Cambois Connection – Onshore Scheme

Coastal Vulnerability Assessment

sse Renewables

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Acronyms

Acronym	Description
AC	Alternating Current
AWB	Artificial Waterbody
BBAC	Berwick Bank Alternative Connection
BBWF	Berwick Bank Wind Farm
BBWFL	Berwick Bank Wind Farm Limited
BGS	British Geological Survey
BNG	Biodiversity Net Gain
CAL1	Cefas Action Level 1
CBRA	Cable Burial Risk Assessment
CCRA	Climate Change Risk Assessment
CEA	Cumulative Effects AHWssessment
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CEMP	Construction Environmental Management Plan
CSIP	Cable Specification and Installation Plan
CVA	Coastal Vulnerability Assessment
DC	Direct Current
DDV	Drop Down Video
EA	Environment Agency
ECC	Export Cable Corridor
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EQS	Environmental Quality Standards
EQSD	Environmental Quality Standards Directive
ES	Environmental Statement
EU	European Union
EUNIS	European Nature Information System
GCS	Good Chemical Status
GEP	Good Ecological Potential

Acronym	Description
GES	Good Ecological Status
GS	Good Status
GW	Giga watt (power)
HDD	Horizontal Directional Drilling
HDPE	High-Density Polyethylene
HMWB	Heavily Modified Waterbody
HRA	Habitats Regulations Assessment
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IEMA	Institute of Environmental Management and Assessment
IMO	International Maritime Organisation
INNS	Invasive Non-Native Species
IPCC	Intergovernmental Panel on Climate Change
JNCC	Joint Nature Conservation Committee
LAT	Lowest Astronomical Tide
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
LSE	Likely Significant Effects
MCZ	Marine Conservation Zone
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs
MLA	Marine Licence Application
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MD-LOT	Marine Directorate Licensing and Operations Team
NCC	Northumberland County Council
NECO	North East Coastal Observatory
NSL	North Sea Link
NTSLF	National Tidal and Sea Level
oEMP	Outline Environmental Management Plan
OCSP	Offshore Converter Station Platform

Acronym	Description
PDE	Project Design Envelope
PFOS	Perfluorooctane Sulfonate
PLONOR	Pose Little or No Risk
PSA	Particle Size Analysis
PSD	Priority Substance Directive
RBMP	River Basin Management Plan
RCP	Representative Concentration Pathways
rBWD	Revised Bathing Water Directive
RIAA	Report to Inform Appropriate Assessment
SAC	Special Areas of Conservation
SPA	Special Protection Areas
SSER	SSE Renewables
SSSI	Site Special Scientific Interest
TJB	Transitional Joint Bay
UK	United Kingdom
UKCP	United Kingdom Climate Projections
UWWT	Urban Wastewater Treatment
UWWTD	Urban Wastewater Treatment Directive
UXO	Unexploded Ordnance
VIGRA	Vision using Generic Algorithms
WFD	Water Framework Directive
ZoI	Zone of Influence

Units

Unit	Description
GW	Giga watt (power)
km	Kilometre (distance)
km^2	Kilometre squared (area)
mg/l	Milligrams per litre (concentration of solids within a liquid)
nm	Nautical mile (distance)

EXECUTIVE SUMMARY

Berwick Bank Wind Farm Limited (BBWFL) is proposing the development of Offshore Export Cables, Onshore Export Cables, an onshore Converter Station and associated grid connection at Blyth in Northumberland (the Cambois Connection, hereafter referred to as 'the Project'). The Offshore Export Cables will reach a proposed landfall[1] location on the Cambois coastline owing to the need to connect into the Applicant's agreed grid connection at Blyth substation. Landfalling at Cambois has been demonstrated to be successful by a number of recent comparable developments and indeed the Applicant has selected the location following a detailed programme of environmental, technical and commercial studies.

The Cambois coastline, including the proposed Landfall location, is within the Northumberland County Council (NCC) Coastal Change Management Area (CCMA), and specifically, is within the Northumberland Local Plan policy area for 'WAT-5'. This plan policy relates to the sustainable development of infrastructure in coastal environments. WAT-5 requires justification for selection of a coastal location, with demonstration that the development is safe over its planned lifetime, that there will not be loss or harm to the coastline and that the development will not impact upon existing coastal defence measures. Where development is proposed within a CCMA, it will only be supported by NCC where a number of conditions can be met. As demonstrated via this Coastal Vulnerability Assessment (CVA), the Applicant has fully met all such requirements. Coastal vulnerability is the risk to coastal communities and infrastructure to potential natural weather extremes, sea level rise and climate change effects resulting in changes to physical and coastal processes and the coastline.

The CVA focuses on:

- All relevant aspects of the Landfall installation process occurring to the west of the sand dune system along the Cambois coastline (Onshore Scheme);
- Landfall installation process underneath the sand dune system (Onshore Scheme);
- Landfall installation process including the trenchless technology underneath the intertidal zone (Onshore Scheme and Marine Scheme);
- Landfall installation process below MLWS, including the trenchless technology 'punch out' / exit pits (Marine Scheme);
- Application of trenchless technology punch out and cable protection during installation, such as rock placement, within the Study Area (Marine Scheme); and
- All relevant aspects of the Landfall described above during the operation and maintenance phase of the Project.

The Applicant's commitment to trenchless technology at the Landfall means that there is no potential for any direct interaction with the intertidal area for both the Onshore Scheme and Marine Scheme. The trenchless technology ducts will pass from an Onshore entry point, within the HDD compound, under existing infrastructure, including road, utilities, railways, sand dune system, Cambois beach and the intertidal area to an HDD "punch out" exit point at least 250 m seawards of MLWS, there is no above ground infrastructure located within the intertidal area.

The Applicant has reduced potential interactions between the Project and the coastline, for example, by committing to adopt trenchless technologies (such as Horizontal Directional Drilling (HDD)) to cross the intertidal area. Nonetheless, all coastal and energy-related infrastructure may be at risk from the effects of climate change (CCC, 2021) and this includes nearshore infrastructure associated with the Project and buried assets. In carrying out this CVA, the Applicant has drawn on the information available at the

[1] The term 'Landfall' is used throughout this CVA to refer to the point where the offshore export cables are brought to shore; it is the key interface between the Marine Scheme and the Onshore Scheme.

time of assessment; this is reported on in full within Volume 2, Chapter 5: Project Description. Alongside the information presented within the Project Description, the Applicant has produced a series of design assumptions for the Project that have fed into the CVA; specifically, the assumptions relating to coastal activity at the Landfall. The design scenario that has fed into the CVA has been based on the collective experience of the Project, lessons-learned from other comparable development (both locally and around the UK) and preliminary Landfall feasibility assessments completed by the Applicant.

The conclusions of the CVA are that as there is no permanent infrastructure in the intertidal area there will be no foreseeable construction-phase impacts which would be inconsistent with the CCMA / WAT-5 policy provisions.

There are two primary topics which require detailed consideration during the operation and maintenance phase of the Project; they relate to the Landfall operations and the stabilisation of trenchless technology exit pits in the nearshore area. Both of these topics have been taken into detailed assessment within the CVA; through the application of mitigation by design, the CVA reaches the conclusion that the Applicant's proposals are fully compliant with the CCMA / WAT-5 policy provisions.

The CVA has been provided exclusively as part of planning for the Onshore Scheme to NCC related to requirements for WAT 5 policy, components of the Marine scheme have been provided for background for project as a whole, to enable NCC to rationally grant consent for the Onshore Scheme. The CVA has not been provided to MMO as part of the Marine Scheme application. The Marine Scheme will be separately determined by MMO under the Marine Licensing process.

It is important to recognise that at this relatively early stage of development, detailed designs are not available. On this basis and in line with the principles of the Rochdale Envelope, a maximum design scenario (MDS) has been established in order to set a Project Design Envelope (PDE); this is explained in-full within Volume 2, Chapter 1: Introduction. Recognising that further detailed information regarding the Landfall will only be made available at a later stage (as informed by the outcome from detailed engineering studies and additional surveys, such as ground investigation (GI) campaigns at Cambois), the Applicant has however committed to further engaging with NCC and key stakeholders (such as the Lead Local Flood Authority and Environment Agency) to share and agree details of the Landfall when available.

1. Introduction

1.1. Introduction

1. Berwick Bank Wind Farm Limited (BBWFL) is a wholly owned subsidiary of SSE Renewables (SSER) (hereafter referred to as 'the Applicant'). The Applicant is proposing the development of Offshore Export Cables, Onshore Export Cables, an onshore Converter Station and associated grid connection at Blyth substation in Northumberland (the Cambois Connection, hereafter referred to as 'the Project'). The purpose of the Project is to facilitate the export of green energy from the generation assets associated with the Berwick Bank Wind Farm (BBWF), located in the outer Firth of Forth. The Project will enable the BBWF to reach full generating capacity by 2030.

2. The Cambois Connection comprises of two distinct proposals, or 'Schemes': the Onshore Scheme and the Marine Scheme. A summary is provided below and in Plate 1. For the onshore components of the Project down to the seaward extent of the Landfall at mean low water springs (MLWS) ('the Onshore Scheme'), consent will be sought via a planning application to Northumberland County Council (NCC) as the local planning authority (LPA) under Section 57 of the Town and Country Planning Act 1990. An Environmental Statement (ES) has been prepared to support the planning application to NCC in accordance with The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (as amended).

3. For the offshore components of the Project seaward of mean high water springs (MHWS) ('the Marine Scheme'), consent is being sought in Scotland and England as the Marine Scheme is located within both Scottish and English waters. In Scotland, the Marine Scheme is entirely within offshore waters (i.e., between the 12 nautical miles (nm) limit and the outer limits of the Scottish Exclusive Economic Zone (EEZ)). In England, the Marine Scheme is within both offshore and territorial waters. Marine Licence Applications (MLAs) were submitted to the Marine Directorate Licensing Operations Team (MD-LOT) and the Marine Management Organisation (MMO) for Scottish and English waters respectively in July 2023, supported with a separate Marine Scheme EIA which is available online[2].

4. The precise location of the proposed Landfall is not yet known but will be along the Cambois coastline. Following stakeholder engagement and formal consultation and as informed by a range of technical studies along the Cambois coastline, the Applicant has committed to adopting trenchless techniques such as, Horizontal Directional Drilling (HDD), to achieve the Landfall for the Offshore Export Cables. This process will involve drilling a borehole underground from one point to another whereupon the Offshore Export Cables are installed through the borehole(s), without the need to excavate an open trench in the intertidal zone; this is explained in full in Section 1.4.

1.2. Coastal Vulnerability Assessment – Requirement and Purpose

5. The location of the Landfall is within the NCC Coastal Change Management Area (CCMA) 'WAT-5' policy area. This Coastal Vulnerability Assessment (CVA) responds to the requirements for consideration of the Onshore Scheme against NCC plan-policies associated with coastal management. Specifically, the CVA has been prepared in response to policy WAT-5 and the request for a CVA made by NCC during the course of pre-application engagement.

6. Although there is no statutory guidance on completing a CVA, the purpose of a CVA is to consider both now and in the future, how a development will interact with the receiving environment. By

[2] https://www.berwickbank.com/cambois-connection

undertaking this process, potential future issues associated with resilience to future climate change impacts can be identified or, greater confidence regarding the absence of potential issues can be provided. Lastly, the process of CVA can also help to identify required mitigation measures needed to help safeguard the Onshore Scheme against climate change, and to help provide for no adverse coastal impacts arising from the Onshore Scheme both now and in the future. This CVA describes the current and future projected baseline conditions and assesses the potential changes due to the installation and presence of the Project on the Northumberland coastline, responding to the NCC policy requirements above and the industry good-practice considerations embedded in the process of CVA.

7. The CVA has been provided exclusively as part of planning for the Onshore Scheme to NCC related to requirements for WAT 5 policy, components of the Marine scheme have been provided for background for the project as a whole, to enable NCC to rationally grant consent for the Onshore Scheme, see Figure 1. The CVA has not been provided to MMO as part of the Marine Scheme application. The Marine Scheme will be separately determined by MMO under the Marine Licensing process. The interrelationship between Onshore Scheme and Marine scheme are shown in Plate 1.

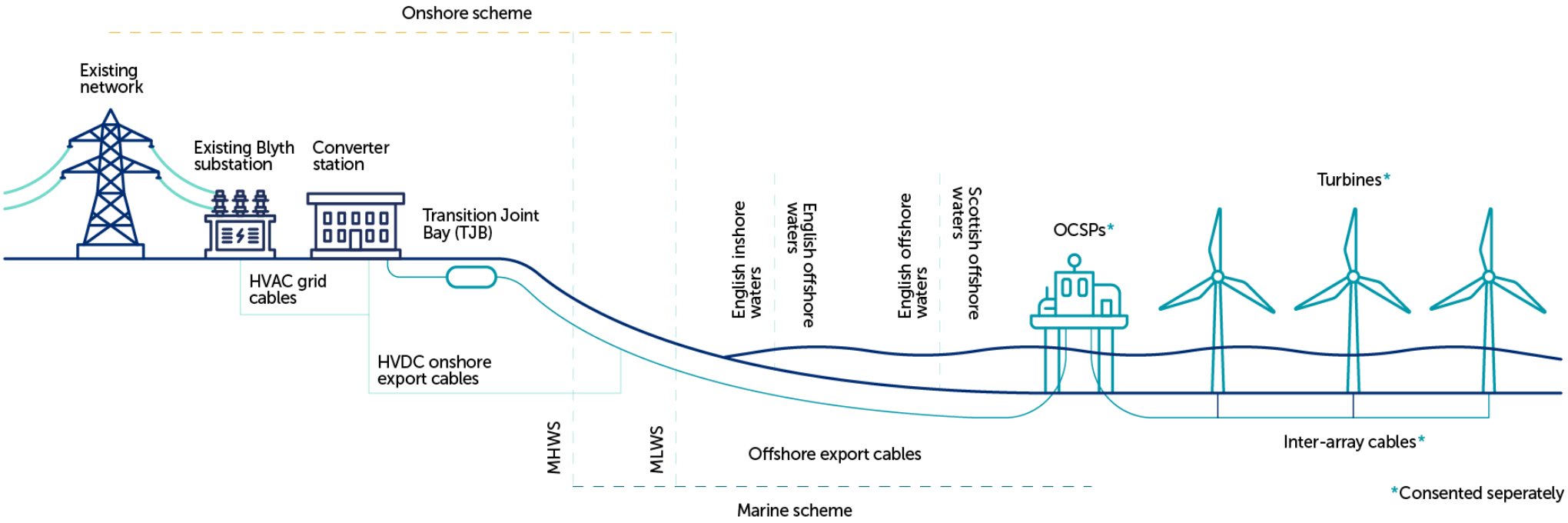

Plate 1 Cross-sectional summary of the Project

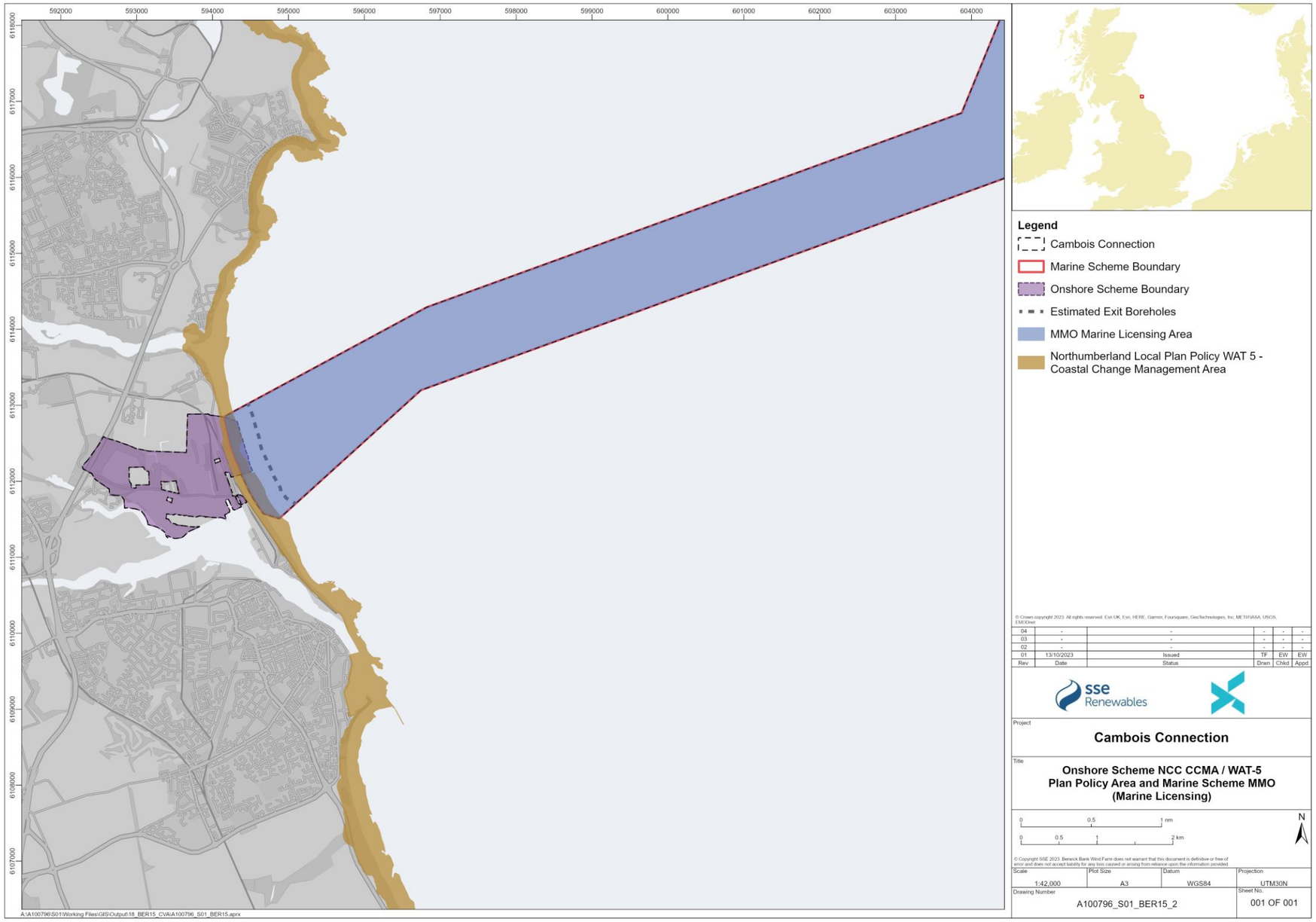

Figure 1 Onshore Scheme NCC CCMA / WAT-5 Plan Policy Area and Marine Scheme MMO (MLA)

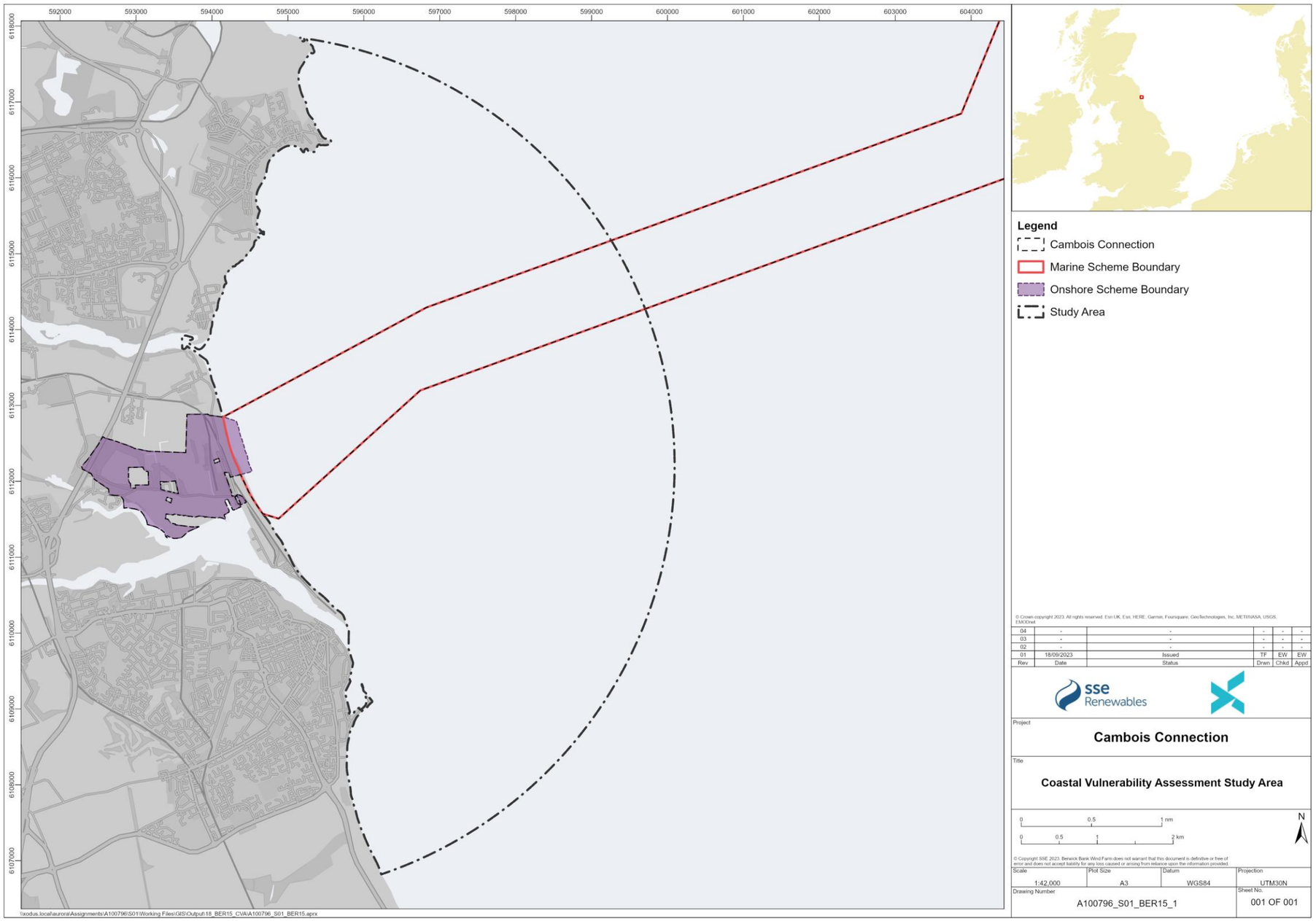

Figure 2 CVA Study Area

1.3. Intertidal Considerations – Onshore Scheme and Marine Scheme

8. The Project comprises two distinct proposals, or 'Schemes'. For the onshore components of the Project located landward of mean low water springs (MLWS) ('the Onshore Scheme'), consent will be sought via a planning application to NCC as the LPA under Section 57 of the Town and Country Planning Act 1990.

9. The offshore components of the Project are seaward of Marine High Water Springs (MHWS) (the Marine Scheme). In England, the Marine Scheme is within offshore waters and inshore waters, as illustrated in Plate 1 that displays an overview of the key components of the Project.

10. The Onshore ES considered the Onshore Scheme (all infrastructure and associated works landward of Mean Low Water Springs (MLWS)) in support of an application for planning permission to NCC.

11. The ES for the Onshore Scheme has considered the Marine Scheme (i) as part of the cumulative effects assessment (CEA); and (ii) in respect of the extent to which the Onshore Scheme and Marine Scheme redline boundaries both include the area between MLWS and MHWS, i.e. the intertidal area.

12. Cumulative effects assessment - the Environmental Impact Assessment (EIA) for the Onshore Scheme has included the Marine Scheme within the CEA. Whilst the Onshore Scheme application will be submitted after the Marine Scheme submission, sufficient information is available for assessing the Onshore Scheme cumulatively with the Marine Scheme, as part of the cumulative impacts assessment of the Onshore Scheme against other neighbouring developments.

13. Intertidal area – there is a necessary overlap between the Marine Scheme and the Onshore Scheme between MHWS and MLWS. As the proposed works under the Marine Scheme in the area seawards of MHWS are included in the Marine Licence Application, these works are included within the Marine Scheme EIA.

14. This approach is in accordance with the applicable legislation, the Marine Works (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) and the Conservation of Offshore Marine Habitats and Species Regulations 2017 and Conservation of Habitats and Species Regulations 2017 (together the Habitats Regulations) and reflects the separate consenting processes for the Marine Scheme and Onshore Scheme application, as outlined within the Applicant's Scoping Report (BBWFL, 2022) and throughout all pre-application consultation with stakeholders.

15. In particular, this approach allows each regulator under the Marine Scheme application and the Onshore Scheme application (i.e. the MMO and NCC, respectively) to determine the application submitted to them in accordance with their statutory role and functions and appropriate areas of competence under the EIA Regulations (and the TCPA (EIA) Regulations 2017 in the case of NCC and the Onshore Scheme) and the Habitats Regulations. The Applicant notes that NCC has agreed to the approach outlined by the Applicant as presented here.

16. The Applicant's commitment to trenchless technology at the Landfall means that there is no potential for any direct interaction with the intertidal area for both the Marine Scheme and Onshore Scheme. The trenchless technology ducts will pass beneath the intertidal area from a point at least 250 m seawards of MLWS to a location onshore landwards of the sand dune system, and there is no above ground infrastructure located within the intertidal area.

1.4. Project Description

17. As described above, the Cambois Connection is comprised of two separate proposals, or 'schemes'; the Onshore Scheme and Marine Scheme are summarised below:

18. The Onshore Scheme includes up to four underground High Voltage Directional Current (HVDC) export cables which be located within an onshore cable corridor between the Landfall, Transition Joint Bays (TJBs) and the new onshore converter station location.

19. The onshore HVDC export cables will extend from up to four TJBs, within a temporary onshore construction compound (located landwards of the Cambois Beach sand dune system), and will connect into an Onshore Convertor Station, proposed to be located adjacent to the existing convertor station for North Sea Link. From the Onshore Convertor Station up to twelve High Voltage Alternating Current (HVAC) grid connection cables will provide a connection from the Onshore Converter Station into the existing Blyth National Grid Substation. The Onshore Scheme will also include the construction of temporary and permanent access routes, including the improvements of existing roads in the area. The location of the Onshore Scheme Landfall HDD compound will be located within the Cambois connection Onshore Scheme boundary to the west of the coast road, locally referred to as Foster Terrace and Unity Terrace, at a location yet to be confirmed. All of these works are located landwards of MHWS.

20. The Applicant is proposing the construction, of up to four high voltage direct current (HVDC) Offshore Export Cables from up to two Offshore Converter Station Platforms (OCSPs) within the BBWF array area to MHWS of the Landfall location near Cambois.

21. The indicative outline construction programme for the Onshore Scheme[3] includes the following:

    - Commencement of site preparation works in Q4 2027;
    - Commencement of landfall construction in Q4 2029;
    - Commencement of onshore Cable installation Q3 2030;
    - Commencement of onshore converter station construction Q4 2030;
    - Completion of landfall construction in Q4 2030; and
    - Completion of converter station construction in Q4 2030; and
    - Completion of export cable installation in Q4 2029, landfall installation is therefore expected to take up to 15 months, and the installation of the Offshore Export Cable Corridor is expected to take up to 18 months.

22. Marine Scheme: The Applicant is proposing the construction, operation and maintenance, and decommissioning of up to four high voltage direct current (HVDC) Offshore Export Cables from up to two Offshore Converter Station Platforms (OCSPs) within the BBWF array area to MHWS of the Landfall location near Cambois, Northumberland. The Marine Scheme includes all aspects of the Project seaward of MHWS; and

23. A complete description of the Marine Scheme Project Description has been provided with the Marine Scheme EIA. A complete description of the Onshore Scheme Project Description is

[3] Until detailed design is progressed and further refined pre-construction, this programme is indicative and subject to further refinement, but is used to inform the CVA (being the best estimate for completion of the Project available at the time of assessment).

provided in Volume 2, Chapter 5: Project Description. The CVA focuses on the most relevant aspects[4] of the two 'Schemes'; principally, this is related to:

- Aspects of the Landfall installation process occurring to the west of the sand dune system along the Cambois coastline (Onshore Scheme);
- Landfall installation process underneath the sand dune system (Onshore Scheme);
- Landfall installation process including the trenchless technology underneath the intertidal zone (Onshore Scheme and Marine Scheme);
- Landfall installation process below MLWS, including the trenchless technology 'breakouts' / exit pits (Marine Scheme);
- Application of cable protection during installation, such as rock placement, within the Study Area (Marine Scheme); and
- All relevant aspects of the Landfall described above during the operation and maintenance phase of the Project.

1.4.1. Onshore Scheme Parameters

24. The PDE for Onshore Scheme Landfall installation parameters using trenchless technology e.g. HDD are provided in Table 1, it should be noted these are subject to further refinement post consent.

Table 1 PDE for Onshore Scheme Landfall parameters

Parameter	Maximum value
Maximum number of cables	4
Maximum number of Transition Joint Bays (TJBs)	4
Maximum dimensions of TJBs (per TJB)	6 m width 25 m length
Maximum length of trenchless technology (onshore to offshore)	2.4 km per cable
Maximum number of trenchless technology ducts*	4
Maximum diameter of trenchless technology ducts (per duct)	0.3 m to 2.5 m
Maximum depth of trenchless technology ducts	30 m
Maximum footprint of trenchless technology / TJB construction compound	15,000 m^2
Maximum footprint of trenchless technology / TJB construction compound (m2)	15,000

* Maximum number of permanent trenchless cable ducts assumed. Should during trenchless landfall installation a bore fail through encounter of unforeseen ground conditions or other failure, a spare bore may be required.

25. Landfall specific measures incorporated as part of the Onshore Scheme's design (referred to as 'designed in measures') and measures which will be implemented regardless of the impact assessment (referred to as 'tertiary mitigation') are outlined below.

[4] The most relevant elements of the Project are the areas of interaction with the Cambois coastline (i.e., onshore operations associated with the Landfall which are close to the coast or overlap with the CCMA) and the nearshore activity (below MLWS) associated with the Marine Scheme. The more offshore components of the Marine Scheme, which make up the Project are considered incapable of influencing coastal change and are not considered in-detail within the CVA.

26. Trenchless techniques, such as HDD will be used at the Onshore Scheme Landfall for the construction of the Onshore Scheme. Works associated with onshore landfall construction activities will avoid any works in the intertidal environment and will reduce the potential for localised disturbance in this area or any restrictions on access to the beach for leisure and recreational purposes.

27. It should be noted that the onshore works associated with Onshore scheme Landfall will be located well landwards of MHWS outwith the sand dune system associated with Cambois beach, thus completely bypassing the intertidal area and adjacent dunes. As shown on Figure 3 , there is no permanent above ground infrastructure associated with the Onshore Scheme and HDD compound within the intertidal zone or within the coastal sand dunes. The location of the Onshore Scheme Landfall HDD compound will be located within the Cambois connection Onshore Scheme boundary to the west of the coast road, locally referred to as Foster Terrace and Unity Terrace, at a location yet to be confirmed.

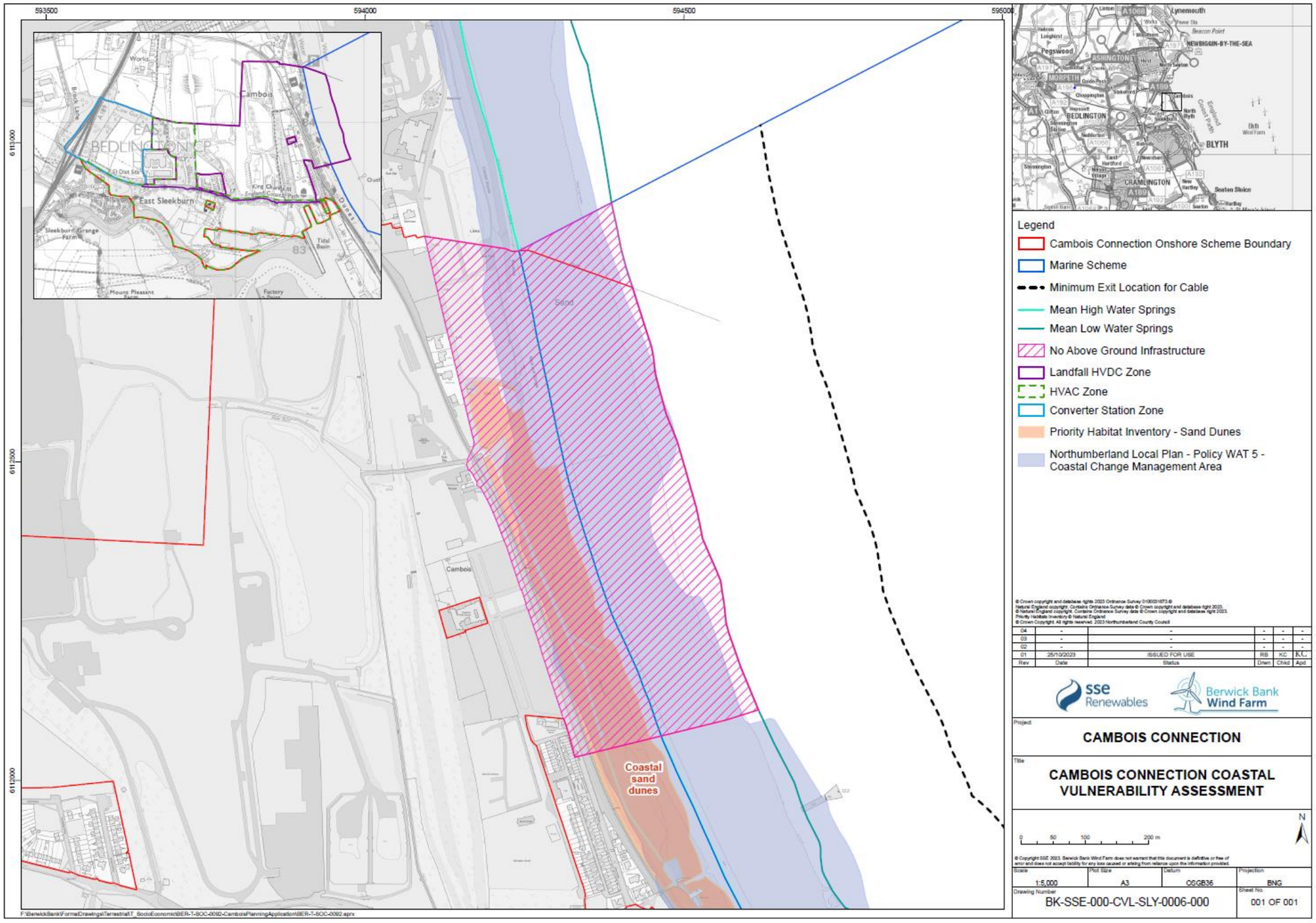

Figure 3 Cambois Connection Coastal Vulnerability Assessment

28. A trenchless technique, such as HDD, will be deployed to bring the Offshore Export Cables ashore via ducts that will be installed from Onshore Landfall HDD compound, landward of the coastal sand dunes and MHWS, to a nearshore trenchless technology exit" punch out" point at least 250 m seaward of MLWS, thus completely bypassing the coastal sand dunes and intertidal area. All construction works and infrastructure associated with the Onshore Scheme will be above MHWS, and landward of the coastal sand dune system and intertidal zone on Cambois beach, and therefore there is no potential for any direct interaction with the coastal sand dune system or the intertidal area.

29. Construction utilising trenchless techniques (such as HDD), will involve drilling from the Onshore Scheme HDD compound, under existing infrastructure, including road, utilities, railways, and beach areas. During construction it is expected that access to the beach will be maintained, and signage may be employed at this time to advise of the works.

1.4.2. Transition Joint Bay (onshore)

30. Transition Joint Bay (TJB) will be located above MHWS (refer to Plate 1) The final location of the TJBs will be determined post consent but will be influenced by the final design (i.e., length, trajectory and the HDD punch out location offshore). The total length of cable ducts would be up to 9.6 km. The cables will be pass through cable ducts that will be drilled beneath the intertidal zone (beach) to connect directly into the underground TJBs) which will be located at the Onshore Scheme landfall, above MHWS.

1.4.3. Landfall Installation (onshore)

31. The trenchless technology for the offshore export cables involves installing an underground cable duct by drilling a hole (or holes) from one point to another. The Offshore Export Cables are then installed through the duct(s). It is likely that the holes will be drilled from a trenchless technology (such as HDD) compound which will be located above MHWS (onshore) to an agreed 'punch out' location in the nearshore marine area (below MLWS), therefore completely bypassing coastal sand dune system, Cambois beach and the intertidal zone, thereby limiting the potential for significant effects on archaeological and cultural heritage receptors in the intertidal area.

32. HDD is discussed in detail below to provide an example description of trenchless techniques, other trenchless technologies may be selected however these would have no worse likely significant effects than HDD, as described below, therefore the MDS is presented within this CVA.

1.4.3.1 HORIZONTAL DIRECTIONAL DRILLING

33. The Offshore Export Cables will be installed at the Landfall using a trenchless technology such as HDD. This involves installing an underground cable duct by drilling a bore from a trenchless technology compound which will be located above MHWS (onshore), the Offshore Export Cables are then installed through the duct(s) drilled to an agreed 'punch out' location in the nearshore marine area (below MLWS), therefore completely bypassing the intertidal zone and coastal sand dune system, as outlined in Plate 2.

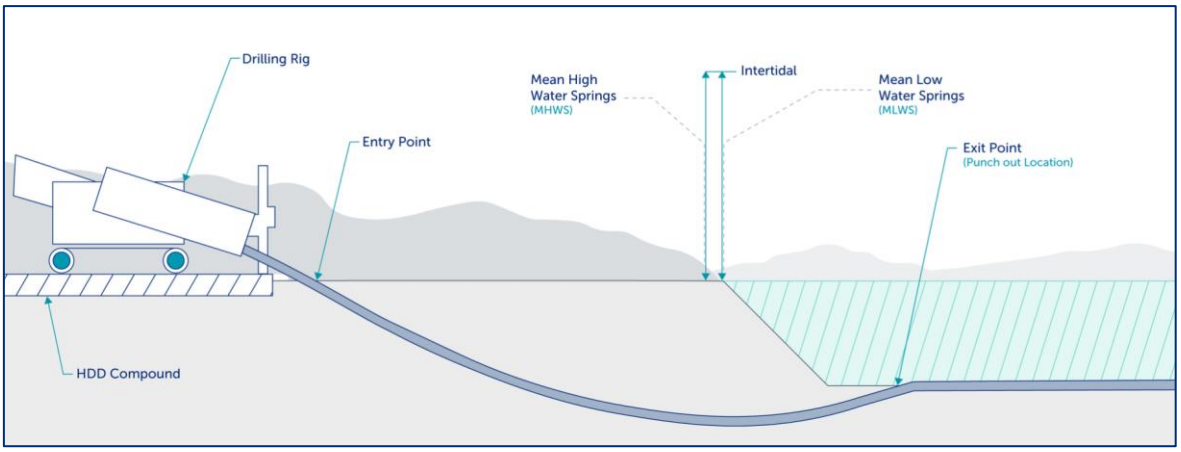

Plate 2 Landfall cross-section

34. The drill rig required to create the trenchless technology boreholes will be located onshore, landward of MHWS, as outlined in Plate 2. A temporary construction compound will be established containing the drill rig, an electrical generator, water tank, mud recycling unit, other construction equipment and machinery, storage areas, a temporary site office, car parking and welfare facilities. The drilling installation would commence from above the MHWS, with the trenchless technique exit point (punch out location) located at least 250 m seaward of MLWS (as outlined in Plate 2). There will be up to five exit pits, each 20 x 5 m, for up to four cable ducts (with one spare in case of failure) due to trenchless cable installation at the Landfall.

35. The trenchless technique “punch out” offshore exit pits are expected to be located between the -2.5 m Lowest Astronomical Tide (LAT) and -10 m LATs, at least 250m seawards of MLWS. Given that there will be no requirement to excavate an open trench at any location between MLWS and MHWS, any interactions with the intertidal zone or coastal sand dune zone will be avoided (Figure 2).

36. Once the cable ducts have been drilled, the Offshore Export Cables will be brought ashore, pulling the cables through the ducts from a barge that will be located in the nearshore area. Once onshore, the Offshore Export Cables will be connected to the Onshore Export Cables in underground chambers (TJBs). These will be located landward of the MHWS and therefore comprise part of the Onshore Scheme. Up to four TJBs will be required (one per cable). These will be permanent structures which will be installed at locations within the wider temporary Landfall construction compound. Once installed the TJBs will be completely buried once installed except for manhole covers for the link and communications boxes to provide access for maintenance and repairs.

37. HDD is a trenchless installation methodology which avoids direct interactions within the intertidal zone, as shown in Plate 2 HDD can be carried out via a marine or shore-led methodology; it is described in detail below based on a shore-led approach - which is most likely - however the principles are largely the same for either methodology.

38. HDD involves drilling a hole (or holes) along an underground pathway from one point to another, through which the Offshore Export Cables are installed, without the need to excavate an open trench. To achieve this a drill rig is located onshore, landward of MHWS. A working area would be established containing the drill rig, electrical generator, water tank, mud recycling unit and temporary site office. The drilling installation would commence from above the MHWS, with the HDD exit point (punch out location) located seaward of MLWS between 500 m and 2,400 m from the HDD entry point. The Applicant is committed to a minimum duct depth of -7.05 m below the intertidal area. Beyond this, as part of the detailed design work required to inform the final landfall methodology, the potential risks relating to cable exposure due to coastal recession and beach

lowering will be considered in greater detail including the effects due to climate change over the operational and maintenance phase of the Project.

1.4.4. Marine Scheme Parameters

39. The Project Design Envelope (PDE) for Marine Scheme Landfall installation parameters using trenchless technology are provided in Table 2 below, it should be noted these are subject to further refinement post consent.

Table 2 PDE for Marine Scheme Landfall parameters

Parameter	Maximum value
Maximum number of trenchless cable ducts*	4
Diameter of cable ducts (m)	0.3 – 2.5
Maximum length of cable ducts (per duct) (m)	2,400
Estimated maximum trenchless burial depth (m) (intertidal)	30
Dimension of exit punches out (m) (subtidal)	20 x 5

* Maximum number of permanent trenchless cable ducts assumed. Should during trenchless landfall installation a bore fail through encounter of unforeseen ground conditions or other failure, a spare bore may be required.

40. Maximum number of permanent trenchless cable ducts assumed. Should during trenchless landfall installation a bore fail through encounter of unforeseen ground conditions or other failure, a spare bore may be required.

41. Landfall specific measures incorporated as part of the Marine Scheme's design (referred to as 'designed in measures') and measures which will be implemented regardless of the impact assessment (referred to as 'tertiary mitigation') are outlined below. As there is a commitment to implementing these measures, they are considered inherently part of the design of the Marine Scheme and have therefore been considered in the assessment presented in technical chapters. These include:

42. Trenchless techniques, such as HDD will be used at the Landfall for the construction of the Marine Scheme. Works associated with Landfall construction activities will avoid any works in the intertidal environment and will reduce the potential for sediment disturbance.

43. During trenchless installation activities at Landfall, there will be an interface between the sea and the drilling fluids used to create the exit pits at the breakouts. Small quantities of drilling fluids may be discharged to the marine environment, however best practice mitigation will be implemented to reduce the amount of drill mud / cuttings released in the event of a release. To limit environmental damage, only biologically inert PLONOR (Pose Little or No Risk) listed drilling fluid will be used.

44. It should be noted that the offshore trenchless technology exit pits have an exit point at least 250 m seaward of MLWS, thus completely bypassing the intertidal area and coastal dune system.

1.4.4.1 CABLE PROTECTION

45. An Indicative Cable Burial Appraisal including parameters such as minimum and maximum target burial depths, has been undertaken as part of the Marine Scheme application. The Indicative Cable Burial Appraisal gives an indication of zones of the Offshore Export Cable Corridor where it may not be possible to achieve the minimum target burial depth of 0.5 m due to ground conditions. In these areas, additional cable protection may be required to ensure the cables are suitably protected.

46. Depending on seabed conditions, Offshore Export Cables will be buried to a minimum target burial depth of 0.5 m with a maximum target burial depth of 3 m. This is the minimum depth required to achieve adequate cable protection through burial. If burial is not possible due to ground conditions, then surface lay and external protection techniques will be employed. Each Offshore Export Cable will be buried in a separate cable trench. Each cable trench will have a maximum width of 2.5 m per cable circuit.

47. The primary aim is to achieve minimum target burial depths through burial of the cables in the seabed. Where it is not possible to achieve minimum target burial depth due to seabed conditions, additional cable protection will be required to protect the cable from third party damage or future exposure.

48. A range of additional cable protection measures are being considered for the Marine Scheme as described in further detail in Table 3 (below), these include:

- Rock protection;
- Concrete mattresses;
- Sand, rock and grout bags; and
- Cable protection systems such as split pipe or other tubular protection system.

Table 3 Summary of Proposed Cable Protection

Form of Protection	Description
Rock Protection	This method of protection involves the placement of rock on top of cables (including within the trench where there is insufficient sediment to rebury the cables) to provide additional protection. Protection is achieved by creating a rock berm.
Concrete Mattresses	Concrete mattresses are constructed using high strength concrete blocks and ultraviolet stabilised polypropylene rope. At the time of writing of this assessment, they are typically supplied in standard 6 m x 3 m x 0.3 m units of standard density, however modifications to size, density, and shape (tapered edges for high current environments, or denser concrete) can be engineered bespoke to the locality.
Sand, Rock and Grout Bags	The placement of sand, rock or grout bags over the Offshore Export Cables provides more localised protection relative to concrete mattresses. Sand and rock bags are pre-filled prior to being placed above the cables. Rock bags consist of various sized rocks contained within a rope or wire net. Sand and rock bags are lowered towards the seabed. Once they are in the correct position they are released on to the seabed. Rock bags are circular in design (see below) with dimensions typically 0.7 m in height by 3 m in diameter.
Cable Protection Systems	Articulated half pipes, generally made of polyurethane or cast-iron can be used to provide protection against impact, abrasion and overbending. Use of articulated half pipes will be assessed based on localised ground conditions and infrastructure use.

49. The design and engineering options available to the Marine Scheme are dependent on the specific conditions and environmental factors along the length of the route. Detailed design studies to refine design parameters will continue beyond the current planning phase and extend into procurement and contracting.

50. Estimated indicative requirements for cable protection along the length of the Offshore Export Cable Corridor have been developed, as detailed in-full within the Marine Scheme EIA; for the nearshore area in English waters, this results in a maximum length of 1,951 m of cable protection (or 14634 m3). A small proportion of this may be required within the CVA Study Area, which is consistent with the requirements for the adjacent North Sea Link interconnector and other transmission infrastructure located locally (the volumes are subject to MMO approval via the separate Marine Licencing process but are presented for clarity and completeness).

51. These indicative estimates have been based on preliminary design information, a preliminary Unmanned Survey Vessel Geophysical Cable Route Survey, and the outputs from an Indicative Cable Burial Appraisal which the Applicant has commissioned. The estimates have been developed

in order to provide the basis for the EIA, and to inform the approximate upper bound of cable protection sought for the Marine Licence (both to MD-LOT for Scottish waters, and to the MMO for English waters).

52. It should be noted that consideration of the cable protection with respect to this CVA is only in relation to the presence of cables within the nearshore.

2. Legislative Context

2.1. Policy and Legislation Overview

53. Consent for the Onshore Scheme is being sought via an application for planning permission to NCC as the LPA under Section 57 of the Town and Country Planning Act 1990 (it is this application which the Onshore Scheme EIA and this CVA supports).

54. The Applicant has applied to MD-LOT and MMO for a Marine Licence under the Marine and Coastal Access Act 2009 in Scottish and English waters respectively; as reported above, MLAs were submitted in July 2023.

55. The general legislative context applicable to the Marine Scheme is summarised in the Marine Scheme EIA (Volume 2, Chapter 2: Policy and Legislative Context) whilst the legislative context applicable to the Onshore Scheme is presented in this application within Volume 2, Chapter 2: Policy and Legislation.

56. A summary of relevant consultation activity is provided in Table 4. A summary of relevant policy considerations is provided in the Appendix.

3. Consultation

57. During the pre-application period for both the Onshore Scheme and Marine Scheme, a wide range of consultation has been carried out (including completion of EIA Scoping with both NCC for the Onshore Scheme and MD-LOT / MMO for the Marine Scheme). Full details of consultation and engagement can be found in Volume 2, Chapter 4: Consultation and Engagement (Marine Scheme) and Volume 2, Chapter 4: Consultation and Engagement (Onshore Scheme). Consultation and engagement of primary relevance to the CVA is summarised in Table 4.

Table 4 Summary of relevant consultation activity

Date	Consultee and Type of Consultation	Issues(s) Raised	Response to Issue Raised and/or Where Considered in this Assessment
13 January 2022	NCC	A meeting was held to introduce the Project to the Local Planning Authority for the Onshore Scheme. Owing to the requirement for a landfall along the Cambois coastline, the approach to the consent application process for this area was discussed, including in terms of any potential overlap in environmental assessments for the Marine Scheme and the Onshore Scheme between MHWS and MLWS, and how NCC may work with the MMO. Confirmation was received that NCC is not a signatory to the Coastal Concordat (MMO, 2021), however the Applicant confirmed their intention to adopt these principles where practicable to help guide the EIA process across both the Onshore Scheme and the Marine Scheme.	Advice from NCC was used to inform the Landfall selection process. Following the discussions with NCC regarding the Coastal Concordat (MMO, 2021), an aligned approach to EIA and associated assessments for the Marine Scheme and Onshore Scheme was discussed and agreed.
24 January 2023	NCC	The Applicant provided a general Project update via a Microsoft Teams meeting. Discussion was undertaken on the potential landfall locations, with Northern landfalls discounted due to constraints, with further feasibility studies required. Onshore Scheme EIA submission expected to be Q3 2023. NCC recommended the Applicant to opt for pre-application advice, discussions were held on who should be approached for advice. NCC recommended council ecologist, public protection team, and potentially archaeology. The most feasible landfall area was discussed, including the challenges, particularly given the close proximity to Cambois Primary School – NCC confirmed that no immediate issues anticipated, and recommended the Applicant to develop and engage with stakeholders, including NCC, and the school itself.	Advice from NCC was used to inform the Onshore Scheme EIA, and the landfall selection process; further discussions with NCC (and specialist stakeholders) were undertaken.

Date	Consultee and Type of Consultation	Issues(s) Raised	Response to Issue Raised and/or Where Considered in this Assessment
		The Applicant confirmed contact with the school had been attempted.	
24 February 2023	NCC pre-application advice under 23/00260/CNA	NCC recommended that the Onshore Scheme EIA be updated to include a section on Coastal Vulnerability. NCC confirmed that the policy from the relevant Shoreline Management Plan is 21.5. Managed Retreat until 2025 then hold the line. Comments from SMP: "*Selective local works (hard points) to assist realignment and safeguard properties and assets – including use of existing revetment to aid this process. Manage the recession process elsewhere to ensure no breaching through dunes. Set any new development back from shore (buffer zone)"* NCC requested that the assessment look at and confirm the following: 1. Ensure adequate beach cover of cables over the lifetime of the asset to allow for the erosion of the beach and sand dunes in the location of the proposed cables as this could pose a public safety risk if they become exposed 2. Detail of any temporary works undertaken for the installation of the cable to consider the implications on the beach and sand dunes 3. Confirmation that the proposed works do not adversely impact the "buffer zone" referenced within the SMP long-term	Advice received has been used to inform the Onshore Scheme EIA, and the development of this CVA. As previously outlined the Applicant has committed to trenchless techniques, such as HDD at the Landfall, therefore avoiding interaction with; Cambois beach, coastal sand dune system and intertidal zone. The approach to the CVA has been informed by a range of relevant best-practice and the specific requirements of WAT-5, the key relevant NCC plan policy for the Cambois coastline which drives the CVA requirement. A 'buffer zone' is referenced in relation to multiple policy units within SMP2, meaning an area that would provide a natural buffer and within which development should be avoided. Although a buffer zone is referenced for policy unit 21.5 relevant to Cambois beach, there is no specific shoreline offset distance (landward or seaward) or spatially defined area to directly inform the buffer zone. Nonetheless, the area of sand dunes and scrub west of the Cambois beach is interpreted by the Applicant to constitute this so-called buffer zone and is considered as such. The Landfall Onshore Compound will be located landward of the sand dune system, no permanent infrastructure will remain on the compound and the Applicant has confirmed the use of trenchless technology, such as HDD, so there will be no direct interaction with the buffer zone, with no anticipated adverse impacts. The Bruun rule has not been followed for several key reasons. The rule is based on the theory of equilibrium profile when in reality, for a dynamic coastline with topographical and seabed

Date	Consultee and Consultation	Type of	Issues(s) Raised	Response to Issue Raised and/or Where Considered in this Assessment
			NCC provided some recommended data sources, and also suggested the application of the Bruun Rule to help inform the CVA.	variability, this theoretical concept does not reflect real conditions and coastal behaviour. The Bruun Rule operates on the basis that the nearshore zone, when subjected to a sea level rise, will shift upward and landward, maintaining the general geometry of the coastline. This approach is a very simplistic approach to shoreface theory and it is not considered suitable for a highly complex sedimentary environment such as the nearshore zone with large spatial and temporal variations in movement of sediment. The Bruun rule relates to a two-dimensional model and does not have any capacity for considering factors such as cross-shore sediment movement / drift and dune erosion which for this site are important considerations. Whilst the Bruun rule has not been followed for the reasons explained above, a detailed CVA has been carried out in support of the Onshore Scheme demonstrating full policy conformance with WAT-5. Further commitments for additional dialogue with NCC, as the detailed design for the Project evolves.
5 October 2023	NCC		A project update was provided to NCC including County ecologist, LLFA (Lead Local Flood Authority], NCC Highways NCC requested further information in approach to CVA as part of outline planning NCC had requested further detail related to trenchless technology and potential for cable exposure	It was confirmed that a Coastal Vulnerability Assessment would be submitted as part of the submission. The Applicant describes the approach taken for the CVA which will be submitted as part of the outline planning application in accordance with feedback received from LLFA (this document). The Applicant confirmed that the use of trenchless techniques would entail punch out locations in the sea at least 250 m seawards of MLWS; geotechnical surveys still ongoing which will then inform where the actual punch out points will be located and onshore punch out points/TJB which will be

Date	Consultee and Consultation	Type of	Issues(s) Raised	Response to Issue Raised and/or Where Considered in this Assessment
				located landward of MHWS landwards of the road and Cambois beach/dune system. LLFA representative from NCC, noted that the approach taken seemed appropriate and should comply with the advice provided in previous correspondence. The Applicant responded to confirm that the use of trenchless techniques would reduce this risk significantly and discussions with other asset owners in the area have been undertaken and any lesson learned would be implemented where appropriate.

4. Baseline Environment

4.1. Study Area

58. During Consultation for pre-application advice the Coastal Protection Authority requested a CVA, however, there is no set guidance on the completion of CVA's.

59. Additionally, there is no set guidance on the definition of a Study Area for the purposes of CVA's, however based on the pre application advice and a range of marine-specific guidance, best-practice and MMO advice, the Study Area should be sufficiently wide as to consider the maximum Zone of Influence (ZoI) of relevance to the topic of coastal vulnerability. In the case of the Project, this is the boundary of the Marine Scheme and the area of seabed and coast which could hypothetically be influenced by changes to physical and coastal processes due to the Marine Scheme.

60. Based upon these data the properties of the physical environment, used to describe the coastal environment to inform the CVA are as follows:

- Bathymetry and Morphology;
- Bedrock and Quaternary Geology;
- Seabed Sediment;
- Wave and Wind Climate;
- Tidal Levels and Currents;
- Coastal Morphology; and
- Anthropogenic Influence.

61. The Study Area for the CVA considers the Landfall area along the Cambois coastline with a 5 km buffer from the area of the Landfall which crosses the NCC CCMA; this is presented in Figure 4 and Figure 5 below.

62. It is important to understand that there are wider potential Zones of Influence which are of relevance to other EIA topics; for example, the maximum ZoI associated with the physical environment and seabed assessment adopts a 10 km ZoI (Marine Scheme EIA, Volume 2, Chapter 7: Physical Environment and Seabed Conditions). In this example, the Study Area adopted for the assessment is based on the tidal excursion extent around the Marine Scheme (~5 km) with a sensitivity of ~ 5 km to ensure more infrequent metocean conditions are represented and to capture the spatial extent influenced by these conditions. For the CVA, the focus is on potential impacts which could give rise to morphological changes on the Northumberland coast in relation to coastal vulnerability. Based on the nature of the Onshore Scheme, the potential impacts are highly localised and entirely captured within the 5 km Study Area.

63. The width of the Marine Scheme and Onshore Scheme boundary at the Landfall is required to accommodate a necessary level of flexibility for refinement of the Landfall location, as explained and justified fully in Volume 2, Chapter 5: Project Description. However, within this area, the actual installation corridor will be smaller (a maximum 1 km in width, comprised of a 500 m buffer either side of an indicative centreline for the Offshore Export Cables). Within this 1 km width, the footprint of activities associated with the Marine Scheme is also significantly less, as reported in Volume 2, Chapter 5: Project Description.

64. The properties of the physical environment, used to help inform the CVA are assessed within the 5 km Study Area.

4.2. Bathymetry and Morphology

65. On the approach to the Landfall, a transect profile along the Marine Scheme route presents the most nearshore area of the site-specific survey, extending from the Landfall at Cambois, Northumberland to approximately 3.75 km offshore. The shallowest depth here was observed to be -1.94 m LAT (i.e. intertidal) and the deepest point to be approximately 26.5 m LAT, as shown in Plate 3. Based on the Hydrofix interpretation of survey data from this survey corridor, no significant bedforms are identified within the survey corridor L16 (Hydrofix, 2023).

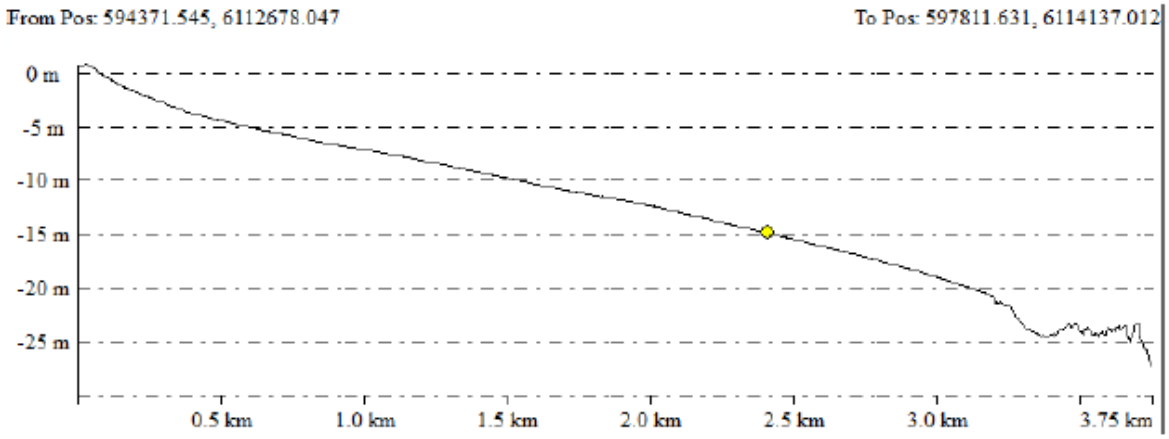

Plate 3 Bathymetry profile showing changes in elevation

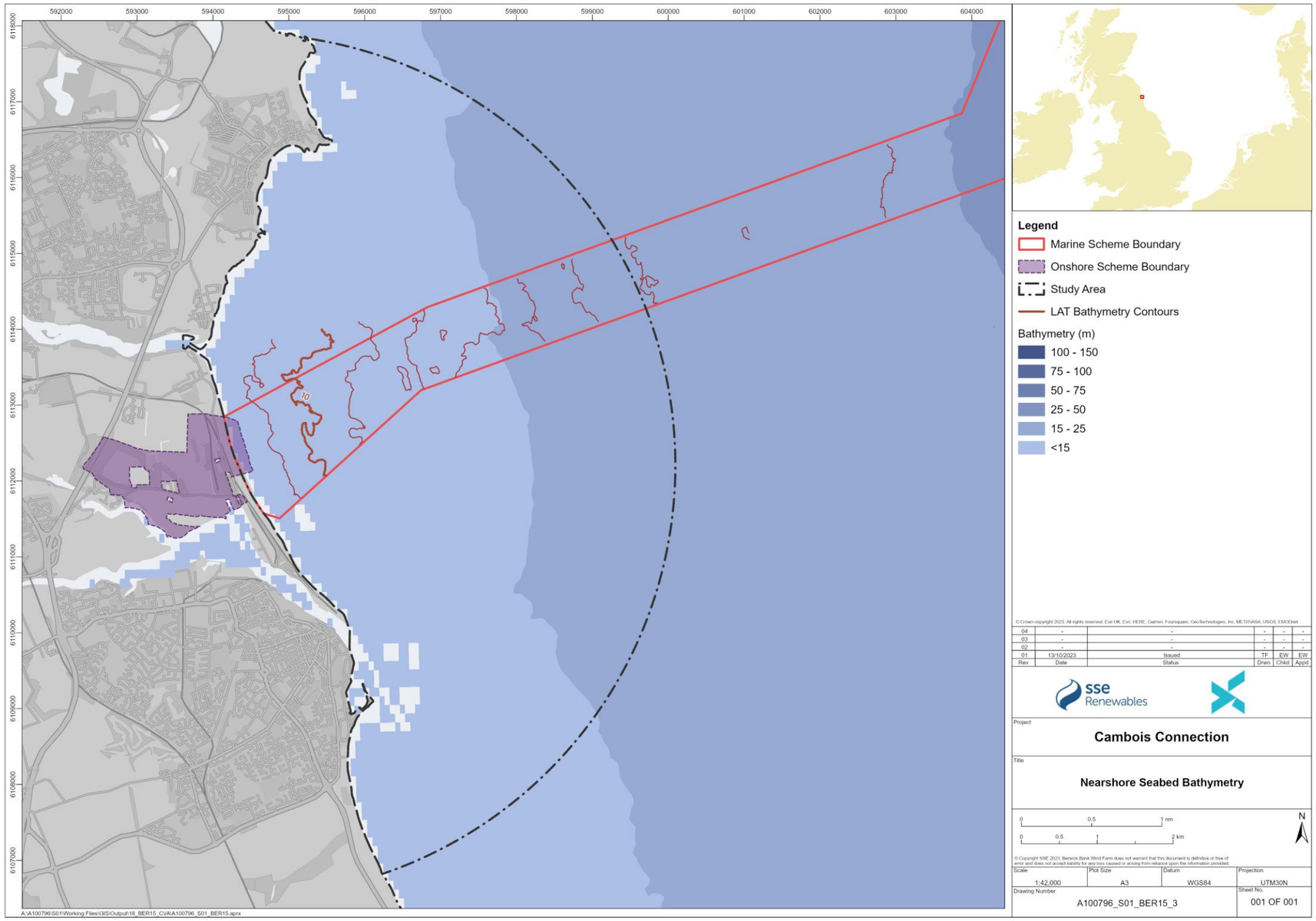

Figure 4 Nearshore Seabed Bathymetry

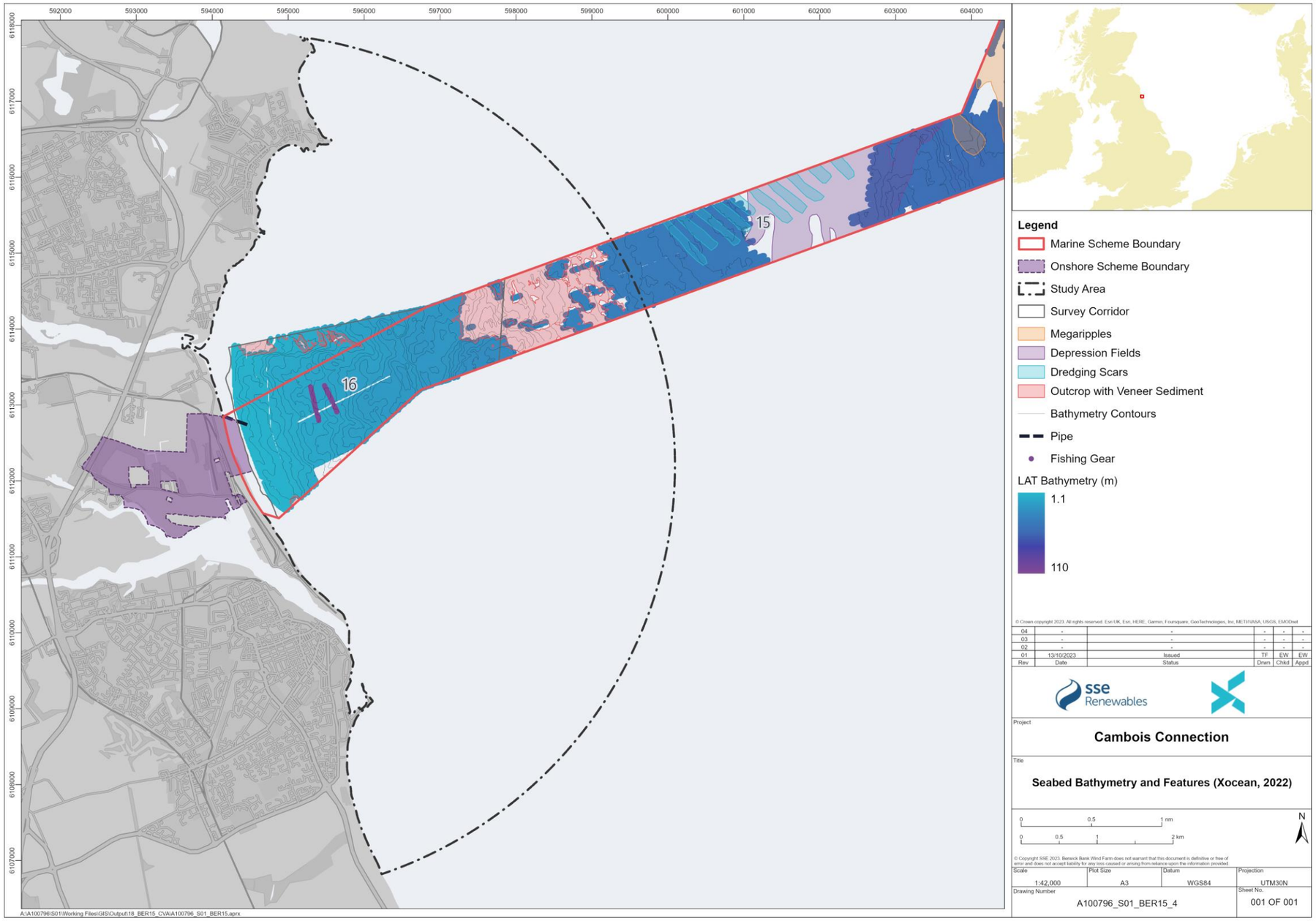

Figure 5 Seabed Bathymetry and Features (Xocean, 2022)

4.3. Bedrock and Quaternary Geology

66. The bedrock lithology that broadly characterise the Landfall and approaches within and adjacent to the CVA Study Area comprises Palaeozoic sedimentary rock of the Coal Measures Group (extending 6.5 km east of the proposed Landfall area, beyond the applied Study Area), indicating the potential for coal within the unit (BGS, 2020).

67. BGS (2020) also identifies the potential for three unnamed igneous (magmatic) intrusions (Carboniferous to Permian), approximately between 1 km and 5 km from the shoreline which intersect with the Study Area. These intrusions are known to outcrop onshore at Alnwick approximately 30 km north of the Marine Scheme. Although the recent geophysical survey identified outcropping Palaeozoic sedimentary bedrock in the Landfall area, it did not note the presence of any coal fissures or igneous intrusions exposed at the seabed surface (XOCEAN, 2022), however, coal exposures are noted within the Onshore Scheme.

68. The Landfall area extending from the shoreline comprises heavily faulted geology in an easterly trending direction extending approximately to a maximum of 17 km from the shoreline (BGS, 2020). An area of rock and hard substrate (defined as rock or clasts > 64 mm within 0.5 m of the seabed) extends approximately 8.7 km east of the proposed Landfall.

4.4. Seabed Sediment

69. At the Landfall, marine seabed sediments interpreted from backscatter were considered to be of two distinct types based on Hydrofix (2023), which are as follows:

- Up to and in proximity to the Landfall, the seabed comprises predominantly sand with isolated instances of outcropping Quaternary rock; and
- Beyond the Landfall, from about 15 m LAT and deeper, the seabed comprises outcropping Quaternary rock, with patches of sandy mud.

4.5. Wave and Wind Climate

70. Throughout the North Sea, strong winds can occur with wave heights depending greatly on fetch limitations and water depths effects. Waves in the northern North Sea can be generated by local winds (i.e. wind waves) or travel into the region having been generated elsewhere in the Atlantic Ocean (i.e. swell waves). The mean annual wave height within the wider region surrounding the Marine Scheme range from approximately 1.59 m to approximately 1.17 m at the proposed landfall and within the CVA Study Area. There is a seasonal variation in the mean annual wave height, with spring and winter mean annual wave heights ranging from 0.85 – 1.05 m and 1.43 – 2.07 m respectively (ABPmer, 2008).

71. Timeseries of wave data is available to download for the Newbiggin buoy, which has been operational from August 2008 to the present, with information accessed through the National Network of Regional Coastal Monitoring Programmes. The Newbiggin buoy is located approximately 3.5 km north of the proposed Landfall location, within the CVA Study Area, in a water depth of 18 m CD. Since commissioning, the significant wave height (i.e., the mean wave height of the highest third of all waves) reached a maximum of 6.3 m in the early months of 2018, associated with a storm event (Cefas, 2022).

72. A wave rose summarising the wave conditions from the Newbiggin wave observation site is presented in Plate 4 for the years between 2013 and 2021 (National Network of Regional Coastal Monitoring Programmes, 2022). In 2022, the significant wave height was greatest in December,

reaching 1.34 m, and lowest in August, with a maximum of 0.5 m. The peak wave period was greatest in January reaching 11.7 seconds and was lowest in August reaching 6.0 seconds (National Network of Regional Coastal Monitoring Programmes, 2022). The significant wave height on average in 2022 was 0.92 m with an average peak wave period of 7.8 seconds (National Network of Regional Coastal Monitoring Programmes, 2022). The dominant wave direction based on observations is waves approaching from the north-northeast to northeast, at just under 26% of the time and a secondary approach direction from the southeast, approximately 12% of the time.

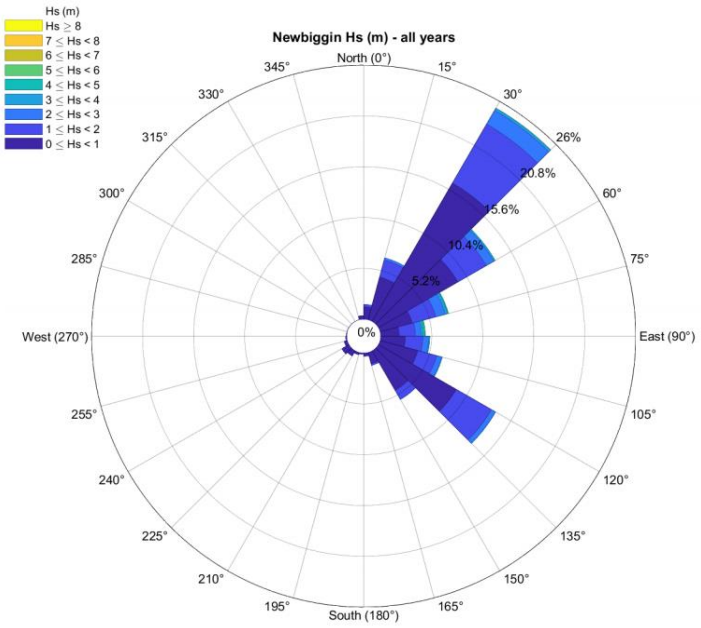

Plate 4 Wave rose summarising conditions from the Newbiggin wave buoy

4.6. Tidal Levels and Currents

73. The main variation in local water levels is due to tidal influences. The National Tidal and Sea Level Facility (NTSLF) provides monitoring of real time and historic tidal gauge information. The nearest national tidal gauge to the Landfall is located in North Shields, in north-east England. The tidal gauge is located south of the Landfall, approximately 14 km from the Project. Table 5 displays the mean spring tidal range and mean neap tidal ranges for the North Shields national tidal gauge as 4.39 m and 2.18 m respectively.

Table 5 Tidal levels for North Shields (55° 0.444'N, 1° 26.388'W) (NTSLF, 2023)

Water Level	Acronym	Tidal Levels (m)
Highest Astronomical Tide	HAT	5.73 m
Mean High Water Springs	MHWS	5.12 m
Mean High Water Neaps	MHWN	4.08 m
Mean Low Water Neap	MLWN	1.90 m
Mean Low Water Springs	MLWS	0.73 m
Lowest Astronomical Tide	LAT	0.00 m
Highest for 2023	H for 2023	5.66 m

Water Level	Acronym	Tidal Levels (m)
Lowest for 2023	L for 2023	0.05 m
Mean Spring Range	MSR	4.39 m
Mean Neap Range	MNR	2.18 m

74. Water levels according to the UKHO Admiralty Total Tide (ATT) service are provided for the proposed Landfall location. At the proposed Landfall area, the mean spring range is approximately 4.2 m, and the mean neap range is 2.2 m (UKHO, 2019). Both modelled tidal ranges support the observed data provided from NTSLF (2023) for the North Shields tidal gauge.

Table 6 Tidal ranges for the Project (ATT, 2022)

Water Level	Acronym	Water Level (m) from LAT - Landfall (55 º 07' N 01º 29' W)
Highest Astronomical Tide	HAT	5.6
Mean High Water Springs	MHWS	5.0
Mean High Water Neap	MHWN	3.9
Mean Sea Level	MSL	2.89
Mean Low Water Neap	MLWN	1.7
Mean Low Water Springs	MLWS	0.8
Lowest Astronomical Tide	LAT	0

75. The average annual spring peak flow is approximately 0.57 m/s at the Landfall area (this extends to approximately 0.60 m/s throughout much of the wider Marine Scheme (ABPmer, 2008) (of limited relevance to this nearshore CVA but presented for context). Mean neap flows at the Landfall area reach approximately 0.24 m/s and 0.30 m/s (ABPmer, 2008). The tidal excursion distance per tide is estimated to be about 5 km, with the full excursion extent associated with flood and ebb being 10 km. According to ATT spring current speeds at the Landfall location reach a maximum of 0.3 m/s on the spring tide and reach 0.2 m/s on a neap tide, refer to Table 7 .

Table 7 Admiralty total tide predictions for the Project Landfall location (tidal diamond SN020G 55 o 06' N 1o 27.5' W)

Tidal Hour	Direction (º)	Spring Rate (m/s)	Neap Rate (m/s)
-6	344	0.2	0.1
-5	318	0.1	0.1
-4	240	0.1	0.1
-3	210	0.2	0.1
-2	188	0.3	0.2
-1	168	0.3	0.1
HW	162	0.2	0.2
+1	157	0.2	0.1

Tidal Hour	Direction (º)	Spring Rate (m/s)	Neap Rate (m/s)
+2	135	0.1	0.1
+3	015	0.2	0.1
+4	006	0.3	0.2
+5	002	0.4	0.2
+6	349	0.3	0.1

4.7. Coastal Morphology

76. The coastal morphology is described within the context of coastal cells and sub-cells. These cells are defined by common patterns in local coastal processes. The Landfall at Cambois will be located within Cell 1 in Management Area 21 – Spital Point to Blyth East Pier. The North East Observatory (2022) provides the most up to date information regarding the coastal morphology of the Landfall site.

77. The Northumberland Coast including the coastline covered by the CVA Study Area is periodically monitored by the Northumberland County Council (2023); the most recent interpretation of Cambois Bay is summarised in Table 8 (Northumberland County Council, 2023).

78. The CVA Study Area is periodically monitored by coastal transects, which are a fixed and stable reference point for onward assessment (the most relevant transect IDs are as follows: iaWDC08 and iaWDC09 (north of the River Wansbeck); iaWDC10 and iaWDC11 (located to the north of the Project boundary), iaWDC12 and iaWDC13 (within the Project boundary) and iaWDC14 (to the south of the Project boundary).

Table 8 Cambois Bay - Survey Summary

Survey Date	Description of Changes Since Last Survey	Interpretation
February / March 2023	Cliff top survey data collected for baseline survey (spring, 2009), the previous Full Measures survey (autumn 2022) and the present Partial Measures survey (spring 2023) is presented in this report. The cliff top survey is carried out as a continuous cliff edge line survey in two locations within Cambois Bay; at Sandy Bay Caravan Park to the north of the River Wansbeck estuary, and Cambois Bay from south of the River Wansbeck to the breakwater at the southern end of the bay. The results from the cliff top monitoring are anticipated to have an accuracy of ±0.2 m due to the technique used. Furthermore, problems in precisely locating the cliff top, due to vegetation growth or the indistinct form of the cliff top, have also affected the data quality. The survey report noted that 'very thick dense vegetation at north end of Cambois cliff top hinders survey of line' and 'a small section of the gabion baskets at Cambois have been displaced'. At Sandy Bay Caravan Park, the northern section of the cliff, backing the rock armour, appears to have remained stable since the previous survey. The southern section has been more active with several	At Sandy Bay Caravan Park [this is located on the outcropping land to the north of the River Wansbeck] it appears the rock amour is being effective in protecting the cliffs with the southern, undefended, section appearing to have been more active. In Cambois Bay, the cliffs have remained stable since the previous survey. Longer term trends: At Sandy Bay Caravan Park the cliff top retreat has been more significant in the southern part of the survey area with up to 5 m of erosion since 2013, whilst the northern part has eroded by c.1-3 m since 2013. In Cambois Bay, the area of greatest cliff top retreat since the surveys began in 2009 is in the centre of the bay opposite the car park in the dunes, Cambois, where up to 12 m of erosion has occurred. The north and

Survey Date	Description of Changes Since Last Survey	Interpretation
	areas of erosion evident. Two lengths of between 6-8m have retreated between 1 to 2 m. Along Cambois Beach there has been very little change along the survey length indicating a period of stability. The largest area of change has occurred adjacent to the buccaneers Car Park where a length of 10 m has retreated 1.5 m.	south of the bay have more typical retreats of c.3-7 m.

79. Information acquired from topographic monitoring along the coastline indicate that in Cambois Bay, beach profiles in the north of the survey area are at higher levels compared to those in the south, suggesting a north-south movement of sediment or a greater input of sediment (possibly from the River Wansbeck) in the north of the survey area (Northumberland County Council, 2022). This is supported by SMP2 survey which suggests net drift is broadly from the north to the south with 1,684 and 994 m3/yr at MWHS and MLWS respectively (Northumbrian Coastal Authority Group, 2009).

80. A series of topographical profiles arising from the most recent available monitoring undertaken in support of SMP2 and commissioned by NCC are summarised together for context in Figure 6.

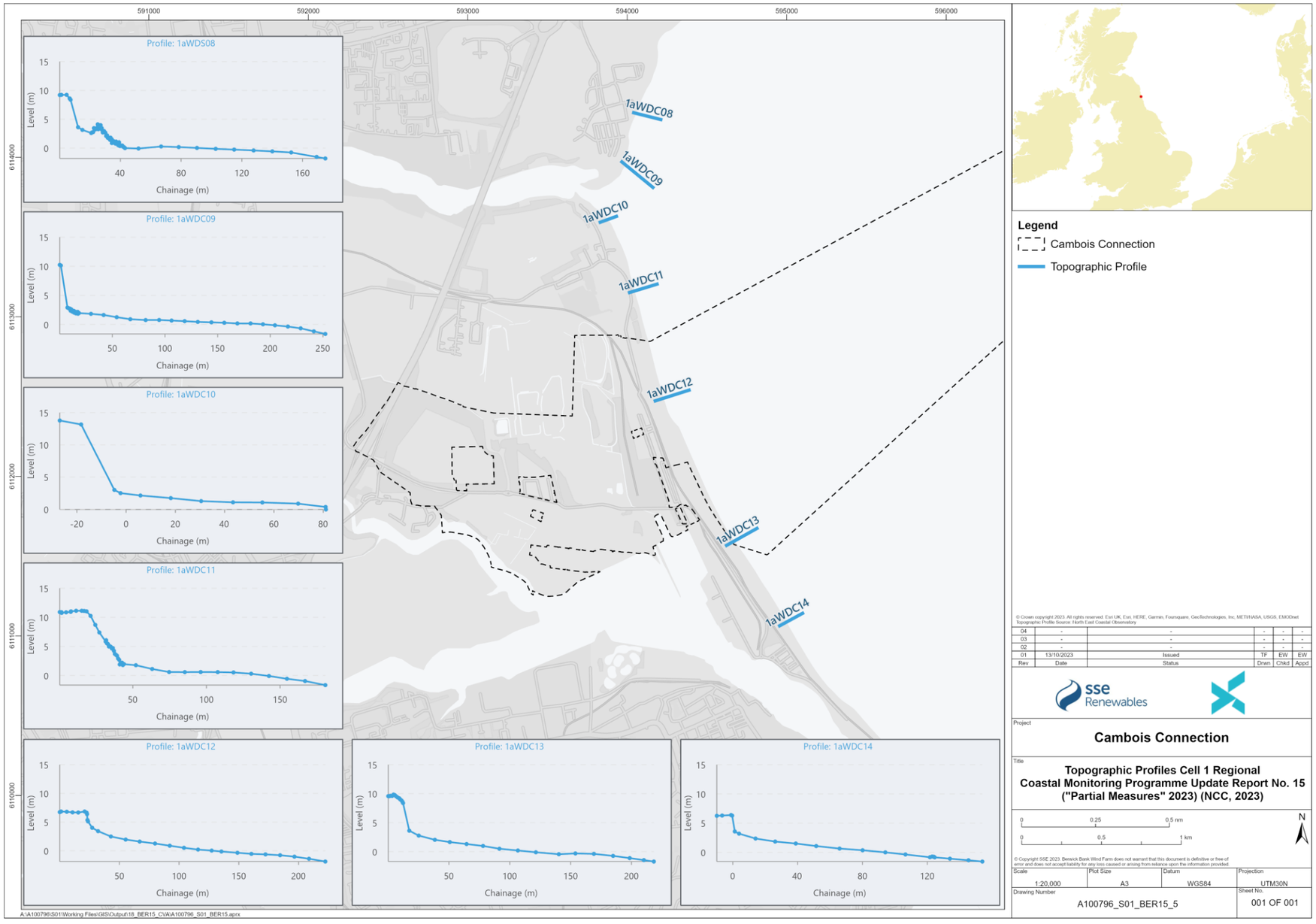

Figure 6 Topographic Profiles (Cell 1 Regional Coastal Monitoring Programme Update Report No. 15 ("Partial Measures" 2023) (NCC, 2023)

81. From ongoing monitoring of the Northumberland Coast, recent cliff top surveys have identified most of the cliff tops to be relatively stable with localised small sections of erosion which are located within the Landfall frontage. The most significant erosion occurs in the centre of the Cambois Bay opposite the carpark in the dune cliffs, where up to 12 m of erosion has occurred between 2009 and 2021. The north and south of the bay have more typical retreats of the north coast of England of between 3 – 7 m since 2009 to 2021 (Northumberland County Council (2022).

82. South of the immediate Landfall location, at Blyth south beach, the dunes have generally demonstrated a long-term trend of stability. Beach profiles exhibit a seasonal cross-shore movement of beach berms, characteristic to summer and winter beach cross-shore profiles (Northumberland County Council (2022). A site visit in December 2022 as illustrated in Plate 5 demonstrate a wide shallow profile beach.

Plate 5 Landfall at Cambois Bay, with photos taken at low water, (top) view to the east, out to sea across the beach, (bottom) view south towards the Port of Blyth, demonstrating dunes backing the beach at Cambois

83. Overall, the available monitoring and site information indicates a relatively stable coastal frontage along the proposed Landfall. Although localised pockets of erosions are identified to occur along the Northumberland coast, these are not directly within the proposed Landfall extent.

4.8. Anthropogenic Influence

84. There is existing infrastructure present within the CVA Study Area that is necessary to consider as part of the existing baseline, and how this may influence the Project in the context of coastal vulnerability.

85. In a broad north to south direction, the key infrastructure and anthropogenic features forming part of the coastal characteristics are as follows:

- Cambois slip / concrete beach access platform adjacent to the Buccaneers car park (approximately 550 m to the north of the Project);
- North Sea Link (NSL) HVDC subsea cable landfall, including subsea cables and protection underneath the intertidal (approximately 500 m to the north of the Project[5]);
- Rock protection to the north and south of the Cambois slip / concrete beach access platform, understood to be associated with the NSL landfall (approximately 450 m to the north of the Project);
- Existing rock revetment / reinforcement on a north-south alignment east of the dunes along large sections of Cambois bay (within the Project boundary);
- Three outfalls associated with historical and/or existing discharges into the Cambois Bay (within the Project boundary); and
- Blyth Demonstrator Wind Farm subsea export cable(s) (within the Project boundary).

86. The Cambois slip is in a relatively good state of repair, being the subject of a relatively recent refurbishment project to bring the slip up to contemporaneous design codes and standards (StatNett, 2018). The NSL cables are buried beneath the Cambois intertidal zone and were installed via open-cut methodologies before commissioning and commencement of operation in 2021.

87. Further to previous historical NCC reporting, some historical erosion around the Cambois slip has been observed previously (both around the rock protection which has been placed to the north and south of the slip, and indirectly further to the south). The three outfalls located within the Project boundary are in varying states of repair with the most northerly of these being in the worst condition (various strut degradation and collapse).

88. Figure 7 provides a summary of existing infrastructure.

[5] The CVA is cognisant of the wider CCMA however based on the scale, nature and extent of the Project as well as the likely environmental interactions with the Cambois coast.

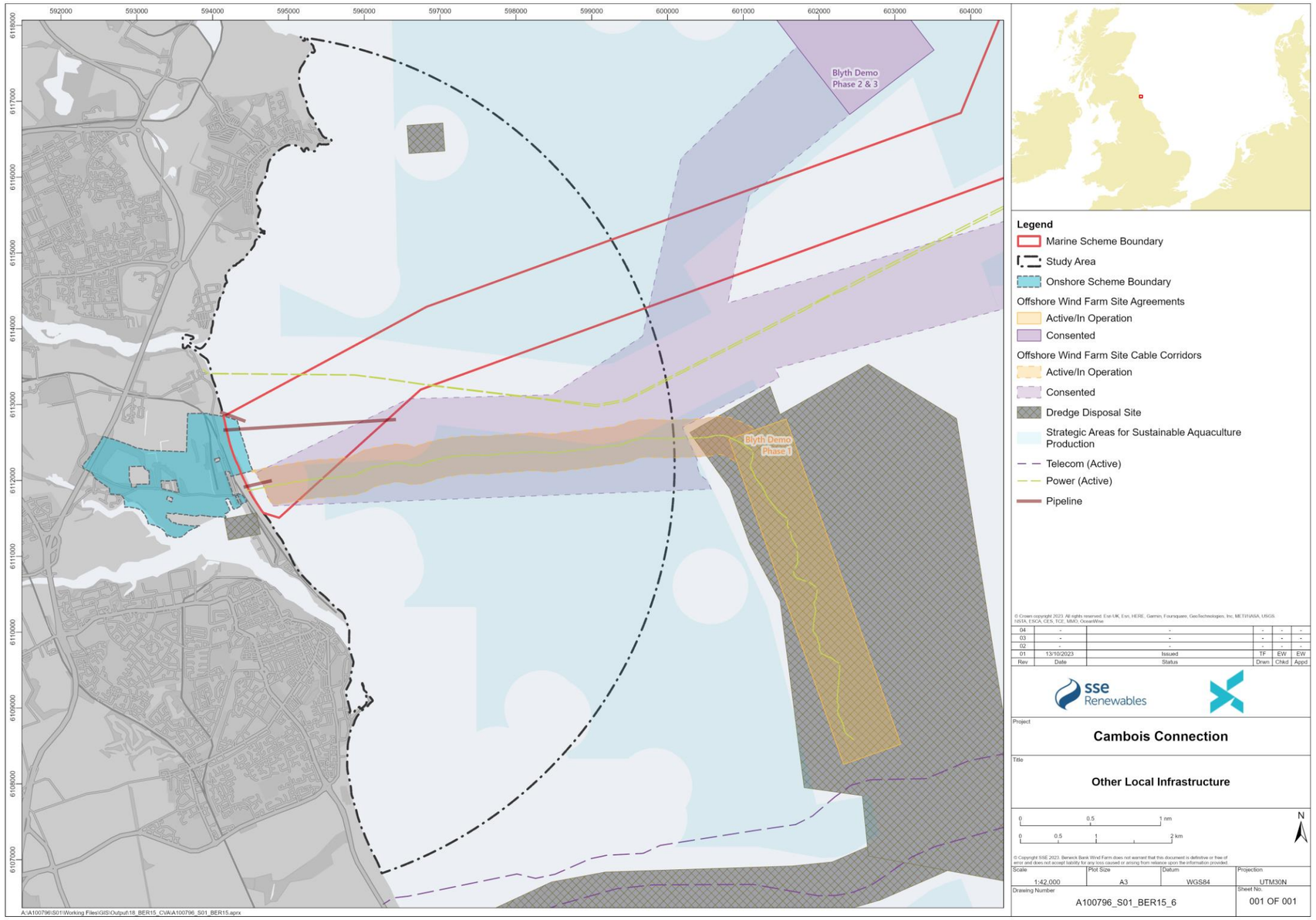

Figure 7 Other Local Infrastructure

4.9. Future Baseline

89. The current baseline description presents an overview of the existing environment. The earliest possible date for the start of landfall construction of Onshore Scheme is Q4 2029, with an expected operational lifetime of 35 years after the commissioning of the Onshore Scheme.

90. The baseline environment for the CVA Study Area is not static and will exhibit a certain degree of variability over time. Such changes will occur with or without the Onshore Scheme being in place.

91. The following sections provide a qualitative description of the evolution of the baseline environment, which are forecast to occur without the Onshore Scheme being in place.

92. Over the duration of the Project, climate change is predicted to modify existing weather patterns, and increase average temperatures, which has a resultant impact on the baseline conditions including sea levels, tides, currents, wave climate and wind climate. The United Kingdom Climate Projections 2019 (UKCP18) and marine report (Palmer et al., 2018), provide up to date climate change projections for the UK and relevant aspects of this data are presented below.

93. Seabed sediments are expected to remain the same into the future as there is limited sediment transport across the CVA Study Area. However, it is possible for more sediment input into the CVA Study Area as a result of increased erosion of the coastline from elsewhere along the Northumberland coast (this prediction appears to be validated by recent NCC reporting which considers future coastal behaviour in the area). This is expected to remain the same seabed sediment type.

94. In a UK context, due to naturally high inter-annual variability in the wave climate and low confidence in future climate change projections, there is presently no clear consensus on future wave climates affecting the north coast of United Kingdom (Wolf et al., 2020). It is also predicted that there will be an overall reduction in significant wave height, combined with an increase in the mean annual maximum wave height by 0.5 m (i.e. larger waves less frequently) and that wave heights to the north of the UK will increase as a result of a retreating Arctic sea ice (Wolf et al., 2020).

95. Plate 6 shows difference plots for the projected change in mean significant wave weight and annual maxima. There is 75% chance that future conditions will be different to past records where there is no observed masking (grey). Blue indicates a net reduction, while red indicates an increase. In the CVA Study Area, Plate 6 indicates a slight reduction in average wave heights. This information aligns with predictions by Wolf et al., (2020).

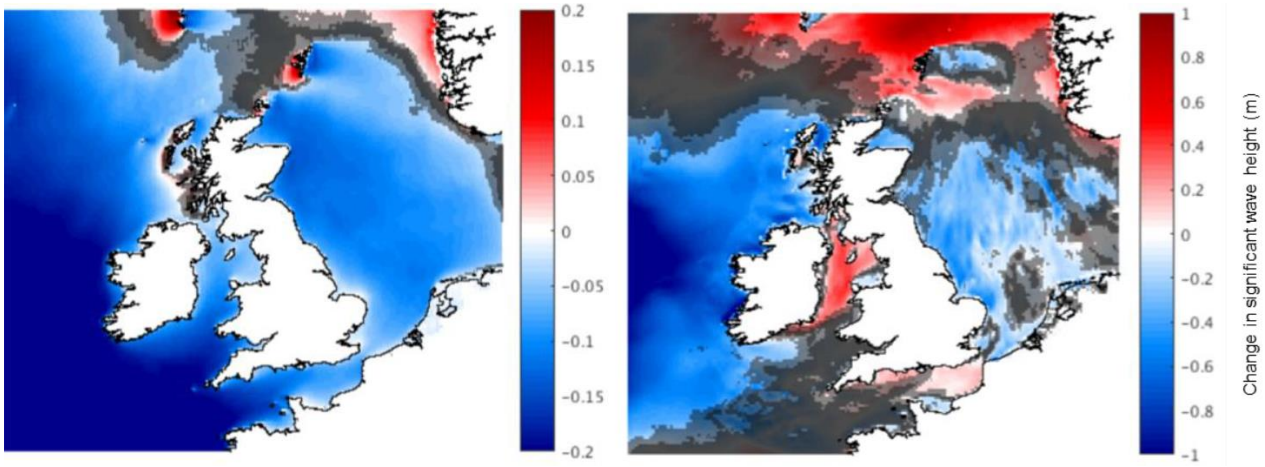

Plate 6 Projected change in mean significant wave height at end of 21st Century for (left) mean significant wave height and (right) annual maxima (Palmer *et al*., 2018)

96. UK Climate Projections (UKCP) provides details of climate change projections for mean sea level at sites around the UK coastline. The projections extend to 2100 for various scenarios (representative concentration pathways, RCP). Based on the 50th percentile for low (RCP 2.6) and high emission (RCP 8.5[6]) scenarios, an illustrative change in mean sea level after 35 years would be between +0.15 to +0.22 m (average annual rates of sea level rise of 4 to 6 mm/year). With the rise in relative sea-level, albeit at relatively low level within the CVA Study Area, this is likely to result in a landward advance of high water and may lead to increased coastal erosion (Horsburgh et al., 2020) along more erodible shorelines. Plate 7 below depicts time-mean sea level predictions for the planned lifetime of the Project in graphical format (this is of relevance to the cell closest to the Landfall).

97. This dataset is visualised within Plate 7 which shows the sea level projections over the lifetime of the Project relative to a baseline period of 1981 - 2000. A mean sea level rise of 0.11 m is projected by 2029 and of 0.33 m by 2064. The range associated with the projection is shown in light blue. In 2029, models project that there is 95% likelihood of a mean sea level rise of more than 0.07 m, with a 5% likelihood of a sea level rise of more than 0.15 m[7]. In 2064, models project that there is 95% likelihood of a sea level rise of more than 0.21 m, with a 5% likelihood of a sea level rise of more than 0.49 m. The projection for the average height of the sea over a year is obtained from multiple models that were used to inform the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report. The projections are output at 12 km resolution round the UK coast and the data shown in Figure 8.

[6] It would not be proportionate to undertake a detailed assessment of the entire CCMA. As per UKCP18, there may be a greater than10% chance that the real-world response lies outside these ranges and this likelihood cannot be accurately quantified.

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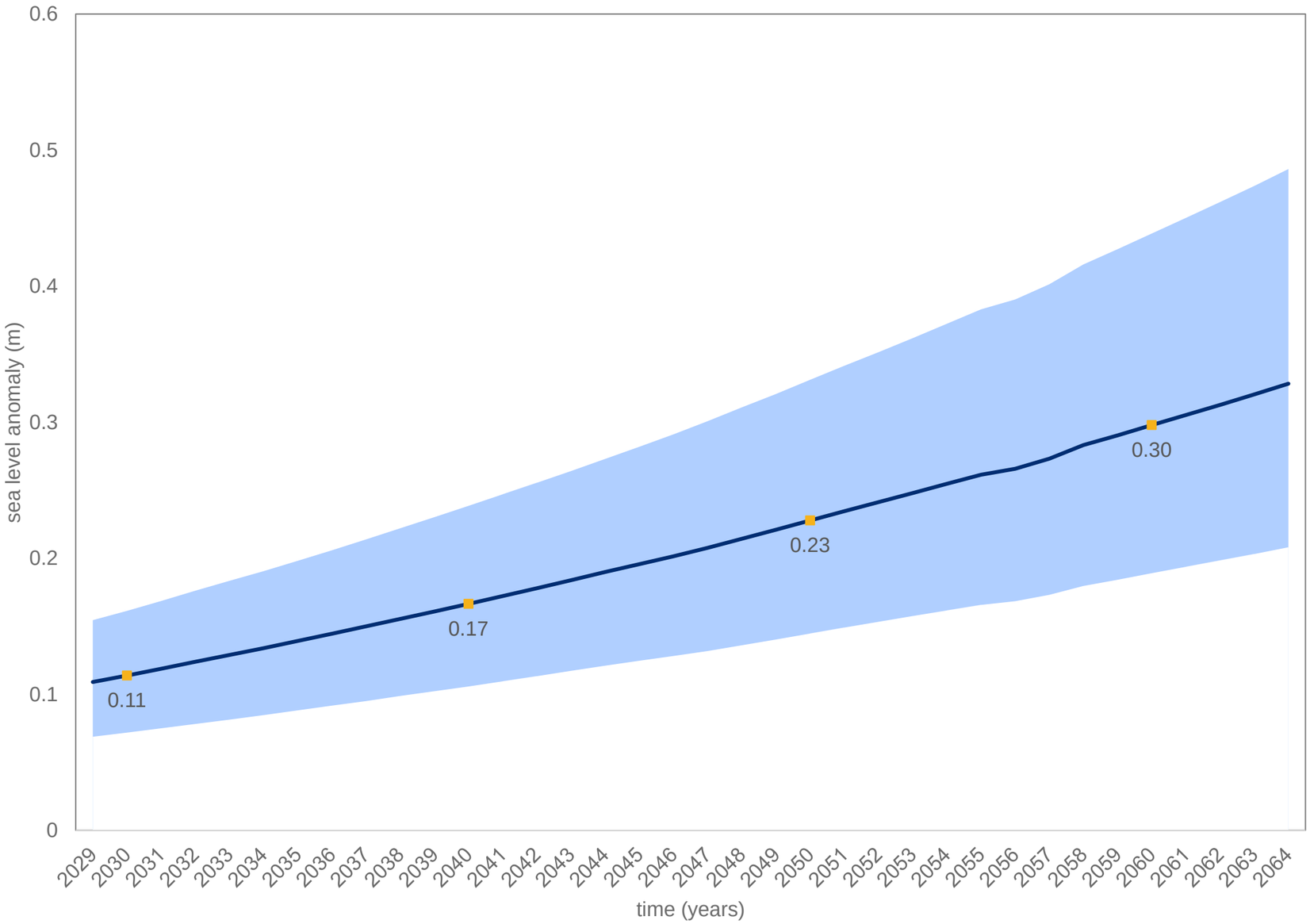

Plate 7 Time-mean Sea Level Predictions 2029-2064 for the Project[8]

[8] Relative to a baseline of 1981-2000 (RCP8.5); the shaded region on the Plate depicts the projection range.

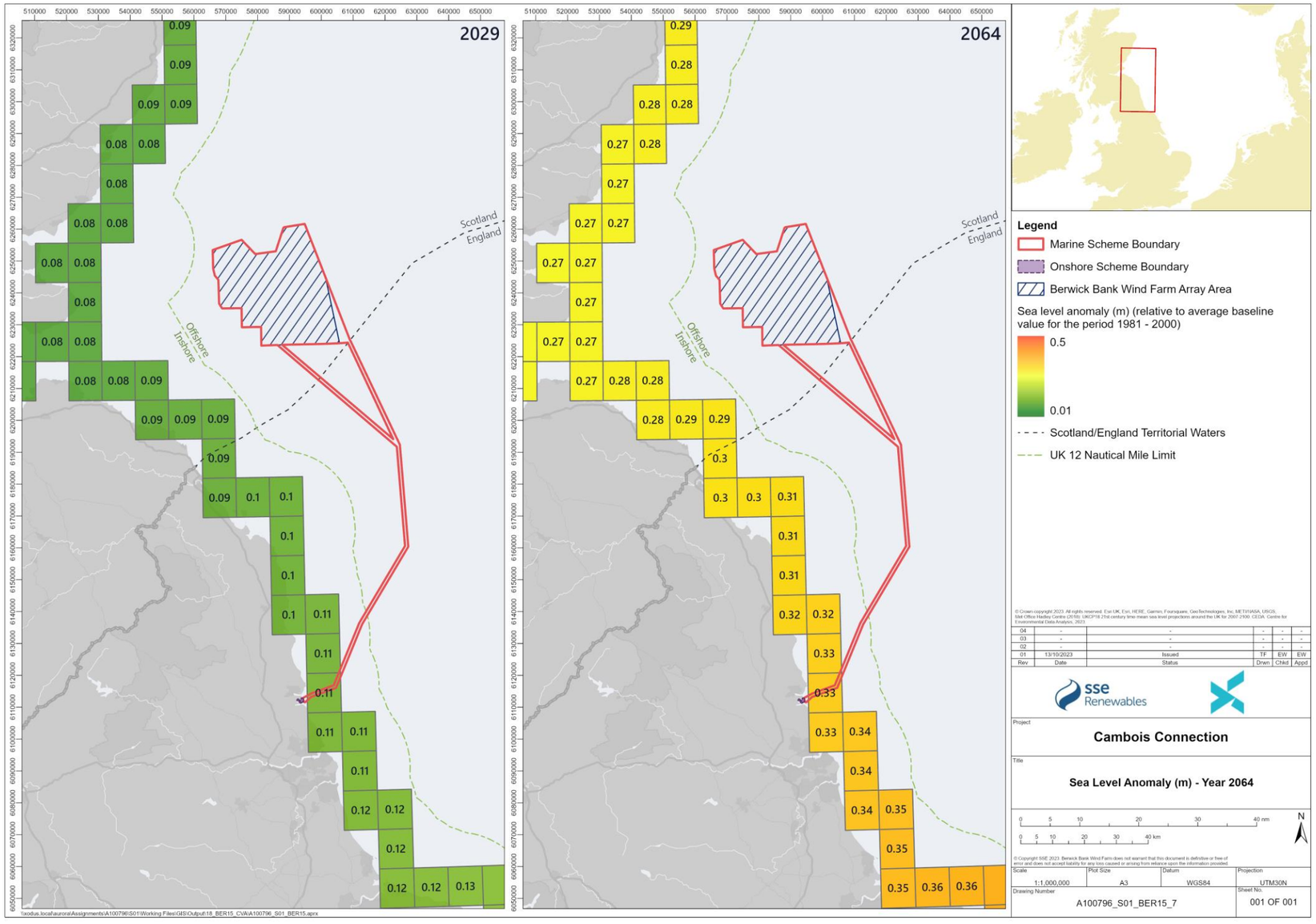

Figure 8 Sea level anomaly (m) - year 2064

98. As well as climate change, isostatic (glacial) rebound from the last Ice-Age is continuing to adjust some land and seabed levels. The part of the UK where the Project is located is subject to negative uplift between around 0 to -0.8 mm/year, as shown in Plate 8, thereby marginally reducing the rate of sea level rise.

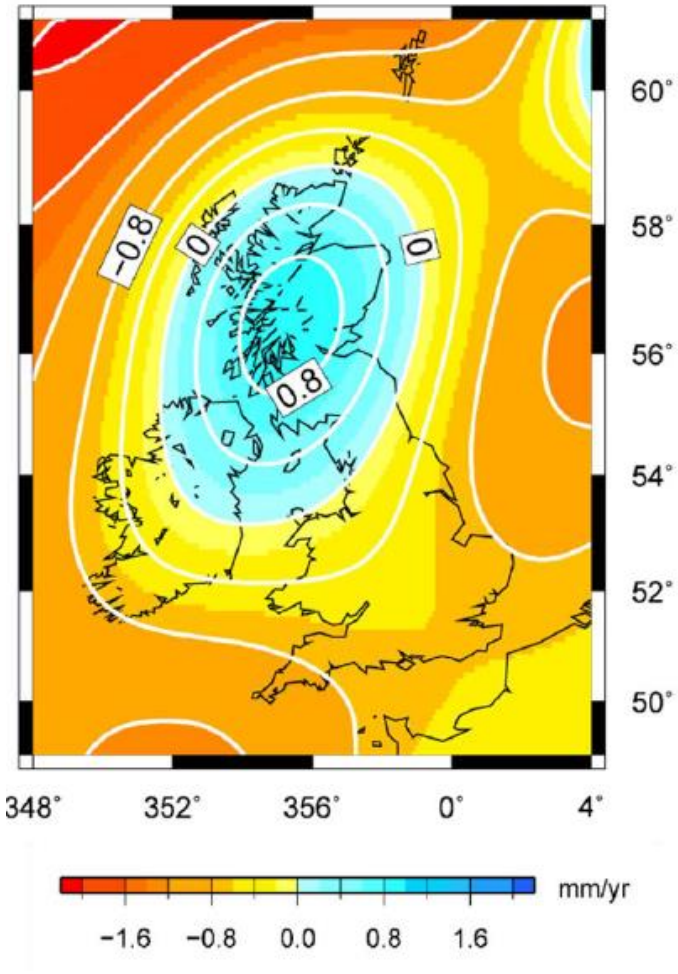

Plate 8 Predicted isostatic uplift rate (Bradley et al. 2011)

99. Despite the potential for relative sea level rise, resulting in higher tidal levels across the CVA Study Area there is not expected to be any change to tidal flows into the future. The tidal range is expected to stay the same, with increases occurring to both the lowest and highest tidal levels. At the same time, the tidal properties through the Marine Scheme are expected to stay the same, because the tidal regime is associated with much larger regional scale tidal movement.

100. With regards to the influence of climate change on coastal environments, trends in coastal erosion and accretion may also be altered as a result of sea level rise and changes to local sediment transport processes. Sea-level rise is expected to contribute to coastal erosion, and it is assessed that 17 % of the UK coastline is currently experiencing erosion. In addition to sea-level rise, coastal erosion results from many factors, including reduced sediment supply, storms and anthropogenic disturbance (Masselink et al., 2020).

101. Specific to the Landfall, the Northumberland and North Tyneside Shoreline Management Plan 2 identified Cambois to have an erosion potential between 10 and 40 m over the next 100 years, while Blyth Beach is estimated to have an erosion potential of between 20 and 60 m over the next

100 years based on no further measures of erosion prevention (Northumbrian Coastal Authority Group, 2009).

102. Any changes that may occur during the design life span of the Project should be considered in the context of both greater variability and sustained trends occurring on national and international scales in the marine environment. SMP2 includes the following reflections on the future of Cambois Bay (policy unit 21.5) (NCC, 2009):

Moving south from the estuary mouth along Cambois Bay towards North Blyth, there is some scope for continued recession of the undefended frontages in the short term but in the medium and longer term some form of management will be required to maintain the assets that would be threatened by erosion or, in the south of the frontage, by potential breaching and resultant sea flooding through into Blyth Harbour. This management would be particularly relevant: (i) at either end of the existing revetment, which presently is highly effective and in a good condition; (ii) at Cambois House; (iii) at the access points to the beach from the car parks; (iv) and further south along the dunes where there is only a modest width of land between the eroding coast and the mineral railway and access road to North Blyth […] However, despite the above erosion risk, it presently would not be economically viable to provide fixed defences along the entire length of Cambois Bay to protect these assets. Instead, the preferred approach would be to use local control points to reconfigure the coast to ensure better continuity between presently defended and presently undefended areas and in doing so to safeguard the critical assets that will, in the longer term, become threatened. This will include prevention of a breach from the coast into the Blyth Estuary through the narrow strip of land. In addition to these works, and in light of the proposals and potential for redevelopment in this area, it is also recommended that a suitable planning buffer zone is allowed by developers to allow for potential recession rates into the future (beyond the time horizon of this SMP). The loss of sandy beach habitat designated under the Northumberland Shore SSSI in this area in the 2nd and 3rd Epochs will be mitigated by a policy of Managed Re-alignment MR at Wansbeck Estuary in the 1st Epoch.

103. More detailed comments specific to policy unit 21.5 (NCC, 2019) go on to refer to selective local works (hard points) to assist realignment and safeguard properties and assets, including the use of the existing revetment described above to aid this process. The SMP2 also describes NCC's intention to manage the recession process elsewhere to ensure no breaching through dunes and their intention to set any new development back from shore (the so-called "buffer zone" within SMP2).

5. Coastal Vulnerability Assessment

104. It is recognised by government and industry that coastal communities and infrastructure is at risk from future climate change (and indeed risks to infrastructure from coastal flooding and erosion is specifically recognised within the findings from the third UK Climate Change Risk Assessment (CCRA3) (CCC, 2021). For new infrastructure, and given the uncertainties around sea level rise, it is therefore considered that 'what if' planning for high coastal risk scenarios can help with understanding what could be done in the event of very high rates of change. On this basis and led by the local NCC requirements associated with WAT-5, a CVA is provided below following a sequential screening, scoping and assessment process.

105. As part of the pre application planning process, NCC, as the delegated Coastal Protection Authority confirmed the need for CVA to consider and confirm the following:

    1. Ensure adequate beach cover of cables over the lifetime of the asset to allow for the erosion of the beach and sand dunes in the location of the proposed cables as this could pose a public safety risk if they become exposed;
    2. Detail of any temporary works undertaken for the installation of the cable to consider the implications on the beach and sand dunes; and
    3. Confirmation that the proposed works do not adversely impact the "buffer zone" referenced within the SMP long-term.

106. These items have been considered within this CVA as presented below.

5.1. CVA Screening

107. In its role as the Coast Protection Authority, NCC has powers to carry out coast protection works, while the prevention and mitigation of coastal flooding sits with the Environment Agency. The Northumberland and North Tyneside Shoreline Management Plan 2 (SMP2) provides a large-scale assessment of the risks from coastal erosion and sea flooding to places, people and the historic and natural environment.

108. SMP2 presents a policy framework to manage these risks over 20, 50 and 100 years. As recognised by SMP2 and the NCC local plan, NCC recognise that there are areas of the Northumberland Coast where there is the need to address the issue of coastal erosion and coastal change to protect commercial, economic and residential areas. Key challenges posed by the SMP include the possible need to relocate caravan parks and golf courses and realign sections of roads in certain areas, as well as specific issues of eroding colliery spoil in the Lynemouth area and sea flooding at Blyth (Cambois Bay is specifically reported upon within SMP2 and associated partial measures survey and reporting effort commissioned by NCC and published on an ongoing basis).

109. As set out within Table 12 and as informed by pre-application discussions with NCC and the LLFA, the location of the Onshore Scheme within the CCMA and across the plan policy area for WAT-5 dictate the requirement for a CVA.

110. Screening Outcome: **CVA required; proceed to CVA Scoping**.

5.2. CVA Scoping

111. The nature of the Project, as described in section 1.4 above and in-full within Volume 2, Chapter 5: Project Description, confirms the applicants commitment to trenchless technology at the Landfall, which means that there is no potential for any direct interaction with the sand dune system, Cambois beach or the intertidal area for both the Onshore Scheme and Marine Scheme.

112. The trenchless technology ducts will pass from the Onshore HDD compound, under existing infrastructure, including road, utilities, railways, and beach areas beneath the intertidal area to an HDD "punch out" exit point at least 250 m seawards of MLWS, as shown in Plate 2. Therefore the interactions with the baseline environment are highly limited. The following topics have been Scoped-in to the CVA:

- The risks associated with the Landfall and specifically, any potential risk of cable exposures or damage based on predicted future changes (e.g. sea level rise or storm floods), including assets above MHWS and below MHWS;
- The risks associated with the Landfall below MHWS, but adjacent to the WAT-5 policy area, in specific relation to stabilisation of trenchless technology (e.g. HDD) exit pits and Offshore Export Cables and their respective exposure to future climate factors (e.g., sea level rise and increased storminess); and
- The risk of the changing climate and the potential (increased) risk of adverse interactions with the receiving environment as a *consequence* of the Project.

113. **Scoping Outcome: undertake CVA for interactions associated with; onshore Landfall; (compound, transition jointing bays and trenchless technology entry point); and nearshore Trenchless technology: punch out (HDD exit pits), protection and Offshore Export Cables and protection**.

5.3. CVA – Onshore Landfall

114. Trenchless technologies, such as HDD, are proven techniques which have been extensively deployed around the UK. HDD, first deployed in the 1970's, has been successfully utilised on numerous landfalls for subsea transmission and offshore wind projects throughout the UK, including Dudgeon, Sheringham Shoal, East Anglia ONE, Greater Gabbard, Galloper, Westermost Rough, Triton Knoll, Hornsea Project One, Shetland HVDC link as well as the recently completed Viking Link interconnector and under construction Dogger Bank Wind Farms (being developed by SSE Renewables) (there are many more examples).

115. The technique is used in both hard and soft ground and can be used for excavation diameters from 200 mm up to 2 m and for drill lengths of up to 4000 m (in the case of 'long' HDD, the technical "boundaries" for the use of trenchless technologies such as HDD are being continually driven by the requirements of more complex landfall locations, partially a result of more technically straightforward sites being at or nearing capacity).

116. In order to bring the Offshore Export Cables to shore, trenchless technologies (such as HDD) will be utilised, as described in Section 1.4 . The Applicant has carried out a range of technical, environmental and commercial studies at the Onshore Landfall compound at Cambois to help inform the selection of the best on-balance location for bringing the Offshore Export Cables to shore. Figure 3 demonstrates no above ground infrastructure or cabling located within the beach and sand dunes.

117. Further detailed engineering design is still ongoing, and this will be informed by the recently completed onshore and marine ground investigations commissioned by the Applicant in 2023. Notwithstanding, preliminary locations for the 'launch' of a trenchless technology such as HDD landward of the sand dune system on the Cambois coastline have been identified. An anticipated location for the citing of the TJB has also been identified, which is again landward of the dune structure on the Cambois coastline.

118. During the construction of the Onshore Scheme Landfall, a works compound will need to be established, as described in Section 1.4 . Based on the outline programme for the Project detailed within Section 1.4, commencement of landfall construction is estimated in Q4 2029 ; whilst there may well be some observable effects from climate change (i.e. increased storminess which to an

extent is already being observed at the time of writing), they are expected to be indiscernible from current conditions at the Landfall location (longer-term climate change effects would not expected until a future date, long after construction has concluded). The landfall works compound will be located in a secure location onshore (landward of the dunes and beach) and application of a Construction Environmental Management Plan (CEMP) will help to ensure impacts from temporary works are adequately controlled. It is anticipated that the location and form of the compound would require confirmation and agreement with NCC through planning condition(s).

119. During the construction phase, access to the Onshore Landfall works compound will be required; it is anticipated that this will be via the existing road network at Cambois (similarly to the works compound, it is anticipated that access routes would require confirmation and agreement with NCC through planning condition(s)). The nature of trenchless technologies means that access requirements to the dunes and beach will be highly limited; this is expected to relate purely to 'spotters'[9] employed during the Landfall installation process.

120. One of the principle potential concerns in terms of coastal vulnerability is the potential exposure of trenchless technology ducts beneath the intertidal zone which could cause a significant risk to people and the environment. Around the UK coastline, there have been some isolated historical examples of cable and/or pipeline exposure, however the examples documented in the public domain pertain to very different designs (buried cables in coastal inlets / bays, and trenches cables and pipelines). By way of illustration, the WaveHub exposure in 2011 (Engineer, 2011; BBC, 2011) adopted an HDD technique through sand dunes, prior to beach jointing and open burial within a relatively high-energy area of shifting sands and complex coastal morphology; through erosion and resultant loss of material covering the cables, they were exposed. As sea level is expected to rise and there is greater anticipated potential for increased 'storminess' at the Landfall location, it will be important to provide for adequate burial so as to safeguard the ducts for the lifetime of the Project.

121. Early investigations into the approach to and (outline) design of trenchless technologies at Cambois have been carried out, indicating an anticipated burial depth of up to a maximum of 30 m[10] for the ducts underneath the intertidal zone at Cambois. As detailed within Section 1.4, the Applicant is committed to a minimum duct depth of -7.05 m below the intertidal. The maximum length of trenchless technology ducts will be approximately 2400 m (noting that the Applicant is committed to exiting a minimum of 250 m seawards from MLWS and exit locations are currently up to and including – 10 m LAT). A worst case scenario has been adopted in the Applicant applying the minimum duct depth and trenchless technology exit location. However, as introduced within Section 1.4, as part of the detailed design work required to inform the final landfall methodology, the design would negate the risks of potential exposures due to coastal recession and beach lowering associated with climate change effects over the operational and maintenance phase of the Project.

122. Unlike other historical exposures, the trenchless technology employed for the Project (such as HDD) will be continually underneath the dunes and the intertidal. With the installation of cables underneath the intertidal zone, the risks of exposure are likely to be much lower. Furthermore, the relatively deep design depths anticipated for the Project mean that exposure is very unlikely.

123. Table 9 provides a summary of the CVA assessment requirements following the NCC pre-application advice, and the Applicant response.

[9] It is common practice for installation contractors to employ spotters (on foot) to monitor site conditions during construction works.

[10] Ducts will be engineered to be at a depth to adequately deliver the Project whilst ensuring risks of exposure are fully managed for the lifetime of the development.

Table 9 Summary of CVA Onshore Landfall (compound, transition jointing bays and trenchless technology entry point, burial under intertidal)

Coastal Vulnerability Assessment	Applicant Response
1. Ensure adequate beach cover of cables over the lifetime of the asset to allow for the erosion of the beach and sand dunes in the location of the proposed cables as this could pose a public safety risk if they become exposed	The trenchless technology ducts will pass from an Onshore entry point, within the HDD compound, under existing infrastructure, including road, utilities, railways, sand dune system, Cambois beach and the intertidal area to an HDD "punch out" exit point at least 250 m seawards of MLWS. There is no above ground infrastructure or cabling located within the intertidal area. As detailed above, the Applicant is committed to a minimum burial depth of -7.05 m below the intertidal. At the time of assessment, a contractor has not been appointed for completion of the Landfall work, nor has detailed design been progressed (this is normal at this stage in the development lifecycle for such a project). The Applicant proposes agreement of planning () conditions with NCC at reserved matters stage. Through this CVA and the commitments detailed below, the risk of exposure and associated public safety implications are considered to be fully managed. **This CVA demonstrates adequate beach cover of cables over the lifetime of the asset to allow for the erosion of the beach and sand dunes in the location of the proposed cables to ensure that cable exposure would not pose a public safety risk.**
2. Detail of any temporary works undertaken for the installation of the cable to consider the implications on the beach and sand dunes	The trenchless technology ducts will pass from an Onshore entry point, within the HDD compound, under existing infrastructure, including road, utilities, railways, sand dune system, Cambois beach and the intertidal area to an HDD "punch out" exit point at least 250 m seawards of MLWS. There is no above ground infrastructure or cabling located within the intertidal area. Figure 3 demonstrates no above ground infrastructure or cabling located within the beach and sand dunes As described in Section 1.4 there will be almost no interaction with the beach, sand dunes and intertidal zone due to the nature of trenchless technologies. **As demonstrated by this CVA and considering the intended trenchless technology compound and Landfall launch will be located above MHWS and landward of the sand dunes and beach at Cambois, there are considered to be no adverse implications on the beach and sand dunes**.
3.Confirmation that the proposed works do not adversely impact the "buffer zone" referenced within the SMP long-term objectives	The trenchless technology ducts will pass from an Onshore entry point, within the HDD compound, under existing infrastructure, including road, utilities, railways, sand dune system, Cambois beach and the intertidal area to an HDD "punch out" exit point at least 250 m seawards of MLWS. There is no above ground infrastructure or cabling located within the intertidal area.

Coastal Vulnerability Assessment	Applicant Response
	Within SMP2, a 'buffer zone' is referenced in relation to multiple policy units, meaning a suitable area within which development will be avoided (with proposals being set-back from the shoreline, creating a natural buffer). For some policy units, this is spatially defined but that is not the case for Cambois based on SMP2 long-term objectives. Nonetheless, the area of dunes and scrub west of the Cambois beach is understood by the Applicant to constitute this so-called buffer zone for the policy unit 21.5. As detailed above, the Applicant does not intend to locate infrastructure in this area (aside from the use of trenchless technology which will pass underneath). By locating the trenchless technology compound and Landfall launch above MHWS and landward of the dunes and beach at Cambois, the buffer zone described by NCC will be avoided and the Onshore Scheme will not lead to any adverse impacts on this area. **The CVA confirms that the proposed works do not adversely impact the "buffer zone" referenced within the SMP long-term objectives**

124. Notwithstanding, in addition to the minimum burial depth commitment described above, the Applicant will seek to provide further assurances to NCC and their supporting stakeholders, as the detailed design for the Project progresses.

125. Full details of construction mitigation measures will be provided in a Construction Environment Management Plan (CEMP), to be agreed with NCC prior to construction commencing. It is anticipated that the location and form of the trenchless technology compound as well as access routes would require confirmation and agreement with NCC through planning condition(s). It is also anticipated that the Landfall design (and burial depths) would require confirmation and agreement with NCC through planning condition(s).

126. **CVA Outcome CVA Onshore Landfall (compound, transition jointing bays and trenchless technology entry point, burial under intertidal): compliant with WAT-5. Applicant to provide further evidence of conformance to NCC via planning condition(s) once further detailed design information available.**

5.4. CVA – Nearshore[11] (Trenchless Technology, punch out, HDD Exit Pits and Offshore Export Cables and protection)

5.4.1. Assessment of Exit Pits (trenchless technology punch out) on physical and coastal processes

127. There will be up to five (one as contingency) exit pits located at the Marine Scheme Landfall, to accommodate up to four cable ducts. The preferred method is to use a trenchless technology, such as HDD, which will be located above MHWS (onshore) with a 'punch out' and associated exit pits located in a marine area below MLWS, bypassing the intertidal area. The potential risks relating to cable exposure due to coastal recession and beach lowering due to climate change, will be included as part of the detailed design work required to inform the final landfall methodology.

128. During the construction phase, the Offshore Export Cable will be installed through trenchless techniques from an onshore location to an exit location (as above, the exit location will be a minimum of 250 m seawards of MLWS and up-to and including - 10 m LAT). To facilitate the trenchless installation, up to five "punch out" exit pits (four plus a spare) may be excavated to a maximum depth of 3 m, over a total area of 500 m^2, associated with a total excavated volume of 1,500 m^3. Excavated material from the seabed would be temporarily stored alongside the exit pits at least 250 m seawards of MLWS as sediment berms, with a temporary but maximum height of up to 1.5 m. The sediment berms would then be used to backfill the exit pits on completion of drilling.

129. The exit pits would temporarily and locally increase the water depth by up to 3 m. The increase in water depth would not ultimately affect the wave regime as the increase in depth would still be within a breaking wave regime based on the wave period and wavelength for the average waves characteristic to the Landfall, as described in section 4.5. In terms of the sediment berms, the sediment berms could be up to 1.5 m high and 9.5 m wide, to account for the excavated volumes from each exit pit, each respective berm would be about 35 m long. As the pits and berms would be orientated offshore, perpendicular to the coastline and wave approach direction, the influence of the berm on the approaching waves is to locally increase wave shoaling where the berm is present.

130. In terms of influence on flows, the increased depths associated with the exit pits(s), would not alter or influence flows. For the sediment berms, the height of 1.5 m is not high enough to disrupt water levels either side of the berm, therefore, the flow will not be disrupted and there will not be any change to flow speeds. Therefore, beyond the immediate proximity to the exit pit(s) and sediment berms, there will be no interruption to flows and only locally increased shoaling to waves in close proximity to the berms. The localised changes to waves would not alter the coastal morphology or littoral drift or regional north to south sediment transport characteristic to the SMP2 management unit and coastal cell. As there is not considered to be change to the littoral drift, there is not considered to be any onward risks to coastal vulnerability along the Cambois coastline.

131. The exit pits and sediment berms are only likely to be present for a period of up to 3 months, before the seabed is reinstated. As described above, any potential impact would be very localised to the exit pits and sediment berms and only with respect to waves. With no onward effect to waves at the coast, this short-term and temporary process is not considered to have any discernible impact in relation to coastal vulnerability along the Cambois coastline.

[11] This is the area of coastline below MLWS which is adjacent to (and not within) the CCMA but is of wider relevance to the process of CVA, as explained in Section 1.4.

132. During seabed reinstatement, concrete mattresses may be used to stabilise the trenchless technology exits with rock placement above, as required (based on the techniques summarised in Section 1.4). In the event rock protection is required, it is anticipated that the exit protection would have a maximum berm height of 1.5 m as applied elsewhere within the Project. The design of the Landfall and trenchless technology exits will be finalised in order to provide an adequate level of protection to Offshore Export Cables for the lifetime of the Project. Whilst noting the design is yet to be finalised for the reasons explained above, the Applicant has already sought provision for the protection required within the MLA to the MMO for works below MHWS at Cambois.

5.4.2. Assessment of trenchless technology exit and Offshore Export Cables protection (in the nearshore zone) on physical and coastal processes

133. Alongside the trenchless technology exit protection as introduced above, cable protection may also be required along sections of the Offshore Export Cables in the nearshore zone, where burial cannot be achieved, and at crossings with third-party assets and infrastructure. As described in Section 1.4 , the preferred method of cable protection will be burial and the use of rock protection will be kept to a minimum. However, as part of this CVA, it is necessary to consider the potential impact of protection measures[12]; specifically, this relates to changes to sediment transport as a result of blockage from remedial cable protection and potential introduction of scour (including edge scour).

5.4.2.1.1 CHANGES TO SEDIMENT TRANSPORT AS A RESULT OF BLOCKAGE FROM PROTECTION

134. For the different sediment sizes that occur across the Marine Scheme[13], the coarser sand fraction that characterises the Cambois coastline and beach, would only be mobilised over a small proportion of the tidal cycle based on the representative flow conditions, with the contribution from waves only marginally increasing the sediment mobility potential. Of the amount available for transport, only a small proportion could theoretically be trapped within the protection, and the exact amount would vary in relation to the tidal processes, wave properties and sediment grain size.

135. Analyses presented in the Marine Scheme Volume 2, Chapter 7: Physical Environment and Seabed Conditions EIAR chapter, demonstrated that the presence of protection will not alter water levels downstream of the protection and therefore there is no large scale change to flow properties, which is still the case at the shallowest location within the Marine Scheme and CVA Study Area. With no variation in tidal flow speeds, the sands and gravels that comprise the majority of the seabed sediment across the Cambois coastline would still be transported. However, it is recognised that locally, in proximity to the protection structure, the protection could temporarily act as a blockage to sediment movement. The protection would be a porous structure, therefore sediment transported as bedload could potentially be trapped within the voids of the protection, meaning the structure would initially act as a localised sink for coarser sediments. This effect, however, would only be temporary and in the short-term, for the localised area of seabed where the protection is present. With time and as the voids within the protection fills or colonises with benthic communities, sediment previously deposited locally, would bypass, pass through or overtop the remedial rock protection. The protection structure is therefore unlikely to cause any hindrance to the transport or

[12] The application of rock protection will be below MLWS, and further east (in an offshore direction) away from the Landfall. This is well outside of the NCC CCMA (and applicability of the plan policy area for WAT-5). However, recognising the need to consider indirect relationships with the Northumberland coastline, cable protection *outside* of the and the plan policy area for WATWA-5 has been considered for completeness.

[13] The sediment mobility potential has been considered in-full within the Marine Scheme EIA and for brevity, it is surmised here. For further details, please refer to Volume 2, Chapter 7: Physical Environment and Seabed Conditions provided as part of the Marine Scheme EIA.

littoral drift of coarse sediment in the medium to long-term, nor is it anticipated to have any detectable impact in terms of the Northumberland coastline and its vulnerability to climate change. As flow speeds would be maintained both upstream and downstream of the protection, there is not considered to be any changes for the finer sediment fraction, such as silts, transported as suspended sediment.

136. Waves observed across the nearshore environment of the Marine Scheme contribute to the sediment transport potential within the nearshore as demonstrated in Volume 2, Chapter 7: Physical Environment and Seabed Conditions. Therefore, as described above in relation to flows, the protection would temporarily trap sediment moved in relation to flows and waves, again meaning the structure would initially act as a localised sink for coarser sediments. It is again considered that this effect would only be temporary and in the short-term, for the section of the protection where wave action interacts with the seabed (the same predictions associated with filling of voids above applies).

137. The potential changes to the tidal, wave and sediment transport regimes as a result of blockage effects from cable and crossing protection measures within the nearshore environment of Marine Scheme is assessed to be minimal. The presence of trenchless technology exit pits, cable and crossing protection on the seabed does not ultimately impact the local wave and tidal regime within the nearshore environment across the Marine Scheme. With no change to waves and tides, there is not anticipated to be onward changes to the sediment transport regime as a result of the Marine Scheme within the nearshore and within CVA Study Area. The assessed sediment transport blockage effect from installed protection (should it be required) would be temporary, with material eventually by-passing. The small scale of any applied protection would not be enough to disrupt the littoral drift along the coast, with no onward changes to the coast and coastal morphology, there is not considered to be any discernible impact to coastal vulnerability along the Cambois coastline.

5.4.2.1.2 POTENTIAL INTRODUCTION OF SCOUR (INCLUDING EDGE SCOUR).

138. The analyses for the potential edge scour properties around the trenchless technology exit, cable and crossing protection is based on empirical formulae as presented in Petersen (2014) and Petersen et al., (2015a; 2015b). In the above studies, the edge scour properties primarily relate to the rock size applied, which influences the scour depth. Analytical assumptions used in the estimation of edge scour are detailed in Volume 2, Chapter 7: Physical Environment and Seabed Conditions EIAR chapter.

139. Based on the applied water depths within the nearshore, the assumed rock size (where a nominal grain size of 67 mm was applied) and the representative spring and neap flow speeds that occur across the nearshore environment Marine Scheme, there is little to no potential for development of edge scour. Even with the application of faster flow speeds of around 1 m/s, which exceed that which frequently occurs within to the nearshore environment, the potential for edge scour is still only centimetres, which would be indiscernible from the natural variation and considered incapable of leading to a discernible impact in relation to coastal vulnerability along the Northumberland coastline.

140. The potential of any edge scour is assessed to be at worst only centimetres with respect to an installed protection (should it be required). Should the edge scour occur, it would be highly localised to the protection. As the minimum depths at which protection could be used is still 500 m away from the MLWS, there is no potential for the edge scour to reach the coast. Therefore, the potential for edge scour is not considered. to have any discernible impact in relation to coastal vulnerability along the Northumberland coastline.

Table 10 Summary of CVA Nearshore Trenchless technology punch out, HDD exit pits, protection and Offshore Export Cables and protection

Coastal Vulnerability Assessment	Applicant Response
1.Ensure adequate beach cover of cables over the lifetime of the asset to allow for the erosion of the beach and sand dunes in the location of the proposed cables as this could pose a public safety risk if they become exposed	The trenchless technology ducts will pass from an Onshore entry point, within the HDD compound, under existing infrastructure, including road, utilities, railways, sand dune system, Cambois beach and the intertidal area to an HDD "punch out" exit point at least 250 m seawards of MLWS. There is no above ground infrastructure or cabling located within the intertidal area. The CVA considers the nearshore exit pits protection and offshore export cables protection, located below MLWS, which is adjacent to (but not within) the CCMA is presented in order to assess the impacts of the Nearshore exit pits and offshore export cables. As detailed above, the Applicant is committed to a minimum burial depth of -7.05 m below the intertidal zone. Independent analysis has identified that approximately 50% of subsea cable failures are attributed to environmental conditions, leading to abrasion or other damage (Dinmomahaddi *et al*., 2019). Subsea cables are notably exposed due to changes in the offshore environment, such as scour and sediment transport as a result of marine physical processes and (or) climate change. To ensure cables remain protected over the lifetime of the project, coastline and beach erosion rates will be used to plan for sufficient depth. The Offshore Export Cables will be protected along the Marine Scheme route (with burial as the preferred method of protection, and external cable protection used where required and at crossings with third-party infrastructure and assets). Provision for materials (such as rock protection / concrete mattresses) have been included within the MLA to the MMO in order to suitably stabilise the HDD exit pits. The exact nature and extent of cable protection will be informed by outputs from the Cable Burial Risk Assessment (CBRA) completed by the installation contractor(s) prior to the commencement of installation. Rock utilised in berms will be clean with low fines; use of graded rock and 1:3 profile berms at areas of rock protection will minimise impacts on the receiving environment. Through this CVA and the commitments detailed below, the risk of exposure and associated public safety implications are considered to be fully managed. **This CVA demonstrates adequate beach cover of cables over the lifetime of the asset to allow for the erosion of the beach and sand dunes in the location of the proposed cables to ensure that cable exposure would not pose a public safety risk.**
2.Detail of any temporary works undertaken for the installation of the cable to	The trenchless technology ducts will pass from an Onshore entry point, within the HDD compound, under existing infrastructure, including road, utilities, railways, sand dune system, Cambois beach and the intertidal

Coastal Vulnerability Assessment	Applicant Response
consider the implications on the beach and sand dunes	area to an HDD "punch out" exit point at least 250 m seawards of MLWS. There is no above ground infrastructure or cabling located within the intertidal area. The CVA considers the nearshore exit pit protection and offshore export cables protection, located below MLWS, which is adjacent to (but not within) the CCMA is presented in order to assess the impacts of the Nearshore exit pits and offshore export cables. **As demonstrated by this CVA and considering the highly limited extent of impacts from temporary works, there are considered to be no adverse implications on the beach and sand dunes .**
3.Confirmation that the proposed works do not adversely impact the "buffer zone" referenced within the SMP long-term objectives	The trenchless technology ducts will pass from an Onshore entry point, within the HDD compound, under existing infrastructure, including road, utilities, railways, sand dune system, Cambois beach and the intertidal area to an HDD "punch out" exit point at least 250 m seawards of MLWS. There is no above ground infrastructure or cabling located within the intertidal area. The CVA considers the nearshore exit pit protection and offshore export cables protection, located below MLWS, which is adjacent to (but not within) the CCMA is presented in order to assess the impacts of the Nearshore exit pits and offshore export cables **The CVA confirms that the proposed works do not adversely impact the "buffer zone" referenced within the SMP long-term objectives**

141. As demonstrated in this CVA, the Applicant will be fully compliant with NCC assessment requirements. However, the Applicant will seek to provide further assurances to NCC and their supporting stakeholders, as well as the MMO (licensing authority for any required marine licence), as the detailed design for the Project progresses.

142. It is anticipated that the detailed design of the Landfall (including methodology for exit pit stabilisation) within the envelope assessed here and ultimately consented would require confirmation and agreement with NCC through planning condition(s). Below MLWS, it is anticipated that the MMO will require the Applicant to provide a Cable Specification and Installation Plan (CSIP) as part of future Marine Licence condition requirements; owing to the location of the Landfall on the Cambois coastline, it is anticipated that NCC would be a consultee to the CSIP during post-consent assessment and discharge of this 'return'.

143. **CVA Outcome Nearshore[14] Trenchless technology punch out, HDD exit pits, protection and Offshore Export Cables and protection compliant with WAT-5. Applicant to provide further detail to NCC via planning condition(s) once further detailed design information available**.

144. NCC local plan requirements related to CVA. The specific requirements for a CVA, as raised by NCC, have been considered by the Applicant in-full, demonstrating full policy conformance with the

[14] This is the area of coastline below MLWS which is adjacent to (and not within) the CCMA but is of wider relevance to the process of CVA, as explained in Section 1.4.

WAT-5 plan policy. Alongside the specific detailed Coastal Vulnerability Assessment requirements discussed above.

145. Table 11 provides a summary of compliance with the high-level requirements detailed in the NCC local plan.

Table 11 Summary of NCC local plan requirements

NCC Local Plan Requirement	Applicant Response
1. Areas vulnerable to coastal change will be managed in accordance with the principles and approach set out in the Shoreline Management Plan (SMP2), while giving full weight to the level of importance of the coast's ecological and heritage value.	The Project comprising the Onshore and Marine Schemes will not hinder the management of the Cambois coastline in accordance with the principles and approach as detailed within SMP2.
2. Development proposals in these areas in particular will be required to: *a. Demonstrate that the need for a coastal location overrides the risk of coastal change and provides wider benefits, such as substantial, sustainable environmental, economic and social benefits;* *b. Provide an Erosion Vulnerability Assessment which demonstrates that the development is safe over its planned lifetime and will not have an unacceptable impact on coastal change processes elsewhere. The assessment should be appropriate to the degree of risk and the location, scale and nature of the development;* *c. Demonstrate that there will not be any harm or loss to the significance of ecological and/or heritage assets and/or designations, including the Northumberland coastal footpath; and* *d. Provide an assessment of the impact of the development on existing coastal defence infrastructure, including whether new infrastructure would be required as a result of the development proposal.*	**A:** There is a clear need for the coastal location for the Onshore Scheme, owing to the need to bring Offshore Export Cables to shore and connection into the grid connection at Blyth substation. **B:** A coastal vulnerability assessment has been conducted, as presented within this document, and as-per the requirements stated by NCC during pre-application engagement. The CVA clearly demonstrates that the Onshore Scheme has no unacceptable impacts upon coastal vulnerability along coastline at Cambois. over its planned lifetime and it will not have an unacceptable impact on coastal change processes. **C:** The adoption of trenchless technologies, such as HDD, is a key commitment which will help to manage potential impacts on the Cambois coastline. A detailed assessment on each of these specific themes has been provided within the main body of the Onshore Scheme EIA; please refer to the following for further details: Volume 2, Chapter 8: Archaeology and Cultural Heritage; Volume 2, Chapter 9: Terrestrial Ecology and Ornithology; and Volume 2, Chapter 15: Socio-economics, Recreation and Tourism. No significant effects have been identified in relation to ecology, archaeology and cultural heritage or socioeconomics (including the Northumberland coastal path) in the Landfall zone. **D:** The adoption of trenchless technologies, such as HDD, will avoid direct interaction with the existing coastal defences along the Cambois coastline.

NCC Local Plan Requirement	Applicant Response
3. Proposals for new or replacement coastal defence schemes will be supported where it can be demonstrated that: *a. The works are consistent with the relevant management approach for the area, set out in the Shoreline Management Plan (SMP2); and* *b. There will be no significant adverse impacts on the coastal environment, including ecological landscape and heritage assets and designations; and* *c. Where required, a programme of mitigation can be agreed.*	This aspect of the NCC local plan is not considered relevant (the Onshore Scheme being associated with renewable energy transmission, as opposed to being a new or replacement coastal defence scheme). a. Not applicable b. Not applicable c. Not applicable
4. Within the Coastal Change Management Area (CCMA), as shown on the Policies Map, development will only be supported, where: *a. It can be demonstrated that it would not result in adverse changes to the coast taking account of any impacts on landform, land stability, the ecology or biodiversity; and* *b. It can be demonstrated that it would need to be located within the zone, as opposed to further inland, by virtue of being concerned with a coastal activity that has a direct environmental, community or economic benefit; and* *c. It will not increase coastal erosion as a result of changes in surface water run-off.* *d. In exceptional circumstances, where it is necessary to reduce a potentially unacceptable level of future risk to people and the development, structures may be required to be small scale, and/or of a temporary form of construction, and/or granted for a temporary period.* *e. If, applying the above criteria, the Coast Protection Authority identifies that there could be a risk of adverse effects, including inland of the CCMA, then an erosion vulnerability assessment will be required as part of the application*	Parts of the Onshore Scheme are located within (under) the CCMA, as depicted in Figure 2 above. **A:** As demonstrated by this CVA, the Project will not result in adverse changes to the coast taking account of impacts on landform, land stability, ecology or biodiversity. A detailed assessment of each of these specific themes has been provided within the main body of the Onshore Scheme EIA; please refer to the following for further details: Volume 2, Chapter 9: Terrestrial Ecology and Ornithology; and Volume 2, Chapter 10 Geology and Soils.. Within the context of these EIA assessment chapters, no significant adverse effects have been identified in relation to landform, land stability, ecology or biodiversity in the Landfall zone. **B:** As summarised above and detailed within section 2, there is a clear need for the coastal location for the Project, owing to the need to bring Offshore Export Cables to shore and to facilitate the grid connection at Blyth substation. **C:** As demonstrated by this CVA, the Project will not increase coastal erosion. The intended location for the converter station (and other onshore infrastructure relevant to surface water run-off) is located distant from the CCMA and plan policy area for WAT-5; it is not considered further within this CVA, but it is assessed in-full within Volume 2, Chapter 11 Hydrology and Hydrogeology as part of the Onshore Scheme EIA. **D:** The CVA carried out by the Applicant demonstrates that there is no potential unacceptable level of future risk to people and the environment therefore there is no

NCC Local Plan Requirement	Applicant Response
	requirement to pursue structures under this policy. **E:** NCC have required the completion of a CVA to demonstrate full compliance with the NCC local plan and plan policy WAT-5; this has now been carried out (i.e., this report) closing out this NCC requirement.

6. Conclusions

146. The Applicant has carried out a CVA which demonstrates full compliance with the NCC plan policy WAT-5, The coastal protection authority requested in pre-application advice that a CVA must consider and confirm the following:

- Ensure adequate beach cover of cables over the lifetime of the asset to allow for the erosion of the beach and sand dunes in the location of the proposed cables as this could pose a public safety risk if they become exposed.
- Detail of any temporary works undertaken for the installation of the cable to consider the implications on the beach and sand dunes.
- Confirmation that the proposed works do not adversely impact the “buffer zone” referenced within the SMP long-term.

147. The CVA considered both. onshore Landfall; (compound, transition jointing bays and trenchless technology entry point); and nearshore; (Trenchless technology punch out, HDD exit pits, protection and Offshore Export Cables and protection).

148. The Applicant’s commitment to utilising trenchless technology means no above ground infrastructure or cabling located within the sand dune, Cambois beach and intertidal area would be required.

149. The trenchless technology ducts will pass from an Onshore entry point, within the trenchless technology compound, under existing infrastructure, including road, utilities, railways, sand dune system, Cambois beach and the intertidal area to an HDD “punch out” exit point at least 250 m seawards of MLWS.

150. The nearshore trenchless technology punch out protection as well as Offshore Export Cables and protection is located in an area of coastline below MLWS which is adjacent to (and not within) the CCMA, the nearshore infrastructure was assessed in order to provide a complete description within the CVA. The CVA confirmed that both; onshore Landfall; (compound, transition jointing bays and trenchless technology entry point); and nearshore; (Trenchless technology punch out, HDD exit pits, protection and Offshore Export Cables and protection) are compliant with WAT-5.

151. This CVA has drawn upon the detailed assessments provided as part of the Onshore Scheme EIA (submitted to NCC as part of this planning application) and the Marine Scheme EIA (recently submitted to the MMO and MD-LOT in support of MLAs for the Marine Scheme). As part of this CVA, the Applicant has considered current conditions and also the potential for the baseline to evolve over the lifetime of the Project (the ‘future baseline’). In considering the lifetime of the Project, the Applicant has drawn on a range of data sources to understand the likely potential changes along the Northumberland coastline, and how these are of relevance to the Project; this includes UKCP18.

152. Owing to the nature of the Project and the Applicant’s commitment to adopting trenchless technologies, such as HDD, as well as the Applicant’s commitment to a minimum burial depth of - 7.05 m below the intertidal area. The potential for increased risk associated with coastal erosion is highly limited. As well as ensuring that the Project is resilient to future climate change, it is also important to understand the potential (increased) risk of adverse interactions with the receiving environment as a consequence of the Project. The limited interactions with the Cambois coastline and the commitments explained within this CVA are considered equally relevant to this. As detailed above, the key areas of focus for the CVA are the Landfall, the HDD exit pits and any areas requiring external cable protection in the nearshore area. Each of these aspects has been subject to a semi-quantitative assessment, concluding that based on the design information available (as summarised in Section 1.4), the Project is fully compliant with NCC plan policy WAT-5.

153. Nonetheless, based on the activities assessed within this CVA, recommendations are as follows:

- Full details of construction mitigation measures will be provided in a CEMP produced by the Applicant, to be agreed with NCC at the Reserved Matters Stage prior to construction commencing;
- The Applicant will finalise and confirm the Landfall design (including burial depth) with NCC through planning condition(s).; and
- The Applicant will seek to provide further assurances to NCC and their supporting stakeholders, as well as the MMO (licensing authority for any required marine licence). It is anticipated that the detailed design of the Landfall (including methodology for exit pit stabilisation) within the envelope assessed here and ultimately consented would require confirmation and agreement with NCC through planning condition(s) and the MMO through marine licence condition(s). Below MHWS, it is anticipated that the Applicant will provide a Cable Specification and Installation Plan (CSIP) as part of future Marine Licence condition requirements.

154. As explained within this report, the Applicant recognises that further information regarding the detailed design of the Landfall and any areas of nearshore cable protection will not be available until detailed design stage (being reliant on further survey and ground investigation effort, technical studies, a further detailed CBRA / burial assessment study and appointment of a contractor(s)). The detailed engineering design will be within the Maximum Design Scenario, and as such will be within the parameters assessed in CVA, and not expected to lead to more adverse impacts. The Applicant will provide detailed engineering design information to NCC to provide the necessary assurances that the Project comprising the Onshore and Marine Schemes is robust from a coastal resilience perspective.

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8. APPENDIX

Table 12 Summary of relevant policy considerations

Relevant Policy	Summary of Relevant Policy Framework	How and Where Considered in the ES CVA
NCC Local Plan 2016 - 2036 Policy WAT 5 (adopted 2022)	**Coastal erosion and coastal change management** Areas vulnerable to coastal change will be managed in accordance with the principles and approach set out in the Shoreline Management Plan (SMP2), while giving full weight to the level of importance of the coast's ecological and heritage value. Development proposals in these areas in particular will be required to: a. Demonstrate that the need for a coastal location overrides the risk of coastal change and provides wider benefits, such as substantial, sustainable environmental, economic and social benefits; b. Provide an Erosion Vulnerability Assessment which demonstrates that the development is safe over its planned lifetime and will not have an unacceptable impact on coastal change processes elsewhere. The assessment should be appropriate to the degree of risk and the location, scale and nature of the development; c. Demonstrate that there will not be any harm or loss to the significance of ecological and/or heritage assets and/or designations, including the Northumberland coastal footpath; and d. Provide an assessment of the impact of the development on existing coastal defence infrastructure, including whether new infrastructure would be required as a result of the development proposal. Proposals for new or replacement coastal defence schemes will be supported where it can be demonstrated that: a. The works are consistent with the relevant management approach for the area, set out in the Shoreline Management Plan (SMP2); and b. There will be no significant adverse impacts on the coastal environment, including ecological landscape and heritage assets and designations; and c. Where required, a programme of mitigation can be agreed. Within the Coastal Change Management Area (CCMA), as shown on the Policies Map, development will only be supported, where:	The Project does cross the CCMA, as identified within Figure 1. On this basis, and as-per pre-application discussions with NCC and the LLFA, a CVA is required. A CVA has been completed (this document) which demonstrates full policy conformance with the WAT-5 plan policy. The Project has been assessed against the context of the current SMP for the Cambois coastline and the works are fully consistent with those aims and management objectives. Owing to the nature of the Outline Planning Application and in the absence of detailed design engineering / Front-End Engineering Design (FEED) for the Project (as is normal at this point in the lifecycle of such a development), the Applicant has proposed measures to provide NCC with additional detail on the design of the Project.

Relevant Policy	Summary of Relevant Policy Framework	How and Where Considered in the ES CVA
	a. It can be demonstrated that it would not result in adverse changes to the coast taking account of any impacts on landform, land stability, the ecology or biodiversity; and b. It can be demonstrated that it would need to be located within the zone, as opposed to further inland, by virtue of being concerned with a coastal activity that has a direct environmental, community or economic benefit; and c. It will not increase coastal erosion as a result of changes in surface water run-off. d. In exceptional circumstances, where it is necessary to reduce a potentially unacceptable level of future risk to people and the development, structures may be required to be small scale, and/or of a temporary form of construction, and/or granted for a temporary period. e. If, applying the above criteria, the Coast Protection Authority identifies that there could be a risk of adverse effects, including inland of the CCMA, then an erosion vulnerability assessment will be required as part of the application.	
National Planning Policy Framework (2012)	**Meeting the challenge of climate change, flooding and coastal change** The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure. Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure. New development should be planned for in ways that: (a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and (b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local	The Applicant has fully considered the potential impacts from climate change on the Project, as reported within the Marine Scheme EIA and Onshore Scheme EIA (this is integrated into both EIAs where future baselines are considered, per the requirements of the EIA Regulations). The Cambois Connection is proposed to help enable the full generating capacity of the BBWF by 2029, and to help aid the UK's decarbonisation targets and the push toward Net Zero by 2050 (and 2045 in Scotland). The CVA (this document) considers the potential impacts from climate change and in particular, coastal change. The UK Marine Policy Statement has been used to inform the development of the Project, as described above and reported in-full within the Marine Scheme EIA. A CCMA has been identified along the Northumberland coastline and the plan policy WAT-5. A CVA has been completed (this document) which demonstrates full policy

Relevant Policy	Summary of Relevant Policy Framework	How and Where Considered in the ES CVA
	requirements for the sustainability of buildings should reflect the government's policy for national technical standards. **Coastal change** In coastal areas, planning policies and decisions should take account of the UK Marine Policy Statement and marine plans. Integrated Coastal Zone Management should be pursued across local authority and land/sea boundaries, to ensure effective alignment of the terrestrial and marine planning regimes. Plans should reduce risk from coastal change by avoiding inappropriate development in vulnerable areas and not exacerbating the impacts of physical changes to the coast. They should identify as a Coastal Change Management Area any area likely to be affected by physical changes to the coast, and: (a) be clear as to what development will be appropriate in such areas and in what circumstances; and (b) make provision for development and infrastructure that needs to be relocated away from Coastal Change Management Areas. Development in a Coastal Change Management Area will be appropriate only where it is demonstrated that: (a) it will be safe over its planned lifetime and not have an unacceptable impact on coastal change; (b) the character of the coast including designations is not compromised; (c) the development provides wider sustainability benefits; and (d) the development does not hinder the creation and maintenance of a continuous signed and managed route around the coast. Local planning authorities should limit the planned lifetime of development in a Coastal Change Management Area through temporary permission and restoration conditions, where this is necessary to reduce a potentially unacceptable level of future risk to people and the development.	conformance with the WAT-5 plan policy.
Planning and Compulsory Purchase Act (2004)	Section 19(1A) of the Planning and Compulsory Purchase Act 2004 requires local planning authorities to include in their Local Plans "policies designed to secure that the development and use of land in the local planning authority's area contribute to the mitigation of, and adaptation to, climate change".	The NCC local plan includes such a provision, and this has been considered as part of the CVA, as reported above.
Climate Change Act (2008)	The Climate Change Act 2008 establishes a legally binding target to reduce the UK's greenhouse gas emissions by at least 80% in 2050 from 1990 levels. To drive progress and	The potential impacts from climate change on the Project are considered in both the Marine

Relevant Policy	Summary of Relevant Policy Framework	How and Where Considered in the ES CVA
	set the UK on a pathway towards this target, the Act introduced a system of carbon budgets including a target that the annual equivalent of the carbon budget for the period including 2020 is at least 34% lower than 1990. The Climate Change Act 2008 also requires the government […] to assess regularly the risks to the UK of the current and predicted impact of climate change [,…] to set out its climate change adaptation objectives […] and to set out its proposals and policies for meeting these objectives.	Scheme EIA and Onshore Scheme EIA. The CVA (this document) considers the potential impacts from climate change and in particular, coastal change.
Marine Strategy Framework Directive (MSFD)	MSFD high-level descriptors of Good Environmental Status relevant to marine processes. Descriptor 6: Sea floor integrity: Seafloor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems are not adversely affected.	The Marine Scheme EIA provides an assessment of anticipated changes to the seabed as a pathway.
	"Descriptor 7: Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems.	The potential permanent alteration of hydrographical conditions during the operational and maintenance phase of the Project is assessed within the Marine Scheme EIA.
UK Marine Policy Statement	Coastal change and coastal flooding are likely to be exacerbated by climate change, with implications for activities and development on the coast. These risks are a major consideration in ensuring that proposed new developments are resilient to climate change over their lifetime Account should be taken of the impacts of climate change throughout the operational life of a development including any de-commissioning period.	The Marine Scheme EIA considers climate change influences relevant to a future baseline. The assessment within the Marine Scheme EIA has been undertaken in respect of the current and future baselines, per the requirements of the EIA regulations. This CVA provides a nearshore-specific assessment of future changes in the Northumberland coastline in relation to future potential coastal vulnerability.
North East Inshore and North East Offshore Marine Plan	North East Inshore and North East Offshore Marine Plan – NE-MPA-1; NE-MPA-2; NE-MPA-3; NE-MPA-4: With respect to NE-MPA-1: "Proposals that may have adverse impacts on the objectives of marine protected areas must demonstrate that they will, in order of preference: avoid, minimise or mitigate – adverse impacts with due regard given to statutory advice on an ecologically coherent network. With respect to NE-MPA-2: Proposals that may have adverse impacts on an individual marine protected area's ability to adapt to the effects of climate change, and so reduce the resilience of the marine protected area network, must demonstrate that they will, in order of preference: avoid, minimise or mitigate – adverse impacts	The potential impacts of the Marine Scheme activities on designated sites designated for geological, geomorphological and sedimentological features is assessed in the Marine Scheme EIA. A MCZ/MPA Assessment has been completed and has been provided alongside MLAs to MD-LOT and MMO.

Relevant Policy	Summary of Relevant Policy Framework	How and Where Considered in the ES CVA
	With respect to NE-MPA-3: Where statutory advice states that a marine protected area site condition is deteriorating or that features are moving or changing due to climate change, a suitable boundary change to ensure continued protection of the site and coherence of the overall network should be considered. With respect to NE-MPA-4: Proposals that may have significant adverse impacts on designated geodiversity must demonstrate that they will, in order to preference: avoid, minimise or mitigate – adverse impacts so they are no longer significant.	
	North East Inshore and North East Offshore Marine Plan – NE-CC-1; NE-CC-2; NE-CC-3: With respect to NE-CC-1: Proposals that may have significant adverse impacts on habitats that provide a flood defence or carbon sequestration ecosystem service must demonstrate that they will, in order of preference: avoid, minimise, mitigate - adverse impacts so they are no longer significant or compensate for significant adverse impacts that cannot be mitigated, compensate for significant adverse impacts that cannot be mitigated. With respect to NE-CC-2: Proposals in the north east marine plan areas should demonstrate for the lifetime of the project that they are resilient to the impacts of climate change and coastal change. With respect to NE-CC-3: Proposals in the north east marine plan areas, and adjacent marine plan areas, that are likely to have significant adverse impacts on coastal change, or on climate change adaptation measures inside and outside of the proposed project areas, should only be supported if they can demonstrate that they will, in order of preference: avoid, minimise or mitigate adverse impacts so they are no longer significant.	The Marine Scheme being a subsea cable, there are no likely significant effects from climate change on the Marine Scheme during the construction, operation and maintenance and decommissioning phases of the Marine Scheme and hence assessment of climate resilience of the Marine Scheme was scoped out for the Marine Scheme EIA (the Scoping out of Climate Change impacts was confirmed by the MMO during a meeting held on 18 April 2023). Based on the Marine Scheme EIA, no significant effects have been identified based on habitats, including those which could provide flood defence or carbon sequestration ecosystem service. In wider relation to climate change, the Applicant has also carried out a Greenhouse Gas assessment – this is reported in Volume 3, Appendix 5.1. Characterisation of the coastal morphology and the potential effect of the Marine Scheme's construction / decommissioning and operation activities are set out on within the Marine Scheme EIA. This CVA provides a nearshore-specific assessment of future changes in the Northumberland coastline in relation to future potential coastal vulnerability.
	Coastal Change *"Where relevant, applicants should undertake coastal geomorphological and sediment transfer modelling to predict and understand impacts and help identify relevant mitigating or compensatory measures"* (Paragraph 5.5.6 of NPS EN-1).	The Marine Scheme being a subsea cable, there are no likely significant effects from climate change on the Marine Scheme during the construction, operation and maintenance and decommissioning phases of the

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NPS EN-1 and EN-3 provisions[15][16]		Marine Scheme and hence assessment of climate resilience of the Marine Scheme was scoped out for the Marine Scheme EIA (the Scoping out of Climate Change impacts was confirmed by the MMO during a meeting held on 18 April 2023). This CVA provides a nearshore-specific assessment of future changes in the Northumberland coastline in relation to future potential coastal vulnerability.
	"...the direct effects on the physical environment can have indirect effects on a number of other receptors. Where indirect effects are predicted, the [Secretary of State] should refer to relevant sections of this NPS and EN 1" (Paragraph 2.6.195 of NPS EN-3).	The predicted changes to the offshore physical environment and seabed conditions have been considered in relation to indirect effects on other receptors elsewhere in the Marine Scheme EIA.
	"the methods of construction, including use of materials should be such as to reasonably minimise the potential for impact on the physical environment […]" (Paragraph 2.6.196 of NPS EN-3).	The Marine Scheme has proposed design and installation methods that seek to reasonably minimise significant adverse effects. This CVA provides a nearshore-specific assessment of future changes in the Northumberland coastline in relation to future potential coastal vulnerability.

8.1. Guidance

155. There is no formal guidance document associated with CCMAs, and the CVA process. However, a range of relevant guidance documents have been used to help inform the CVA; this includes:

- Independent Assessment of UK Climate Risk (CCRA3) (Climate Change Committee, 2021);
- A Coastal Concordat for England (Defra, 2019);
- Planning Practice Guidance: Climate Change (Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government, 2019);
- Guidance Note. Marine Physical Processes Guidance to inform Environmental Impact Assessment (EIA). GN041 (NRW, 2020);
- Nature conservation considerations and environmental best practice for subsea cables for English Inshore and UK offshore waters (Natural England and JNCC (2022);
- Coastal Change Management Areas: Opportunities for sustainable solutions in areas subject to coastal change (Royal Haskoning DHV, 2019);

[15] Whilst it is acknowledged that neither BBWF nor the Marine Scheme / Onshore Scheme comprise or form part of an NSIP, NPSs are however a statement of government intention relating, in this case, to renewable energy projects, therefore can be taken into consideration during the preparation of the CVA.

[16] A suite of draft revised Energy NPSs were published and consulted on by the UK Government in March 2023, and consultation closed on 23rd June. The consultation responses will be subject to consideration and the draft revised NPSs may now be revised before the NPSs are formally adopted. There is currently no date for the next stage of the review process.

- The Northumberland Shoreline Management Plan 2 (Royal Haskoning DHV, 2009);
- Cell 1 Regional Coastal Monitoring Programme Walkover Inspection Surveys;
- Cell 1 Regional Coastal Monitoring Programme Update Report 12: ‘Partial Measures’ Survey;
- Cell 1 Regional Coastal Monitoring Programme Analytical Report 12: ‘Full Measures’ Survey;
- Topographic Beach Profiles, North East Coastal Observatory (NECO); and
- A range of relevant UK HDD feasibility studies available in the public domain (Various).