Neart na Gaoithe

Neart na Gaoithe Offshore Wind Farm

Offshore Transmission Works Marine Licence Variation: Supporting Environmental Information Report

July 2020

Rev 1.0

DOCUMENT REFERENCE: NNG-GOB-ECF-REP-0005

Neart na Gaoithe Offshore Wind Farm

Offshore Transmission Works Marine Licence Variation: Supporting Environmental Information Report

SIGN OFF		
Name (Role)	Signature	Date
Approved by: David Sweenie NnGOWL Development Manager	[Redacted]	23/07/2020
Reviewed by: Claire Gilchrist NnGOWL Offshore Consents Manager		22/07/2020
Prepared by: Fraser Malcolm GoBe Consultants		21/07/2020

Contents

Figures

Tables

Acronyms and Abbreviations

TERM	DESCRIPTION
AC	Alternating Current
AEZ	Archaeological Exclusion Zone
AIS	Automatic Identification System
AHT	Anchor Handling Tug
CBRA	Cable Burial Risk Assessment
CLV	Cable Lay Vessel
DSV	Dive Support Vessel
DoL	Depth of Lowering
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
ES	Environmental Statement
FLO	Fisheries Liaison Officer
FMMS	Fisheries Management and Mitigation Strategy
HRA	Habitats Regulations Assessment
HDD	Horizontal Directional Drilling
HDPE	High-Density Polyethylene
IEC	International Electrical Commission
LAT	Lowest Astronomical Tide
LSE	Likely Significant Effect
MBES	Multibeam Echo Sounder
MHWS	Mean High Water Spring
MLWS	Mean Low Water Spring
MOD	Ministry of Defence
MS-LOT	Marine Scotland Licensing Operations Team
NLB	Northern Lighthouse Board

TERM	DESCRIPTION
NSVMP	Navigational Safety and Vessel Management Plan
NtM	Notice to Mariners
OECC	Offshore Export Cable Corridor
OSP	Offshore Substation Platforms
O&M	Operation and Maintenance
OSV	Offshore Support Vessel
PLGR	Pre-Lay Grapnel Run
pSPA	proposed Special Protection Area
PVC	Polyvinyl Chloride
ROV	Remotely Operated Vehicle
SEIS	Supplementary Environmental Information Statement
SBP	Sub-Bottom Profiler
SPA	Special Protection Area
SSS	Sidescan Sonar
TJB	Transition Joint Bay
UKHO	United Kingdom Hydrographic Office
WSI and PAD	Written Scheme of Investigation and Protocol for Archaeological Discovery
XLPE	Cross-Linked Polyethylene

Defined Terms

TERM	DESCRIPTION
Addendum	The Addendum of Additional Information submitted to the Scottish Ministers by NnGOWL on 26 July 2018.
Application	The Environmental Impact Assessment Report, Habitats Regulations Appraisal Report submitted to the Scottish Ministers by NnGOWL on 16 March 2018; the Addendum of Additional Information submitted to the Scottish Ministers by NnGOWL on 26 July 2018 and the Section 36 Consent Variation Report dated 08 January 2019.

TERM	DESCRIPTION
Company	Neart na Gaoithe Offshore Wind Limited (NnGOWL) (Company Number SC356223). NnGOWL has been established to develop, finance, construct, operate, maintain and decommission the Project.
Consent Conditions	The terms that are imposed on the Company under the Offshore Consents that must be complied with.
Consent Plans	The plans, programmes or strategies required to be approved by the Scottish Ministers (in consultation with appropriate stakeholders) in order to discharge the Consent Conditions.
Contractors	Any Contractor/Supplier (individual or firm) working on the Project, hired by NnGOWL.
EIA Report	The Environmental Impact Assessment Report, dated March 2018, submitted to the Scottish Ministers by NnGOWL as part of the Application.
Inter-array Cables	The offshore cables connecting the wind turbines to one another and to the OSPs.
Interconnector Cables	The offshore cables connecting the OSPs to one another.
Marine Licences	The written consents granted by the Scottish Ministers under the Marine (Scotland) Act 2010, for construction works and deposits of substances or objects in the Scottish Marine Area in relation to the Wind Farm (Licence Number 06677/19/0) and the OfTW (Licence Number 06678/19/1), dated 4 June 2019 and 5 June 2019 respectively.
Offshore Consents	The Section 36 Consent and the Marine Licences.
Offshore Export Cable Corridor	The area within which the offshore export cables are to be located.
Offshore Export Cable Corridor Extension Area	The area currently outwith the consented Offshore Export Cable Corridor (OECC) and subject to a further Marine Licence Variation, within which short sections of the offshore export cables are to be located in order to avoid an obstruction within the originally consented corridor that forms part of the OfTW Area.
Offshore Export Cables	The offshore export cables connecting the Offshore Substation Platforms (OSPs) to the landfall site.
OfTW	The Offshore Transmission Works comprising the OSPs, offshore interconnector cables and offshore export cables required to connect the Wind Farm to the Onshore Transmission Works at the landfall.
OfTW Area	The area outlined in red and blue in Figure 1 attached to Part 4 of the OfTW Marine Licence.
OnTW	The onshore transmission works from landfall and above Mean High Water Springs (MHWS), consisting of onshore export cables and the onshore substation.
Original Application	The application letter, application form and Environmental Statement (ES) submitted to the Scottish Ministers by NnGOWL on 13 July 2012 for Section 36 Consent and Marine Licences together with the SEIS submitted to the Scottish Ministers by NnGOWL on 7 June 2013
Project	The Wind Farm and the OfTW.
Section 36 Consent	The written consent granted on 3 December 2018 by the Scottish Ministers under Section 36 of The Electricity Act 1989 to construct and operate the Wind Farm, as varied by the Scottish Ministers under Section 36C of the Electricity Act 1989 on 4 June 2019.

TERM	DESCRIPTION
Section 36 Consent Variation Report	The Section 36 Consent Variation Report submitted to the Scottish Ministers by NnGOWL as part of the Application as defined above on 08 January 2019.
Subcontractors	Any Contractor/Supplier (individual or firm) providing services to the Project, hired by the Contractors (not NnGOWL).
Wind Farm	The offshore array as assessed in the Application including wind turbines, their foundations and inter-array cabling.
Wind Farm Area	The area outlined in black in Figure 1 attached to the Section 36 Consent Annex 1, and the area outlined in red in Figure 1 attached to Part 4 of the Wind Farm Marine Licence.

1 Introduction

1.1 Project Background

1. Neart na Gaoithe Offshore Wind Farm Limited (NnGOWL) (Revised Design) received consent under Section 36 of the Electricity Act 1989 from the Scottish Ministers on 03 December 2018 (the S36 Consent) and was granted two Marine Licences by the Scottish Ministers, for the Wind Farm and the associated Offshore Transmission Works (OfTW), on 03 December 2018 (the Marine Licences).
2. The S36 consent and Wind Farm Marine Licence were revised by issue of a Variation to the S36 Consent and Marine Licence 06677/19/0 on 4 June 2019, and the OfTW Marine Licence by the issue of Marine Licence 06678/19/1 on the 5 June 2019. The revised S36 Consent and associated Marine Licences are collectively referred to as 'the Offshore Consents'.

1.2 Project Summary

3. The Wind Farm Area is located to the northeast of the Firth of Forth, 15.5 km directly east of Fife Ness on the east coast of Scotland. The Wind Farm Area covers approximately 105 km^2. Offshore Export Cables will be located within the 300 m wide Offshore Export Cable Corridor (OECC) running in an approximately southwest direction from the Wind Farm Area, making landfall at Thorntonloch beach to the south of Torness Power Station in East Lothian.
4. Figure 1-1 shows the Wind Farm Area and OECC, boundaries and cable route to shore.
5. The Offshore Consents allow for the construction and operation of the following main components, which together comprise the Project:
    - 54 wind turbines generating a maximum total output of 450 MW;
    - 54 jacket substructures installed on pre-piled foundations, to support the wind turbines;
    - Two alternating current (AC) substation platforms, referred to as Offshore Substation Platforms (OSPs), to collect the generated electricity and transform the electricity from 66 kV to 220 kV for transmission to shore;
    - Two jacket substructures installed on piled foundations, to support the OSPs;
    - A network of inter-array subsea cables, buried and/or mechanically protected, to connect strings of turbines together and to connect the turbines to the OSPs;
    - One interconnector cable connecting the OSPs to each other;
    - Two buried and/or mechanically protected, subsea offshore export cables to transmit the electricity from the OSPs to the landfall at Thorntonloch and connecting to the onshore buried export cables for transmission to the onshore substation and connection to the National Grid network; and
    - Minor ancillary works such as the deployment of metocean buoys and permanent navigational marks.
6. It is currently anticipated that offshore construction will take approximately three years and will commence in August 2020.

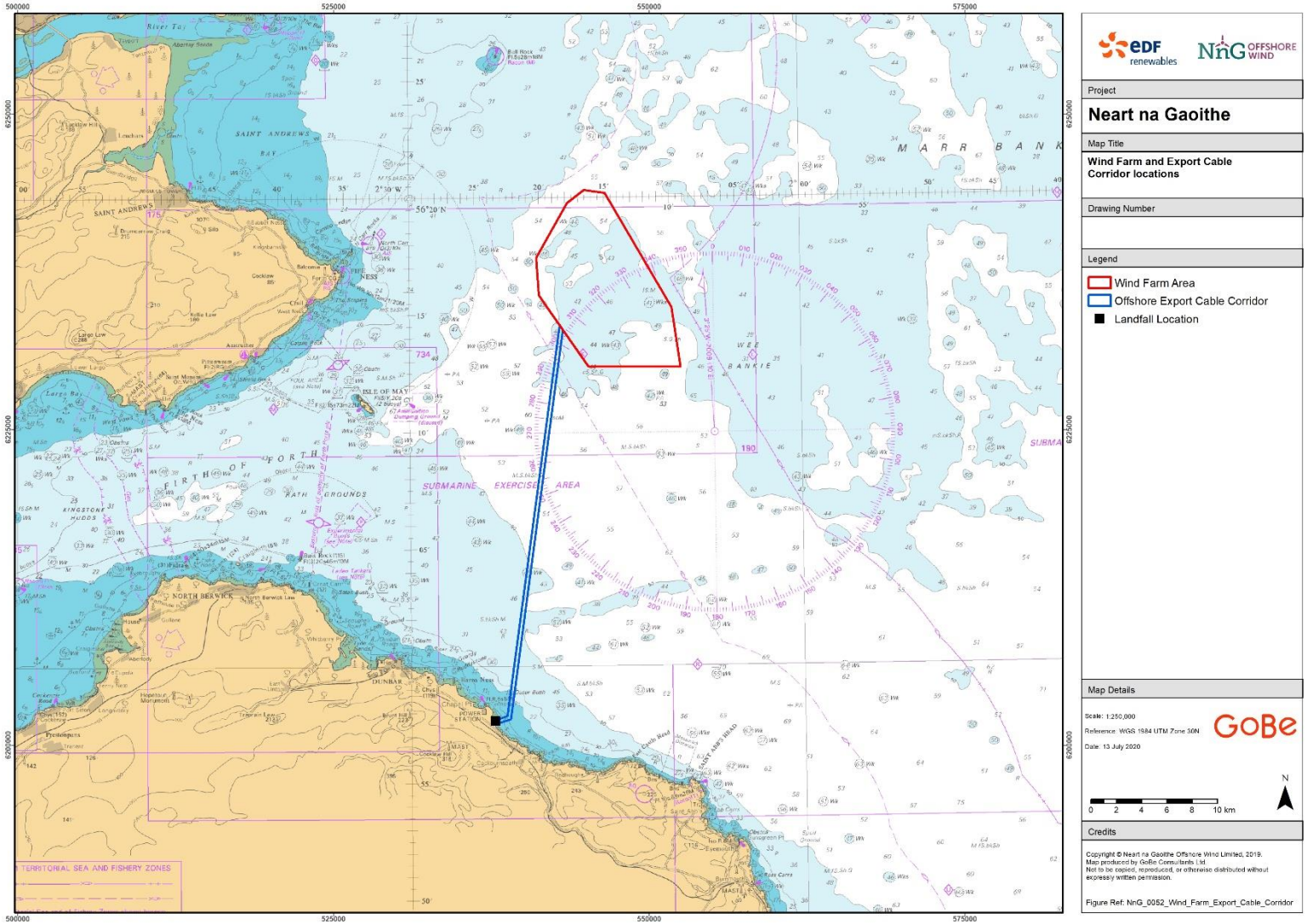


Figure 1-1: Location of Neart na Gaoithe Wind Farm and OECC

1.3 Document Purpose

7. The NnGOWL (Revised Design) S36 Consent and Marine Licences contain a variety of conditions that must be discharged through approval by the Scottish Ministers prior to the commencement of any offshore construction works. Offshore construction of the Wind Farm is due to commence in 2020 and NnGOWL is currently undertaking preparatory work to progress the necessary pre-construction conditions under the existing Offshore Consents.

8. NnGOWL commissioned pre-construction seabed surveys to inform the final design of the wind farm and offshore transmission infrastructure. Geophysical surveys comprising sidescan sonar (SSS), multibeam echo sounder (MBES) and sub-bottom profiler (SBP) was undertaken along the inter-array cable routes and OECC.

9. Following analysis of the geophysical survey data and progression of front-end engineering design work a number of constraints have been identified that require engineering solutions that are beyond the licensed activities and deposits covered by the current OfTW Marine Licence. NnGOWL are therefore seeking a Variation to the current OfTW Marine Licence to cover the following licensed activities and deposits.

   - **Addition of High-density Polyethylene (HDPE) or steel cable ducts to the Licensed Deposits**: Whilst the original application covered the activities and effects associated with installation of the Offshore Export Cable at landfall there is currently no provision within the licensed deposits set out in OfTW Marine Licence Condition 2.3 to account for the cable ducts. NnGOWL are therefore seeking the addition of materials to accommodate the cable ducts through which the offshore export cable will be pulled during construction at the landfall location during Horizontal Directional Drilling (HDD).
   - **Inclusion of trial trenching within the licensed activities**: NnGOWL would like to include trenching trials within the licensed activities to optimise the settings of the trenching tool to maximise burial success of surface laid cables to be completed prior to the export cable installation campaign. The original application covered the activities and effects associated with installation and removal of the offshore export cable, but the licensed deposits do not allow for the temporary and short-term deposit and removal of additional cable lengths.
   - **Extension to the Offshore Export Cable Corridor**: An obstruction has been identified at a single location across the OECC which would require extensive engineering solutions (including rock protection) to ensure export cables could be installed safely; further information on this obstruction is provided in Section 2. The preferred option is therefore to reroute around this obstruction. This would require rerouting outside of the currently consented OECC and into a small area directly adjacent to the OECC, hereafter referred to as the OECC Extension Area.
   - **Increase of the permitted grout volumes**: During finalisation of the OSP piled foundation design it has been identified that the current grout quantities set out in the Licensed Deposits Part 2 Section 2.3 of the OfTW Marine Licence are insufficient to accommodate the length of the grouted pile and casing connections are the OSP locations. NnGOWL are therefore seeking to increase the grout quantities set out in the OfTW Marine Licence.

10. NnGOWL are therefore seeking a Variation to the OfTW Marine Licence to cover the deposits and activities noted above.

11. This Supporting Environmental Information Report has been prepared in support of the application to vary the OfTW Marine Licence to MS-LOT for the changes to the licensed deposits and activities described within Section 2. This document reviews the proposed parameter changes and receptors

assessed within the Neart na Gaoithe Environmental Impact Assessment (EIA) Report (March 2018) and provides consideration of whether there will be any new potential impacts and/or any changes in significance of impact to what was described within the original application. The document is intended to provide the regulatory authorities (and their statutory advisers, where relevant) with the necessary supporting information to inform the Marine Licensing Variation process.

12. This report provides justification for the requested variation and explains why the changes can be considered as non-material.

1.4 Proposed programme of works

13. Offshore construction of the Project will commence in August 2020 and is scheduled to finish in September 2022.

14. Figure 1-2 sets out the construction programme for the Project and highlights the window for completion of the Works associated with this Marine Licence Variation. The orange bars indicate the construction windows where construction activities that are covered by the OfTW Marine Licence will be completed.

15. Works relevant to this OfTW Marine Licence variation are the landfall works scheduled between September 2020 and May 2021, the installation of the offshore export cables which will commence in July 2021 with a scheduled completion data of September 2021. And the OSP casing and pile installation which will be completed as part of the wider campaign which also includes turbine foundations scheduled between August 2020 and November 2021.

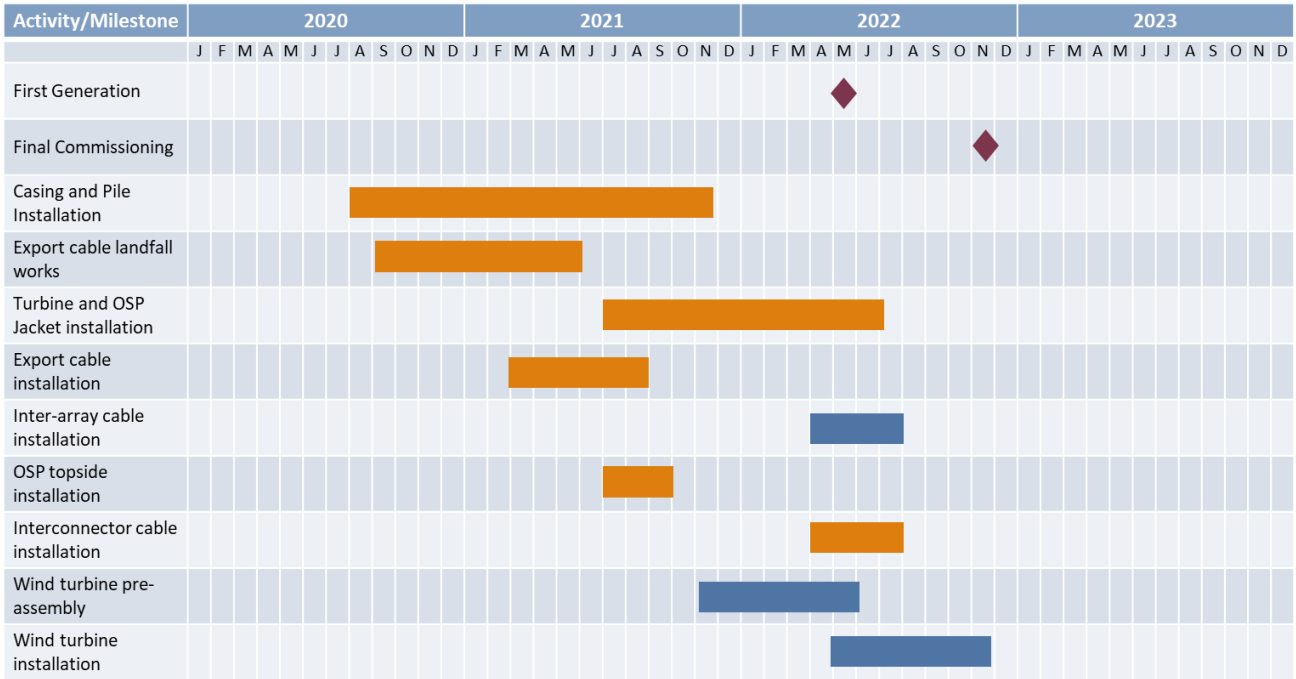


Figure 1-2: Neart na Gaoithe offshore construction programme.

1.5 Report Structure

16. This document provides information relating to the OECC Extension Area and the installation of cables therein. The structure and scope of sections is summarised below in Table 1-1.

Table 1-1: Document structure.

SECTION		OVERVIEW
1	Introduction	Provides an overview of the project background, the purpose of this document and a summary of the Marine Licence Variation.
2	Description of Proposed Changes	A description of the proposed changes to the licenced deposits and activities covered by the application to vary the OfTW Marine Licence.
3	Environmental Conditions	Summary of the physical, biological and human environmental baseline conditions within the OECC, Extension Area and within the Wind Farm as relevant to the offshore export cables.
4	Environmental Appraisal of the Proposed Amendments	Provides a high-level overview of the receiving environment and an assessment of the potential impacts from the proposed changes and consideration of cumulative effects.
5	Assessment of Likely Significant (LSE) and Adverse Effects on Integrity	Provides an assessment of the potential for the proposed changes, alone and in-combination with other plans or projects, to result in a LSE on any relevant European designated site.
6	Conclusions	Provides a conclusion of the receptors that are potentially sensitive to the proposed changes and a summary of the next steps involved with the acquisition of necessary consents and approvals for the Variation.

2 Description of the Proposed Changes

2.1 Introduction

17. This section sets out the proposed amendments to the consented Project Design Envelope taking into account the following considerations in respect of each change:

- The need for the amendment;
- Description of the proposed deposits or licensed activities; and
- Comparison with the consented envelope.

2.2 Addition of HDPE or Steel Cable Ducts to the Licensed Deposits

2.2.1 Need for the variation

18. Offshore export cable installation will commence with the export cables being pulled through a conduit from seaward of Mean Low Water Springs (MLWS) towards the TJB, which is positioned in a field landward of Thorntonloch beach. This conduit will be installed by means of HDD. Installation works associated with the conduit will be undertaken as a separate activity prior to cable installation and are expected to commence in September 2020.

19. Chapter 4 of the EIA Report (NNGOWL, 2018) described the HDD methodology required for export cable installation at the landfall location. Since the submission of the Application, detailed design has taken place and the installation methods at the landfall location described and considered within the EIA Report remain unchanged.

20. The Application describes the requirement for HDPE ducts to be installed under the beach between the TJB (onshore) and the HDD exit pit (nearshore). However, the licensed deposits set out in Part 2 of the OfTW Marine Licence Condition 2.3 does not provide an allowance for the horizontal cable ducts. NnGOWL are therefore seeking a Variation to the Marine Licence to accommodate the permanent deposit of the cable ducts. Further to the completion of detailed design, the duct pipe material will either be HDPE or steel.

21. The HDD methodology in the Application describes the duct installation as a 'pull through' method, however, it may be the case that the HDD ducts are installed by pushing from onshore toward the exit pit in the nearshore area. This approach reduces the number of vessels required in the nearshore area and aims to minimise risk of delays resulting from weather downtime. This approach does not change the outcome of the assessments presented in the EIA Report (NnGOWL, 2018). The HDD methodology is presented in Section 2.2.2.1 for completeness.

2.2.2 Description of the proposed changes

2.2.2.1 HDD Methodology

22. There will be two HDD bores, one for each cable circuit, which will remain within the consented OECC and installed to a depth of up to 20 m below ground.

23. The TJB, or HDD 'entry pit' will be located in a field landward of Mean High Water Springs (MHWS), behind Thorntonloch beach. Drilling fluid containing bentonite, or similar, will be used to aid the drilling process as detailed in the Application. As required by Condition 3.1.8 of the OfTW Marine Licence any chemicals, including drilling fluids, will be submitted for approval to MS-LOT where they are to be used within an open system in advance of the relevant activity.

24. The 'exit pit' will be located approximately 750m seaward of the TJB and will comprise an area of up to 20 m long, 20 m wide and 2 m deep. A jack-up barge equipped with an excavator and/or a backhoe dredger or similar mechanical means will be used to carry out the excavation works at this location. This material will be side-cast until backfilling after duct installation.

25. The HDD drilling/cable installation process will comprise four stages as described below:

    - A small diameter pilot hole will be drilled from the entry pit to approximately 20 m from the exit pit, for the purpose of defining the profile of the proposed HDD bore, into which the HDD ducts are to be installed ahead of the export cables. The pilot rod will then be removed and replaced by a reamer which is used to increase the diameter of the bore. The final 20 m will not be drilled until after the rest of the bore is complete; to minimise the potential for fines to be released to the marine environment during 'punch out'.
    - The steel reamer will be pushed through the pilot hole towards the exit pit, enlarging the diameter of the hole as it progresses. This may need to be repeated a number of times, depending on the strength of the soil/rock through which it passes, in order to enlarge the bore diameter sufficiently as to accommodate the HDD ducts.
    - When this has been done the last part of the bore will be punched out into the exit pit. This exit pit will have been excavated to a sufficient depth to receive the bore and HDPE or steel duct pipe and to allow the export cable to be continuously buried beyond that point during installation in Summer 2021. To reduce the likelihood of seabed material infilling the bore between punch out and duct installation, the bore may be temporarily capped by the positioning of sandbags or similar for a short duration until the HDD ducts have been pushed/pulled through.
    - The duct pipe is installed into the bore by either pushing from the field onshore or pulling from offshore, using a winch through the bore. Once the duct is installed it will be capped with a steel plate, or similar, and secured until ready for cable installation in Summer 2021. The process is repeated for the second circuit. Once the duct installation is complete, the exit pit will be backfilled with the excavated material and the seabed reinstated. The jack-up barge/backhoe dredger or similar equipment used for this task will then be removed. If required a marker buoy will be temporarily deployed displaying a special mark with appropriate lighting until cable pull-in operations commence. Appropriate permissions, such as statutory sanction, will be sought be sought in advance of any marker buoy deployment.

26. Offshore export cable installation is expected to commence in June 2021. The jack-up barge and backhoe dredger or similar mechanical equipment will return to the exit pit location and excavate the exit pit following the same methodology as undertaken previously. The end of the HDD duct will be exposed and the temporary steel plate removed. A pre-installed rope will be used to pull a winch wire through the HDD duct. When ready, the export cables will be pulled from the CLV through the HDD duct pipe to the TJB, by means of the shore-based winch. When the cable has been successfully pulled through the HDD ducts it will be buried at the exit pit location using the material side-cast during excavation of the exit pit.

27. The CLV will then sail out towards the offshore wind farm area, continuing to lay the cable along the offshore export route.

28. Table 2-1 details the main types of construction vessels and their role in the export cable landfall installation campaign.

Table 2-1 : Main export cable landfall installation vessels

VESSEL TYPE	ROLE
DP2 Cable Lay Vessel (CLV)*	Cable delivery from port of manufacture; Pre- and Post- lay surveys; Cable laying.
Jack-Up Barge	To assist with cable burial in the near shore area, if required.
Backhoe Dredge Barge	To assist with cable burial / protection in the near shore area as required.
Offshore Support Vessel (OSV)*	Deployment of burial and trenching tools.
Dive Support Vessel (DSV)	May be required to assist with cable pull-in at the landfall location.

(*) Vessels present for full offshore wind farm installation campaign.

29. Ancillary vessels such as guard vessels may also be required during construction.

2.2.2.2 Amendments to the licensed deposits

30. The EIA Report considered ducts comprising of HDPE or Polyvinyl Chloride (PVC). The installation contractor engaged in NnGOWL is considering the option to install ducting made of steel. NnGOWL are therefore seeking that the following deposits are added to Part 2 of the OfTW Marine Licence under Condition 2.3:
    - Horizontal cable ducts formed of HDPE or steel (km): 1.8.
    - Temporary deposits of sandbags at the bore exit pit prior to duct installation. Sandbags will be manufactured from biodegradable heavy-duty hessian jute material or similar and will measure approximately 400 mm x 900 mm each. The total anticipated weight of deposits will be up to 420 kg.

2.2.3 Comparison with the consented design envelope

31. Table 2-2 sets out a comparison of the deposits considered within the Project EIA, noting that these are not named within Part 2 of the OfTW Marine Licence, and the deposits which are the subject of this Marine Licence Variation.

Table 2-2: Comparison of cable ducting consented design envelope and amended deposits associated with this Marine Licence Variation

DESIGN PARAMETER	CURRENTLY CONSENTED PARAMETER AS SET OUT IN PROJECT APPLICATION (NnGOWL, 2018)	PROPOSED DEPOSITS ASSOCIATED WITH THE CURRENT OfTW ML	DESCRIPTION OF CHANGE
Cable ducting installation methodology	HDD or Open Cut Trenching	HDD considered to be the base case; retain open cut trenching as contingency	No change

DESIGN PARAMETER	CURRENTLY CONSENTED PARAMETER AS SET OUT IN PROJECT APPLICATION (NnGOWL, 2018)	PROPOSED DEPOSITS ASSOCIATED WITH THE CURRENT OfTW ML	DESCRIPTION OF CHANGE
Material of cable ducts	HDPE or PVC	HDPE or steel	Addition of alternative ducting material
Temporary deployment of sandbags	Not specified	Temporary deployment of up to 12 sandbags weighing approximately 420 kg in total	Temporary deployment within area of direct construction activity, therefore no increased footprint.

2.3 Inclusion of Trial Trenching within the Licensed Activities

2.3.1 Need for variation

32. NnGOWL's preferred cable protection mechanism is to achieve a safe DoL that will mitigate the risk of other sea users and protect the integrity of installed subsea cables. In order to maximise burial success NnGOWL are seeking to undertake trenching trials along the OECC to optimise burial / trenching tool settings prior to cable installation. Selection of trenching trial locations will take account of the variable sedimentary habitats identified along the OECC and within the OECC Extension Area. The original application covered the activities and effects associated with installation and removal of export cable, but the licensed deposits do not allow for the temporary and short-term deposit and removal of additional cable lengths. The trenching trials are considered necessary to maximise the success in reaching the target DoL and therefore minimise requirement for additional protection measures.

2.3.2 Description of the proposed change

33. NnGOWL are therefore seeking to add trenching trials to the licensed activities covered by the OfTW Marine Licence. Trenching trials will be completed at three locations within the OECC, OECC Extension Area or within the Wind Farm Area in the vicinity of the export cable routes.

34. The trenching trial will comprise deployment of a 1 km length of export cable on the seabed within the offshore export cable corridor and along the export cable route at each of the trial locations. The burial tool will be deployed as described in Section 2.4.2.2 above and progress along the 1 km cable burying the cable to the target DoL as identified in the Project CBRA (see the Project Cable Plan (CaP) (NNG-NNG-ECF-PLN-0009) for more details). Burial depths will be monitored by the burial tool during installation or by a remotely operated vehicle (ROV) or similar to determine the final burial depth of the trial cable. The trenching trials will be completed by a CLV or a suitable alternative.

35. Following completion of the trenching trial, the cable will be recovered to the deck of the vessel and returned to shore for recycling and disposal. Up to three trenching trials will be undertaken between September 2020 and June 2021 in advance of the export cable installation campaign.

36. The EIA Report considered the impact of installation of up to 86 km of export cables which is sufficient to cover the lengths of cable required for trenching trials. NnGOWL are therefore seeking that the following wording is added to the Description of the Works set out in Part 2 of the OfTW Marine Licence under Condition 2.1, item 2:

- Up to 86 km of offshore export cables for transmission of electricity from the OSPs to the landfall site and additional temporary deployment of cables for the purposes of trial trenching.

2.3.3 Comparison with the consented envelope

37. The deposits and activities associated with the trial trenching remain within the worst case design envelope assessed with the Application and EIA Report (NnGOWL, 2018) submitted in support of the OfTW Marine Licence. Table 2-3 sets out the currently consented Project deposits and the deposits covered by this proposed Marine Licence Variation.

Table 2-3: Comparison of offshore export cable design envelope and amended deposits associated with this Marine Licence Variation

DESIGN PARAMETER	CURRENTLY CONSENTED PARAMETER AS SET OUT IN PROJECT APPLICATION (NnGOWL, 2018)	PROPOSED DEPOSITS ASSOCIATED WITH THE CURRENT OfTW ML	DESCRIPTION OF CHANGE
Number of Export Cables	2	2, plus up to 3 trial cables deployed as part of trenching trials	Addition of three temporary deposits of cables for the purposes of trial trenching
Total Length of Cabling (km)	86	Up to 86 (inclusive of cables for trial trenching)	No Change
Length per Cable (km)	43	Up to 43 (inclusive of cables for trial trenching)	No Change
Specification of cable	220 kV 3-phase AX XLPE insulated	220 kV 3-phase AX XLPE insulated	No Change
Means of cable protection	Cable burial by ploughing / jetting / cutting. Additional rock protection or alternative where required.	Cable burial by ploughing / jetting / cutting. Additional rock protection or alternative where required.	No Change
Width of seabed affected (m)	10	10	No Change
Area of direct seabed disturbance (km^2)	0.86	0.86	No Change
Target burial depth (m)	Approximately 1 m	Approximately 1 m	No Change

2.4 Extension of the Offshore Export Cable Corridor

2.4.1 Need for the variation

38. An area of steeply protruding rock at the seabed has been identified following geophysical surveys located along the existing OECC approximately 9 km offshore from the from the Transition Joint Bay (TJB) at Thorntonloch beach. These rock protrusions rise steeply from the seabed in two discrete sections which obstruct the 300 m wide consented OECC. Following appraisal of the geophysical data, this rock feature is considered to be a hazard to the export cable installation process. In order to reduce the risk of cable free spans and to ensure that the cable is adequately protected throughout the lifespan of the Project, extensive rock placement and/or rock cutting would be required to install the cable across this feature within the currently consented OECC. Since the existing cable corridor is only 300 m wide there is limited scope for rerouting around these rock features within the existing OECC covered by the current OfTW Marine Licence.

39. To ensure cable burial and lasting cable security, cable burial within sedimentary substrates is the preferred cable protection option; therefore, it is proposed that the cable be re-routed around the rock protrusions through an area with ground conditions known to be more conducive to cable burial.

2.4.2 Description of the proposed change

40. The geophysical surveys have identified an area of sedimentary substrates immediately to the west of the existing OECC within the proposed OECC Extension Area which is likely to be more suitable for cable burial. The OECC Extension Area is approximately 2.77 km long and 0.21 km wide covering an area of approximately 0.35 km^2. Figure 2-1 sets out the location of the OECC Extension Area, the proposed cable routing and the boundaries of the consented Wind Farm Area and OECC.

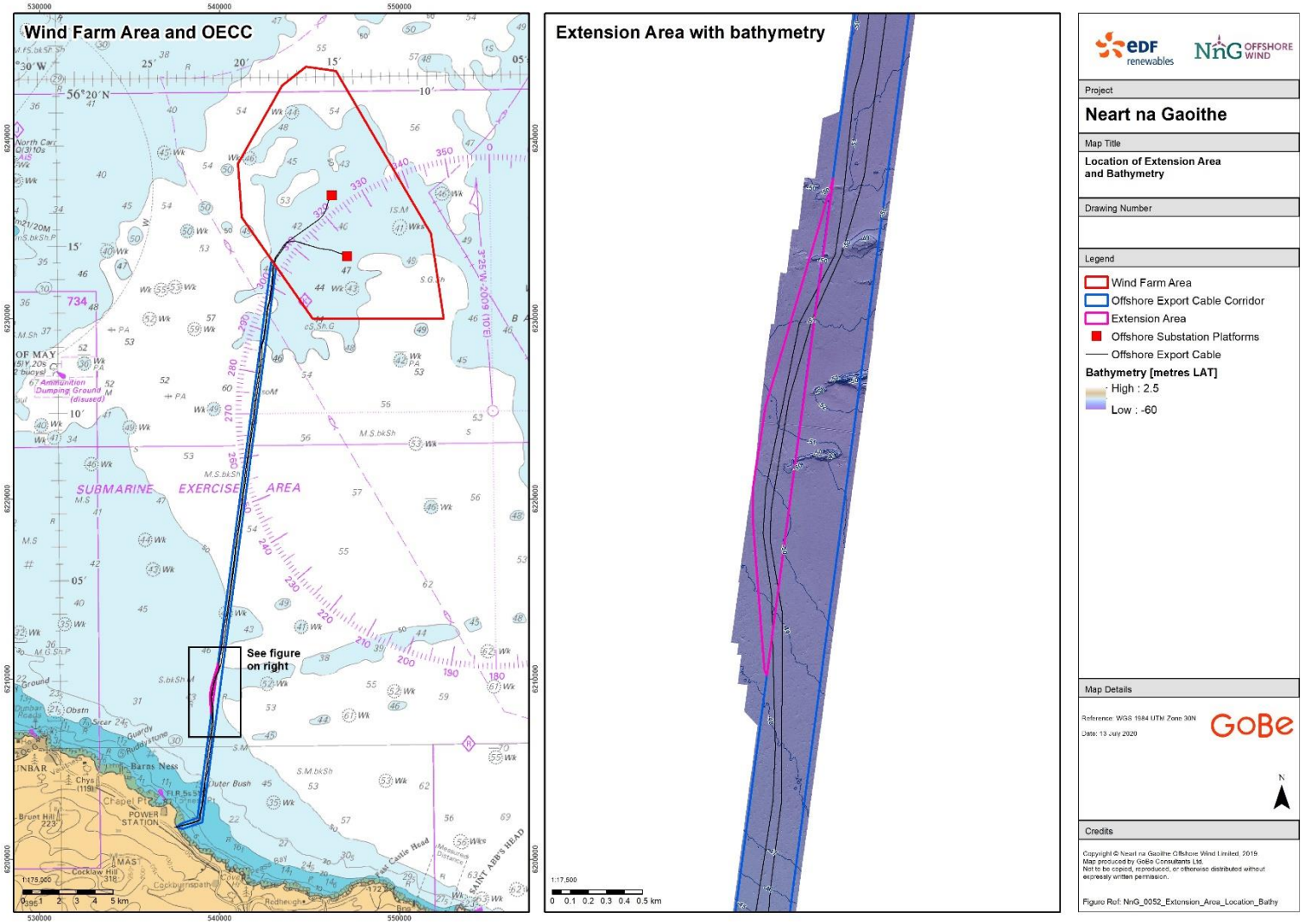


Figure 2-1: Location of the OECC Extension Area, the existing OECC and the Wind Farm Area

2.4.2.1 Infrastructure to be installed

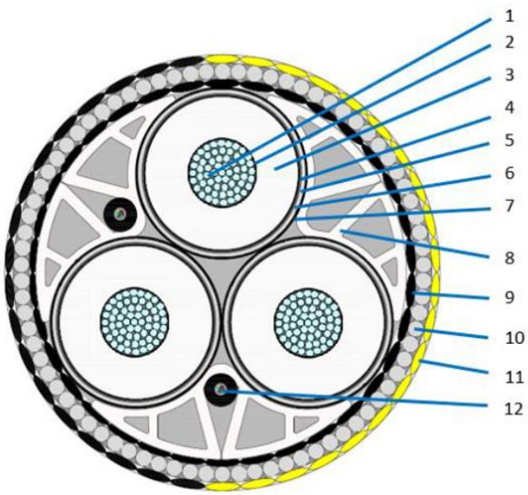
41. The offshore export cables to be installed, and any associated burial and protection measures required, will remain as described within the Project EIA Report (NnGOWL, 2018). However, the Variation seeks to extend the OECC to cover installation of a section of each offshore Export Cable within the OECC Extension Area. Both offshore export cables will be rerouted through the OECC Extension Areas.

42. The consented length of each offshore export cable is approximately 43 km. Based on the current routing it is anticipated that each export cable will be approximately 38 km between the OSPs and the TJBs subject to micrositing. Approximately 3 km of each export cable will be routed within the OECC Extension Area.

43. It is anticipated that the cable will be buried in the seabed along the majority of the export cable route based on the currently known geotechnical conditions in the area, with the exception of the nearshore area where there are areas of exposed rock substrate. The cable reroute aims to minimise the requirements for additional protection offshore. NnGOWL would like to retain the option to install additional protection, within the consented allowance, as a contingency in the event that a sufficient burial depth cannot be reached to adequately protect the cable, or if the cable becomes exposed during the operational phase of the Project.

44. The offshore export cables will comprise two 3 core 220 kV armoured submarine power cables. The offshore export cables will be designed in accordance with industry standards as set out in the relevant International Electrotechnical Commission (IEC) and DNV-GL guidance.

45. The main components of the offshore export cables are shown in Figure 2-2 and are described briefly below.



Item	Description	Details
1	Conductor	Aluminium stranded power core covered with water blocked tape
2	Conductor Screen	Extruded semi-conducting compound
3	Insulation	Cross-linked polyethylene (XLPE)
4	Insulation Screen	Extruded semi-conducting compound
5	Water Barrier	Water blocking tapes
6	Metallic Sheath	Lead alloy sheath
7	Core Outer Sheath	Semi-conducting extruded polyethylene
8	Layup	Power core interstices filled with extruded shaped fillers
9	Bedding	Synthetic tape
10	Armour	90 galvanised steel wires flushed with bitumen
11	Serving	Polypropylene strings
12	Cables	48 single fibres supported in a water repellent gel within a stainless steel tube

Figure 2-2: Offshore export cable design

Power Cores

46. The offshore export cables will comprise three power cores each with a cross-sectional area of approximately 630 mm^2. The conductors will be formed of aluminium conductors as shown in Figure 2-2.

47. The cores will be insulated with cross-linked polyethylene (XLPE). For waterproofing each core will be surrounded with a semi conducting water blocking tape suitable for subsea use.

Fibre optic data cable

48. The offshore export cables will be bundled with two fibre optic sub-cables supported in a water repellent gel within a stainless steel tube, protected by inner polyethylene sheath, galvanised steel wire armour and an outer polyethylene sheath.

Cable armouring and outer sheathing

49. Appropriate filler materials (e.g. ropes or extruded polymeric profiles) will be included within the cable interstices to provide a robust and stable base for the application of armouring.

50. The offshore export cables will then be protected by one layer of galvanised steel wire flushed with bitumen for corrosion protection. The armouring provides external mechanical protection, weight and strength. Polypropylene rovings are applied over the armour wires for outer protection of the cable. The outer serving is black with a helical stripe for identification.

Electromagnetic fields

51. A desk based assessment has been carried out by the cable manufacturer on behalf of NnGOWL on the attenuation of electromagnetic fields (EMFs) associated with the offshore export cables.

52. The study calculated the magnetic field magnitudes at seabed level and 1 m above seabed level generated from the offshore export cables at a burial depth of 1.0 m. The magnitudes were calculated using the Finite Element Method. The study confirmed that EMF decreases rapidly with distance from the cables.

53. The modelling outputs predict that the EMF generated by the export cables will reduce to zero within 5 m of the cables when it is carrying the maximum current of 599 A. The maximum generated EMF identified is 14 µT at the surface of the seabed directly above the cable. Therefore, the predicted maximum magnetic field strength of the export cables at the seabed is expected to be lower than the earth's magnetic field (~50 µT).

2.4.2.2 Offshore export cable installation methodology

54. An indicative export cable installation sequence is presented in Figure 2-3 below. Greater detail on each of the stages in the installation process (EC1 – EC3) is then provided in the subsequent sections.

55. It is currently anticipated that export cable installation will be completed by a cable lay vessel (CLV). The burial of the cable will be performed by both jetting and cutting tools which will be operating from a separate support vessel to the CLV.

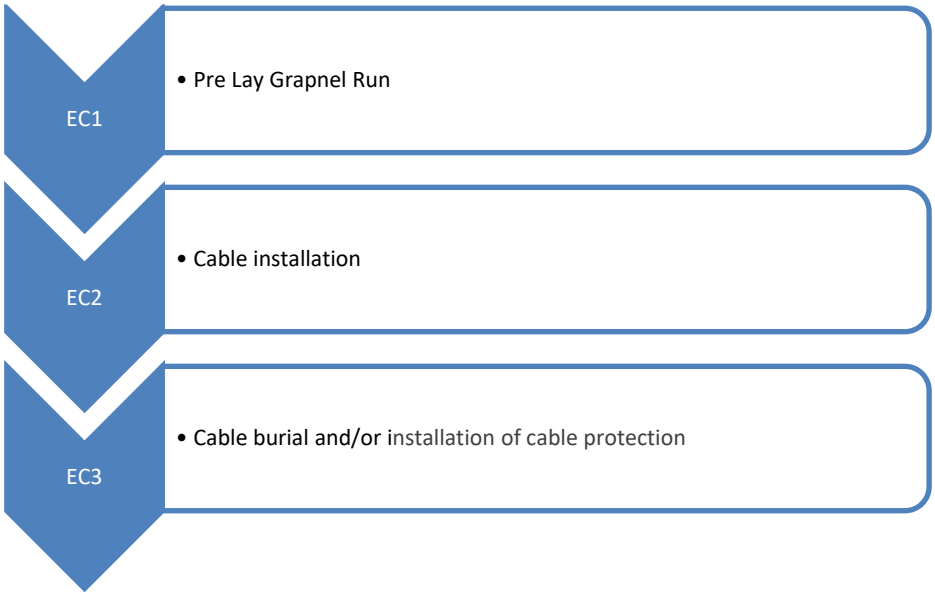


Figure 2-3: Export Cable installation sequence

Export Cable Installation Stage EC1 – Pre-Lay Grapnel Run

56. Seabed debris or features (for example scrap trawler warps or ships' crane wires that may have been jettisoned by vessels onto the seabed) can be detrimental to the trenching or burial tool. Therefore, after boulder clearance and before the start of cable laying operations the cable route will be cleared of any remaining obstructions by undertaking a pre-lay grapnel run (PLGR).

57. An anchor handling tug (AHT) will be mobilised with a towed grapnel rig which will be towed along the offshore export cable routes from as close to the exit point of the horizontal ducts as possible to the OSPs.

58. Any debris recovered to the deck will be retained on board the vessel for disposal onshore.

Export Cable Installation Stage EC2 – Cable installation

59. The export cable will be loaded onto the CLV turntable at the cable manufacturing facility. The export cable will be pulled through horizontal ducts at landfall, direct from the CLV and terminated at the TJB. Once the cable has been pulled into the ducts and secured onshore, the support team will ensure the cable is located over the proposed cable route and then cable laying will commence with the CLV progressing along the route paying out the cable and laying it on the seabed.

60. The CLV will continue to lay the cable and monitor the touch down location along the existing OECC in the direction of the OSP. On approach to the OECC Extension Area the CLV will deviate from the existing OECC laying the cables to the west of the rocky protrusions and through the OECC Extension Area. The CLV would then re-enter the existing OECC and continue to lay the cable in the direction of the OSP.

61. Once at the OSP the CLV will stop approximately 100 m from the platform. The export cable will be cut and sealed. Second end pull-in of the export cable would then take place via a messenger wire and winch mounted on the OSP cable deck.

Export Cable Installation Stage EC3 – Cable burial and protection

62. The surface laid cable will then be buried into the seabed to a target Depth of Lowering (DoL) sufficient to mitigate the risk of cable damage by other sea users and/or physical processes. A Cable Burial Risk Assessment (CBRA) has been carried out along the full length of the export cable route to determine a suitable depth of lowering for cable protection and to ensure the safety of other sea users.

63. A jetting tool will be used in softer ground conditions and a mechanical cutting tool over harder ground. Burial will be completed from an OSV equipped for trenching or burial. A hybrid tool may be used that can be set to use both water jetting and/or mechanical cutting simultaneously to achieve required burial depths. A hybrid tool is useful in where there to account for highly variable seabed conditions. If required a second pass of the trenching tool will be completed.

64. Following cable burial, a post-lay survey of the cables will be completed to confirm the DoL. Where the target DoL is not achieved alternative protection methods will be considered. It is estimated that up to 15% of the total consented offshore export cable lengths (12.8 km) may require additional cable protection. The following materials will be considered for cable protection:

    - Durable crushed or original rock of defined size range;
    - Concrete 'mattresses'; and
    - Bags (high strength nylon fibre) of gravel, hardened sand-cement grout, or concrete (grout/concrete pre-filled and hardened onshore). The bag option may include a technique where the grout is introduced to the nylon fibre bag offshore through proprietary pipes (the bags being permeable to water but not to grout).

Installation vessels

65. The main types of construction vessels and their role in the export cable installation campaign are presented in Table 2-4.

Table 2-4: Main export cable installation vessels

VESSEL TYPE	ROLE
Anchor Handling Tug (AHT)	Undertaking PLGR operations.
DP2 Cable Lay Vessel (CLV)	Cable delivery from port of manufacture; Pre- and Post- lay surveys; Cable laying.
Offshore Support Vessel (OSV)	Deployment of burial and trenching tools.
Dive Support Vessel (DSV)	May be required to assist with cable pull-in at the landfall location.

66. Ancillary vessels such as guard vessels may be required during construction.

2.4.3 Comparison with the consented design envelope

67. The deposits associated with the proposed Variation to the OfTW Marine Licence application for the OECC Extension Area would not result in a significant addition to those currently consented by the

existing OfTW Marine Licence (given that this will represent a transfer of the location of the offshore export cable installation rather than an additional installation). The overall deposits will remain within the Project design envelope set out in the EIA Report for the Project (NnGOWL, 2018) and as permitted by the current Offshore Consents. Table 2-5 sets out the currently consented Project deposits and the deposits covered by this proposed Marine Licence Variation.

Table 2-5: Comparison of offshore export cable design envelope and amended deposits associated with this Marine Licence Variation

DESIGN PARAMETER	CURRENTLY CONSENTED PARAMETER AS SET OUT IN PROJECT APPLICATION (NnGOWL, 2018)	PROPOSED DEPOSITS ASSOCIATED WITH THE CURRENT OfTW ML	DESCRIPTION OF CHANGE
Number of Export Cables	2	2, plus up to 3 trial cables deployed as part of trenching trials (See Section 2.2 for more information)	No Change
Total Length of Cabling (km)	86	Up to 86 (this includes trial trenching)	No Change
Length per Cable (km)	43	Up to 43 (this includes trial trenching)	No Change
Specification of cable	220 kV 3-phase AX XLPE insulated	220 kV 3-phase AX XLPE insulated	No Change
Means of cable protection	Cable burial by ploughing / jetting / cutting. Additional rock protection or alternative where required.	Cable burial by ploughing / jetting / cutting. Additional rock protection or alternative where required.	No Change
Width of seabed affected (m)	10	10	No Change
Area of direct seabed disturbance (km^2)	0.86	0.86	No Change
Target burial depth (m)	Approximately 1 m	Approximately 1 m	No Change

68. It is anticipated that the export cables including the reroute through the OECC Extension Area will be approximately 38 km per export cable subject to final micrositing. However, NnGOWL would like to retain the full Project design envelope to ensure there is sufficient contingency within the consented licensed deposits.

2.5 Increase of the Permitted Grout Volumes

2.5.1 Need for the variation

69. Following further geophysical data analysis and confirmation of casing and pile lengths at the OSP locations NnGOWL's installation contractor has estimated the required grout quantities required to

ensure secure fixing of casings and piles within drilled sockets. The final estimates are greater than those described within Part 2 of the OfTW Marine Licence Condition 2.3. NnGOWL are therefore, seeking to increase the grout quantities to ensure adequate capacity for pile installation.

2.5.2 Description of the proposed change

70. The installation of the casing and piles for the OSPs will remain unchanged, using a drill-only or drive-drill-drive method as described in the EIA Report and confirmed within the approved Construction Programme and Construction Method Statement (CoP & CMS) (Document Reference: NNG-GOB-ECF-PLN-0002). Installation of the casings and piles will be completed using the following high level procedure:

- Subsea Template (SST) deployed to the seabed;
- First casing is upended into the SST and hydraulic guides will ensure verticality of the casing. The casing will then self-penetrate the seabed under its own weight.
- A drill string and underreamer is lowered through the casing and will drill the socket to the required depth.
- Once the casing is at the required depth and stable the drill is engaged and will commence drilling out the pile socket. Once the required depth is achieved, this process is repeated for the remaining three casings at each OSP location.
- The first pile will then be lowered into the casing and centralised using pile grippers on the SST. The remaining two piles will then be lowered into positing and fixed in place using the pile grippers.
- Grout comprising an Ordinary Portland cement will be pumped into the annulus between the pile and rock socket. Grout specific gravity measurements will be taken to determine density at the seabed by means of a Remote Operated Vehicle-held nuclear densitometer or alternative. The grout pumping will stop once the required density has been obtained.
- The SST will be recovered to deck, and the installation vessel will relocate to the next turbine locations.

71. No change is proposed for the casing and pile installation procedure for the OSPs. However, the total grout quantity is considered insufficient to meet the required grout density for installation. NnGOWL are therefore seeking that the deposits are amended within Part 2 of the OfTW Marine Licence under Condition 2.3 to the following:

- Total grout quantity (m^3): 650

2.5.3 Comparison with the consented design envelope

72. Table 2-6 sets out a comparison of the deposits considered within the Project EIA where they relate to quantities of grout required to secure the piled foundations at each of the OSP locations, and the deposits which are the subject of this Marine Licence Variation.

Table 2-6: Comparison of consented grouting quantities and amended deposits associated with this Marine Licence Variation

DESIGN PARAMETER	CURRENTLY CONSENTED PARAMETER AS SET OUT IN PROJECT APPLICATION (NnGOWL, 2018)	PROPOSED DEPOSITS ASSOCIATED WITH THE CURRENT OfTW ML	DESCRIPTION OF CHANGE
Total Grout Quantity (m^3)	600	650	Increase of 50 m^3

3 Environmental Conditions

3.1 Physical Environment

73. A range of studies and site-specific surveys have been completed by NnGOWL to establish the physical characteristics of the Wind Farm Area and OECC. These studies informed the Scoping process undertaken as part of the EIA process for the Project and are presented in the Original ES (NnGOWL, 2012) and Supplementary Environmental Information Statement (SEIS) (NnGOWL, 2013). In addition, site specific geophysical surveys have been conducted and analysed to determined seabed habitat type within the vicinity of the OECC Extension Area. A combination of the site specific data and the wider contextual data from the Original EIA has been used to inform the baseline for this Marine Licence Variation.

3.1.1 Bathymetry

74. Water depths within the OECC Extension Area is shallowest towards the southern extent at approximately 49 m below Lowest Astronomical Tide (LAT). The depth gently increases towards the north end of the OECC Extension Area to a maximum depth of around 51 m below LAT. The OECC Extension Area exhibits similar bathymetry to the adjacent OECC (maximum depth of 58 m) with the exception of the steep rocky protrusions which are absent within the OECC Extension Area.

3.1.2 Geological characteristics

75. Studies undertaken as part of the Original EIA reported that the sediments within the Wind Farm Area mainly comprise of muddy sand, fine to very fine sand and gravelly sand (NnGOWL, 2012). The sediment type within the OECC Extension Area is similar to the adjacent OECC being comprised of sandy gravel and sandy mud and clay sediments. These sediment types are prevalent across the majority of the OECC. The exceptions are areas of exposed bedrock comprised of carboniferous limestone in the nearshore area and the protrusions of igneous dykes, approximately 10 km offshore within the existing OECC and to the east of the OECC Extension Area. The aim of this Marine Licence Variation is to provide sufficient space to deviate around the igneous protrusions within the existing OECC

3.1.3 Tidal processes

76. The hydrodynamic conditions are relatively uniform across the OECC Extension Area, the existing OECC and Wind Farm Area, with a mean spring tidal range of 4.6 m. Current speeds reach approximately 0.6 m/s on the flooding mean spring tide, and 0.4 m/s on the flooding mean neap tide. The flood tide is stronger than the ebb tide. The 50-year return storm surge current is of comparable strength, at about 0.6 m/s. The absence of major bedforms around the OECC Extension Area and along the existing OECC suggests little sediment transport and a relatively stable seabed, classed as ‘slightly mobile’.

3.1.4 Wave regime

77. The OECC Extension Area, OECC and Wind Farm Area receive waves most frequently from a north-north-easterly direction (22.5 degrees); mean wave periods range between 2 and 9 seconds; and significant wave heights are up to about 6 m. Waves also arrive from both the south-eastern and southwestern quadrants, but these form only a minor component of the wave direction spectrum.

78. The wave climate across the OECC Extension Area, existing OECC and Wind Farm Area is uniform, with little spatial variation in either significant wave height or mean / peak wave period. The significant wave height is shown to vary between 1.2 m and 1.4 m (50%ile) and 5.2 m and 5.4 m (99%ile), with the mean

wave period varying between 4.5 s and 5.0 s (50%ile) and 8.5 s and 9.0 s (99%ile), and peak wave period varying between 9.5 s and 10.0 s (50%ile) and 14.0 s and 15.0 s (99%ile).

3.2 Biological Environment

3.2.1 Benthic environment

79. The dominant sediment type identified within the Wind Farm Area is slightly gravelly muddy sand, with patches of coarser sediment also recorded. The OECC and OECC Extension Area is characterised by deep circalittoral mud and gravelly muddy sand, typical of the outer Firth of Forth. In the vicinity of the OECC Extension Area infaunal analysis of grab samples identified benthic communities that align with the biotope *Amphiura filiformis and Nuculoma tenuis in circalittoral and offshore sandy mud* (SS.SMu.CSaMu.AfilNten). This infaunal biotope was identified along the OECC and within the Wind Farm Area. Figure 3-1 and Figure 3-2 presents the distribution of the main habitat types within the OECC Extension Area and existing OECC.

80. Video analysis within the OECC, OECC Extension Area and the Wind Farm Area observed species more commonly associated with the biotope complex Seapens and burrowing megafauna in circalittoral fine mud (SS.SMu.CFiMu.SpnMeg), covering much of the existing OECC and a large a proportion of the Wind Farm Area. Discrete areas within the existing OECC and the Wind Farm Area support dense areas of brittlestar (*Ophiothrix fragilis*) which fitted the biotope SS.SMx.CMx.OphMx.

81. The Project does not overlap with any conservation sites designated for benthic habitats or species.

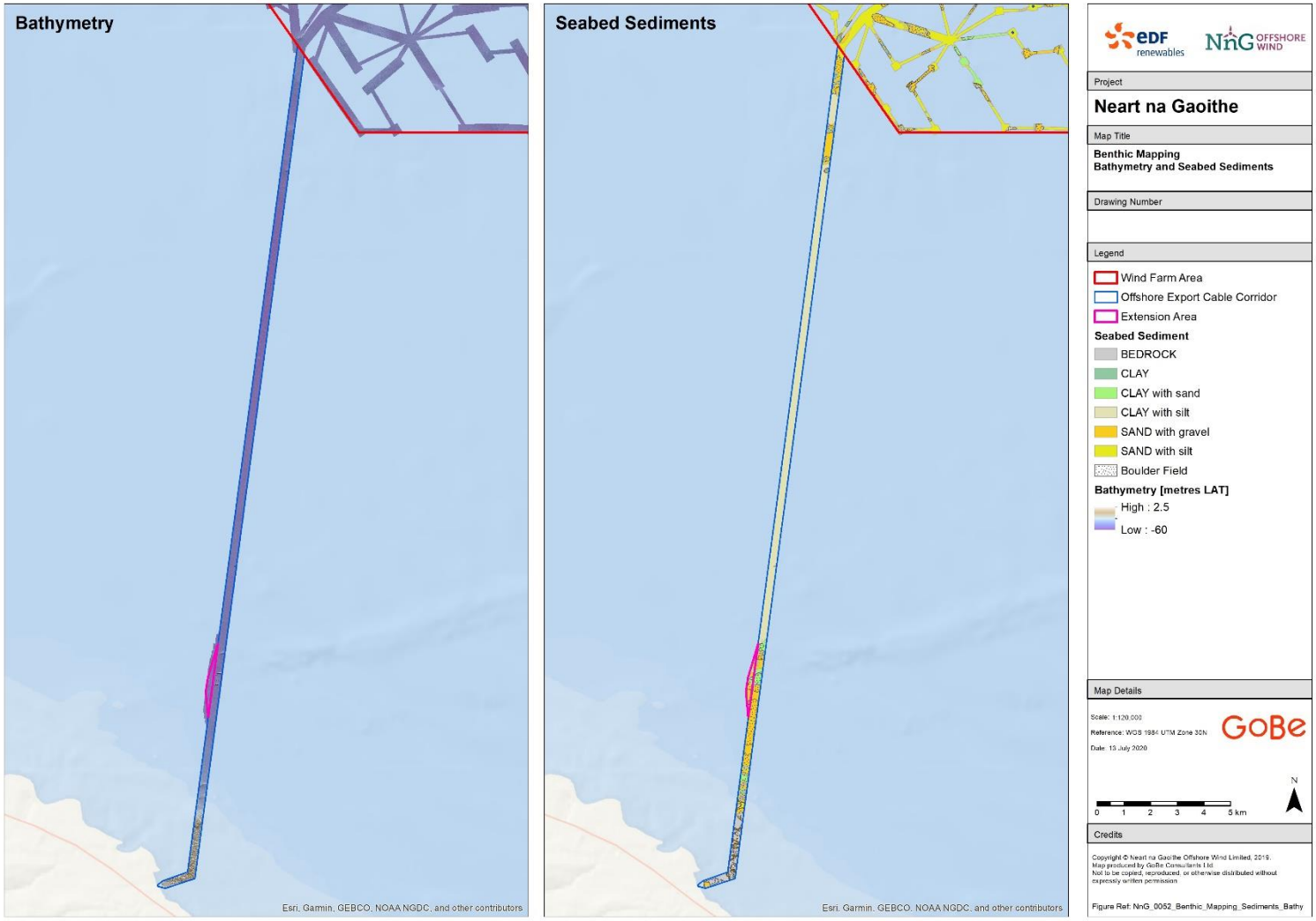


Figure 3-1: Bathymetry and seabed sediments along the OECC.

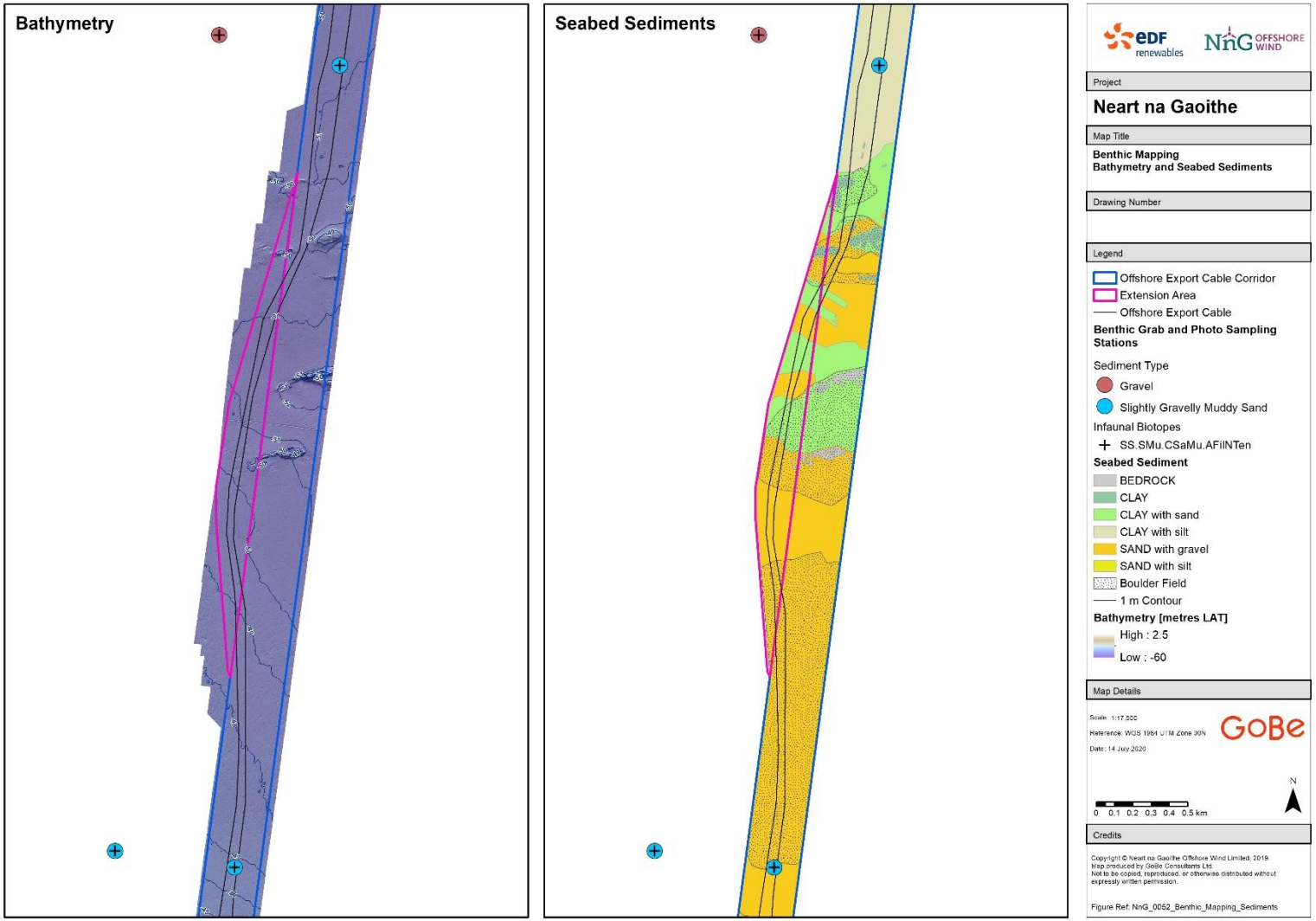


Figure 3-2: Bathymetry and seabed sediments within the OECC Extension Area and adjacent OECC.

3.2.2 Fish and shellfish ecology

82. The fish and shellfish assemblage within the vicinity of the OECC Extension Area, existing OECC and Wind Farm Area are typical of coastal areas in this region of the North Sea (Barne et al., 1997; Eleftheriou et al., 2004).

83. Demersal species that inhabit the muddy sand and gravel habitats in the region include cod, haddock, monkfish, flatfish species and sandeel. Pelagic species that may be present in the area include herring, sprat and mackerel. Elasmobranchs such as lesser spotted dogfish, tope and thornback rays are also common within the wider region. A number of these species have feeding, nursery and spawning habitats that overlap with the OECC Extension Area, existing OECC and Wind Farm Area (Coull et al., 1998; Ellis et al., 2012).

84. Freshwater riverine habitats along the east coast of Scotland and England support a number of migratory species that may pass through the OECC Extension Area and the Wind Farm Area during the ocean-going phase of their lifecycle (Malcolm et al., 2010). Migratory species include Atlantic salmon, sea trout, eel and lamprey species.

85. A number of shellfish species are also typically found in the region and have distribution that overlaps the OECC Extension Area, the existing OECC and Wind Farm Area including Nephrops and squid.

3.2.3 Marine mammals

86. A series of marine mammal surveys were used to inform the EIA for the Project to determine the number and distribution of marine mammals. The survey work focused around the Wind Farm Area. Visual boat surveys, acoustics surveys and aerial survey data was collected between 2009 and 2010 (NnGOWL, 2018).

87. Six species of marine mammals were recorded from the survey work: harbour porpoise, minke whale, white-beaked dolphin, killer whale and grey and harbour seal. The most abundant species recorded was harbour porpoise which was recorded regularly throughout the year. The second most frequently recorded marine mammal was grey seal with the majority of grey seal sightings in the spring and autumn periods. The remaining species, white-beaked dolphin, harbour seal and minke whale and killer whale, were recorded infrequently and in low numbers. There were no records of bottlenose dolphins during site-specific survey, however, due to the known distribution and presence of the resident Moray Firth population, it is considered likely that they will be present in the Firth and Tay region.

88. The results from the baseline surveys indicate that the Wind Farm Area does not support high numbers or densities of marine mammals. The OECC Extension Area is considered to be likely to support similar assemblages of marine mammals.

3.2.4 Ornithology

89. Three years of monthly boat-based surveys were undertaken to inform the EIA for the Project between 2009 and 2012 (NnGOWL, 2018). The survey work focused on the Wind Farm area with no site specific surveys overlapping the OECC Extension Area nor the majority of the existing OECC. A total of 29 seabird species were identified during the site-specific surveys. The three most abundant species recorded during the surveys were Northern gannet, Atlantic puffin and common guillemot. Together these three species accounted for 62.3% of all birds recorded in the offshore site in Year 1, and 77.1% of all birds recorded in the offshore site in Year 2. All three species were recorded in all months.

90. Thirteen species of seabird were considered to be key species and were assessed in greater detail on account of the high numbers present at certain times of year, the likely high connectivity to Special

Protection Areas (SPAs) (nine species), and their sensitivity to potential effects. These key species were fulmar, sooty shearwater, Northern gannet, little gull, lesser-blacked gull, herring gull, great black-backed gull, black-legged kittiwake, Arctic tern, common guillemot, razorbill, Atlantic puffin and little auk. All other species occurred only sporadically and in low or very low numbers. It is assumed that the species assemblage within the OECC Extension Area is similar in nature to that recorded around the Wind Farm Area.

3.3 Human Environment

3.3.1 Marine archaeology and cultural heritage

91. A desk-based study and archaeological assessment of geophysical and geotechnical survey data was carried out to identify potential archaeological assets that may be affected and to establish their current condition. This work also provided information upon which to base the assessment of archaeological potential (NnGOWL, 2012). The current geophysical data has been reviewed to refine the marine archaeological baseline to inform Project mitigation.

92. The original desk-based assessment reviewed existing maritime records to identify potential wrecks in the Wind Farm Area or within the OECC and compared the locations with magnetic anomalies picked up in the geophysical survey of the site. There are nine recorded or charted wrecks and obstructions from the Seazone dataset located within the Wind Farm Area and one live wreck within the OECC.

93. No archaeological assets have been identified within the OECC Extension Area from desk based sources or during analysis of the recent geophysical survey data.

3.3.2 Shipping and navigation

94. A shipping survey conducted in 2010 found that between 16 and 17 vessels per day pass within 10 NM of the Wind Farm Area, with an average of 2 per day passing though the wind farm (NnGOWL,2018). A busy shipping route lies to the south of the wind farm, intersecting the OECC close to the OECC Extension Area. This is mainly used by tankers and cargo vessels heading into and out of the Firth of Forth. Navigational features include a general practice and submarine exercise area that overlies the OECC Extension Area, as well as the wider OECC and Wind Farm Area, and the Forth Ports Ltd authority area which is 8.4 NM west of the wind farm.

95. Some recreational craft may be seen during summer daylight hours on a route that passes through the OECC, close to the OECC Extension Area.

3.3.3 Commercial fisheries

96. The principal fishing activities were identified through assessment of available Automatic Identification System (AIS) data and consultation with local fishery stakeholders to inform the EIA (NnGOWL, 2018). The active fisheries in the region are:

    - Potting for crustacea species such as lobster, brown crab and velvet crab, and seasonally deploying hook and lines for mackerel;
    - Bottom otter trawls targeting Nephrops using single or twin gears;
    - Boat dredges targeting scallops; and,
    - Other (hydraulic) dredging vessels targeting razor shell and soft-shelled clam.

97. Consultation with fishermen suggested that fishing grounds for Nephrops coincide with the OECC Extension Area, as well as with the wider OECC, however, Nephrops are not heavily targeted across the Wind Farm Area. The Nephrops fishery also seasonally targets squid within the same area. Ports with demersal otter trawling vessels potentially operating across the OECC Extension Area, existing OECC and the Wind Farm Area include Pittenweem, Eyemouth, Port Seton and Dunbar. Potting regularly occurs across the OECC Extension Area, as well as across the wider existing OECC (generally more exploratory) and Wind Farm Area and is ubiquitous in the region. Vessels targeting this area are predominantly located within the Anstruther and Eyemouth Fishery Districts.

98. Pittenweem is the principal fishing port in the region, followed by Dunbar and Eyemouth. Other ports that record lower levels of landings are Crail, Methil and Leven, Anstruther, St Andrews, and West Wemyss.

3.3.4 Military and aviation

99. There are no aviation assets or active military exercise areas that could be affected by the activities within the OECC Extension Area.

3.3.5 Nature conservation designations

100. A number of European designations are located along the east coast of Scotland and north east of England. However, only the Outer Firth of Forth and St Andrews Bay Complex pSPA has potential connectivity with the proposed offshore export cable installation within the OECC Extension Area. Details of the pSPA are set out in Section 4.5 and the location of pSPA in relation to the OECC Extension Area, the existing OECC and the Wind Farm Area is shown in Figure 5-1.

4 Environmental Appraisal of the Proposed Amendments

4.1 Introduction

101. This section provides an environmental assessment of the changes set out in Section 2. It is intended to represent a concise summary of information drawn largely from that collated to inform the Environmental Statement (ES) and Supplementary Environmental Information Statement (SEIS) (NnGOWL, 2013) produced to support the Original Application (NnGOWL 2012), and the Application for the Project Offshore Consents including the Scoping Report (NnGOWL, 2017), Scoping Opinion (MS-LOT, 2017) and Environmental Impact Assessment (EIA) Report (NnGOWL, 2018).

4.2 Screening of Potential Effects of Addition of HDPE or Steel Cable Ducts

102. The Original EIA considered the impacts of HDD works at the landfall area in relation to environmental receptors. The assessment focused on disturbance to seabed habitats in terms of both local physical and biological receptors. The cable ducting did not represent a material consideration when identifying potential impacts or the magnitude of an impact. On the basis that the EIA conducted in support of the Original Application was still valid impacts on environmental receptors resulting from HDD works at the landfall location were scoped out of the along and in-combination EIA for the Project.

103. The use of steel ducting does not represent a material change and does not invalidate the impact determinations reported within the Environment Statement (NnGOWL, 2012) and subsequently scoped out of the recent EIA (NnGOWL, 2018).

4.3 Screening of Potential Effects of Inclusion of Trial Trenching within the Licensed Activities

104. The Project worst case design envelope used to assess the effects on environmental receptors reported within the EIA Report covered cable laying and burial activities representative of the activities associated with trial trenching. There is sufficient head room within the worst case design envelope to cover the potential affect associated with trial trenching. The trenching trials will require deployment of three additional lengths of cable. The EIA Report and associated OfTW Marine Licence covers two separate cable deployments, i.e. one for each export cable. However, the number of separate cable deployments was not a material consideration in determining potential impacts and the magnitude of potential impacts.

105. Trenching trials does not change the worst case design envelope considered within the EIA Report for the Project (NnGOWL, 2018). The impact determinations therefore remain valid and relevant to the proposed changes associated with the Variation.

4.4 Screening of Potential Effects of OECC Extension Cable Reroute

106. Effects on environmental receptors (as outlined in the following sections) resulting from rerouting the cable through the OECC Extension Area may arise as a result of the impact pathways during Construction and Operation:

- Direct disturbance to seabed habitats and species as a result of construction activity;
- Increased suspended sediment resulting from seabed disturbance during installation;
- Habitat loss / change as a result of placement of rock protection;
- Emission of EMFs from subsea cables during operation.

107. The worst case scenario for decommissioning would be to remove all subsea cables at the end of the operational phase of the Project. The impacts associated with decommissioning would be synonymous with Construction phase impacts detailed above.

108. When considering effects from these sources, there a number of important points to consider which have a bearing on both the magnitude of effect and sensitivity of the receptor:

- The footprint of the proposed offshore export cable installation and operation within the OECC Extension Area will be instead of, rather than in addition to, the same area covered by the Project Offshore Consents, i.e. there will be no overall increase in the area of impact when considering the cumulative impact of the activities licensed by the Offshore Consents and the activities covered by this Marine Licence Variation. Therefore, it is considered that the assessment of effects presented in the previous assessments (e.g. the Scoping Report and EIA Report) remain valid for the assessment of impacts within the OECC Extension Area;
- The footprint of the OECC Extension Area will be relatively small in relation to the known distribution of similar environmental receptors;
- The offshore export cable installation within the OECC Extension Area will be carried out as part of the Construction activities permitted under the Project Offshore Consents and will not result in an increased construction period; and
- Mitigation has been designed into the proposed rerouting of offshore export cable installation through the assumed application of the relevant conditions in the Offshore Consents in relation to the installation and operation of the export cables within the OECC Extension Area. It is assumed that all consent plan requirements, and management and mitigation measures required by the Offshore Consents (as would be reasonably considered relevant to the export cable installation works within the OECC, and specifically those set out in the OfTW Marine Licence) will also be implemented in relation to the proposed Variation. Where specific management or mitigation measures are considered particularly relevant to the potential impacts of the export cable installation within the OECC Extension Area on a specific receptor, these are referenced in the screening table below (Table 4-1).

109. The assessment criteria and EIA terminology used in the EIA Report (NnGOWL 2018) have been adopted for the purpose of this document. Further information and detail are presented within Chapter 6 of the EIA Report – EIA Methodology.

110. The Original ES (NnGOWL, 2012) and the Scoping Report and EIA Report produced to support the Application for the revised design (NnGOWL, 2017; 2018) have been reviewed to identify the environmental receptors that may be sensitive to the proposed construction and operation of the offshore export cables within the OECC Extension Area.

111. Each of the relevant receptors that have the potential to be affected have been subject to a screening exercise; Table 4-1 sets out the results of this screening having considered the potential impacts that may arise from rerouting the export cable route through the OECC Extension Area and the validity of previous EIA determinations. It is concluded that there would be no significant impact to any receptors, as described in Table 4-1, resulting from the reroute of the export cable through the OECC Extension Area, therefore, no further environmental assessment is presented.

4.4.1 Screening of potential cumulative effects

112. The proposed changes are restricted to a small discrete location adjacent to the existing OECC area. No additional plans / projects were identified which could potentially impact on environmental receptors in the vicinity of the OECC Extension Area other than the Project. The proposed reroute of the export cables within the OECC Extension Area will replace the equivalent activities and deposits covered by the Offshore Consents as assessed in the Original Application (NnGOWL, 2012) and the EIA Report (NnGOWL, 2018). In addition, it is assumed that the relevant mitigation and management measures and Consent Conditions associated with the current Offshore Consents will be similarly applied to the proposed export cable route within the OECC Extension Area as referenced in Table 4-1. No additional cumulative Projects relevant to the Extension Area have been identified.

Table 4-1: Screening of the potential for LSE arising on environmental receptors from the proposed reroute of the export cables through the OECC Extension Area.

RECEPTOR	DISTURBANCE TO SEABED	INCREASED SUSPENDED SEDIMENT	HABITAT LOSS / CHANGE	EMF	JUSTIFICATION
Marine Processes	×	×	×	×	Impacts to Marine Processes was scoped out of the Project Application on the basis that the Original EIA determinations (NnGOWL, 2012) were still valid. The Original EIA concluded that there would be no impact on marine processes as a result of the construction or operation of the Wind Farm and OfTW. The reroute of the export cables within the OECC Extension Area does not result in any additional impact given that it replaces installation in the OECC rather than adding to it. The installation methods and quantity of deposits remains within the consented Project design envelope. It is concluded, therefore, that the reroute of the export cables within the OECC Extension Area will not have a significant effect on the marine processes.
Benthic Subtidal Ecology	×	×	×	×	Impacts to Benthic Subtidal Ecology was scoped out of the Project Application on the basis that the Original EIA determinations (NnGOWL, 2012) were still valid. The Original EIA concluded that there would be no significant impact on benthic habitats and species as a result of the construction or operation of the Wind Farm and OfTW. The reroute of the export cables within the OECC Extension Area does not result in any additional impact given that it replaces installation in the OECC rather than adding to it. The installation methods and quantity of deposits remains within the consented Project design envelope. It is concluded that the reroute of the export cables within the OECC Extension Area will not have a significant effect on the Benthic Subtidal Ecology.
Fish and Shellfish Ecology	×	×	×	×	Impacts to Fish and Shellfish receptors for the impact pathways relevant to the Works were scoped out of the Project Application on the basis that the Original EIA determinations (NnGOWL, 2012) were still valid. The Original EIA concluded that there would be no significant impact on fish and shellfish and species as a result of direct disturbance increased suspended sediment concentrations, habitat loss / change or EMF associated with the construction or operation of the Wind Farm and OfTW. The reroute of the export cables within the OECC Extension Area does not result in any additional impact on fish and shellfish receptors either spatially or temporally. The installation methods and quantity of deposits remains within the consented Project design envelope. It is concluded that the reroute of the export cables within the OECC Extension Area will not have a significant effect on the Fish and Shellfish Ecology within area.

RECEPTOR	DISTURBANCE TO SEABED	INCREASED SUSPENDED SEDIMENT	HABITAT LOSS / CHANGE	EMF	JUSTIFICATION
Marine Mammals	N/A	×	×	×	Impacts to Marine Mammal receptors for the impact pathways relevant to the Works were scoped out of the Project Application on the basis that the Original EIA determinations (NnGOWL, 2012) were still valid. The Original EIA concluded that there would be no significant impact on marine suspended sediment, habitat loss / change or EMF associated with the construction or operation of the Wind Farm and OfTW. The reroute of the export cables within the OECC Extension Area does not result in any additional impact on marine mammal receptors either spatially or temporally. The installation methods and quantity of deposits remains within the consented Project design envelope. It is concluded that the reroute of the export cables within the OECC Extension Area will not have a significant effect on the Marine Mammals within the local area or in the wider region.
Ornithology	×	×	×	×	There are no direct impact pathways associated with cable installation and operation that will interact with ornithology receptors. Indirect impacts that could occur as a result of effects on prey species or supporting habitats are predicted to be not significant as described above in relation to fish and shellfish resources and benthic subtidal ecology. The reroute of the export cables within the OECC Extension Area will not have an effect on ornithology receptors in the area.
Nature Conservation (National)	×	×	×	×	The OECC Extension Area does not overlap with any nature conservation sites designated for benthic habitats. The OECC Extension Area (and the wider existing OECC) lies within the Outer Firth of Forth and St Andrews Bay Complex pSPA. The impacts on supporting prey habitats and species were considered within the Project HRA. Further consideration of the potential effects on the pSPA arising from the reroute of the export cables within the OECC Extension Area are set out in Section 5.7.
Commercial Fisheries	×	×	×	×	Impacts to Commercial Fisheries were assessed within the project EIA (NnGOWL, 2018) taking into account a refreshed baseline. The EIA concluded that the implementation of a suitable mitigation strategy including disruption payments would reduce the significance of the effects on the various commercial fishing fleets to minor. As the reroute of the export cables within the OECC Extension Area does not result in any additional spatial or temporal impact and the installation methods and quantity of deposits remains within the consented Project design envelope (e.g. no change in the additional rock protection or alternatives where required between the consented parameters and

RECEPTOR	DISTURBANCE TO SEABED	INCREASED SUSPENDED SEDIMENT	HABITAT LOSS / CHANGE	EMF	JUSTIFICATION
					those proposed by the variation), it is considered that the EIA determinations remain valid. Furthermore, installation of the export cables over the rocky outcrops around KP9 would require significant deployment of rock protection to grade the seabed and additional rock armour to protect the cable which is likely to pose a greater risk to commercial fisheries. In addition, NnGOWL are committed to implementing the following mitigation measures to reduce the risk of interaction with Commercial Fisheries stakeholders: • Implementation of a Fisheries Management and Mitigation Strategy (FMMS); • Promulgation of information on construction activities through Notice to Mariners (NtM) and publication of regular Kingfisher bulletins; • Engagement of a Project Fisheries Liaison Officer (FLO) to ensure continued engagement with local fishery stakeholders; and • Continued engagement with a Commercial Fisheries Working Group.
Shipping and Navigation	×	×	×	×	There is no potential pathway of effect upon shipping and navigation resulting from disturbance to the seabed, increased suspended sediment, habitat loss / change or EMF. Vessel traffic will be managed through implementation of a Navigational Safety and Vessel Management Plan (NSVMP) (NNG-NNG-ECF-PLN-0010) and by promulgation of information through NtMs, Kingfisher Bulletins and submission of notifications to the UK Hydrographic Organisation (UKHO).
Marine Archaeology and Ordnance	×	×	×	×	Impacts to Marine Archaeology and Ordnance was scoped out of the Project Application on the basis that the Original EIA determinations (NnGOWL, 2012) were still valid. The Original EIA concluded that there would be no significant impact on Marine Archaeology assets as a result of the construction or operation of the Wind Farm and OfTW as long as suitable measures were put in place to safeguard known archaeological receptors. Recent geophysical survey analysis did not identify any archaeological assets within the OECC Extension Area. Furthermore, in line with the wider Project, an archaeological Written Scheme of Investigation and Protocol of Archaeological Discovery (WSI and PAD) will be implemented setting out archaeological exclusion zones (AEZs)

RECEPTOR	DISTURBANCE TO SEABED	INCREASED SUSPENDED SEDIMENT	HABITAT LOSS / CHANGE	EMF	JUSTIFICATION
					and a protocol to be followed in the event that potentially important artefacts are identified in the vicinity of the OECC Extension Area.
Aviation and MOD	×	×	×	×	There are no impact pathways that could interact with aviation and Ministry of Defence (MOD) receptors associated with the reroute of the export cables within the OECC Extension Area.

4.5 Screening of Potential Effects of Increase of Permitted Grout Volumes

113. Grout lines will inject grout directly into the annulus between the pile and socket at each of the OSP locations. Deployed grout volumes will be monitored to ensure grout is installed within the pile and injection will cease once an adequate grout density is achieved. Live monitoring of grouting activities will ensure that surplus grout is not injected, and operations will cease before the grout overflows onto the seabed. The final grout volume was not a material consideration when identifying potential impacts or the magnitude of an impact. The additional grout volumes will therefore be deployed within the pile socket at each OSP location and will not represent a change to the worst case design envelope assessed within the Original Application ES, or subsequent Scoping Report (NnGOWL, 2017) and EIA Report submitted in support of the Project (NnGOWL, 2018).

114. The increase in permitted grout volumes by 50 m^3 does not represent a material change and does not invalidate the impact determinations reported within the Environment Statement (NnGOWL, 2012) and subsequently scoped out of the recent EIA (NnGOWL, 2018).

5 Assessment of Likely Significant Effects and Adverse Effects on Integrity

5.1 Introduction

115. This section is intended to provide consideration of the potential for the reroute of the export cables within the OECC Extension Area to lead to a Likely Significant Effect (LSE) on the conservation objectives of any relevant European designated (Natura 2000) or Ramsar site (referred to as a Stage 1 – screening assessment).

116. Under the 2010 Habitats Regulations, the competent authority would be required to make an Appropriate Assessment of the implications of a proposed activity in view of any affected designated site's conservation objectives, should it be determined that the proposed activity has the potential to cause a LSE. The information presented in this section, is intended to provide the competent authority with the relevant information to enable them to determine whether an Appropriate Assessment is required and where required, to provide the information to support the Appropriate Assessment process.

117. An LSE is defined, in this context, as any effect (either alone or in-combination with other projects) that may be reasonably predicted as a consequence of a plan or project to have the potential to have a LSE on the favourable conservation status of the features for which the site was designated, but excluding trivial or inconsequential effects (and with due regard to the conservation objectives for the site).

5.2 Designated Sites

118. The Outer Firth of Forth and St Andrews Bay Complex proposed SPA (pSPA) has been identified as relevant to this assessment due to the area of overlap with the OECC Extension Area and existence of potential impact pathways relevant to the site features. Figure 5-1 displays the OECC Extension Area relevant to this application, the Project existing OECC, the Wind Farm Area and the pSPA.

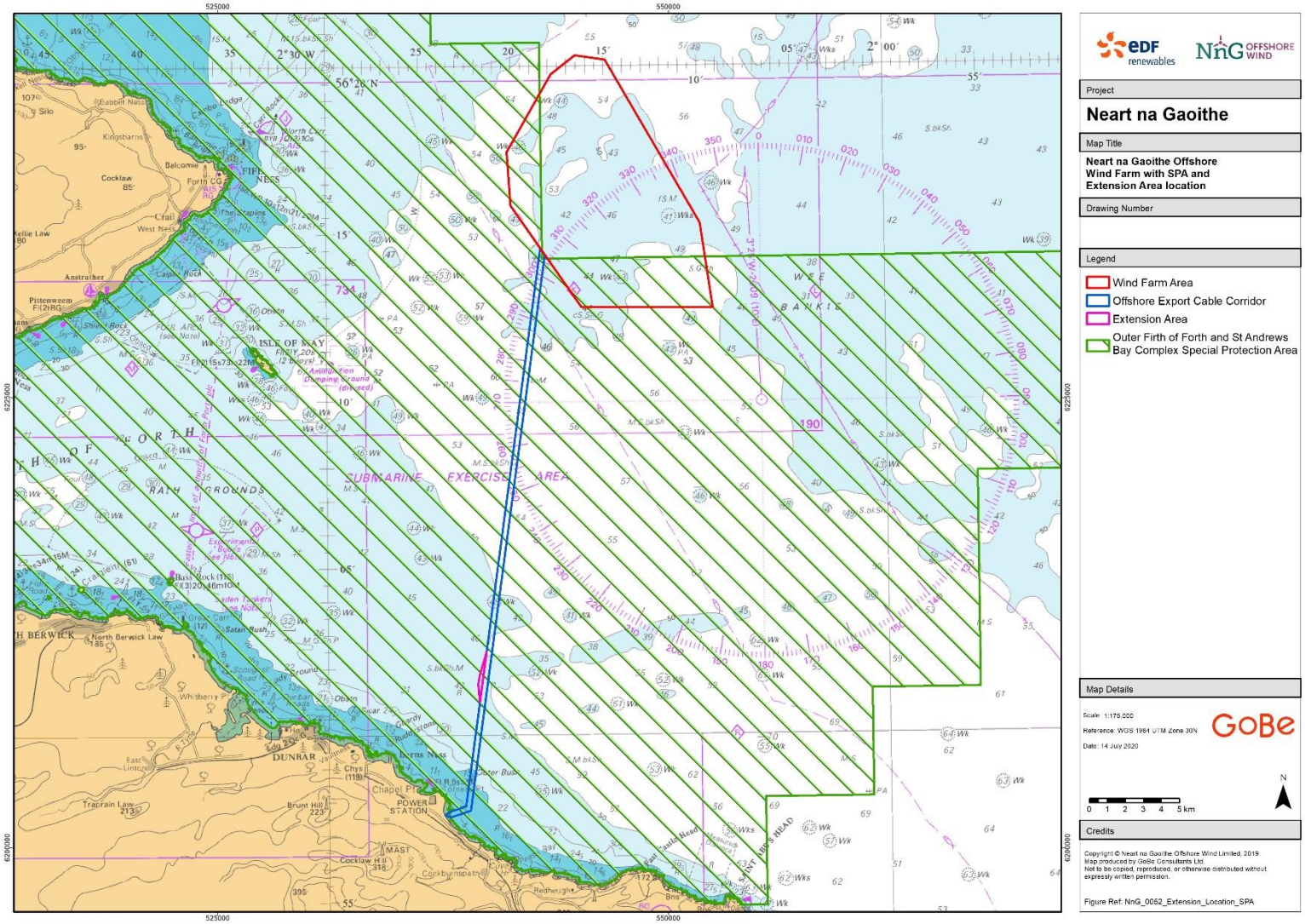


Figure 5-1: OECC Extension Area, the adjacent OECC and Wind Farm Area relative to the Outer Firth of Forth and St Andrews Bay Complex pSPA

5.3 Consideration of LSE Resulting from use of HDPE or Steel Ducts

119. As described in Section 4.2 the activities associated with installation of the ducts at Thorntonloch remain within the consented design envelope. Impacts associated with HDD at the landfall were screened out of the HRA Report submitted in support of the Application (NnGOWL, 2018) for the Project. As the type of ducting was not a material consideration in screening of potential impacts into the HRA is considered that the HRA screening conclusions and subsequent Appropriate Assessment (MS-LOT, 2019) remain valid. Therefore, no risk of LSE is predicted to the qualifying features or supporting habitats of the Outer Firth of Forth and St Andrews Bay Complex pSPA.

5.4 Consideration of LSE Resulting from Trial Trenching

120. As described in Section 4.3 the activities and deposits with trial trenching are within the worst case design envelope assessed in the EIA Report where they relate to the installation of the OECC. The HRA Report submitted as part of the Application for the Project (NnGOWL, 2018) considered the potential effects of habitat disturbance associated with cable laying and loss associated with cable and scour protection. The HRA concluded that 'impacts from loss or disturbance of habitat within the pSPA will not adversely affect the integrity of the Outer Firth of Forth and St Andrews Bay Complex pSPA in light of the qualifying interests, their condition and vulnerabilities and the conservation objectives'. As the proposed changes are within the consented design envelope the conclusions of the HRA remain valid. Therefore, no risk of LSE is predicted to the qualifying features or supporting habitats of the Outer Firth of Forth and St Andrews Bay Complex pSPA.

5.5 Consideration of LSE and the Potential for AEOI resulting from OECC Extension Reroute

121. The cable installation and operation and maintenance (O&M) activities referred to within this report were considered within the Project Application EIA Report and HRA within the current OECC. The cable installation activities and O&M activities associated with the Works will replace the same quantity of deposits as detailed within the OfTW Marine Licence associated with the current Project Offshore Consents. The impacts associated with the proposed Works are not additive with the impacts associated with the activities covered by the current Offshore Consents for the Project. The assessment considers the implications of rerouting the cable within the OECC Extension Area. The associated effects of the Works can be considered with reference to the worst case effects from the construction of the Project as detailed in the Application.

122. As the purpose of this assessment is to identify the potential for any LSE and given that the footprint of the proposed activities falls within the Consented Project design envelope and will be spatially restricted to the OECC Extension Area, effect pathways to more distant designated sites are considered unlikely.

123. Potential sources of impacts from each aspect of the activities associated with the Works are considered below in Table 5-1, as applicable to the Outer Firth of Forth and St Andrews Bay Complex pSPA.

5.5.1 Direct disturbance to seabed habitats and species as a result of construction activity

124. The cable lay and burial activities described in Section 2.4.2.2 will result in an area of approximately 0.06 km^2 of seabed habitats being affected within the OECC Extension Area. There is potential for direct disturbance to supporting subtidal habitats with the designated site as a result of cable lay and burial activities. This impact would be of a limited duration and would be of limited spatial scale being restricted to a small proportion of the overall OECC Extension Area.

5.5.2 Increased suspended sediment resulting from seabed disturbance during installation

125. The works has the potential to have an indirect impact on supporting habitats as a result of increased suspended sediment and siltation; increase in turbidity; and release of contaminants from disturbed sediments. The Original ES reported that concentrations of sediment contaminants were low across the OECC. In addition, modelling undertaken to inform the physical processes assessment in the Original ES concluded that sediment would settle out of the water column within a few hours and within 2 km of the export cable. The thickness of deposition was predicted to be very thin; typically, < 0.1 mm and up to a maximum of 3 mm. This impact would be of a limited duration and would be of limited spatial scale being restricted to within 2 km of the offshore export cable.

5.5.3 Habitat loss / change as a result of placement of rock protection

126. In the event that additional cable protection is required it is anticipated that up to 15% of the total export cable length may require rock placement or similar. The potential maximum footprint of deposits resulting from additional protection measures would be up to 0.009 km^2 which equates to less than 3% of the OECC Extension Area. Whilst the change may be permanent the area of habitat loss or change accounts for a very small proportion of the OECC Extension Area.

5.5.4 Electromagnetic fields

127. Some fish and benthic invertebrate species are known to have the ability to detect EMFs. EMFs have the potential to affect the behaviour of fish and invertebrate species in close proximity to the cables. Modelling undertaken to discharge Offshore Consent conditions for the Project noted that the EMF for the offshore export cables buried to 1 m would be below the Earth's magnetic field at the seabed surface and would be zero within 5 m. Whilst burial does not reduce the strength of EMFs it does increase the distance between the cable surface and organisms in the vicinity. Although the impact will be long-term persisting for the duration of the operational phase of the Project the spatial scale is limited to within the immediate vicinity of the cable surface.

5.6 Consideration of LSE Resulting from Increase of Permitted Grout Volumes

128. The OSP locations are located offshore to the east of the Outer Firth of Forth and St Andrews Bay Complex pSPA. As described in Section 4.5 the additional grout volumes will be injected within the pile socket at each of the OSP locations and will not result in any additional impacts to the seabed or surrounding habitats. The installation of the casing and piles and associated grout deposits will not have any connectivity with the qualifying features of the pSPA.

5.7 Summary of Potential for LSE and AEOI Resulting from OECC Extension Reroute

5.7.1 The Outer Firth of Forth and St Andrews Bay Complex pSPA

Table 5-1: The Outer Firth of Forth and St Andrews Bay Complex pSPA

Description of the site	The Outer Firth of Forth and St Andrews Bay Complex pSPA overlaps with the OECC Extension Area, the existing OECC and partially overlaps with the Wind Farm Area. The site comprises of marine and coastal habitat. Qualifying species • Arctic tern *Sterna paradisaea*, black-headed gull *Chroicocephalus ridibundus*, common gull *Larus canus*, common scoter *Melanitta nigra*, common tern *Sterna hirundo*, eider *Somateria mollissima*, gannet *Morus bassanus*, goldeneye *Bucephala clangula*, guillemot *Uria aalge*, herring gull *Larus argentatus*, kittiwake *Rissa tridactyla*, little gull *Hydrocoloeus minutus*, long-tailed duck *Clangula hyemalis*, manx shearwater *Puffinus puffinus*, puffin *Fratercula arctica*; razorbill *Alca torda*, red-breasted merganser *Mergus serrator*, red-throated diver *Gavia stellata*, shag *Phalacrocorax aristotelis*, Slavonian grebe *Podiceps auratus* and velvet scoter *Melanitta fusca*.	
Conservation objectives of the site	To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving the aims of the Birds Directive for each of the qualifying species; and To ensure for the qualifying species that, subject to natural change, the following attributes are maintained in the long term: • The species as a viable component of the site; • No significant disturbance of the species or significant reduction in ability of the species to utilise important parts of the site; and • Distribution and extent of habitats and the structure, function and supporting processes of the habitats supporting the qualifying species and their prey are maintained	
Potential for LSE	**Direct disturbance to seabed habitats and species as a result of construction activity**	Seabed disturbance during installation will not have a direct effect on qualifying species of the pSPA; however, fish and invertebrate prey species may be temporarily displaced from the area within the direct footprint of the OECC Extension Area. Due to the limited spatial extent and availability of alternative foraging grounds disturbance of seabed habitats within the OECC Extension Area would not result in any significant change to prey availability. The HRA completed as part of the Application (NnGOWL, 2018) for the Offshore Consents considered the impacts of the wider Project on prey availability. The proposed Works in-combination with the Project remains within the assessed Design Envelope, it is therefore, considered that the conclusions within the HRA are valid for the current assessment. The HRA concluded that '*the potential impacts will be localised and short-term, with fish population returning to normal background levels. Consequently, the distribution and extent of the species will be maintained in the long term.*'

		The duration, magnitude and extent of impacts resulting from cable installation within the OECC Extension Area on the SPA qualifying species is, therefore, assessed as being unlikely to compromise the conservation objectives the pSPA. Consequently, no potential for LSE is predicted (alone or in-combination).
	Increased suspended sediment resulting from seabed disturbance during installation	There is potential for a sediment plume to occur that could affect the ability of birds to forage in the water column. The Original ES (NnGOWL, 2012) concluded that there would be only short-term increases in SSC that may temporarily exceed background levels (from the main construction works); however, the resulting plumes would not be advected beyond the near field and rapidly dispersed by the tidal regime in the area and will settle out within a few hours of disturbance. Settled material will be the same as that occurring naturally and will be subject to the natural processes of erosion/deposition experienced in the region. The levels of sediment disturbance and suspended sediment concentrations resulting from the cable installation within the OECC Extension Area will be substantially less than the worst case impacts assessed within the Original ES. In addition, in-combination effects with the consented Project will be within the Project design envelope assessed within the Original ES. The increase in sediment in the water column will, therefore, be relatively low, localised, short term and occur once during installation; this will not impact on the ability of seabirds to forage. As such, the duration, magnitude and extent of impacts resulting from increased suspended sediment concentrations and prey availability in the water column on pSPA qualifying species are assessed as being unlikely to compromise the conservation objectives of the pSPA. Consequently, no potential for LSE is predicted (alone or in-combination). The HRA concluded that '*the potential impacts from trenching cables within the pSPA will be localised and temporary and not have a long-term impact on the habitat*'.
	Habitat loss / change as a result of placement of rock protection	If rock protection is required there is the potential for a loss of habitat which may support prey species of some of the qualifying bird species of the pSPA. The area of potential habitat loss within the OECC Extension Area is approximately 0.009 km^2 which represents less than 0.01% of the total area of the SPA (2,720.68 km^2). The total area of potential habitat loss in-combination with the consented Project would be approximately 0.1527 km^2, or 0.006 % of the SPA area. Due to the limited spatial extent of habitat loss it is concluded that the reroute of the export cables within the OECC Extension Area will not cause a significant reduction in the extent, distribution or quality of habitats that support the qualifying species or their prey. Consequently, no potential for LSE with respect to designated pSPA interests is predicted (alone or in-combination). The HRA concluded that '*that the very small area of seabed habitat lost within the pSPA as a result of turbine installation and cable protection will not cause a significant reduction in the extent, distribution or quality of habitats that support the qualifying species or their prey*.'
	Electromagnetic Fields (EMF)	The EMFs will be up to 14 µT at the surface of the seabed directly above the cable. The predicted maximum magnetic field strength of the export cables at the seabed is expected to be lower than the earth's magnetic field (~50 µT). In addition, the EMF will fall to zero within 5 m of the offshore export cable. Given, the low EMFs produced and the limited spatial extent there is no potential for any significant effects to supporting habitats or prey species associated with foraging qualifying species of the SPA. Consequently, no potential for LSE with respect to designated pSPA interests is predicted (alone or in-combination).

5.8 Implication of Amendments on Nature Conservation Objectives

129. For the Outer Firth of Forth and St Andrews Bay Complex pSPA, it can be concluded with confidence that the proposed Variation will not affect the population or distribution of the qualifying features of the Natura 2000 site. This is due to the limited duration, magnitude and extent of the impact related to the direct disturbance to seabed habitats and species, increased suspended sediment concentrations, habitat loss / change as a result of placement of rock protection and emission of EMFs. Therefore, it can be concluded that there will be no LSE as a result of the proposed Variation within the OECC Extension Area on the Outer Firth of Forth and St Andrews Bay Complex pSPA.

5.9 In-Combination Effects

130. In relation to the features of the pSPA considered above, Table 5-1 has concluded on both alone and in-combination potential for LSE. Given the small scale nature of the disturbance arising from the amendments, both spatially and temporally, it has been concluded that there is no potential for an in-combination LSE for the Outer Firth of Forth and St Andrews Bay Complex pSPA.

5.10 Conclusion

131. The purpose of Section 5 of this document is to determine if the proposed Variation to the OfTW Marine Licence constitutes an LSE on the Outer Firth of Forth and St Andrews Bay Complex pSPA.

132. The assessment undertaken in this section has established that given the nature of the effects predicted (both in magnitude and duration), the scale of the features present and the existing activity levels taking place in the area, there is no potential for LSE on the qualifying features of the Outer Firth of Forth and St Andrews Bay Complex pSPA.

6 Conclusion

133. This Supporting Environmental Information Report has been prepared in advance of Construction of the Project to cover the following proposed changes:
    - Inclusion of both HDPE and steel materials as licensed deposits for ducting at the landfall site;
    - Inclusion of export cable trenching trials as part of the licensed deposits.
    - Rerouting of a small section of the offshore export cables within the OECC Extension Area;
    - An increase in the permitted grout volumes at the OSP foundation locations;
134. This document is intended to provide the regulatory authorities (and their statutory advisers, where relevant) with the necessary supporting information to conclude that the proposed amendments constitute a non-material change and so can be included in a Variation to the existing OfTW Marine License.
135. This report has provided a consideration of the changes against the currently consented worst case design envelope and where required appraised the potential environmental effects resulting from the proposed changes. Receptors that may be affected by the amendments have been identified and assessed. It is considered that there are no changes to the determinations reported within the EIA Report and therefore no significant effects (alone or cumulatively) are predicted to occur.
136. The LSE assessment presented within this document has been established through a review of the following:
    - The nature of the effects predicted (both in magnitude and duration);
    - The scale of the features present; and
    - The existing activity levels taking place in the area.
137. No LSE is concluded for the Outer Firth of Forth and St Andrews Bay Complex pSPA.

7 References

Barne, J.H., Robson, C.F., Kaznowska, S.S., Doody J.P., Davidson N.C. and Buck, A.L. (1997). Coasts and Seas of the United Kingdom Region 4 South-east Scotland: Montrose to Eyemouth (JNCC Peterborough) (Coastal Directories Series).

Coull, K.A., Johnstone, R and Rogers, S.I., (1998). Fishery sensitivity Maps in British Waters. (Published and distributed by UKOOA Ltd)

Eleftheriou, A., Basford, D. and Moore D.C. (2004). Synthesis of Information on the Benthos of Area SEA5. (Report for the Department of Trade and Industry. Final Draft May 2004.)

Ellis, J.R., Milligan, S. P., Readdy, L., Taylor, N. and Brown, M.J., (2012). Spawning and nursery grounds of selected fish species in UK waters. Sci. Ser. Tech. Rep., (Cefas, Lowestoft) 147: 56 pp.

Malcolm, I.A., Godfrey, J. and Youngson, A.F., (2010). Review of migratory routes and behaviour of Atlantic Salmon, sea trout and European eel in Scotland's coastal environment: implications for the development of marine renewables. (Scottish Marine and Freshwater Science,1, 14)

NnGOWL, (2012). Neart na Gaoithe Offshore Wind Farm Environmental Statement, July 2012. Neart Na Gaoithe Offshore Wind Ltd.

NnGOWL, (2013). Neart na Gaoithe Supplementary Environmental Information Statement, June 2013. Neart Na Gaoithe Offshore Wind Ltd.

NnGOWL, (2018). Neart na Gaoithe Offshore Wind Farm Environmental Impact Assessment Report. March 2018. Neart Na Gaoithe Offshore Wind Ltd.

NnGOWL, (2018). Habitats Regulations Appraisal Report. Neart Na Gaoithe Offshore Wind Ltd.