increased SSCs and associated deposition during the Scenario 4 O&M phase **will not, and cannot reasonably be expected to, lead to a significant risk of hindering the achievement of the conservation objective** of restoring both ocean quahog aggregations and offshore subtidal sands and gravels features to a favourable condition for the following reasons: • The **extent**, **structure**, and **supporting processes** of the ocean quahog aggregations and offshore subtidal sands and gravels features will not be significantly negatively impacted by the decommissioning activities of Morven North and the tier 3, tier 2, and tier 1 projects. This is due to only small increases in SSCs and associated deposition anticipated to reach the Firth of Forth Banks Complex MPA, with conditions returning to the baseline within a few tidal cycles.

9.12 Proposed monitoring

9.12.1.1 The potential effects to the Firth of Forth Banks Complex MPA designated features will not lead to a significant risk of hindering the achievement of the conservation objectives of maintaining or recovering the features to good condition, with the current acknowledgement of the Designed-in measures (Table 9.8). Accordingly, no monitoring is required.

9.13 Conclusion

9.13.1 Marine Protected Area screening

9.13.1.1 The screening stage of this MPA Assessment identified a single MPA, the Firth of Forth Banks Complex MPA, with the potential to be affected (other than insignificantly) by the indirect impacts from construction, O&M, and decommissioning phases of Morven North. The Firth of Forth Banks Complex MPA was therefore carried through to a Stage 1 assessment for a full assessment against the relevant conservation objectives in relation to the potential indirect impacts arising from the construction, O&M, and decommissioning of Morven North.

9.13.2 Marine Protected Area Stage 1 Assessment

9.13.2.1 This Stage 1 assessment considered the effects of Morven North construction, O&M, and decommissioning phases on the ocean quahog aggregations and offshore subtidal sands and gravels protected features of the Firth of Forth Banks Complex MPA. This included consideration of effects on physical attributes and targets of the relevant protected features, and subsequently on the conservation objectives, using the best available scientific evidence to support the assessment process and with due regard to the relevant Conservation and Management Advice JNCC (2014b).

9.13.2.2 As there is no spatial overlap between the Firth of Forth Banks Complex MPA and Morven North, no direct effects have been screened in for assessment. Indirect effects during the construction, O&M and decommissioning phases associated with increased SSC and associated deposition, and changes in physical processes were assessed.

9.13.2.3 Cumulative effects on features of the Firth of Forth Banks Complex MPA resulting from Ossian OWF, Bowdun OWF, the Ossian OWF Export Cable, and the MHPGC Project, MBAGC Project, and Morven South were also considered in the Stage 1 assessment. Additionally, the Berwick Bank Wind Farm, Cambois Connection, Seagreen 1 Offshore Windfarm, and Seagreen 1A Offshore Wind Farm projects were also assessed for cumulative impacts on the Firth of Forth Banks Complex MPA features, although these projects are located outside of the Benthic ZoI.

9.13.2.4 The assessment of impacts to both protected features concluded that the conservation objective of restoring the ocean quahog aggregations and offshore subtidal sands and gravels protected features to favourable condition will not be hindered by the construction, O&M, or decommissioning phases of Morven North in isolation or cumulatively with any other project or activity.

9.13.2.5 No significant risks to the achievement of the Firth of Forth Banks Complex MPA conservation objectives have been identified in the Stage 1 assessment, and as a result a Stage 2 assessment is not required.

9.14 References

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