Cambois Connection – Onshore Scheme

Environmental Statement Volume 3

Technical Appendix 11.1: Flood Risk Assessment (Cable Route)

sse Renewables

Cambois Connection Onshore Scheme

Technical Appendix 11.1: Flood Risk Assessment (Landfall and Cable Routes)

SSE Renewables Developments Ltd.

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Basis of Report

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Acronyms and Abbreviations

AEP	Annual Exceedance Probability, the probability of a flood occurring in any year expressed as a percentage, or chance, i.e., 1% (1 in 100). This is commonly referred to as a 'Return Period' expressed in years, i.e., a 1% AEP event would be referred to as a 1 in 100-year event.
BBWF	Berwick Bank Wind Farm
BBWFL	Berwick Bank Wind Farm Limited
DEFRA	Department for Environment, Food & Rural Affairs
EA	Environment Agency
ECC	Export Cable Corridor
ES	Environmental Statement
FRA	Flood Risk Assessment
GW	Gigawatts
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
LPA	Local Planning Authority
LPA	Local Planning Authority
m aOD	metres above Ordnance Datum. A ground or flood level expressed as a height above the Ordnance Datum located in Newlyn, Cornwall.
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
NCC	Northumberland County Council
Nm	Nautical Miles
NPPF	National Planning Policy Framework
PPG	Planning Practice Guidance
SSER	SSE Renewables (UK) Ltd

1.0 Introduction

SLR Consulting was commissioned by Berwick Bak Wind Farm Limited to prepare a Flood Risk Assessment (FRA) in relation to a proposed development at Cambois, Blyth, Northumberland (NZ 29239 84212) (hereafter referred to as 'the Site', Figure. 11.1.1, Appendix B) to support the Environmental Impact Assessment (EIA) and preparation of the Environmental Statement (ES) for the proposed application to Northumberland County Council (NCC).

Berwick Bank Wind Farm Limited (BBWFL) is a wholly owned subsidiary of SSE Renewables (SSER) (hereafter referred to as 'the Applicant'). The Applicant is proposing the development of Offshore Export Cables, Onshore Export Cables, an Onshore Converter Station and associated grid connection at Blyth in Northumberland, known as the 'Cambois Connection' ('the 'Project'). The onshore components of the Project, landward of Mean Low Water Springs (MLWS) comprise the Onshore Scheme.

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

The Project comprises two distinct proposals, or 'Schemes', which will require three separate consents. For the Onshore Scheme (all activities and infrastructure landward MLWS) consent will be sought via a planning application to NCC as the local planning authority (LPA) under Section 57 of the Town and Country Planning Act 1990.

The offshore components of the Project seaward of Mean High Water Springs (MHWS) ('the Marine Scheme') are 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 Scottish Exclusive Economic Zone). In England, the Marine Scheme is within offshore waters and inshore waters.

The Onshore Scheme comprises an application for the construction of onshore cable routes and a converter station connecting to the BBWF, located in the North Sea. A preliminary Site boundary (the Site) has been established which would allow for survey and design evolution of the ongoing scheme.

1.1 Context and Site Location

The Site is located between the Port of Blyth and Cambois, to the north of the River Blyth, to the east /north-east of Sleek Burn and west of the North Sea. The Site is located to the east of the A189 with access provided off Brock Lane in the south and Unity Terrace/Foster Terrace in the east. The Site is centred around National Grid Reference: NZ 29199, 83720 and lies wholly within the administrative area of NCC.

This FRA report corresponds to the following aspects of the Onshore Scheme:

- A new landfall located along the Cambois coastline;
- High Voltage Direct Current (HVDC) onshore export cables connecting the offshore export cables at the new landfall and the new proposed converter station; and
- High Voltage Alternating Current (HVAC) onshore cables connecting the new proposed converter station and the existing National Grid substation to the south.

A new electrical converter station is also proposed as part of the overall scheme. The assessment of flood risk in relation to this element is provided as part of a separate FRA report prepared by Stantec

1 BBWF is subject to a separate consenting process. Applications for consent under Section 36 of the Electricity Act 1989 (as amended) and relevant marine licences for the offshore generation and transmission infrastructure was submitted to MS-LOT and accepted in December 2022. The Branxton onshore infrastructure is subject to a separate planning application submitted to East Lothian Council and was validated in March 2023.

(see Technical Appendix 11.2, ES Volume 3). The proposed electrical converter station is not assessed as part of this report.

1.2 Background and Aims

The aim of the FRA is to support the development of the Onshore Scheme in relation to flood risk and outline the potential for the onshore export cable corridor (ECC) to be impacted by flooding, the impacts of the works associated with establishing the onshore ECC on flooding, and the proposed measures which could be incorporated to mitigate any identified risk. The report has been produced in accordance with the National Planning Policy Framework[2] (NPPF) and its associated Planning Practice Guidance[3] (PPG), taking due account of current best practice documents relating to assessment of flood risk published by the British Standards Institution BS8533[4] and NPS EN-1[5]..

1.3 Data Sources Considered

In assessing the flood risk to the Site, the following sources have been reviewed:

- Berwick Offshore Wind Connection Flood Risk Scoping Report[6];
- Mapping published on the Environment Agency (EA)'s website:
  - Risk of Flooding from Rivers and Sea;
  - Flood Map for Planning[7];
  - Long Term Flood Risk Information[8];
    - Risk of Flooding from Reservoirs;
    - Risk of Flooding from Surface Water;
- British Geological Survey (BGS)[9] mapping for details of superficial and bedrock geology http://mapapps.bgs.ac.uk/geologyofbritain/home.html;
- Cranfield Soil and Agrifood Institute Soilscapes map viewer[10] for soil information;
- EA LiDAR data from the Department for Environment Food & Rural Affairs, https://environment.data.gov.uk/DefraDataDownload/?Mode=survey;
- Northumberland County Council Level 1 & 2 Strategic Flood Risk Assessment[11,12];
- Department of Food and Rural Affairs (DEFRA)'s 'MAGIC'[13] website.

2 National Planning Policy Framework: Communities and Local Government. (September 2023).
3 Planning Practice Guidance: Flood Risk and Coastal Change, Ministry of Housing, Communities and Local Government (Published March 2014, Updated August 2022).
4 BS8533:2017, Assessing and managing flood risk in development: Code of Practice (December 2017)
5 Department for Energy Security & Net Zero, Overarching National Policy Statement for Energy (EN-1), March 2023
6 Berwick Offshore Wind Connection, Flood Risk Scoping Report, Stantec, January 2023
7 Environment Agency Flood Risk for Planning, https://flood-warning-information.service.gov.uk/long-term-flood-risk/ [Accessed October 2023].
8 Environment Agency Long Term Flood Risk, https://www.gov.uk/check-long-term-flood-risk [Accessed October 2023].
9 British Geological Survey, Geoindex Onshore, https://mapapps2.bgs.ac.uk/geoindex/home.html [Accessed October 2023].
10 Soilscapes, Cranfield Soil and Agrifood Institute, Cranfield University, DEFRA, http://www.landis.org.uk/soilscapes/ [Accessed October 2023].
11 Northumberland County Council, Level 1 Strategic Flood Risk Assessment, Scott Wilson, September 2010
12 Northumberland County Council, Level 2 Strategic Flood Risk Assessment, URS, October 2015
13 Magic Map Application, DEFRA, https://magic.defra.gov.uk/MagicMap.aspx [Accessed October 2023].

1.4 Climate Change

The NPPF requires that flood risk is considered over the lifetime of the development and therefore consideration needs to be given to the potential impacts of climate change.

In February 2016, the EA issued updated guidance on the impacts of climate change on flood risk in the UK to support NPPF. This was most recently updated in May 2022 and advice sets out that peak rainfall intensity, sea level, peak river flow, offshore wind speed and extreme wave heights are all expected to increase in the future as a result of climate change. Consideration of the changes to these parameters should use the allowances outlined below based on the anticipated lifetime of the development.

Data has been received from the EA with respect to modelled peak water levels for coastal areas around Cambois. The EA have provided peak tidal levels at the coast around Blyth which have been extracted from the National Coastal Model dataset. This therefore does not provide projected peak water levels within the River Blyth. The EA has confirmed that they do not hold any detailed hydraulic modelling for the area.

The climate change allowance guidance acknowledges that there is considerable uncertainty with respect to the absolute level of change that is likely to occur. As such, the document provides estimates of possible changes that reflect a range of different emission scenarios, over different epochs.

Changes in relation to sea level change, offshore wind speed and wave height, peak river flow and peak rainfall intensity as a result of climate change are appropriate for this assessment and are discussed below.

1.4.1 Anticipated Lifetime of Development

The NPPF practice guidance classifies land uses into five categories. Utilities infrastructure, such as these works, is classified as “Essential Infrastructure”. The onshore cable has an anticipated development lifetime of 40 years, and therefore falls within different epochs when considering climate change allowances for different climatic changes.

Design of the ECC will need to consider the credible maximum scenario with regards to climate change which includes the upper end allowance for fluvial flows and sea level change, plus an additional 2 mm per year for each year on top of sea level rise allowances from 2017 for storm surges.

This flood risk assessment will consider the 1 in 1000 (1%) Annual Exceedance Probability Event (AEP) for fluvial and tidal flood risk..

1.4.2 Sea Level Change

To take into account the effects of climate change over the lifetime of the Onshore Scheme (40-years; i.e., to 2063), the most recent advice on climate change provided by the EA should be applied. An extract of this advice, *Table 1: Sea Level Allowance for each epoch in mm per year (based on a 1981 to 2000 baseline) by River Basin District*[14], is reproduced as Table 1-1 for the Northumbria area of England. Flood risk assessments should assess both the higher central and upper end allowances.

14 UK Government Guidance: Flood Risk Assessments: climate change allowances - https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#table-1 [Accessed October 2023].

Table 1-1: Sea Level Allowance for each epoch in millimetres (mm) per year, with total sea level rise for each epoch in brackets (use 1981 to 2000 baseline) by River Basin District

Area of England	Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (metres)
Northumbria	Higher Central	4.6 (161)	7.5 (225)	10.1 (303)	11.2 (336)	1.03
	Upper end	5.8 (203)	10 (300)	14.3 (429)	16.5 (495)	1.43

The anticipated sea level rise throughout the 40-year anticipated lifetime of development, up until 2063, is 0.26m using the higher central allowance and up to 0.34m using the upper end allowance.

1.4.3 Offshore Wind Speed and Extreme Wave Height

It is envisaged that wave heights progressing towards areas of open coast may change due to increased water depths (i.e., sea level rise) as well as changes to the frequency, duration and severity of storms. EA provide allowances for offshore wind speed and extreme wave height based on a 1990 baseline which are applicable all around the English Coast. Table 2*: Offshore Wind Speed and Extreme Wave Height Allowance (based on a 1990 baseline)*[15] is reproduced below in Table 1-2. The EA requires that flood risk assessments adopt the appropriate allowance for wind speed and wave height if these allowances are not included in the relevant coastal model.

Table 1-2: Offshore Wind Speed and Extreme Wave Height Allowance (based on a 1990 baseline)

Applies all around the English coast	2000 to 2055	2056 to 2125
Offshore wind speed allowance	5%	10%
Offshore wind speed sensitivity test	10%	10%
Extreme wave height allowance	5%	10%
Extreme wave height sensitivity test	10%	10%

The flood risk assessment should therefore assess the impacts of a 10% uplift in offshore wind speed and extreme wave height if these allowances are not included in the relevant coastal model. The model provided by the EA is the National Coastal Dataset which does not consider windspeed.

1.4.4 Peak River Flow

Guidance states that for "Essential Infrastructure" (wind turbines, essential utilities infrastructure in a flood risk area for operational reasons, including storage and distribution and noted in Annex 3 of the NPPF) development located in Flood Zone 2, 3a or 3b (see Section 4.1), the higher central allowance should be considered. For the Northumberland Rivers Management Catchment in which the Site is located and as shown in Table 1-3, this equates to a 30% increase in peak flow by the 2050s, which corresponds to the proposed 40-year (to 2063) design life.

15 UK Government Guidance: Flood risk assessments: climate change allowances - https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#offshore-wind-speed-and-extreme-wave-height-allowance [Accessed October 2023].

Table 1-3: Peak River Flow Allowances by River Basin

River Basin District	Allowance Category	2020s	2050s	2080s
Northumberland Rivers Management Catchment	Central	21%	23%	25%
	Higher Central	25%	30%	44%
	Upper End	36%	45%	66%

1.4.5 Peak Rainfall Intensity

For peak rainfall intensity the PPG guidance states that flood risk assessments for "Essential Infrastructure" developments with a lifetime between 2061 and 2100, the central allowance for the 2050s epoch for both the 3.3% AEP storm event and 1% AEP storm event should be used. As detailed in Table 1-4.

Table 1-4: Peak Rainfall Intensity Allowances

Management Catchment	Annual Exceedance Probability (%)	Allowance Category	Total potential change anticipated for the 2050s	Total potential change anticipated for the 2070s
Northumberland Rivers Management Catchment	3.3	Upper End	35%	40%
		Central	20%	30%
	1	Upper End	40%	45%
		Central	25%	30%

2.0 Baseline Context

2.1 Local Hydrology

The Site is adjacent to the North Sea in Northumberland, inland from the coast in North East England. The River Blyth and Sleek Burn are EA Main Rivers[16]. The reaches of these at the Site are tidal watercourses, located immediately south and west of the Site, conveying flows east into the North Sea. There are also a number of ordinary watercourse features present within or in close proximity to the Site which outfall into these tidal waterbodies.

All local watercourses are identified below in Figure 11.1.2 and described in further detail in the following sections. It should be noted that some sections of open channel/swale represented in the mapping (which are unlabelled to the north of the Site) form part of the historic drainage for the previous industrial works on the former Britishvolt Battery Manufacturing Plant Site and are not considered part of the named watercourses.

2.1.1 North Sea

The Site is located adjacent to the open coastline associated with the North Sea. The North Sea at Blyth has a semi-diurnal tidal cycle meaning there are 2 high tides and 2 low tides per day. Everyday tidal levels in the North Sea at Blyth vary from around -2.22m above Ordnance Datum (aOD) to 2.62m aOD[17].

2.1.2 River Blyth

The Site is located immediately north of the River Blyth at its estuary, flowing in an easterly direction past the Site into the north sea. The River Blyth is an Environment Agency Main River,[16] which past the Site is tidal in nature with water levels changing with the prevailing tide in the North Sea. Due to funnelling effects upriver, everyday water levels in the River Blyth are likely higher than those predicted in the open sea. Blyth port area is located at the southern boundary of the Site. The River Blyth estuary feeds into the Port of Blyth, before discharging into the North Sea.

2.1.3 River Wansbeck

The River Wansbeck is an EA Main River[16] located 900m north of the Site and flows in a south easterly direction into the North Sea. The channel past the Site is tidal in nature and water levels vary with the incoming tide. Due to its proximity to the River Blyth it is likely the water levels in the River Wansbeck are similar to the River Blyth.

2.1.4 Sleek Burn

Sleek Burn is an EA Main River[16] and is a tributary of the River Blyth, which it joins at a confluence in the Blyth estuary to the south of the Site. The Sleek Burn is located adjacent to the Site along the south-western boundary, flowing in a south-easterly direction towards the River Blyth. Sleek Burn is also tidal along the reach that goes past the Site with water levels changing in accordance with the incoming tide from the North Sea.

2.1.5 Cow Gut

Cow Gut is an ordinary watercourse which rises at Brock Lane to the north-west of the Site. It is shown on Ordnance Survey mapping to be culverted beneath the A189, on the western boundary of the Site. The Cow Gut then forms part of the northern boundary of the Site, through an area of woodland before passing into a culvert beneath land on the former Britishvolt site. The Cow Gut has been rerouted (Photograph 2-1) following initial development of the former Britishvolt site. This includes sections of new culverts and open channel through the Site. The route of the Cow Gut mapped from

16 Main River Map, Environment Agency
17 Tide Times, Blyth Tide Times, https://www.tidetimes.org.uk/blyth-tide-times

the Site walkover is presented in Figure 11.1.2. The Cow Gut routes south out of the Site to outfall into the River Blyth estuary.

Cow Gut flows over predominantly Mudstone and Sandstone geology which is overlain by Glacial Till/Diamicton. This is a very small watercourse which is unlikely to interact with the more permeable bedrock. It would therefore be expected that there would be little to no baseflow (Photograph 2-2) in the watercourse, which is likely sourced from overland flows locally.

Photograph 2-1: Re-Routed Channel of Cow Gut

Photograph 2-2: Dry Channel of Cow Gut downstream of A189

2.1.6 Maw Burn

Maw Burn is an ordinary watercourse which drains an upgradient area to the north of the Site of approximately 1.01km^2 over mudstone and sandstone bedrock overlain by Glacial Till/Diamicton. Similar to the Cow Gut watercourse, due to the presence of diamicton deposits locally, it would be expected that there would be little to no baseflow in the watercourse which is likely sourced from overland flows locally. Baseflows would only be expressed in the downstream reaches which would be drowned out by high tide.

Maw Burn outfalls into the North Sea (Photograph 2-3) to the east of the Site via a culvert (Photograph 2-4) beneath Unity Terrace and the railway line.

Photograph 2-3: Maw Burn Outfall into North Sea

Photograph 2-4: Culvert Outfall of Maw Burn towards North Sea

Photograph 2-5: Open Section of Maw Burn

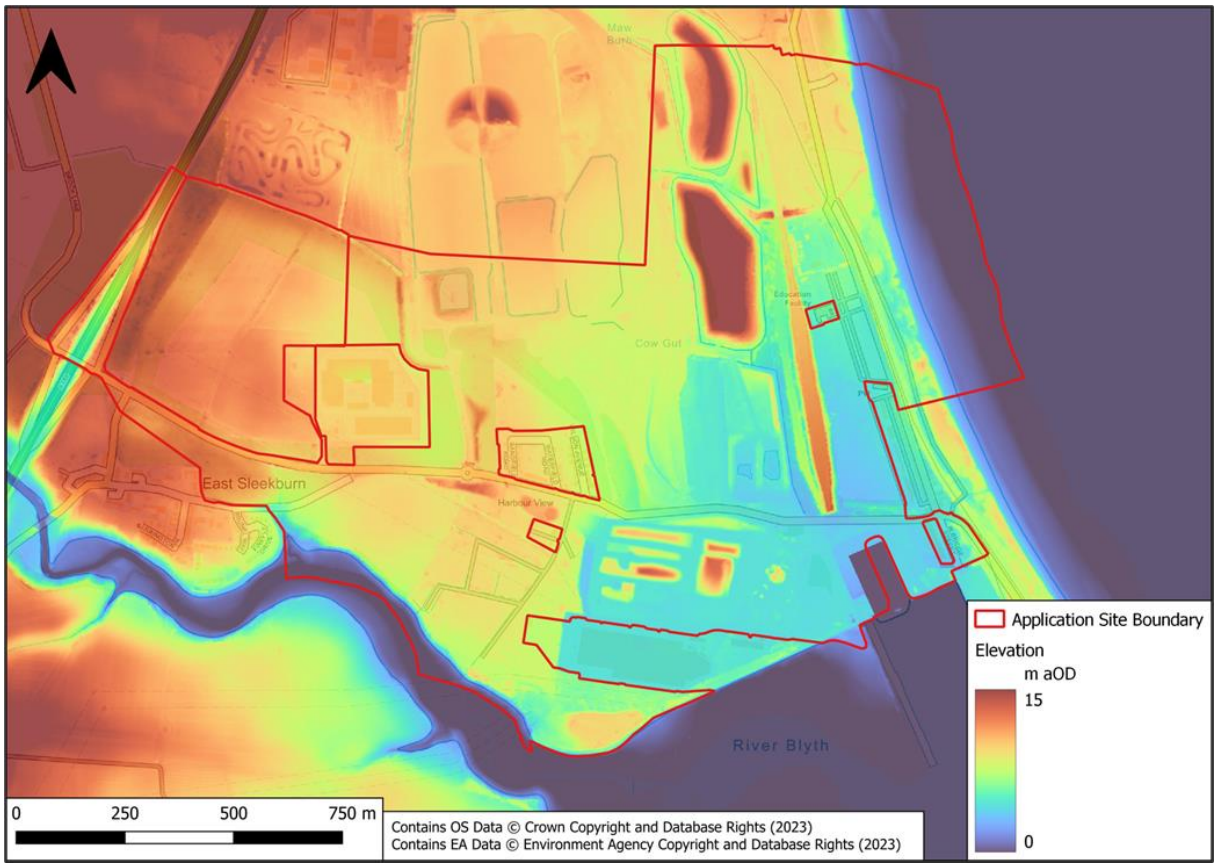
2.1.7 Other Ordinary Watercourses

There are a number of ordinary watercourses/small drainage ditches in the south of the Site, south of Harbour View and Brock Lane. It is assumed these watercourses collect overland flows from surrounding land locally and were observed to discharge into Sleek Burn.

2.2 Site Topography

Ground level data across the Site has been obtained from the EA Open Data[18] website for 1m resolution aerial photogrammetry (LiDAR) data using a Digital Terrain Model (DTM) which is a bare earth model and therefore excludes built features and vegetation. This data is presented below in Figure 2-1.

Figure 2-1: 1m DTM LiDAR Plot of the Site



Ground levels across the Site fall to the south and east towards the Sleek Burn, River Blyth estuary and the North Sea. The highest ground levels on Site are found up to 22.5m above Ordnance Datum (aOD) in an area of raised ground around Maw Burn, to the west of the Primary School. In line with the prevailing topography across the Site (i.e., on land), ground levels fall from 14.8m aOD in the north-west of the Site, adjacent to the A189 and fall to -1m aOD in the channel of Sleek Burn to the south-west. Ground levels also fall to 2.2m aOD around the Port of Blyth in the south-eastern extent of the Site.

2.3 Geological and Hydrogeological Features

2.3.1 Geology

The National Soil Resources Institute[19] dataset suggests that the soils at the Site consist of 'Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils'. Where development has already occurred (i.e., the former Britishvolt site), it is likely these shallow soils have been reworked and instead comprise of made ground.

18 Environment Agency open data webSite http://environment.data.gov.uk [Accessed October 2023].
19 Soilscapes map, http://www.landis.org.uk/soilscapes/ [Accessed October 2023].

BGS mapping[20] indicates that the Site is underlain by the Pennine Middle Coal Measures Formation (Sandstone). A change of bedrock strata is noted in the south-west and north western extents of the Site to another unit of the Pennine Middle Coal Formation. This is a marked lithological change to a combination of mudstone, siltstone and sandstone.

Superficial deposits of Tidal River or Creek Deposits (clay, silt, sand and gravel) are noted to the south-western extent of the Site (along Sleek Burn and River Blyth). Blown Sand is noted in the east along the higher ground set back from the intertidal zone (shoreline). Marine Beach deposits (Sand and Gravel) are noted along the intertidal zone in the east. The remaining areas of the Site are underlain by Diamicton deposits.

2.3.2 Hydrogeology

The bedrock geology across the Site, as well as the Tidal River or Creek, Blown Sand, and Marine Beach Deposits, are designated by the Environment Agency[21] as Secondary A aquifers, defined as permeable layers that can support local water supplies and may form an important source of baseflow to rivers.

The Diamicton deposits are designated by the Environment Agency as a Secondary (undifferentiated) aquifer, which are defined as units where it is not possible to attribute A or B status and water storage/permeability is a function of the lithological characteristics locally.

The Site is not located within a Source Protection Zone associated with groundwater abstractions.

Groundwater data provided in BGS) Records indicates that groundwater levels across the Site are highly variable (in alignment with the inconsistent geological units) and range from around -2.2m aOD to -11.1m aOD. Groundwater levels are likely to vary on a semi diurnal cycle in line with the tide locally, particularly closer to the coast and the River Blyth estuary. It is expected that groundwater would flow through the bedrock in an easterly direction towards the sea with some flows expressed via the River Blyth as baseflow to the river.

Given that the majority of the Site is overlain by diamicton, recorded in borehole records as boulder clay, shallow standing groundwater in the diamicton deposits is unlikely. Elevated groundwater may occur in the Tidal River or Creek Deposits, Blown Sand and Marine Beach deposits coinciding with high tide.

2.4 Existing Site Drainage

The majority of the Site comprises of greenfield land and therefore incidental rainfall shed from the Site will discharge in line with the prevailing topography. Given the existing watercourse network on Site, it is likely that the majority of flows are intercepted by Cow Gut or Maw Burn, or the network of drainage channels across land in the south of the Site. Infiltration to ground is possible in the Tidal River or Creek Deposits, Blown Sand, and Marine Beach Deposits but will be limited in the Diamicton.

Construction work has commenced on the former Britishvolt site, and flows derived from the south of this site are routed into the realigned Cow Gut. The north of the former Britishvolt site appears to drain into Maw Burn. All flows derived from the Site eventually discharge into the North Sea either directly, via Maw Burn, or via the River Blyth which receives inflow from Cow Gut.

20 British Geological Survey, Geoindex, http://mapapps.bgs.ac.uk/geologyofbritain/home.html? [Accessed October 2023].
21 Magic Map Application, managed by Natural England, delivered by Landmark: https://magic.defra.gov.uk/MagicMap.aspx [Accessed October 2023].

3.0 Planning Policy and Guidance

3.1 Development Proposals

This report is specific to ECC of the Onshore Scheme which forms part of a larger development for an offshore windfarm and associated onshore development (the Project).

With reference to NPPF, essential utility infrastructure, including infrastructure for electricity supply including generation, storage and distribution systems, are classified as an *'Essential Infrastructure'* development type.

3.2 Flood Zone Classification

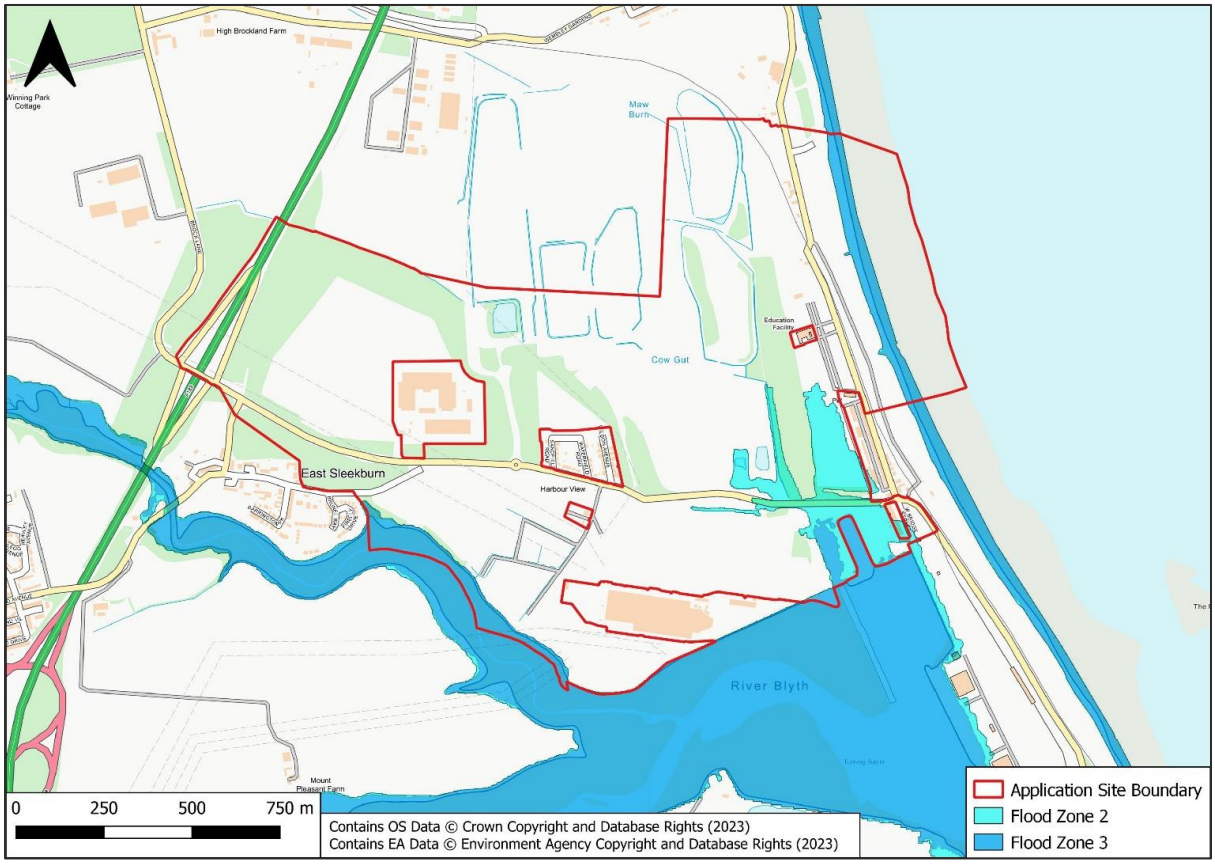
The definition of Environment Agency flood zones is provided in PPG Table 1: Flood Zones:

- Zone 1 - Low Probability (Flood Zone 1) is defined as land which could be at risk of flooding from fluvial or tidal flood events with less than 0.1% annual probability of occurrence (1:1,000 year) i.e., considered to be at 'low probability' of flooding.
- Zone 2 - Medium Probability (Flood Zone 2) is defined as land which could be at risk of flooding with an annual probability of occurrence between 1% (1:100 year) and 0.1% (1:1,000 year) from fluvial sources and between 0.5% (1:200 year) and 0.1% (1:1,000 year) from tidal sources i.e., considered to be at 'medium probability' of flooding.
- Zone 3a - High Probability (Flood Zone 3a) is defined as land which could be at risk of flooding with an annual probability of occurrence greater than 1% (1:100 year) from fluvial sources and greater than 0.5% (1:200 year) from tidal sources i.e., considered to be at 'high probability' of flooding.
- Zone 3b - the Functional Floodplain (Flood Zone 3b) This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise:
    - land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or
    - land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).

Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

An extract of the EA Flood Map for Planning is reproduced below as Figure 3-1. This mapping indicates the site lies across Flood Zones 1, 2 and 3 and therefore at risk of flooding from fluvial or tidal sources.

Figure 3-1: Extract of the EA Flood Map for Planning



3.3 National Planning Policy

This FRA report has been completed in accordance with the guidance presented in the NPPF[2] and with reference to PPG[3].

3.3.1 Flood Risk Compatibility

The proposed scheme is classified as an "essential infrastructure" development type associated with infrastructure for electricity supply including generation, storage and distribution systems; including electricity generating power stations, grid and primary substations.

As outlined in Table 3 of the PPG guidance (reproduced as Table 3-1) 'essential infrastructure' development types are Flood Zone 3 and are subject to the Exception Test.

Table 3-1: Flood Risk Vulnerability and Flood Zone Compatibility

Flood Risk Vulnerability Classification (PPG Table 2)		Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone (PPG Table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	Exception Test Required	✓	✓	✓
	Zone 3a	Exception Test Required	x	Exception Test Required	✓	✓
	Zone 3b (functional floodplain)	Exception Test Required	x	x	x	✓

Key: ✓ Development is appropriate x Development should not be permitted

3.3.2 Sequential Test

With reference to the NPPF, the Sequential Test gives preference to locating new development in areas that are at lowest risk of flooding (i.e. Flood Zone 1). The Environment Agency Flood Map for Planning and Strategic Flood Risk Assessment are geared to providing the basis for applying this test.

The Sequential Test requires developers to:

".....demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed."

This FRA supports the ECC of the onshore scheme are part of the wider offshore wind development. Clearly elements of the ECC route, particularly at the landfall, are always going to be in areas at risk of flooding due to their direct connection to the offshore scheme regardless of their location along the coastline. The ECC is considered water resilient development located below ground and therefore will not be impacted by flooding at the surface.

This FRA will ensure that the ESS is appropriately designed and safe throughout its construction, operation and decommissioning phases. On this basis we assume that the sequential test is passed.

3.3.3 Exception Test

The exception test, as set out in paragraph 164 of NPPF, states that

"For the exception test to be passed it should be demonstrated that:

(a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and

(b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Both elements of the exception test should be satisfied for development for be allocated or permitted".

The development will provide electricity generation from renewable energy sources for distribution into the local electricity network. This sustainable benefit outweighs the flood risk to the ECC which are flood and water resilient.

This FRA sets out the scheme fulfils point b by demonstrating the prevailing flood risk and how the development will be made safe throughout the construction, operational and decommissioning lifetime.

3.4 Local Planning Policy

Northumberland Local Plan22 was adopted in March 2022 and sets out strategic planning policies of the Council as well as the general scale and distribution of new development requirement to meet Northumberland's needs to 2036. It also provides planning principles and policies which should be factored in to any planning application within the district.

Relevant policy from the Local Plan includes:

Policy WAT 3

'Flooding

1. *In assessing development proposals the potential for both on and off-Site flood risk from all potential sources will be measured, taking into account the policy approach contained within: the relevant Catchment Flood Management Plan; the Northumberland Local Flood Risk Management Strategy; the Northumberland Outline Water Cycle Study; and the findings of Drainage Area Studies.*
2. *Development proposals will be required to demonstrate how they will minimise flood risk to people, property and infrastructure from all potential sources by:*

    a. *Avoiding inappropriate development in areas at risk of flooding and directing the development away from areas at highest risk. Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere. The Sequential Test and, if necessary, the Exceptions Test, will be applied (subject to minor development and change of use exemptions) in accordance with national policy and the Northumberland Strategic Flood Risk Assessment. Site Specific Flood Risk Assessments will be required for:*

        i. *All development in Flood Zones 2 and 3; and*
        ii. *In Flood Zone 1, for all proposals involving:*
            - *Sites of 1 hectare or more;*
            - *land which has been identified by the Environment Agency as having critical drainage problems;*
            - *land identified in a strategic flood risk assessment as being at increased flood risk in future; or*
            - *land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.*

    b. *For developments where (2a) above applies, it will be ensured that:*
        i. *The impact of the development proposal on existing sewerage infrastructure and flood risk management infrastructure is assessed, including whether there is a need to reinforce such infrastructure or provide new infrastructure in consultation with the relevant water authority;*
        ii. *The development takes into account climate change and the vulnerability of its users;*
        iii. *The Site is configured so that the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;*
        iv. *The development is made resistant and resilient, in terms of its layout, mix and/or building design, in accordance with national policy and the findings and recommendations of the Northumberland Strategic Flood Risk Assessment;*
        v. *Sustainable drainage systems are incorporated as appropriate, in accordance with Policy WAT 4;*
        vi. *Any residual flood risk can be safely managed; and*

[22] Northumberland County Council, Northumberland Local Plan 2016-2036, Adopted 31 March 2022.

vii. *Safe access and escape routes are incorporated, where appropriate, as part of an agreed emergency plan*

c. *Pursuing the full separation of foul and surface water flows as follows:*
   i. *A requirement that all development provides such separation within the development; and*
   ii. *Where combined sewers remain, the Council will work with statutory sewerage providers to progress the separation of surface water from foul;*

d. *Ensuring that built development proposals, including new roads, separate, minimise and control surface water run-off, using Sustainable Drainage Systems, modified as necessary where mine water is present; in relation to this:*
   i. *Surface water should be managed at source wherever possible, so that there is no net increase in surface water run-off for the lifetime of the development;*
   ii. *Surface water should be disposed of in accordance with the following hierarchy for surface water run-off:*
      - *To a soakaway system, unless it can be demonstrated that this is not feasible due to poor infiltration with the underlying ground conditions and/or high groundwater levels;*
      - *To a watercourse, unless there is no alternative or suitable receiving watercourse available;*
      - *To a surface water sewer;*
      - *As a last resort, once all other methods have been explored, disposal to combined sewers;*
   iii. *Where greenfield Sites are to be developed, the surface water run-off rates should not exceed, and where possible should reduce, the existing run-off rates;*
   iv. *Where previously developed Sites are to be developed:*
      - *The peak surface run-off rate from the development to any drain, sewer or surface water body for any given rainfall event should be as close as reasonably practicable to the greenfield run-off rate for the same event, so long as this does not exceed the previous rate of discharge on the Site for that same event; or*
      - *Where it is demonstrated that the greenfield run-off rate cannot be achieved, then surface run-off rate should be reduced wherever possible by a minimum of 50% of the existing Site run-off rate;*

e. *Full consideration should be given to solutions within the wider catchment area, including blue-green infrastructure-based solutions and those providing ecosystem services, with wider solutions especially applied if local solutions could be harmful to biodiversity, landscape or built heritage;*

3. *In relation to flood alleviation schemes:*
   a. *The early implementation of approved schemes will be supported through development decisions;*
   b. *Any proposal for additional schemes should demonstrate that they represent the most sustainable solution and that their social, economic and environmental benefits outweigh any adverse environmental impacts caused by new structure(s), including increasing the risk of flooding elsewhere.*

4. *Any works relating to the above, which impact on natural water systems, should consider the wider ecological implications, applying the ecosystem approach, and link into green infrastructure initiatives wherever practicable.'*

4.0 Flood Risk Screening

A screening study has been completed to identify whether there are any potential sources of flooding at the Site which may warrant further consideration. If required, any potential significant flooding issues identified in the screening study would then be considered in subsequent sections of the assessment.

There are a number of potential sources of flooding, and these include:

- Flooding from rivers or fluvial flooding;
- Flooding from the sea or tidal flooding;
- Flooding from surface water and overland flow;
- Flooding from groundwater;
- Flooding from sewers;
- Flooding from reservoirs, canals, and other artificial sources; and
- Flooding from infrastructure failure.

The risk of flooding from each of these sources to the Onshore Scheme cable route is assessed below with regards to both the construction and operational phases of development. It is envisaged that any risks identified in the construction phase would also potentially be applicable to the cable decommissioning phase of development, however buried cables would remain in-situ.

The cable decommissioning phase will disconnect the cable from the onshore converter station and National Grid substation. Buried cables along the cable route will remain in situ. A separate FRA for the converter station element of the development has been produced by Stantec to support the application and this is available as Technical Appendix 11.2, ES Volume 3. This FRA is therefore only relevant for the landfall and cable route throughout all phases of development.

4.1 Flooding from Rivers or Fluvial Flooding

EA guidance defines the following flood risk categories:

- Flood Zone 1 – land considered to have a low probability of fluvial flooding with an annual occurrence probability of less than 0.1% (1:1,000 year).
- Flood Zone 2 – land considered to have a medium probability of fluvial flooding with an annual occurrence probability of between 1% (1:100 year) and 0.1% (1:1,000 year).
- Flood Zone 3a – land considered to have a high probability of fluvial flooding with an annual occurrence probability of between 5% (1:20 year) and 1% (1:100 year (fluvial)) and 0.5% (1:200 year (tidal)).
- Flood Zone 3b – land considered to have a very high probability of fluvial flooding with an annual occurrence probability of greater than 5% (1:20 year).

An extract of the EA Flood Map for Planning is reproduced below as **Error! Reference source not found.**.

The EA Flood Map for planning contained in Figure 3-1 **Error! Reference source not found.** indicates that the Site lies in areas designated as Flood Zones 1, 2 and 3. However it should be noted that the areas of flooding indicated are derived from tidal waterbodies (Sleek Burn, River Blyth and North Sea) and therefore the flood risk identified refers to tidal flooding.

Fluvial watercourses on Site include the Cow Gut, Maw Burn and associated tributaries. Whilst not explicitly modelled for both watercourses, during coincidental events of extreme fluvial flooding and high tide, fluvial flows discharging off Site could be restricted by the tidal level and could result in flows backing up into the upgradient catchment area. This may therefore result in some out of bank flow/fluvial flooding onto the Site. This is considered a residual risk of tidal flooding.

Any risk of flooding of the Site during the operational phase is considered negligible given that the development proposals are for a below ground cable with water/flood resilient design. Similarly, decommissioning of the cable connection will see buried cables remaining in-situ and flood risk resulting from any proposed works would be negligible.

A risk of flooding from rivers and fluvial sources only arises during the construction phase and is therefore assessed in Section 5.0.

4.2 Flooding from the Sea or Tidal Flooding

The Site is situated adjacent to the open coast to the east and tidal waterbodies to the south. The EA Flood Map for planning indicates that areas of the Site fall into Flood Zones 2 and 3. The Site is inherently at risk of flooding from the sea or tidal sources.

During the operational phase, it is accepted that any flooding on the Site would not impact the buried cable elements of the development.

Tidal flood risk does need to be considered during the construction phase of development. This prevailing risk is therefore assessed in greater detail in Section 5.0.

4.3 Flooding from Surface Water and Overland Flow

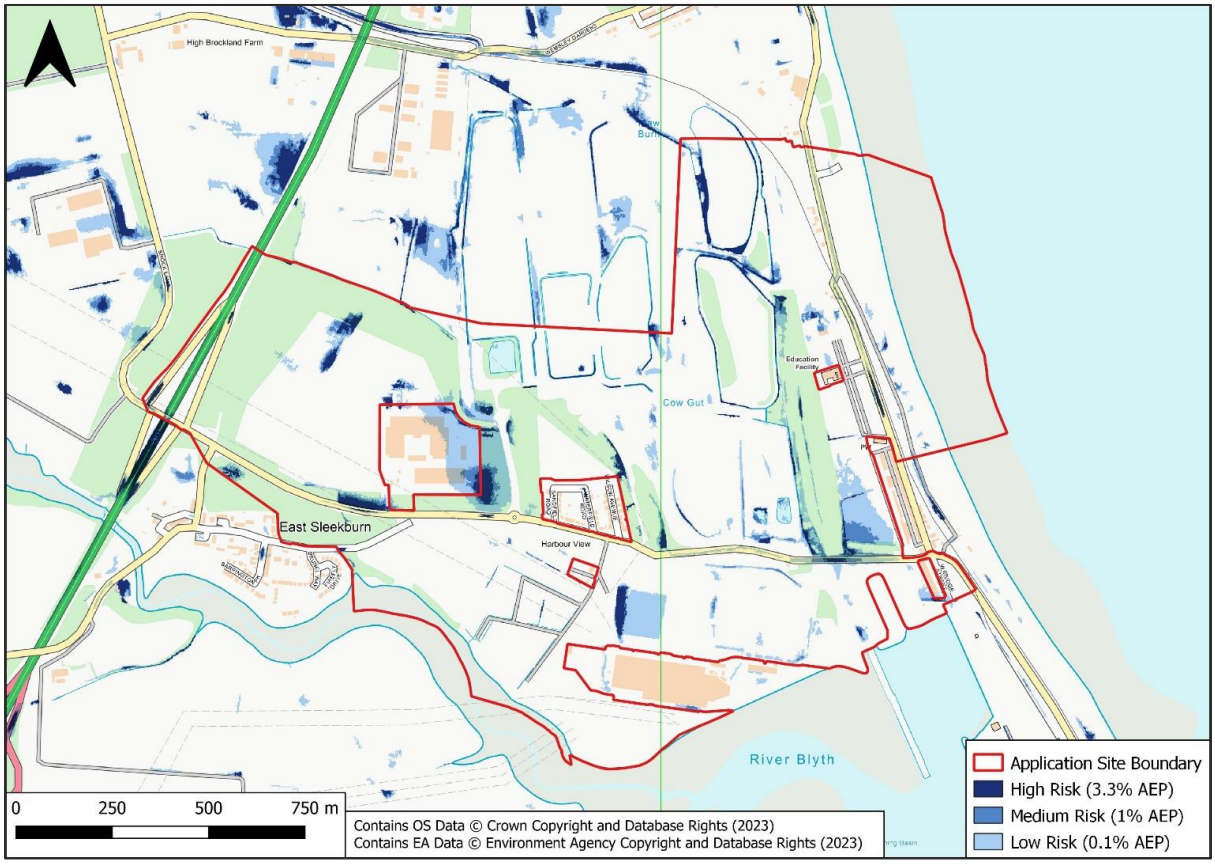
The Site slopes to the south-east towards the River Blyth estuary/North Sea, making it a receptor for surface water runoff. There are a number of small ordinary watercourses on the Site which would intercept any flows generated on Site from incidental rainfall. It is anticipated that an elevated surface water flood risk is presented along these ordinary watercourse corridors due to their depression in the landscape locally. Ponding of surface water is also expected to occur in any localised depressions on the Site or in areas where the progression of flow to the south-east is restricted (e.g. Brock Lane through the Site is raised with respect to land in the north).

The EA defines the surface water flood risk categories as:

- **Very Low:** less than 1 in 1,000 annual probability of flooding in any given year;
- **Low:** less than 1 in 100 annual probability but greater than or equal to 1 in 1,000 annual probability of flooding in any given year;
- **Medium**: between 1 in 100 annual probability and 1 in 30 annual probability of flooding in any given year; and
- **High:** greater than 1 in 30 annual probability of flooding in any given year.

An extract of the EA Surface Water Flood Map is contained below in Figure 4-1.

Figure 4-1: Environment Agency Surface Water Flood Map



The surface water flood mapping supports the conceptual understanding that there is an elevated risk of flooding along the ordinary watercourse corridors. As demonstrated in the mapping, these flows are generally retained in channel and would therefore not pose a flood risk to the Site.

Elevated flood risk is also noted in a number of locations along the northern boundary of Brock Lane, which is locally raised in the landscape and therefore inhibits the south easterly progression of flows off Site from the north. Some of these locations were noted to be served by culverts which will convey flow beneath Brock Lane (for example the Cow Gut culvert which conveys flows beneath Brock Lane to an outfall within the Port of Blyth. If no culvert exists or if culverts were to become blocked, stormwater would pond at the base of Brock Lane and overtop once the water levels reach the deck level of the road. The remaining flows would infiltrate/evaporate away accordingly over time.

Areas of high risk are noted around the existing NSL (North Sea Link) Site, to the north of East Sleekburn. Evidence observed from the walkover identified drainage within the Site boundary which would seek to manage and alleviate this flood risk. The flood risk mapping around this area of the Site is therefore likely overestimating the prevailing risk and may have been based on topographical mapping captured prior to development of the NSL.

Whilst there are areas of the Site considered to be at risk of flooding from surface water sources, the majority of the Site is considered very low risk. All cables associated with the development will be buried below ground and therefore flooding at the surface would not negatively impact the Onshore Scheme cable route.

Management of surface water runoff throughout the construction phase will be provided as part of the Construction Environmental Management Plan (CEMP), managing runoff from the Site with the aim that it does not exceed the existing regime. This drainage will be installed during the initial construction phase and decommissioned once construction and land reinstatement is complete.

The modification to land cover during the project construction phase will be reinstated after the cable installation, thus there will be no change to the surface water flood risk. This is due to the absence of changes to hydrological and hydrogeological catchment characteristics.

As detailed in Section 1.4.5, peak rainfall intensity is expected to increase by 30% throughout the project lifetime. This will inherently impact the frequency and severity of surface water flooding. As discussed, given the nature of the development (below ground) any flooding at the surface will not impact or be detrimental to the Onshore Scheme cable route during the operational and decommissioning phase.

Drainage installed during the construction phase will be sized to provide attenuation of runoff for extreme events. This drainage will increase the attenuation provided on Site, in comparison to the existing scenario, alleviating the flood risk locally. The risk of flooding from surface water sources to the Onshore Scheme cable route throughout all three phases is low following adequate provision of drainage in the CEMP.

4.4 Flooding from Groundwater

As detailed in Section 2.3.1, the Site is underlain by bedrock geology of the Lower Pennines Coal formation which is overlain across the majority of the Site by diamicton deposits, with deposits of Tidal River or Creek Deposits, Blown Sand and Marine Beach Deposits along major watercourse floodplains and the intertidal zone.

It would be expected for groundwater flows to be present within the more permeable superficial geology (Tidal River or Creek Deposits, Blown Sand and Marine Beach Deposits) and bedrock, however these standing water levels would vary on a semi diurnal cycle with the incoming tide.

The diamicton geology is reported within BGS boreholes as boulder clay. It is unlikely therefore that groundwater is able to penetrate the strata. Groundwater may be present in pockets or layers of more permeable geology however the extent is likely limited.

It is envisaged that the cable route would be adequately cased or lined and would be designed to be water resilient. Therefore, any groundwater which may arise around the cable would not cause damage or negatively impact operation of the cable during the operational, construction or decommissioning phase.

Evidently, laying cables along sections of the ECC route close to the coast or tidal waterbodies during periods of high tide (when groundwater levels are likely to be higher) is not ideal. Therefore, this should preferentially be undertaken during periods of low tide. In the event of discovery of shallow groundwater within the diamicton, this would likely be a pocket of perched groundwater, and therefore could be pumped out if considered problematic during the construction phase and discharged at greenfield rates to have no impact on groundwater flood risk elsewhere.

The risk of flooding from groundwater is low and not considered further.

4.5 Flooding from Sewers

With reference to NCC's Strategic Flood Risk Assessment[10,11], there are no recorded incidents of sewer flooding locally. Given the largely greenfield nature of the Site, it is unlikely that there are any sewers available for flooding to occur from. The former Britishvolt site is partially developed with some of the engineered drainage installed. This drainage is installed in accordance with the Lead Local Flood Authority Guidance[23] at the Site and therefore any failure or surcharge should revert to the predevelopment regime and likely discharges off Site via the network of ordinary watercourses.

In the absence of sewer plans, failure of any drainage infrastructure which may be present beneath road network locally would discharge in a south-easterly direction in line with the prevailing topography. These flows would be intercepted by ordinary watercourses and discharged away from the Site. Any sewer flooding which may arise would likely be shallow in nature.

Any shallow flows onto the Site will not impact the buried cable in the operational and decommissioning phase. Shallow flooding during the construction phase may cease works

[23] North East Lead Local Authorities, Sustainable Drainage Local Standards, July 2020

temporarily, however flows would discharge either overland or via watercourse networks and therefore the duration of surface water flooding on Site would be small.

The impact of flooding from sewers on the development is considered low and not assessed further. The development also has no impact on sewer flooding elsewhere.

4.6 Flooding from Reservoirs, Canals and Other Artificial Sources

With reference to Reservoir Flood Mapping[8] provided by the EA, the south-western boundary of the Site, which extends into the estuarine area of Sleek Burn, is considered to be at risk of flooding from reservoirs (Sir Edward's Lake). The mapping indicates that all flows would be retained in the channel of the Sleek Burn and the River Blyth past the Site and therefore no flooding onto dry land (i.e., the Site) would occur.

There are no canals or other artificial sources in the vicinity of the Site which could arise in flooding.

Flooding from reservoirs, canals and other artificial sources is inherently low throughout all phases of development and not considered further. The development also has no impact on reservoirs, canals and other artificial sources elsewhere.

4.7 Flooding from Infrastructure Failure

The Site is not afforded protection from flood defences, nor are there any pumping stations in the vicinity of the Site, failure of which could result in flooding.

There are a number of culverts on and around the Site conveying the Cow Gut, Maw Burn and their associated tributaries. The majority of culverts observed on Cow Gut and Maw Burn are fitted with a trash screen to prevent blockages. Several of these culverts are new and have likely been sized, following ordinary watercourse consent, to convey flows within the Cow Gut for the design 1% AEP plus climate change event.

In the event of surcharge, collapse, or blockage from any of the culverts locally, flows would back up into the upgradient catchment, preferentially flowing around the culvert and discharging back into the watercourse downstream. Any flooding which may occur at the surface would not impact the buried cable during the operational or decommissioning phase. Any areas of flooding noted during construction will be avoided / evacuated as required. The prevailing risk in all pashes would therefore be very low.

Industry practice guidance will be followed throughout the construction phase to ensure that siltation does not occur in local watercourses and culverts, thus reducing the likelihood of blockage. Debris within the culverts should be removed as and when required throughout all phases, which will form part of an ongoing maintenance plan for the Site. As discussed above, a number of these culverts have been recently installed, and therefore hydrological analyses would have been required as part of the consenting application to ensure no impacts to flow conveyance during extreme events.

Consequently, the risk of flooding from infrastructure failure is low across all phases and is not considered further.

4.8 Flood Risk Summary

Table 3-1 summarises the flood screening assessment for the construction and operational phases of the Onshore Scheme cable route.

Table 4-1: Flood Screening Assessment Summary

Potential Source	Construction Phase: Potential Significant Flood Risk at Site?	Operational / Decommissioning Phase: Potential Significant Flood Risk at Site?
Rivers or Fluvial Flooding	Yes	No
Sea or Tidal Flooding	Yes	No
Surface Water and Overland Flow	No	No
Groundwater	No	No
Sewers	No	No
Reservoirs, Canals and other Artificial Sources	No	No
Infrastructure Failure	No	No

5.0 Technical Assessment of Flood Risk

The assessment of flood risk in Section 4.0 indicates that the development is not considered at risk of flooding from any potential flood source during the operational phase.

The assessment does however conclude that during the construction phase, the following sources of flooding would pose a risk to the Site:

- Flooding from rivers and fluvial flooding; and
- Flooding from the sea and tidal flooding.

It should be noted that the flood risk associated with rivers and fluvial flooding is considered a residual risk of tidal flooding and would only occur during coincidental events of high fluvial flows and astronomical high tide.

5.1 Historical Flooding

Recorded flood outlines provided by the EA[24] indicate that at the southern most parts of the Site, adjacent to the River Blyth and Sleek Burn, flooding occurred on the 05/12/2013 – 06/12/2013 following overtopping of the natural high ground along the river banks. This is not noted in the SFRA[11] as the reporting predates the flood event. The flood investigation report produced by NCC indicates that flooding occurred due to an extreme tidal surge along the eastern coast. The report also acknowledges that the impacted area will be at greater risk following future sea level rise.

5.2 Flooding from Tidal Sources

The EA Flood Map for Planning indicates that the Site is situated across flood zones 1, 2 and 3 associated with tidal sources (North Sea, River Blyth, Sleek Burn).

To further assess the prevailing risk, a data request was submitted to the EA for tidal flood levels along the River Blyth, Sleek Burn and the North Sea. The flood model outputs provided by the EA are contained in Appendix 01.

The EA does not have any detailed hydraulic modelling of the River Blyth and Sleek Burn and therefore have only provided outputs derived from the National Coastal Dataset. Whilst we can apply this data to estimate in channel tidal levels in both the River Blyth and Sleek Burn, this does not account for funnelling effects which would occur up the estuary meaning that riverine tidal water levels are likely greater than those out to sea.

5.2.1 Flood Modelling

Table 5-1 summarises the tidal flood levels for the North Sea across a range of return periods, as taken from the National Coastal Model. As discussed, these levels will also be applied to Sleek Burn and the River Blyth in lieu of more appropriate data.

24 Historic Flood Map, Environment Agency, Historic Flood Map - data.gov.uk

Table 5-1: National Coastal Model Flood Model Outputs for Node 3612

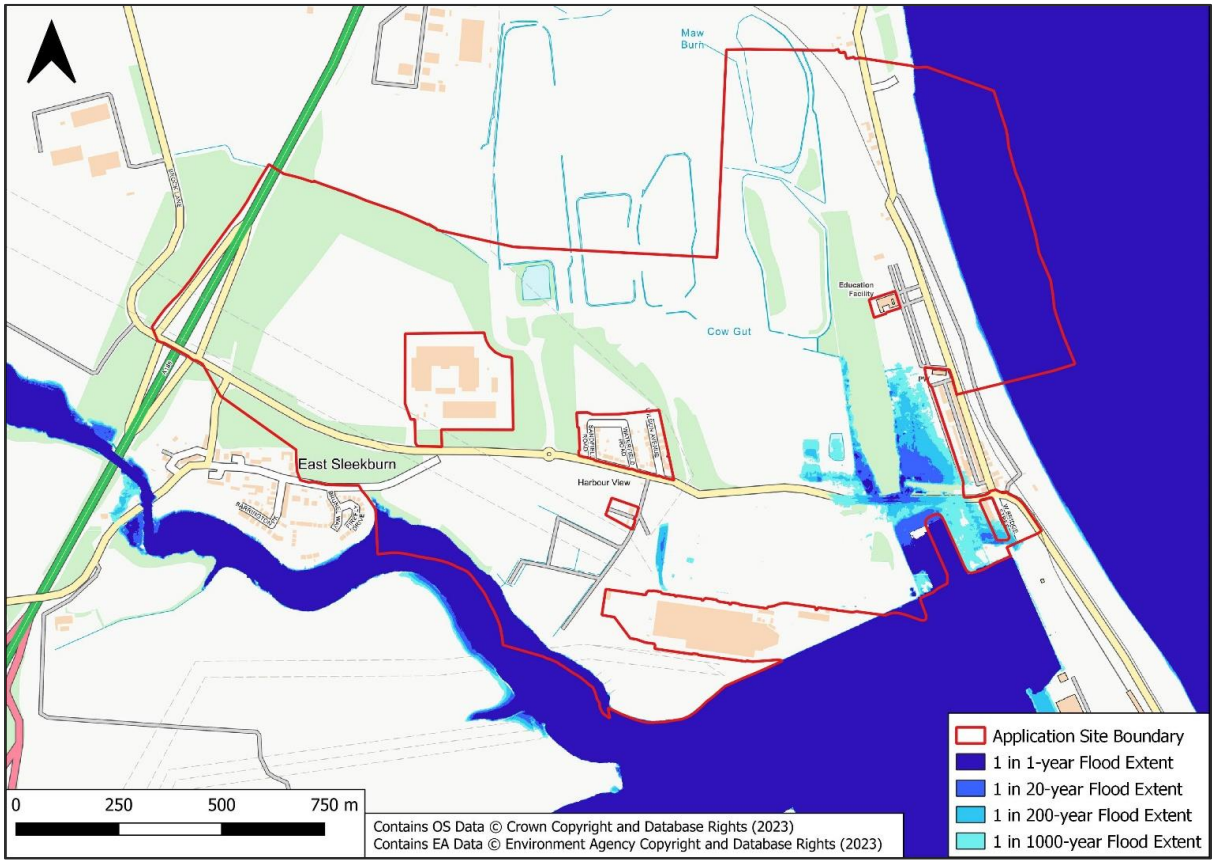
Return Period (1 in X years)	Node 3612 (Water Level in m aOD)
1	3.22m
2	3.29m
5	3.40m
10	3.48m
20	3.58m
25	3.61m
50	3.70m
75	3.76m
100	3.79m
150	3.86m
200	3.90m
250	3.94m
300	3.96m
500	4.05m
1000	4.16m

As discussed in Section 2.2, minimum ground levels within the Site boundary are as low as -1m aOD within the channel of Sleek Burn and increase to 2.2m aOD on dry land around the Port of Blyth in the south-east. This means that these areas of the Site are considered to be at risk of flooding on an annual basis with flood depths up to 1.02m on some areas of land. These frequent flood events are either within the immediate estuary channel (which the Site boundary overlaps into) or in and around the port basin. There is also a risk of flooding along the coast to the east of the Site where landfall works are proposed.

Throughout the remaining more extreme flood events, the modelling indicates that the majority of the Site will remain flood free, with the impacted areas generally corresponding to the intertidal zone, estuarine areas of Sleek Burn and flooding around the port basin, which would potentially back up into the Cow Gut resulting in flooding of the low-lying areas in the south-eastern area of the Site. Figure 5-1 below identifies the extent of flooding anticipated for the 1 in 1, 1 in 20, 1 in 200 and 1 in 1000-year flood events. Based on the mapping we can conclude that the Site falls across flood zones 1 to 3b.

We would note that the majority of the Site will remain flood free for all modelled tidal events with an annual probability of up to 1 in 1000.

Figure 5-1: Modelled Flood Extents



Given that there is an inherent risk of tidal flooding to some areas of the Site, an emergency flood response plan should be developed for the construction and decommissioning phases of development if any works are to take place within these areas.

This plan should seek to enforce the cessation of working during extreme events and provide flood free routes (walking and vehicular) for evacuation from the Site. Stockpiling and storage areas (materials and vehicles) should be situated away from areas of potential tidal flood risk.

5.2.2 Residual Flood Risks

5.2.2.1 Flooding from Rivers and Fluvial Flooding

It is envisaged that fluvial flooding may occur on the Site following coincidental events of extreme fluvial flooding on the Cow Gut and Maw Burn, alongside incoming high tide from the North Sea impacting tidal levels in the River Blyth and Sleek Burn preventing free discharge from the Site.

From the mapping in Figure 5-1, it is clear that under flood conditions (with a 1-yearly annual occurrence), tidal water levels are potentially able to back up into Cow Gut watercourse on Site. This does not occur along Maw Burn as the upstream elevations of the watercourse are above the peak tidal water levels.

The mapping provided in Figure 5-1 assesses only peak tidal water levels. During coincidental events of fluvial flooding and extreme high tide (tide lock scenario with flows unable to freely discharge offsite), fluvial flows within Cow Gut and Maw Burn would back up into the upgradient catchment area. The most significant flooding would be predicted in the low lying land to the North of Brock Lane which is a preferential route for flood water from both Cow Gut and Maw Burn.

Areas of fluvial flooding on the Site would be able to progress downstream once tidal levels began to drop. Based on the semi diurnal cycle, it is expected that the period of extreme high tide (i.e., flood peak) would only last for 2 to 3 hours. Fluvial flows could also proceed downstream once the tidal level

is breached. We would not expect that fluvial flows would extend much beyond the tidal water level if this low probability event were to occur.

Whilst such flooding would not be impactful during the operational phase, there would potentially be a risk during the construction phase in these areas of the Site. The emergency flood response plan recommended should therefore also consider residual flood risks of tidal flooding (fluvial flooding) and denote Site specific triggers for demobilisation of equipment and evacuation of the Site for both scenarios (tidal and residual tidal risks).

5.3 Climate Change

It is widely accepted that increases in sea level, wave height, wind speed, fluvial flows and peak rainfall will occur throughout the anticipated lifetime of development as a consequence of climate change.

Evidently, all of these changes will have no impact during the operational and decommissioning phase due to the nature of development. Nor will climate change impact the prevailing flood risk during the construction phase (i.e., present day).

Given that the Site is insensitive to the impacts of climate change on flood risk, it is not considered necessary to further quantify what these specific risks/changes will be. It is widely accepted that the likelihood and severity of flooding will increase throughout the anticipated lifetime of development however this will have negligible impact on the Onshore Scheme cable route itself.

5.4 Flood Risk Summary

The assessment of flood risk concludes that some areas of the Site are at risk of flooding during the construction phase from tidal events with also a residual risk of fluvial flooding following tide lock at the outfall of Maw Burn and Cow Gut. It is also acknowledged that the frequency and severity of flooding will increase throughout the anticipated lifetime of development due to climate change. We would however note that the Onshore Scheme cable route will not impact on flood risk locally and adequate surface water drainage will be provided during the construction of the ECC and discharged at greenfield rates.

As the prevailing flood risk during the construction phase is inevitable due to the nature of development, mitigation measures should be implemented at the Site to reduce the risk to the development and personnel. These mitigation measures are outlined in Section 6.0.

6.0 Flood Mitigation

The analysis of flood risk discussed in Section 5.0 indicates that some areas of the Site are at risk of flooding for tidal events with an annual exceedance probability of 100% and rarer. Through the assessment of flood extent, it is shown that large areas of the Site would remain flood free from generic tidal flooding, with only areas on the open coast and along the Sleek Burn and River Blyth impacted.

The assessment of flood risk has also analysed residual fluvial flood risk events which would occur from coincidental events of extreme fluvial flooding and periods of high tide which would essentially restrict flow from the fluvial watercourses (Maw Burn and Cow Gut), discharging offSite. The assessment concludes that there is an inherent risk of flooding from these fluvial sources which should, alongside tidal flood risks, be addressed with suitable mitigation practices.

This section therefore details the flood response, maintenance and management procedures to be undertaken at the Site to mitigate the prevailing flood risk.

6.1 Flood Response

The main risk of flooding to the Site arises from tidal sources (i.e., the North Sea, River Blyth, Sleek Burn) however there is also a residual risk of fluvial flooding occurring on the Site following coinciding fluvial flood events and astronomical high tide. This residual risk is significantly less probable than tidal flooding as this involves two different extreme events. It is considered that any flooding on the Site from tidal or fluvial sources is classed as a significant risk, however due to external factors of windspeed and wave height, any activity undertaken on the coast at landfall is considered to be at the greatest risk. Based on initial feasibility planning, other than at landfall it is unlikely that any cable routing for the ECC will be within areas assessed to be at potential risk of flooding.

An emergency flood response plan should be developed for any works within areas of the Site considered to be at risk of flooding. This plan will specify actions to be undertaken following specific triggers, with clear dry routes for evacuation of people from the Site. Based on the flood mapping in Figure 5-1, a westerly route along Brock Lane away from the Site is the most preferable. Flood alerts provided by the EA are as follows, and these should be refined alongside Site specific triggers as part of the emergency flood response plan given that flood warnings for the Site, which typically provide 2-hours' notice of an impending flood, are not available:

- The Site is covered by the EA's general early notification (Floodline) of possible flooding, known as flood alerts, within the covered area of 'North Sea from Berwick to St Mary's Lighthouse'.

The flood emergency plan should form part of a wider emergency response plan for the Site.

6.2 Maintenance and Management

Maintenance and management procedures are required at the Site to mitigate the prevailing flood risk. These procedures primarily involve regular maintenance and clearing of debris from culverts, manholes and ordinary watercourses, which is considered essential to prevent blockages and siltation.

Maintenance of any temporary drainage provision should also be undertaken as required in accordance with published guidance. Records of these maintenance works undertaken on Site should be provided as part of a Site management plan.

7.0 Conclusion

The flood risk screening undertaken as part of this assessment concluded that some areas of the Onshore Scheme cable route are considered to be at risk of flooding from tidal and fluvial sources. Flooding from fluvial sources is however considered a residual risk of tidal flooding, occurring during coincidental events of extreme fluvial flooding and high tide preventing flows from Cow Gut and Maw Burn discharging off Site.

Analysis of the tidal flood risk indicates that this is only prevalent during the construction phase and, once the cable is in situ, any flooding at the surface will not impact on the Onshore Scheme cable route. The assessment of tidal levels in comparison to Site levels indicates some areas of the Site, which expands across a broad area, will likely flood annually from tidal sources. However, it should be noted that the majority of the Site would remain flood free for all events up to 1 in 1000 years, with the most impacted areas including low lying land around the estuary and expectedly, the areas of the Site which overlap into the intertidal zone along the North Sea coastline. On this basis, the Site falls across all flood zones from 1 (low probability) to 3b (functional floodplain), however, development may not necessarily be undertaken within all of the aforementioned areas.

This flood risk assessment has also considered residual flood events which includes fluvial flooding along Cow Gut and Maw Burn which would potentially occur following coincidental events of extreme fluvial flooding and high tide, preventing fluvial flows discharging offsite into the estuary or to the coast. It has not been possible to quantify the probability of this flood risk, however, in consideration that this would require two extreme flood events to occur simultaneously, the probability of occurrence is likely low. Equivalent to that of tidal flooding, this flood mechanism is only considered a risk during the construction phase.

Flood mitigation measures have been proposed at the Site to help alleviate the prevailing flood risk during the construction phase. These include:

- Provision of an emergency flood response plan for the Site. This should specify specific trigger levels and actions to be undertaken in preparation of an impending flood; and
- Routine maintenance and management of all watercourse and drainage infrastructure which is formally recorded as part of a Site maintenance plan.

It is assumed that temporary surface water drainage for the Site will be provided in the CEMP. This will ensure that surface water runoff from the Site does not increase across areas away from proposed works, as a consequence of development.

Based on the information outlined in this flood risk assessment, and following the flood mitigation measures proposed, the perceived level of flood risk to the Site and development is generally low. Whilst it is acknowledged that tidal flooding will occur in coastal, estuarine and low-lying areas contained within the Site boundary, the duration of flooding is only short-term meaning work could recommence after 2-3 hours. Through the implementation of recommended flood mitigation, the development is therefore considered safe and does not increase or exacerbate flood risk elsewhere.

Appendix A Environment Agency Flood Model Outputs

Flood Map for Planning

Environment Agency

Legend

- Statutory Main Rivers
- Defences
- Flood Storage Areas
- Areas benefiting from flood defence
- Flood Zone 3
- Flood Zone 2

1: 10,000

0 250

Metres

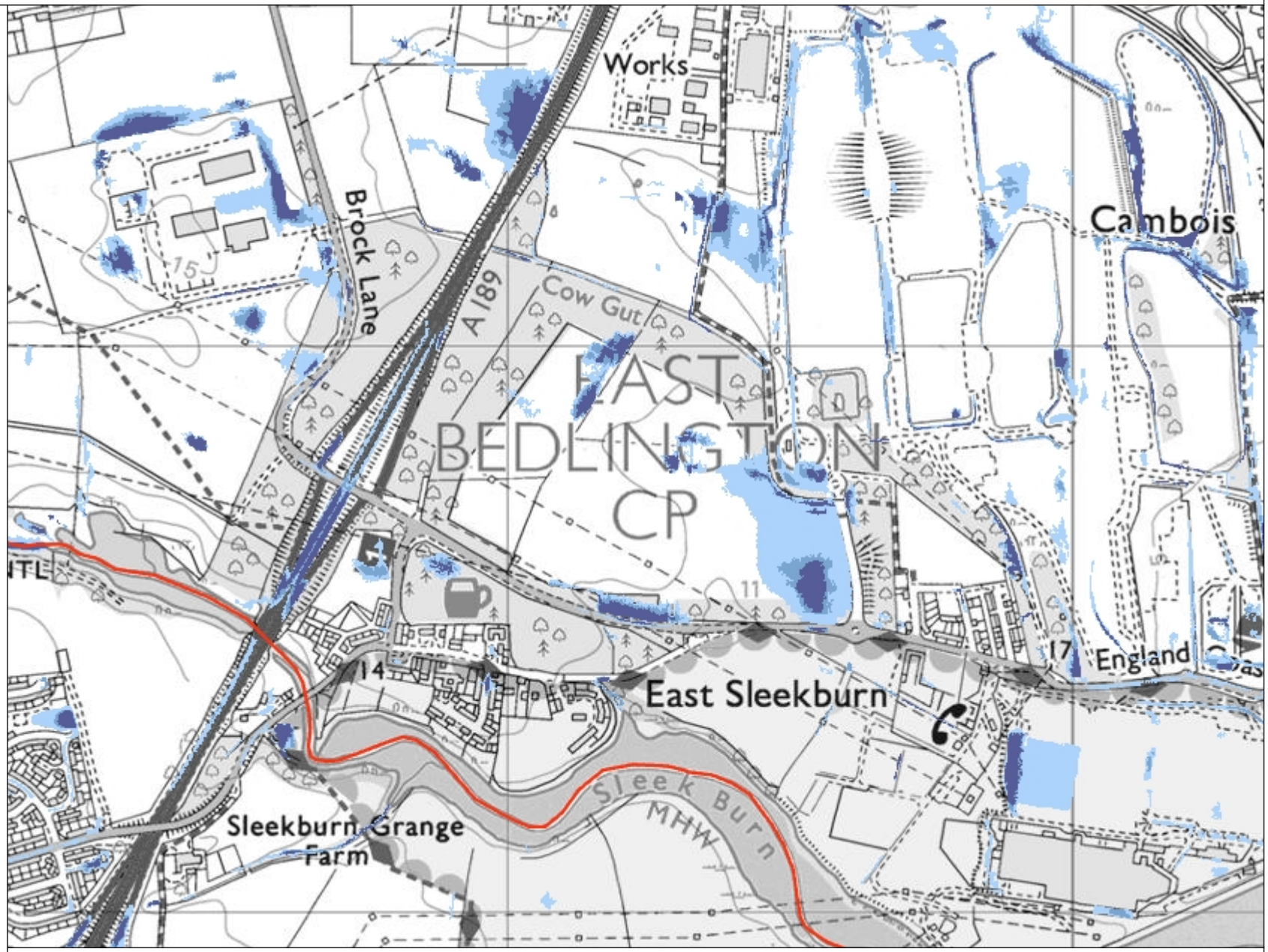
N W E S

Surface Water Flood Risk

Environment Agency

Legend

- Statutory Main Rivers
- Flood Extent 1 in 30
- Flood Extent 1 in 100
- Flood Extent 1 in 1000



1: 10,000

0 250

Metres

N W E S

Environment Agency

Legend

Node Points with
Modelled Tidal Flood Levels ★

Node Point Location Plan
Blyth

Date: Nov 2022 Scale: N.T.S. Status: Final

MapEdit data quality flag: Adequate

Data Source: MapEdit 16-11-2022

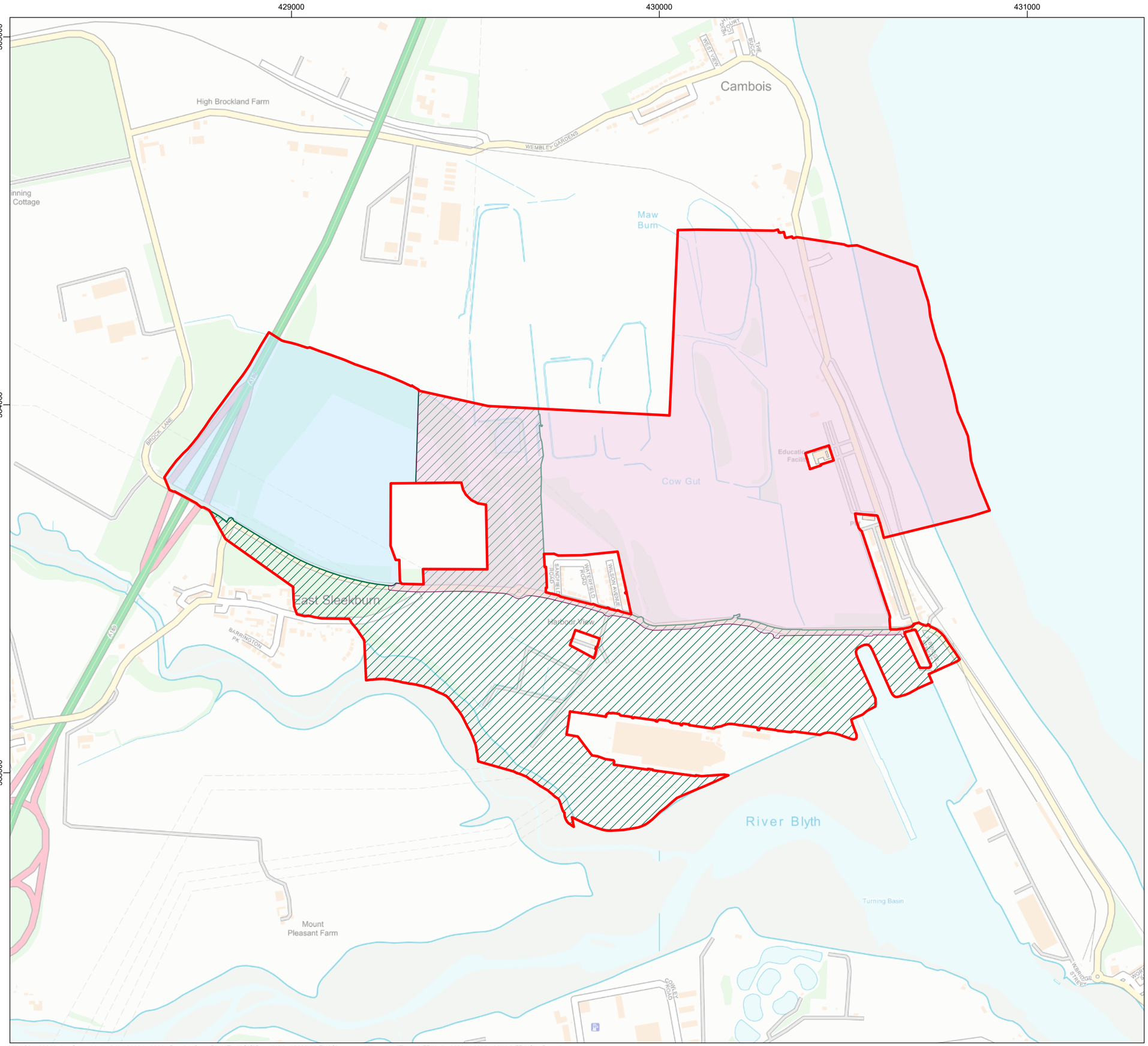
Approved by: James Carradice 16-11-2022

Tidal Node Point Table
Blyth

Chainage		3612	3614	3616	3618
Easting		432,630.05	433,690.89	434,367.90	434,378.05
Northing		584,237.77	582,543.25	580,683.91	578,813.10
Level at Return Period (1:x)*	*1*	3.22	3.22	3.23	3.22
	2	3.29	3.3	3.3	3.29
	5	3.4	3.4	3.41	3.4
	10	3.48	3.49	3.49	3.48
	20	3.58	3.58	3.58	3.58
	25	3.61	3.61	3.61	3.61
	50	3.7	3.7	3.7	3.7
	75	3.76	3.76	3.76	3.76
	100	3.79	3.79	3.8	3.79
	150	3.86	3.86	3.86	3.86
	200	3.9	3.9	3.9	3.9
	250	3.94	3.94	3.94	3.93
	300	3.96	3.96	3.96	3.96
	500	4.05	4.05	4.05	4.04
	1000	4.16	4.16	4.16	4.15

*Levels are in mAOD

Appendix B Figures



Legend

- Site Boundary
- Landfall HVDC Zone
- HVAC Zone
- Converter Station Zone

Rev	Date	Status	Drwn	Chkd	Appd
04	-	-	-	-	-
03	-	-	-	-	-
02	-	-	-	-	-
01	13/10/2023	First Issue	FG	JS	SP

sse Renewables

SLR

Project

CAMBOIS CONNECTION ONSHORE SCHEME

Title

FIGURE 11.1.1: SITE BOUNDARY PLAN

N

0 100 200 300 400 500 Metres

Scale	Plot Size	Datum	Projection
1:10,000	A3	OSGB36	BNG

Drawing Number: 404.000041.00001.0075.0

Sheet No.: 1

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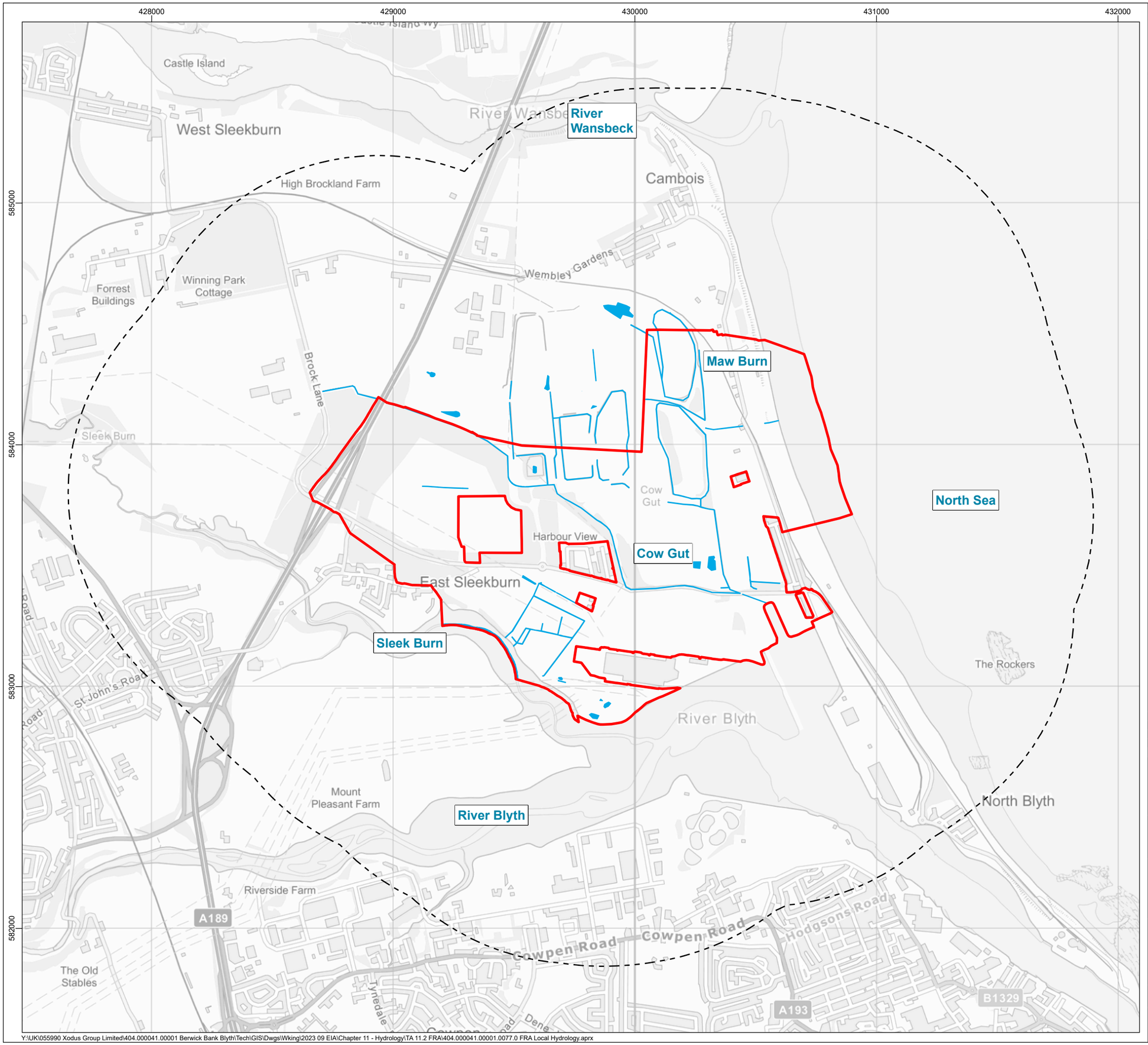

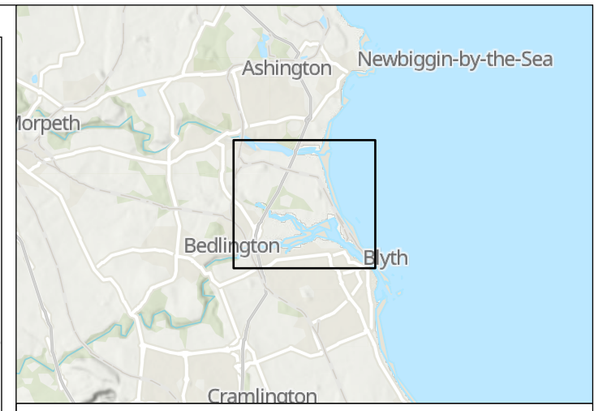

Legend

- Site Boundary
- Hydrology Study Area 1 km Buffer
- Waterbody

Rev	Date	Status	Drwn	Chkd	Appd
04	-	-	-	-	-
03	-	-	-	-	-
02	-	-	-	-	-
01	13/10/2023	First Issue	FG	JS	SP

sse Renewables

SLR

Project

CAMBOIS CONNECTION ONSHORE SCHEME

Title

FIGURE 11.1.2: LOCAL HYDROLOGY

N

0 0.2 0.4 0.6 0.8 1 Kilometres

Scale	Plot Size	Datum	Projection
1:15,000	A3	OSGB36	BNG

Drawing Number	Sheet No.
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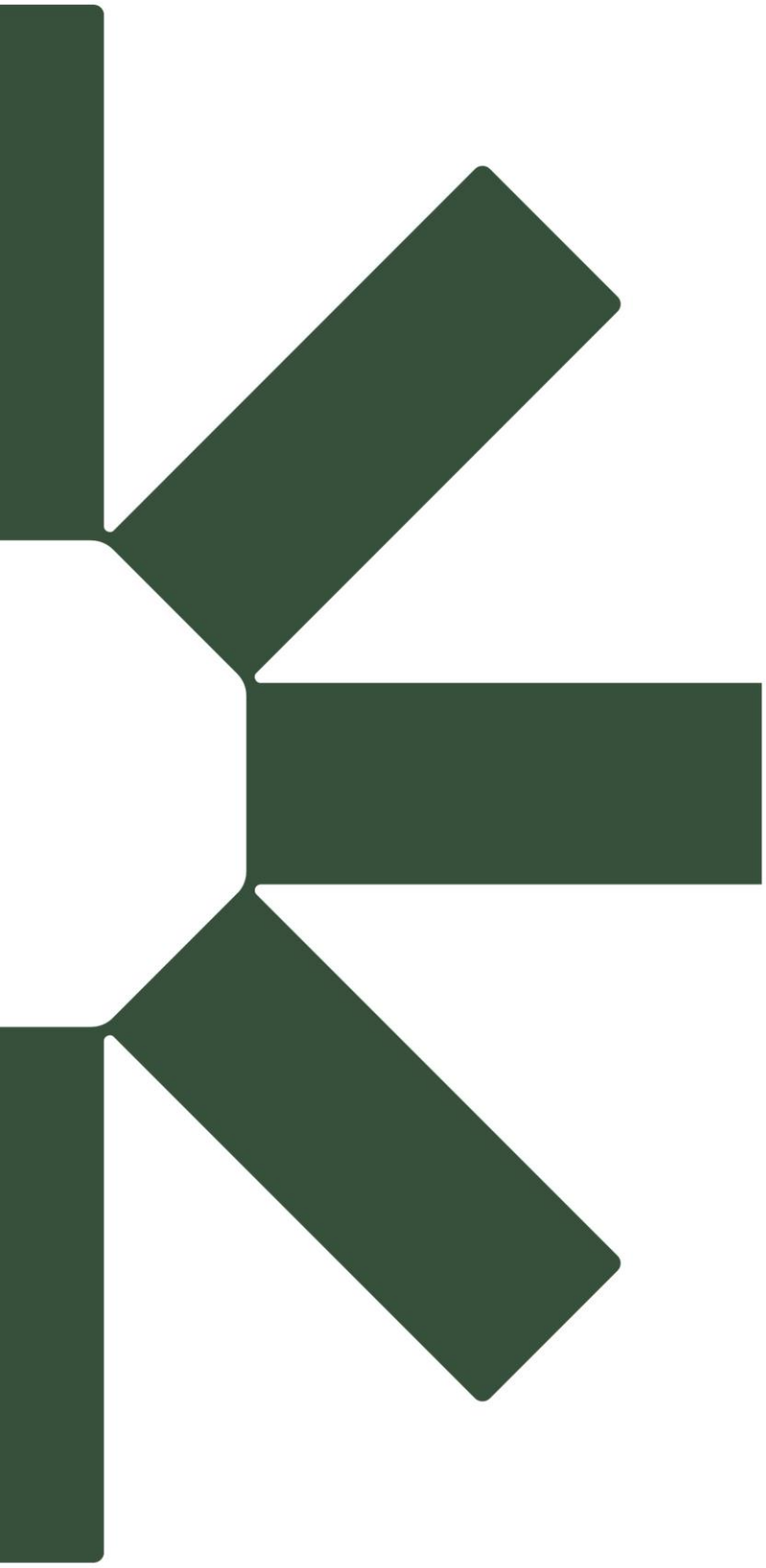

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