Preliminary Environmental Information Report Volume 2

Appendix 12.1 Preliminary Flood Risk Assessment

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Contents

1 Introduction

1.1 Overview

1.1.1 The Applicant has prepared this preliminary Flood Risk Assessment (FRA) as part of the LionLink Project (here after referred to as the 'Proposed Scheme'). This will accompany the Preliminary Environmental Information Report (PEIR) for the Proposed Scheme. Following this, a final FRA will be prepared and submitted with the forthcoming Environmental Statement (ES), supporting the application for development consent.

1.1.2 The Proposed Scheme requires a site-specific FRA as the study area (i.e., the Draft Order Limits) covers more than 1 hectare and is inclusive of land in Flood Zones 2 and 3. A FRA is a requirement of such development types, as set out in National Policy Statement (NPS) EN-1, at **paragraph 5.8.13.**

1.1.3 Within the PEIR, the Proposed Scheme has been split geographically into the Proposed Onshore Scheme and the Proposed Offshore Scheme. This FRA addresses the Proposed Onshore Scheme design elements and has been produced to support the application for development consent and the accompanying Environmental Statement (ES) under the Planning Act 2008.

1.2 Purpose of the report

1.2.1 This document includes a summary of flood risk from all relevant sources to the Proposed Onshore Scheme and the predicted impact of the Proposed Onshore Scheme on flood risk elsewhere.

1.2.2 This FRA also describes how the risk of flooding has been avoided by situating vulnerable infrastructure outside of flood zones. For other less vulnerable components forming part of the Proposed Onshore Scheme, flood risk will be managed by design, including inclusion of control measures to address any potential residual impacts associated with the Proposed Onshore Scheme. The measures are documented within the Outline Onshore Code of Construction Practice (CoCP), **Appendix 2.1** of this PEIR.

1.2.3 The findings of the FRA are also reflected in the **Chapter 12 Hydrology, Hydrogeology and Drainage** of the PEIR.

1.3 Scope

1.3.1 The scope of this assessment has been agreed through pre-application engagement with the Environment Agency, as well as Suffolk County Council, acting in their role as Lead Local Flood Authority (LLFA). Additional Non-Statutory Consultations relating to hydrology, hydrogeology and drainage have been received from East Suffolk Council, Alde and Ore Association, Suffolk Wildlife Trust and Parish and Town Councils: Friston Parish Council, Aldeburgh Town Council, Walberswick Parish Council, and Middleton cum Fordley Parish Council.

2 Planning Policy Context

2.1.1 National Policy Statements (NPS) relevant to the Proposed Onshore Scheme are published by the Department for Energy Security and Net Zero, which set out the requirements for assessing and approving energy related Nationally Significant Infrastructure Projects (NSIP), including:

a. Overarching National Policy Statement for Energy (EN-1), January 2024 (Ref 1), in particular Section 5.8 (FRA) and 5.6 (Coastal Change).
b. National Policy Statement for electricity networks infrastructure (EN-5), January 2024 (Ref 2), particularly Section 2.3.

2.1.2 With regard to the assessment of flood risk, the NPS also refer to the primary national planning documents for guidance, as follows:

a. National Planning Policy Framework (NPPF) (Ref 3), published in December 2024. This Framework sets out the government's planning policies for England and outlines how these are expected to be applied. The NPPF states that the main considerations for any development should be to minimise vulnerability to flooding and apply a sequential, risk-based approach to the location of development, accounting for current and future climate change impacts.
b. Planning Practice Guidance (PPG): PPG on flood risk and coastal change (Ref 4), published August 2022, advises on how to take account of and address the risks associated with flooding and coastal change, stating that the aim is to steer new developments towards areas of lower flood risk. It sets out the basis for the Sequential Test and Exception Test. The associated PPG on flood risk assessments: applying for planning permission (Ref 5) (August 2024), and on climate change allowances (Ref 6) are also provided by the Environment Agency.

2.1.3 Under Section 38 of the Electricity Act 1989 (Ref 7), National Grid must adhere to the provisions outlined in Schedule 9 of the same Act. Schedule 9 stipulates that license holders, when formulating proposals for electricity transmission, must consider the importance of preserving natural beauty, conserving flora, fauna, and geological or physiographical features of special interest, and protecting sites, buildings and objects of architectural, historical or archaeological significance. Additionally, they must take reasonable measures to mitigate any adverse effects that the proposals may have on the natural beauty of the countryside or on any such flora, fauna, features, sites, buildings, or objects. This includes flood risk.

3 Available Information

3.1.1 The evidence base related specifically to flood risk is presented below.

Environment Agency

a. Flood map for planning (Ref 8) – The Environment Agency's Flood map for planning provides flood risk information for planning applications and details flood zones, water storage areas and all rivers, sea and surface water layers. It includes layers for defended and undefended flood risk, for present day and for future climate.
b. Long term flood map (Ref 9) – The long-term flood risk for an area in England documents how climate change might increase the chance of flooding in an area, the possible cause of flooding and how to manage flood risk. This service details an area's long term flood risk from the rivers and sea, surface water, reservoirs and groundwater (where data is available).
c. Asset Information Management System (AIMS) database (Ref 10) – A record of flood defence assets, identifying their ownership or organisation responsible for maintenance, details of defence heights and condition, and maintenance records. This includes more flood defence assets than are shown on Flood map for planning.
d. Detailed hydraulic modelling – The Environment Agency has provided Product 5 (hydraulic modelling reports and hydrology reports) for the following models:
    i. East Suffolk Flood Study (JBA Consulting, 2006) – *1D ISIS model of Thorpeness Hundred River.*
    ii. River Minsmere and Leiston Drain (JBA Consulting, 2013) (new modelling is currently under development by the Environment Agency) – *1D ISIS model.*
    iii. Friston River (JBA Consulting, 2016) – *1D-2D ISIS Tuflow model.*
    iv. East Anglian Coastal Modelling (JBA Consulting, 2019) – *2D Tuflow models, including Blyth estuary from Dunwich to Southwold.*
    v. Wrentham (JBA Consulting, 2020) – *1D Flood Modeller Pro model.*
    vi. River Blyth (Mott MacDonald, 2020) – *1D-2D Flood Modeller Pro Tuflow model for the tidal River Blyth and its upper catchment, with some watercourses including the Dunwich River modelled as 2D-only Tuflow.*
    vii. Adle, Ore and Fromus (Mott MacDonald, 2020) – *1D-2D Flood Modeller Pro Tuflow model of the Fromus.*
e. Shoreline Management Plan (Ref 11) – The study area is within the Lowestoft to Felixstowe SMP7 Shoreline Management Plan, and specifically the Easton Broad to Dunwich Cliffs Subsection and Dunwich Cliffs to Thorpeness Subsection.

Suffolk County Council (LLFA)

a. Preliminary Flood Risk Assessment (PFRA) and update (AECOM, 2011, 2017) (Ref 12 and Ref 13) – The PFRA is a high-level screening of the readily available information to assess the local flood risk. The key stages involve collecting information on historic and potential floods and flood risks,

assembling the information into a preliminary assessment report, and providing a review of the ten national indicative areas identified by the Environment Agency against the local information from the preliminary assessment report. The findings of the PFRA indicate through very coarse mapping that areas within the Draft Order Limits in Suffolk lie in the vicinity of a potential flooding area, defined by a 1km grid square using data from a 0.5% AEP rainfall event. More refined data is published in the Friston Surface Water Study undertaken by BMT in May 2020.

b. Local Flood Risk Management Strategy (LFRMS) – The LFRMS details how flood risk can be managed and reduced within the County and how the Council will work with partners and developers to manage flood risk in the future. The strategy includes detailed guidance on the protocol for local planning authorities and developers and a local design guide for Sustainable Drainage Systems (SuDS) across the county. At the time of writing, there is no mention of any flood events in the study area.
c. Section 19 Flood Investigation Reports – The Section 19 Reports for Suffolk County Council investigate instances of significant flooding on a case-by-case basis in order to consider factors such as the likely source of flooding, the number of properties affected and any actions to implement going forward. One was published for Friston in 2020 (Ref 14).
d. Friston Surface Water Management Plan (SWMP) – The village of Friston has an anecdotal history of surface water flooding. The latest recorded significant surface water flooding was experienced on 06 and 21 October 2019 and were investigated by Suffolk County Council as LLFA as required by Section 19 of the Flood and Water Management Act 2010. The Section 19 report recommended actions including liaison with farms to promote improved agricultural practices for surface water runoff, notify properties at risk of surface water flooding and provide resilience information. Prior to this event, Friston had experienced minor surface water flooding, mainly contained within the extents of the highway with no reports of internal flooding in recent years. As a result of this a baseline hydraulic modelling assessment and the assessment of an observed flooding event with validation of the hydraulic model and economic appraisal was undertaken by BMT for the Friston Surface Water Study in May 2020.
e. Flood risk management asset register – The LLFA is responsible for maintaining a register of flood risk management assets, and their condition. At this time the register is under development (Ref 15).

East Suffolk Council

a. Suffolk Coastal and Waveney District Councils Level 1 Strategic Flood Risk Assessment (SFRA) (AECOM, April 2018) (Ref 16) – The adopted Level 1 SFRA sets out the flood risk to East Suffolk from a range of sources to the defined administrative area and helps inform the Sequential Test through documenting a sequential approach to the allocation of development. This allows an area-wide comparison of future development sites with respect to flood risk considerations.
b. Suffolk Coastal and Waveney District Councils Level 2 Strategic Flood Risk (SFRA) (AECOM, June 2018) (Ref 17) – The Level 2 SFRA has been adopted by Waveney and East Suffolk Councils. The purpose of the Level 2 SFRA is to

build on the findings of the Level 1 SFRA and analyses the level of flood risk associated with allocated development sites within the study area in accordance with the NPPF and the National Planning Practice Guidance (PPG). The Level 2 SFRA identifies allocated sites for development and the recommendations for managing flood risk in each location. The SFRA includes susceptibility to groundwater flooding figures.

c. Local Plan (2020) (Ref 18) – The adopted East Suffolk Council Local Plan (2020) sets out the strategy to outline how East Suffolk will be developed in order to meet is social, economic, and environmental needs. The implemented Local Plan provides a guide on location of future development and the requirements for East Suffolk. In relation to flood risk, the Council, in its capacity as the Flood Risk Management Authority, ensures that flood risk related to development is effectively managed through the planning system. The Local Plan, supported by the SFRA and LFRMS, documents the vision and framework for the future growth of the district, identifying where development could take place.

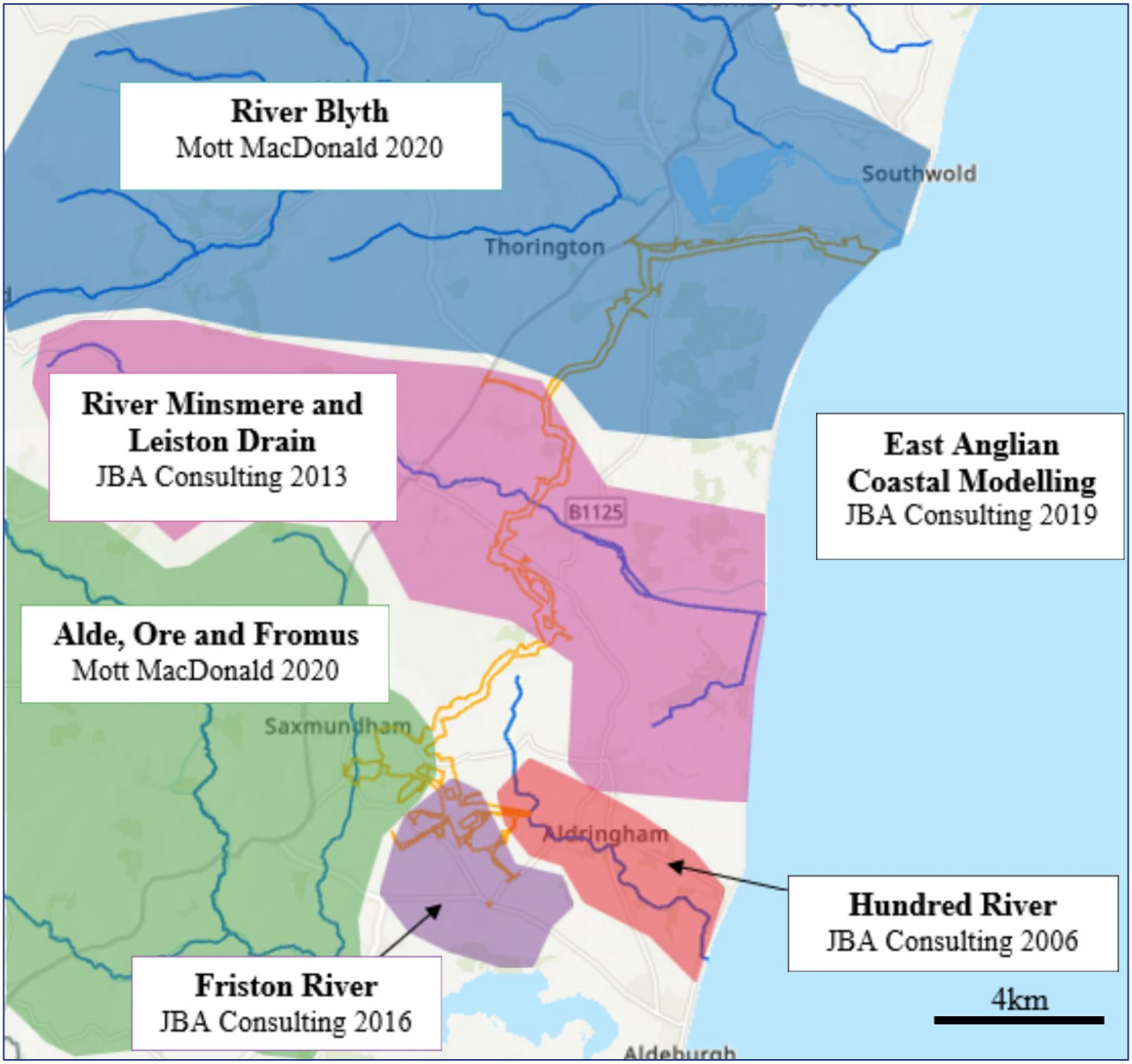
Southwold Town Council

3.1.2 Southwold Town Council reviewed the Proposed Scheme's Environmental Impact Assessment (EIA) Scoping Report (Ref 19) and produced a response to the Planning Inspectorate dated 02 April 2024. The response detailed the social, economic and environmental concerns in relation to the Proposed Scheme.

Reydon Parish Council

3.1.3 Reydon Parish Council Neighbourhood Plan 2019-2036 (Ref 20) – The Neighbourhood Plan was adopted May 2021, and forms part of the statutory planning framework for development in Reydon village. All developments within the village must comply with the policies in the plan as appropriate to the specific proposal. The adopted Neighbourhood Plan allows the community to influence proposed changes such as the development of the village, planning to ensure the village can deal with challenges such as flood risk, and the provision of infrastructure.

Inset 3.1: Hydraulic models in the catchment and their approximate spatial extent in relation to the Draft Order Limits[1]



[1] The Draft Order Limits of the Proposed Onshore Scheme (red) is also shown with the option for the Full Build Out of Kiln Lane Substation Scenario, as set out in **Chapter 2 Description of the Proposed Scheme**.

4 The Environmental Baseline Conditions

4.1.1 The Draft Order Limits of the Proposed Onshore Scheme are in the county of Suffolk, between the towns of Friston to the south and Walberswick to the north.

4.1.2 The land use across the study area, outside of small isolated settlements, is predominantly rural farmland. Key roads within the Draft Order Limits include the B1119, B1122 and B1125, with spurs to connect to the A12. The north of the study area at the proposed Landfall point at Walberswick is rural coastal marshland.

4.1.3 The majority of the underlying bedrock geology along the Suffolk coastline and within the Draft Order Limits is sands, gravels, silts and clays of the Crag formation and Neogene and Quaternary Rocks (undifferentiated). The bedrock geology inland surrounding the River Deben and River Alde has areas of the Thames group – clay, silt, sand and gravel. Superficial geology varies, comprising various lithologies of the Lowestoft Formation.

4.1.4 The main soil types are deep well drained sandy soils, which are often ferruginous soils and deep stone less non-calcareous and calcareous clayey soils. These soil types allow free drainage.

4.1.5 The site has an undulating topography which varies by approximately 30m across the study area. There are topographic highs of 20-30m above Ordnance Datum (maOD) towards the central section around Darsham, and low of 0 maOD at the coast.

4.1.6 Given the extent and position of the Draft Order Limits, there are numerous watercourses within the study area. Designated 'main rivers' include the River Wang, River Blyth, Wenhaston watercourse, Dunwich River, Minsmere River, Hundred River, Easton Broad and the River Blyth (Estuary). **Table 4.1** lists the key watercourses in relation to the sections listed in **Figure 2.1 Zoning Plan** of the PEIR.

4.1.7 The Lead Local Flood Authority (LLFA) is Suffolk County Council. East Suffolk Internal Drainage Board (IDB) present within the study area, with the River Fromus, Minsmere Old River and Dunwich River all within its drainage area. Unnamed Tributary of the River Fromus 1 specifically is an IDB maintained watercourse within the Draft Order Limits. Unnamed Tributary of the Minsmere Old River 5 is not an IDB maintained watercourse where it intersects with the Draft Order Limits at the A12, but is IDB maintained further downstream near its confluence with Minsmere Old River.

Table 4.1: Watercourses within the Draft Order Limits, descending south to north, along with their designation

Watercourse	Designation	Proposed Onshore Scheme Section
Hundred River	Main river	A
River Fromus	Main river	A
Unnamed Tributary of the River Fromus 1	Ordinary watercourse	A
Unnamed Tributary of the Hundred River 2	Main river	B2
Unnamed Tributary of the Hundred River 1	Main river	B2
Unnamed Tributary of the Minsmere Old River 4	Main river/Ordinary watercourse	B3
Unnamed Tributary of the Minsmere Old River 3	Ordinary watercourse	B3
Unnamed Tributary of the Minsmere Old River 2	Ordinary watercourse	B4
Unnamed Tributary of the Minsmere Old River 1	Main river	B4
Minsmere Old River	Main river	C1
Unnamed Tributary of the Minsmere Old River 5	Main river	C2
Dunwich River	Main river	C2
Dunwich River (tidal)	Main river	D

5 Description of the Proposed Scheme

5.1 Context and drivers for Proposed Scheme

5.1.1 The Proposed Scheme will play an important role in reducing the UK's reliance on fossil fuels and supporting the UK government's objectives to create a secure, reliable, and affordable energy supply for the UK population. The Proposed Onshore Scheme proposes the installation of offshore and onshore Underground HVDC Cables between the proposed Landfall Site and proposed Converter Station, and proposed Underground HVAC Cable Corridor between the proposed Converter Station and the Kiln Lane Substation (see **Chapter 5 EIA Approach and Methodology** of the PEIR for information on the assessment scenarios).

5.2 Details of Proposed Scheme

5.2.1 The Project comprises a new interconnector with a capacity of up to 2.0 gigawatts (GW) between the National Electricity Transmission Systems (NETSs) of Great Britain (GB) and the Netherlands, including a connection into a wind farm located in Dutch waters. The Proposed Scheme has been geographically split into Onshore and Offshore components, with this FRA considering the Proposed Onshore Scheme, accordingly.

5.2.2 The Proposed Onshore Scheme illustrated in **Figure 2.2 Proposed Onshore Scheme** of the PEIR comprises the Kiln Lane Substation, proposed Underground HVAC Cable between the Proposed Converter Station and Kiln Lane Substation, the Proposed Converter Station, the proposed Underground HVDC Cable between the Proposed Converter Station and the proposed Landfall Site.

5.2.3 Kiln Lane Substation is the proposed connection point for the Project into the GB NETS. The current position is that there could be up to four projects, including the Project, potentially connecting to the NETS at Kiln Lane Substation: East Anglia One North (EA1N) and East Anglia Two (EA2) Offshore Windfarm projects, being promoted by Scottish Power Renewables (SPR), which have been granted consent to develop and connect to Kiln Lane Substation as part of these schemes; Sea Link electricity network reinforcement project, being promoted by NGET and is proposing to connect to Kiln Lane Substation, and the Proposed Onshore Scheme as part of the Proposed Scheme.

5.2.4 As part of a development consent granted to SPR, Kiln Lane Substation already benefits from consent, pursuant to 'The East Anglia ONE North (EA1N) Offshore Wind Farm Order 2022' and 'The East Anglia TWO (EA2) Offshore Wind Farm Order 2022'. However, as part of the Project's Connection Agreement, the Proposed Scheme will need to obtain permissions to extend Kiln Lane Substation to accommodate two new 400 kilovolts (kV) bays which will connect to the proposed Converter Station approximately 2.5km away at Saxmundham.

5.2.5 This PEIR considers two scenarios for the Kiln Lane Substation. If another scheme (EA1N/EA2, or Sea Link) constructs the Kiln Lane Substation as already consented via a separate DCO, then the Proposed Onshore Scheme would plan to amend Kiln Lane Substation. However, it is possible that the Proposed Onshore Scheme could be implemented before the aforementioned schemes. On a precautionary basis, this FRA will assume that the entirety of the Kiln Lane Substation would be constructed as part of the Proposed Scheme, and that no part of it would form committed development and the future baseline in terms of flood mitigation and ground levels.

5.2.6 In relation to the proposed Underground HVAC Cable Corridor, it would be routed in a general north-west direction from the Kiln Lane Substation. At this PEIR stage, two route options for the proposed Underground HVAC Cable Corridor are being considered. The Southern Route option (the worst case for which is considered the construction of the proposed Underground HVAC Cable Corridor for the Proposed Scheme, in addition to laying ducting within that same corridor for the Sea Link scheme), and the Northern Route option (i.e., the construction of the proposed Underground HVAC Cable Corridor for the Proposed Scheme only). **Chapter 2 Description of the Proposed Scheme**, and **Chapter 5 EIA Approach and Methodology** of this PEIR describe the consenting scenarios and their associated optionality in detail.

5.2.7 On a precautionary 'worst-case' basis, this FRA has assumed that entirety of the land identified for the proposed Undeground HVAC Cables (i.e., both route options as shown on **Figure 2.2 Proposed Onshore Scheme**) could be used for the construction of the Proposed Scheme, and that no part of it would form committed development and the future baseline in terms of flood mitigation. This is the more conservative assessment, as it encompasses all associated options that currently comprise the Proposed Scheme.

5.3 Criticality of Proposed Onshore Scheme components

5.3.1 Certain components of the Proposed Onshore Scheme are considered by the design team to be inherently more susceptible to flood related damage or impacts to the continued operation of the infrastructure comprising the Proposed Onshore Scheme (see **Table 5.1**).

Table 5.1: Components of the Proposed Onshore Scheme and their criticality

Infrastructure	Components	Critical* component?
Kiln Lane Substation	Gas Insulated Switchgear (GIS) substation to connect to the existing 400kV overhead lines	**Yes**
	Removal of one overhead line tower and installation of two new towers to turn circuits into the new substation	**Yes**

Infrastructure	Components	Critical* component?
	During construction, temporary towers and/or masts to facilitate the reconfiguration of the Overhead Line (OHL) connections	**Yes**
	Substation access road	No
	Associated mitigation and landscaping	No
Proposed Underground HVAC Cable between proposed Converter Station and Kiln Lane Substation	Underground open trenched 400kV cable sections	No
	Underground trenchless 400kV cable sections	No
	Joint bays with above ground earthing link pillars	No
Proposed Converter Station	Two buildings, containing converter equipment, up to 26m in height;	**Yes**
	One building containing converter neutral bay equipment, up to 26m in height	**Yes**
	One control building, containing control room, offices, welfare, meeting rooms, Low-Voltage Alternating Current (LVAC) and telecoms up to 15m in height	**Yes**
	Two spare parts storage buildings, up to 15m in height	No
	AC AIS switchgear yard, including AC AIS cable sealing ends within up to two buildings, up to 26m in height	**Yes**
	Converter Transformer compound, located between the Reactor Hall and the AC yard and Filter equipment	**Yes**
	Permanent access road and internal access road	No
	Site wide drainage	No
	Motion activated security lighting system	No
	Landscaping/landscape planting	No
Proposed Underground HVDC Cable between proposed Converter Station and Proposed Landfall Site	Underground open trenched 525kV cable sections	No
	Underground trenchless 525kV cable sections	No
	Underground joint bays	No
Proposed Landfall Site	Underground transition joint bay and underground trenchless cable ducts between the proposed Underground HVDC Cables and the offshore marine HVDC Cables	No

*Critical in this context refers to those components of the Proposed Scheme that, in the event of being flooded, are considered by the design team to be susceptible to damage or disruption that could affect the continued operation of the overall infrastructure.

5.4 Timescales of Proposed Scheme

5.4.1 Construction of the Proposed Scheme is expected to span from 2028 to 2032. Temporary construction compounds will be present during the construction phase.

5.4.2 The Proposed Scheme is assumed to have a design life of 40 years; however, the lifespan of components may be extended with regular maintenance and refurbishment.

5.4.3 For the purposes of this FRA, future flood risk to the Proposed Scheme will be assessed to 2125. This is in line with NPPF and PPG, and in line with the available NAFRA2 flood mapping data. At the end of its nominal design life, flood risk would require reassessment.

5.5 Development vulnerability classification

5.5.1 The Proposed Scheme is considered to be 'essential infrastructure', in accordance with the NPPF Annex 3 flood receptor vulnerability classification:

"Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including infrastructure for electricity supply including generation, storage and distribution systems; including electricity generating power stations, grid and primary substations storage; and water treatment works that need to remain operational in times of flood."

5.5.2 This classification has been confirmed in consultation feedback from the Environment Agency.

5.6 Flood Zone compatibility

5.6.1 Flood Zones are defined in the PPG for Flood Risk and Climate Change (see **Table 5.2**).

Table 5.2: Flood Zone definitions

Flood Zone	Definition
Zone 1 – Low Probability	Land having a less than 0.1% Annual Exceedance Probability (AEP) of river or sea flooding, (shown as 'clear' on the Flood Map for Planning – all land outside Zones 2, 3a and 3b).
Zone 2 – Medium Probability	Land having between a 1% and 0.1% AEP of river flooding; or land having between a 0.5% and 0.1% AEP of sea flooding.
Zone 3a – High Probability	Land having a 1% or greater AEP of river flooding; or Land having a 0.5% or greater AEP of sea flooding.
Zone 3b – Functional Floodplain	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

Flood Zone	Definition
	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 AEP 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% AEP 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).

5.6.2 Most of the Draft Order Limits are within Flood Zone 1 (low probability). However, some parts of the Draft Order Limits occupy Flood Zones 2 and 3, particularly at river crossings, which is not unexpected for a linear infrastructure project. Taken as a whole, essential infrastructure is not considered incompatible in Flood Zone 3a or 3b (functional floodplain), but the Exception Test (as defined in NPPF and PPG, see **Section 5.8** for further details) must be satisfied.

5.6.3 In these cases, in Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood. In Flood Zone 3b (functional floodplain) essential infrastructure that has passed the Exception Test, should be designed and constructed to:

a. remain operational and safe for users in times of flood;
b. result in no net loss of floodplain storage; and
c. not impede water flows and not increase flood risk elsewhere.

5.7 Sequential Test

5.7.1 The Sequential Test ensures that a sequential, risk-based approach is followed to steer new development to areas with the lowest risk of flooding. It should demonstrate that there are no reasonably available sites in areas with a lower probability of flooding from any source that would be appropriate to the type of development proposed.

5.7.2 A sequential approach has been taken in determining the location of the proposed Landfall Site, proposed Underground Cable Corridor, Kiln Lane Substation and the proposed Converter Station with flood risk being considered in the route selection process along with the numerous other technical, environmental, and socio-economic constraints. This process sought to ensure that the Proposed Scheme is sited in the areas at lowest flood risk, where possible, whilst acknowledging the flood risk of the wider area, and the need to coordinate design with other energy NSIPs within the area. Additionally, due to the nature of the Proposed Scheme and it connecting the Netherlands to the UK

under the sea and requiring a location of the proposed Landfall, this subsequently means infrastructure is required to be located within proximity to the coastline. Along with the wider interest of the local area, this process has indicated that there are no other potential sites within the proximity of the Draft Order Limits that are entirely within Flood Zone 1 and suitable for the proposed Underground Cable Corridor and the proposed infrastructure; small residual areas may need further consideration to ensure a sequential approach has been adopted to site layout. Further details of how flood risk and other factors have shaped the route selection and alternatives are provided in **Chapter 3 Alternatives and Design Evolution**.

5.8 Exception Test

5.8.1 To satisfy the Exception Test, the Proposed Scheme must demonstrate that:

a. development that has to be in a flood risk area will provide wider sustainability benefits to the community that outweigh 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.

5.8.2 This FRA outlines the requirements for assessing flood risk from all sources over the Proposed Scheme's lifetime, ensuring its design and mitigation demonstrate long-term safety without increasing risk elsewhere.

6 Consultation

6.1 Scoping opinion

6.1.1 The EIA Scoping Report was submitted in March 2024. For flood risk elements, non-statutory consultation had been held in 2022 and 2023 to inform the scoping assessment. Flood and water consultees included:

a. Environment Agency;
b. Suffolk County Council;
c. East Suffolk Council;
d. Alde and Ore Association; and
e. Parish and Town Councils.

6.1.2 Further engagement was undertaken with the Environment Agency in July 2023 and Suffolk County Council and East Suffolk Council in August 2023, and points pertaining to flood risk were the surface water flood risk at Friston (including a site visit April 2024) and coastal flood risk at the then proposed Landfall Site at Southwold (which is now no longer being taken forward).

6.1.3 The Planning Inspectorate responded with a Scoping Opinion in April 2024 for the Proposed Scheme (case reference EN020033). Details of the responses to the EIA Scoping Opinion on water and flood risk issues are provided in **Chapter 12 Hydrology, Hydrogeology and Drainage**.

6.1.4 Key points are summarised below in relation to how these have been addressed in the FRA at PEIR.

6.2 Summary of consultation feedback

6.2.1 The Environment Agency set out key requirements for FRA and climate change allowances incorporated into such assessments. Operational phase impacts to main rivers can be scoped out if it can be confirmed that no part of the scheme being assessed will result in an increase in built footprint, raising of ground levels or ground disturbance, within the 1% AEP fluvial floodplain, including an allowance for climate change. The Environment Agency advises that the construction phase needs to be assessed within 1% AEP fluvial and 0.5% AEP tidal floodplain, and in the same zones during the operational phase, but with climate change allowances. The same applies to the assessment of the decommissioning, which should be supported by a Decommissioning Environmental Management Plan.

6.2.2 The Environment Agency provided a list of the available hydraulic models and other data in the area. They reiterated the importance of due consideration being given to surface water flood risk at Friston, in relation to the Kiln Lane Substation. The Environment Agency also identified the need to assess the potential for the Proposed Scheme to impact on coastal defences, particularly near the proposed Landfall Site.

6.2.3 The LLFA advised on flood risk impacts on ordinary watercourses, and recommended the Friston Surface Water Management Plan be considered in the FRA.

6.2.4 Suffolk County Council Highways advised that several key roads such as the A12 in the study area are at risk of flooding and reliant on defences or pumping. Such routes could impact on construction phase activities as well as maintenance during operation, and decommissioning activities.

6.2.5 East Suffolk Council (district council level), will not act as the LLFA, but had previously undertaken the SFRA when partnerered as Suffolk Coastal and Waveney Councils.

6.2.6 Southwold Town Council advised that the sea wall defences maintained by the Environment Agency at Southwold have a “hold the line” policy (maintaining or upgrading coastal protection (Ref 11)), but are being outflanked and require regular maintenance work[2]. The Resilient Coast project is actively considering managed realignment of some lengths of coastline.

6.2.7 Walberswick Parish Council advised on the importance of considering coastal flood risk, especially the potential for the Proposed Scheme to impact on existing natural coastal defences such as saltmarsh and coastal margin habitats.

6.2.8 Friston Parish Council advised on the availability of more detailed information on surface water flooding at Friston, of relevance to the Kiln Lane Substation. The Friston Surface Water Management Plan and previous modelling will sought to be obtained and reviewed to inform the assessment in the subsequent ES.

6.2.9 Benhall and Sternfield Parish Council highlighted the need to consider surface water runoff management from the proposed Converter Station, which could impact on flows in a watercourse draining into the River Fromus.

6.2.10 Reydon Parish Council and Brampton with Stoven Parish Council advice pertained to a location for proposed Landfall that is no longer under consideration in the latest design.

6.2.11 The Forestry Commission identified that any tree planting schemes as part of the Proposed Scheme should maximise the ecosystem benefits wherever possible, and this would include how planting might be used to reduce flood risk.

[2] Note that consultees were commenting on an earlier design phase which included the landfall at Southwold, which is no longer being taken forward.

7 Climate Change

7.1 Overview

7.1.1 NPS EN-1 requires NSIPs to assess the potential flood risk impacts on and to the Proposed Onshore Scheme across a range of climate scenarios. PPG for FRA and climate change sets out the use of climate change allowances during planning processes to minimise vulnerability and provide resilience to the development and its users over the whole design life of the development. These allowances are derived from the Environment Agency and are considered on a management catchment scale across England. Relevant climate change allowance data should be considered by designers in assessing the most sustainable means of addressing potential climate change impacts with regards to peak river flows**,** peak rainfall intensity and sea level rise where appropriate. NPS EN-1 also requires sensitivity tests of the Proposed Onshore Scheme to credible maximum climate change scenarios.

7.1.2 The Proposed Onshore Scheme is at risk from several different flood mechanisms, and each have different approaches to incorporating climate allowances. The requirements are set out below.

7.1.3 As previously highlighted the Proposed Scheme is anticipated to have a 40 year design life, with options to extend beyond this (see **Chapter 2 Description of the Proposed Scheme** of the PEIR for further information). Therefore, on a precautionary basis this FRA will assess the risk with climate change to 2125. For construction phase works, these will be assessed based on the flood risk for present-day climate change scenarios, due to the anticipated five year length of the construction phase.

7.2 Peak river flow allowances

7.2.1 For rivers within the study area that are not tidally influenced, the anticipated change in peak river flows are provided for each management catchment (East Suffolk management catchment) (**Table 7.1**).

7.2.2 The Proposed Scheme is categorised as essential infrastructure within Annex 3 of the NPPF, and therefore the Higher Central climate change allowance[3] should used for selection of the design flood to be applied in the assessment. A credible maximum scenario should also be assessed as a sensitivity test, using the Upper End allowance.

[3] Climate change allowances are based on percentiles. A percentile describes the proportion of possible climate projection scenarios that fall below an allowance level. The 50th percentile is the point at which half of the possible scenarios for peak flow fall below it, and half fall above it. The Central allowance is based on the 50th percentile. The Higher Central allowance is based on the 70th percentile. The Upper End allowance is based on the 95th percentile.

7.2.3 The Higher Central allowance should be used for the design of safe access, escape routes and places of refuge to ensure the safety of construction and operational workers on the Proposed Scheme.

7.2.4 For assessment of off-site impacts and calculating compensatory floodplain storage, the Central allowance should generally be used. However, where an affected area contains essential infrastructure, the Higher Central allowance should be used.

Table 7.1: Peak river flow allowances for East Suffolk management catchment

Epoch	Year range	Central	Higher Central	Upper End
2020s	2015 to 2039	8%	13%	25%
2050s	2040 to 2069	7%	13%	29%
2080s	2070 to 2125	19%	**29%**	***54%***

Numbers in **bold** refer to the key uplift for design. Numbers in ***bold and italic*** refer to the uplift for the Credible Maximum scenario.

7.3 Sea level allowances

7.3.1 For areas at risk of flooding from the sea, and including tidally dominated rivers, allowances are provided for future projected coastal water levels for each river basin district (Anglian river basin district).

7.3.2 Firstly, an allowance is required for future still water return levels, accounting for sea level rise and isostatic shift (see **Table 7.2**). For a development with a lifetime to 2125, both the Higher Central and Upper End allowances should be assessed for sea level rise. A credible maximum scenario should also be assessed as a sensitivity test, using the H++ allowance, which is 1.9m of sea level rise to 2100.

7.3.3 Secondly, there are allowances for increases in offshore wind speed and extreme wave height (see **Table 7.3**). These are used to inform the impacts of overtopping of coastal defences. In some areas, the available coastal modelling has already incorporated these allowances. A credible maximum scenario should also be assessed using the sensitivity test allowances on top of the main allowances.

Table 7.2: Sea level rise allowances for still water tidal levels for Anglian river basin district

Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (m)
Higher Central	5.8 (203)	8.7 (261)	11.6 (348)	13 (390)	**1.20**
Upper End	7 (245)	11.3 (339)	15.8 (474)	18.1 (543)	**1.60**
H++			–		***1.9*** *(to 2100)*

Numbers in **bold** refer to the key uplift for design. Numbers in ***bold and italic*** refer to the uplift for the Credible Maximum scenario.

Table 7.3: Sea level rise allowances for offshore wind and extreme waves for Anglian river basin district

Allowance	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%***

Numbers in **bold** refer to the key uplift for design. Numbers in ***bold and italic*** refer to the additional uplift for the Credible Maximum scenario.

7.4 Rainfall intensity allowances

7.4.1 For site drainage and surface water flooding in smaller catchments (less than 5km^2), increased rainfall intensity allowances are provided for each management catchment (East Suffolk management catchment) (see **Table 7.4**).

7.4.2 For development with a lifetime beyond 2100, the Upper End allowance should be used for both the 3.3% (1 in 30) and 1% (1 in 100) AEP events, for the 2070s epoch. It must show there is no increase in flooding elsewhere, and the development would be safe from surface water flooding, for the Upper End 1% (1 in 100) AEP event.

Table 7.4: Rainfall intensity allowances for East Suffolk management catchment

Epoch	Year range	3.3% (1 in 30) AEP event		1% (1 in 100) AEP event	
		Central	Upper End	Central	Upper End
2050s	2040 to 2069	20%	40%	20%	45%
2070s	2061 to 2125	20%	**40%**	20%	**40%**

Numbers in **bold** refer to the key uplift for design.

8 Site Specific Flood Hazards

8.1 Introduction

8.1.1 The Proposed Scheme intersects multiple potential flood hazards from different sources. This section outlines each hazard. Climate allowances identified in the previous section are considered in assessing future flood risk and identifying gaps in available information. Recommendations to address gaps are outlined. A concluding table summarises all flood hazards across the Draft Order Limits.

8.2 Risk of flooding from the sea

8.2.1 The Flood map for planning provides flood extent data for rivers and the sea with defences and without defences, for present day and for future climate. This data is based on the latest NAFRA2 modelling and makes use of local detailed hydraulic modelling where this was available. For interactions between rivers and the sea, for example in tidally influenced rivers, the underlying hydraulic modelling may or may not have undertaken a joint probability analysis of peak river flows coinciding with high tides.

8.2.2 For flooding from the sea, this is provided for the 3.3% (1 in 30), 0.5% (1 in 200) and 0.1% (1 in 1000) AEP events. Sea and tidal flooding uses the Upper End climate allowance for 2125.

8.2.3 For the Proposed Scheme, the assessment should be made using the Higher Central allowance, with a sensitivity test to the H++ for sea level rise (for a credible maximum). Therefore the Flood map for planning climate change scenarios are expected to be generally suitable for the assessment as they provide the correct events and climate scenarios. The H++ scenario is not available at this stage however, so the 0.1% (1 in 1000) AEP event with climate is therefore used on a precautionary basis.

8.2.4 In Section C (see **Figure 2.1 Zoning Plan** of the PEIR), the Proposed Scheme passes the Minsmere River. While this may be tidally influenced, the associated flood risk is considered in the fluvial section of this assessment.

8.2.5 Section D of the Proposed Scheme is close to the sea. The Flood map for planning does not show any formal designated flood defences in this area, and consequently the defended and undefended flood extents are the same. However, AIMS data indicates numerous Environment Agency-maintained defence assets around this area, including embankments, flood walls and flood gates, natural high ground, dune systems and shingle beach embankments. Some of these are noted to be in poor condition.

8.2.6 The proposed Landfall Site at Walberswick is located on high ground and is not in an area at risk of flooding from the sea in a 0.5% (1 in 200) or 0.1% (1 in 1000) AEP event from the sea in the present day, either defended or undefended.

However, taking account the effects of future climate and sea level rise, a small portion of the south-west corner of the construction area for the proposed Landfall Site may become at risk of flooding in the 0.5% (1 in 200) AEP event by 2125; given the temporary nature of the construction compound, this is unlikely to be at risk.

8.2.7 Flooding in this area is primarily associated with coastal inundation (storm surge taking account the effects of windspeed and extreme waves), combined with flooding from the Dunwich River system, which is a designated 'main river', and discharges into the River Blyth to the north-east of the Proposed Scheme.

8.2.8 At this location, the latest Shoreline Management Plan identifies that the coastal management units include a mixture of Hold the Line policies and Managed Retreat policies. Further consideration should be given to the potential effect of any Managed Retreat and long term coastal erosion impacting on flood risk from the sea in the area of the Proposed Scheme.

8.2.9 Given that sea and tidal flood risk will require sensitivity testing to the H++ scenario, further hydraulic analysis is recommended in Section D, which will be presented as part of the subsequent ES.

8.3 Risk of flooding from rivers

8.3.1 Flood map for planning provides flood extent data from rivers and sea with defences and without defences, for present day and for future climate. This data is based on the latest NAFRA2 modelling, and combines with local detailed hydraulic modelling where available. For flooding from rivers, this is provided for the 3.3% (1 in 30), 1% (1 in 100) and 0.1% (1 in 1000) AEP events. Fluvial flooding uses the Central climate allowance for the 2080s epoch.

8.3.2 For the Proposed Scheme, the assessment should be made using the Higher Central allowance, with a sensitivity test to the Upper End (for a credible maximum). Therefore the Flood map for planning climate change scenarios are considered to be not sufficient for the assessment. The 0.1% (1 in 1000) AEP event with climate change has therefore been used in this FRA on a precautionary basis, pending explicit modelling of this hazard, which will be presented as part of the ES.

8.3.3 In Section A (see **Figure 2.1 Zoning Plan** of the PEIR):

a. The proposed Underground HVAC Cable Corridor intersects Unnamed Tributary of River Fromus 1 (including the 3.3% (1 in 30) AEP event with climate);
b. Parts of the proposed Underground HVDC Cable Corridor and proposed Converter Station are within the wider flood extents associated Unnamed Tributary of River Fromus 1 which are not shown in the Flood map for planning; however, these are indicated in the Surface water flood map, and are covered in the next section;

c. A new permanent access route for the proposed Converter Station will include a crossing of the River Fromus and associated its floodplain, which includes the 3.3% (1 in 30) AEP event with climate change; and
d. The Kiln Lane Substation and its associated construction compounds are not in an area indicated to be at risk from flooding from rivers based on the Flood map for planning.

8.3.4 In Section B:

a. The proposed Underground HVDC Cable Corridor (in a trenchless methods area) and preferred access route intersects Unnamed Tributary of Hundred River 1-2, including an area of functional floodplain (flooding in the 3.3% (1 in 30) AEP event with climate); and
b. The proposed Underground HVDC Cable Corridor (in a trenchless methods area) intersects Unnamed Tributary of Minsmere Old River 1-4, including an area of functional floodplain (flooding in the 3.3% (1 in 30) AEP event with climate). This watercourse benefits from a number of maintained flood defence assets at this location, including engineered high ground.

8.3.5 In Section C:

a. The proposed Underground HVDC Cable Corridor (in a trenchless methods area) intersects Minsmere Old River and the upper reaches of Dunwich River, including an area of functional floodplain (flooding in the 3.3% (1 in 30) AEP event with climate). Unnamed tributary of Minsmere Old River 5 intersects with the proposed access link from the A12 near Darsham.

8.3.6 In Section D, there are no further areas of the Proposed Scheme in areas associated with fluvial flood risk, beyond the tidally influenced Dunwich River that is outlined in the coastal risk section above.

8.3.7 The Historic Flood Map indicates only one area near the proposed Landfall Site that has experienced past flooding, presumably from the tidal Dunwich River and coast. The extent does not include the area for the proposed Landfall Site itself. Flooding observed in the Minsmere catchment appears to be predominantly tidally influenced and the extent does not include upstream of Middleton, or include areas within the Draft Order Limits. Absence of flooding on the Historic Flood Map should not be taken as evidence of abence of flooding.

8.3.8 There are numerous smaller watercourses that intersect or flow adjacent to the Draft Order Limits for the Proposed Scheme across much of its route, for which there is no mapped flood extents provided in the Flood map for planning rivers and sea layers. This does not mean there is no flood risk associated with these watercourses, although typically the extent may be more localised in nature. In these cases, the surface water flood risk mapping provides a useful proxy for flood hazard from these smaller watercourses, and this is therefore covered in the next section.

8.3.9 Given that fluvial flood risk for a suitable climate scenario is not available, and that there are several areas of flood risk to the Proposed Scheme or of potential flood risk to nearby receptors under the current design information, further hydraulic

modelling or hydraulic calculations will be undertaken where needed to inform the design of the Proposed Onshore Scheme for the ES to ensure it is safe from flooding for its lifetime, as well as avoiding impacts to other receptors. Engagement with the Environment Agency will be undertaken to check if existing detailed hydraulic models are suitable for use with updates.

8.4 Risk of flooding from surface water

8.4.1 Surface water flooding occurs where rainfall overwhelms the capacity of the land or drainage systems, and can occur far from rivers. Mapping tends to show flooding associated with ponding in depressions in the landscape, and overland flowpaths. Some of these overland flowpaths, as discussed above, can be associated with watercourses – and for the smaller watercourses for which no fluvial flood mapping is available, this dataset provides a useful proxy. The Flood map for planning includes Risk of Flooding from Surface Water (RoFSW) maps for present day. This data is based on the latest New National Model, which does take some account of different losses to the ground as well as for the effect of urban drainage systems. For flooding from surface water, this is provided for the 3.3% (1 in 30), 1% (1 in 100) and 0.1% (1 in 1000) AEP events. At this time, the climate change scenarios for surface water are not yet available on the Flood map for planning. The Long term flood mapping service includes the flood extents for a climate change scenario using the Central allowance for the 2040 to 2060 (2050s) epoch.

8.4.2 For this Proposed Scheme, the assessment should be made using the Upper End allowance. Therefore the available climate change scenarios are **not suitable** for the assessment without more detailed hydraulic modelling. At this stage, the 0.1% (1 in 1000) AEP event with climate has therefore been used on a precautionary basis. As set out above, further hydraulic modelling or hydraulic calculations will be undertaken where needed to inform the design of the Proposed Onshore Scheme.

8.4.3 In general much of the route has only relatively localised areas of surface water flood risk, and these tend to be concentrated in areas associated with watercourses and their valleys.

8.4.4 In Section A (see **Figure 2.1 Zoning Plan** of the PEIR):

a. The proposed Converter Station and proposed Underground HVAC Cable Corridor (including trenchless method areas, and open trenched areas) and access routes are located within substantial areas of overland flowpaths draining towards the River Fromus, with some areas at risk in the 3.3% (1 in 30) and 1% (1 in 100) AEP events with climate change. Kiln Lane Substation and associated construction compounds and access roads are within substantial areas of overland flowpaths draining towards Friston, though most of these areas are within an area of low risk of surface water flooding (1% (1 in 1000) AEP event with climate). Runoff from within the Draft Order Limits draining towards areas highly sensitive to surface water flooding, such as Friston, would require all site runoff to be managed and warrant more detailed

investigation as the design develops. The modelling developed for the Friston Surface Water Management Study may be suitable and this will sought to be obtained and reviewed to inform the assessment in the subsequent ES.

8.4.5 In Section B:

a. The proposed Underground HVDC Cable Corridor (including trenchless methods areas, and open trenched areas) and access routes intersect areas of overland flowpaths (including some associated with watercourses not shown in the fluvial flood maps), with some areas at risk in the 3.3% (1 in 30) and 1% (1 in 100) AEP events with climate change. Runoff from within the draft Order Limits drains towards areas that may be more sensitive to surface water flooding, such as at Fordley Road – and would require all site runoff to be managed.

8.4.6 In Section C:

a. The proposed Underground HVDC Cable Corridor (including trenchless method areas, and open trenched areas) and access routes intersect areas of overland flowpaths (including some associated with watercourses not shown in the fluvial flood maps), with some areas at risk in the 3.3% (1 in 30) and 1% (1 in 100) AEP events with climate change. Runoff from within the Draft Order Limits drains towards areas that may be more sensitive to surface water flooding, such as at Westleton and local roads – and would require all site runoff to be managed.

8.4.7 In Section D:

a. The proposed Landfall Site and proposed Underground HVDC Cable Corridor are in areas of negligible surface water ponding or overland flowpaths, with only some isolated ponding in landscape depressions. Two construction compounds include very small areas of surface water ponding. Runoff from within the Draft Order Limits drains towards areas that may be more sensitive to surface water flooding, such as at Walberswick – and would require all site runoff to be managed.

8.4.8 Given that surface water flood risk for a suitable climate scenario is not available, and that there are several areas of flood risk to the Proposed Scheme or of potential flood risk to nearby receptors, under the current design information, further hydraulic modelling or hydraulic calculations will be undertaken where needed to inform the design of the scheme for the ES to ensure it is safe from flooding for its lifetime, as well as avoiding impacts to other receptors. Engagement with the Environment Agency and LLFA will be undertaken to check if existing detailed hydraulic models are suitable for use with updates.

8.5 Risk of flooding from groundwater

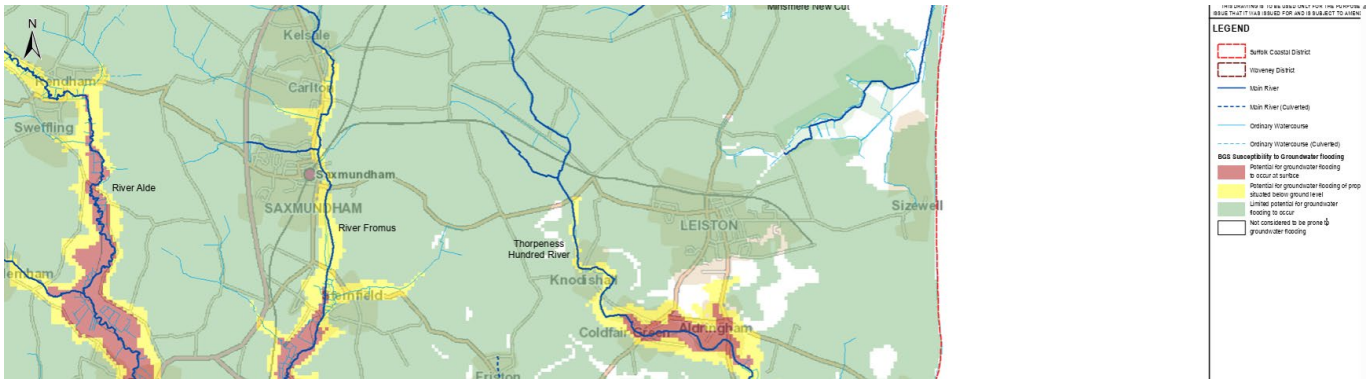
8.5.1 The British Geological Society (BGS) Susceptibility to Groundwater Flooding maps provides an indication of the potential extent of groundwater flood hazard. This data does not assess the risk because it does not quantify the likelihood or impact of emergence, only identifies areas which may be susceptible.

8.5.2 The majority of the Draft Order Limits are within areas assessed to have a limited potential for groundwater flooding to occur.

8.5.3 In Section A, there is potential for groundwater flooding of property situated below ground level in the area associated with the valley bottom of the River Fromus at Saxmundham (**Inset 8.1**). This could impact below-ground infrastructure of the Proposed Scheme in this area, which may include buried cables or piling associated with a new crossing of the River Fromus for construction access.

8.5.4 There may be other isolated locations with potential for groundwater flood risk, including anomalous discharges from springs leading to overland flow, which are not captured in the available datasets.

Inset 8.1: Extract of Susceptibility to Groundwater Flooding Map from the East Suffolk Councils Level 1 SFRA, centered on Section A.



8.6 Risk of flooding from reservoirs

8.6.1 The Long term flood mapping service includes flood extents associated with the failure of reservoirs, both for when rivers levels are normal as well as when there is also flooding from rivers.

8.6.2 Flooding from reservoirs is unlikely. An area is considered at risk if people's lives could be threatened in the event of a dam or reservoir failure. There are no areas identified in the mapping at risk from flooding from reservoirs within the Draft Order Limits of the Proposed Scheme.

8.7 Risk of flooding from other sources

8.7.1 Flood risk may come from additional sources such as Anglian Water's infrastructure (for example burst water mains or sewer flooding). Anglian Water infrastructure is being considered as part of the ongoing development of the Drainage Strategy, which will be presented as part of the subsequent ES. The generation of additional foul water discharges arising from the Proposed Scheme will be collected in sealed storage tanks and regularly emptied and disposed of in accordance with regulatory requirements.

8.8 Summary of Potential Flood Sources

8.8.1 A summary flood risk from all sources is presented in **Table 8.1**, for each area of the Proposed Onsore Scheme (see **Figure 2.1** of the PEIR).

Table 8.1: Summary of flood risk at the Draft Order Limits

Source	Flood risk in Draft Order Limits in each section shown on Figure 2.1 Zoning Plan of the PEIR
Sea	**A** – Negligible **B** – Negligible **C** – Negligible **D** – Low risk – a small area of the construction compound for the proposed Landfall Site will lie within the extent of sea flooding and flooding from the tidal Dunwich River in the 0.5% (1 in 200) AEP event after taking into account future climate change and sea level rise to 2125, but is not at risk in the present day. The potential for impacts on flooding from Managed Realignment of the coastal defences and coastal erosion should be investigated further. Given that sea and tidal flood risk will require sensitivity testing to the H++ scenario, further hydraulic analysis is recommended in Section D, which will be presented as part of the subsequent ES.
Rivers	**A** – Parts of the Proposed Scheme (including the proposed Underground Cable Corridor, associated access routes and proposed Converter Station) intersect the River Fromus (where there is a proposed new river crossing) and an Unnamed Tributary of River Fromus 1. This includes some areas at high risk of flooding (3.3% (1 in 30) AEP event with climate based on the Central allowance to 2080s). **B** – Parts of the Proposed Scheme (including the proposed Underground HVDC Cable Corridor and associated access routes) intersect with an Unnamed Tributary of Hundred River 1-2 and an Unnamed Tributary of Minsmere Old River 1-4. This includes some areas at high risk of flooding (3.3% (1 in 30) AEP event with climate based on the Central allowance to 2080s). **C** – Parts of the Proposed Scheme (including the proposed Underground HVDC Cable Corridor) intersect with upper reaches of Minsmere Old River and Dunwich River, and the access route from the A12 intersects with an Unnamed Tributary of Minsmere Old River 5. This includes some areas at high risk of flooding (3.3% (1 in 30) AEP event with a climate allowance based on the Central allowance to 2080s). **D** – Negligible (beyond that associated with the sea and tidal Dunwich River) Given that river flood risk for a suitable climate scenario is not available, and that there are several areas of flood risk to the Proposed Scheme or of potential flood risk to nearby receptors, further hydraulic Engagement with the Environment Agency will be undertaken to check if existing detailed hydraulic models are suitable for use for the subsequent ES. Given that fluvial flood risk for a suitable climate scenario is not available, and that there are several areas of flood risk to the Proposed Scheme or of potential flood risk to nearby receptors under the current design information, further hydraulic modelling or hydraulic calculations will be undertaken where needed to inform the design of the Proposed Onshore Scheme for the ES to ensure it is safe from flooding for its lifetime, as well

Source	Flood risk in Draft Order Limits in each section shown on Figure 2.1 Zoning Plan of the PEIR
	as avoiding impacts to other receptors. Engagement with the Environment Agency will be undertaken to check if existing detailed hydraulic models are suitable for use with updates. This will be presented as part of the subsequent ES.
Surface water	**A** – Parts of the Proposed Scheme (including the proposed Converter Station and proposed Underground HVAC Cable Corridor, access routes, Kiln Lane Substation and associated construction compounds) are in areas of high risk (3.3% (1 in 30) AEP events with climate change based on Central allowance to 2050s). **B** – Parts of the Proposed Scheme (including the proposed Underground HVDC Cable Corridor and associated access routes) are in areas of high risk (3.3% (1 in 30) AEP events with climate change based on Central allowance to 2050s). **C** – Parts of the Proposed Scheme (including the proposed Underground HVDC Cable Corridor and associated access routes) are in areas of high risk (3.3% (1 in 30) AEP events with climate change based on Central allowance to 2050s). **D** – The Proposed Scheme (including the proposed Underground HVDC Cable Corridor, proposed Landfall Site and associated construction compounds) are in very low risk of surface water flooding. In all areas, runoff from within the Draft Order Limits needs to be managed to prevent off-site impacts. Some areas, such as at Friston are sensitive to surface water flooding already. Given that surface water flood risk for a suitable climate scenario is not available, and that there are several areas of flood risk to the Proposed Scheme or of potential flood risk to nearby receptors, further hydraulic modelling or calculations will be presented within the subsequent ES. The modelling developed for the Friston Surface Water Management Study may be suitable and this will sought to be obtained to inform the assessment in the subsequent ES.
Groundwater	**A** – Limited potential for groundwater flooding to occur at the surface, except in the area within the valley bottom of the River Fromus where there is potential for groundwater flooding to underground assets. **B** – Limited potential for groundwater flooding to occur at the surface **C** – Limited potential for groundwater flooding to occur at the surface **D** – Limited potential for groundwater flooding to occur at the surface
Other sources	An information request on drainage incident records will be requested from Anglian Water. A utilities search is being undertaken and risks will be presented as part of the subsequent ES.

9 Flood Risk Management Measures

9.1 Key principles

9.1.1 Avoidance and mitigation measures will be taken to ensure, insofar as is reasonably practicable, the Proposed Scheme is safe from flooding for its lifetime, and that flood risk to surrounding receptors is not increased. The design flood level will be the 1% (1 in 100) AEP event in most parts of the Draft Order Limits, plus an appropriate allowance for climate change, and an appropriate freeboard allowance for residual uncertainty. In Section D, the coastal influence means the design flood at the proposed Landfall Site will be the 0.5% (1 in 200) AEP tidal event, plus climate change and sea level rise, and freeboard allowance for residual uncertainty. Temporary construction phase works such as construction compounds do not require such an extreme allowance for future climate change.

9.1.2 During construction and operation and maintenance of the Proposed Scheme, appropriate measures must be taken to ensure flood risk hazards are mitigated. The following methods are ways in which this has been addressed in the design development of the Proposed Scheme:

a. Apply a sequential approach to site layout by avoiding the location of infrastructure in areas of Flood Zone 2 or 3, insofar as is reasonably practicable. Thereafter, design components placed in areas at risk of flooding, now or in the future, to ensure that they are not susceptible, or are less susceptible, to flood damage of a kind that would disrupt operations. As the design continues to be refined, the sequential approach to site layout will remain under close consideration to avoid placing components in flood risk areas; and
b. Any remaining design elements that need to be placed in flood risk areas, following application of a sequential approach, should be designed to be compatible with floodwater in a way that avoids the need for flood defences or ground raising, insofar as is reasonably practicable. Adapting designs to raise vulnerable components above the design flood level is preferable to wholesale ground raising in Flood Zone 2 or 3, which could cause displacement of flood water and exacerbate impacts to nearby receptors.

9.1.3 It is recognised that the majority of the Proposed Scheme is subsurface electricity cables, mostly using cut-and-cover techniques, but some areas (particularly those associated with intersecting watercourses) via trenchless techniques are at a deeper level. With a suitable waterproof casing, the proposed Underground Cables themselves are compatible with being flooded. Where located in the Flood Zones, it would need to be demonstrated in the ES that the subsurface features do not impact groundwater emergence and associated runoff pathways. Therefore, it is considered that the proposed Underground Cables themselves can be located in areas at risk of flooding, following attempts

to reduce the number of or length of the proposed Underground Cable in such areas insofar as reasonably practicable.

9.1.4 The Proposed Scheme includes a number of permanent (operational phase) and temporary (construction phase) ground-level components, including the Kiln Lane Substation and the proposed Converter Station (Section A) and proposed Landfall Site (Section D). These are considered potentially susceptible to flood damage and are critical components of the operation of the Proposed Scheme. These will therefore be located outside of, or above, the relevant design flood level.

9.1.5 Across the Draft Order Limits there are various temporary construction compounds and temporary and permanent access routes. These are considered less susceptible to potential flood damage, but will be located outside of the design flood risk extent insofar as is reasonably practicable. Such components are not critical to the operation of the Proposed Scheme and would not necessarily be raised above the design flood level, depending on their relative vulnerability.

9.1.6 In additional to the design flood levels, essential infrastructure must be shown to be resilient (either continuously operating during, or quick to recover from) extreme floods, showing no risk to life. This is the 1% (1 in 1000) AEP event plus allowance for climate change.

9.1.7 Residual uncertainty analysis will be required in later detailed design stages to identify the freeboard allowance to design flood levels. At this stage, it is recommenced that the design makes a freeboard allowance assumption of at least 300mm above the design flood levels, subject to agreement with the Environment Agency.

9.1.8 Determining the design flood levels from available information may be possible in some cases with the release of the latest Environment Agency data. There are some gaps against the specific requirements for this Proposed Scheme.

Table 9.1: Flood risk assessment gaps for required climate change scenarios, timescales and design events

Source	Requirements	Available information	Proposed approach
Sea	0.5% (1 in 200) AEP Higher Central and a sensitivity test for H++ to design life of Proposed Scheme	3.3% (1 in 30), 0.5% (1 in 200), 0.1% (1 in 1000) AEP Upper End climate allowance for 2125	Design to (0.5%) 1 in 200 AEP event with Upper End to 2125 on precautionary basis Sensitivity test using 0.1% (1 in 1000) AEP event with Upper End to 2125 in lieu of H++

Source	Requirements	Available information	Proposed approach
			Further hydraulic analysis to feed into ES
Fluvial (rivers)	1% (1 in 100) AEP Higher Central and a sensitivity test for Upper End to design life of Proposed Scheme	3.3% (1 in 30), 1% (1 in 100), 0.1% (1 in 1000) AEP Central climate allowance for the 2080s epoch	Design and sensitivity test using 0.1% (1 in 1000) AEP event with Central to 2080s Further hydraulic modelling to feed into ES
Surface water	1% (1 in 100) AEP Upper End to design life of Proposed Scheme	3.3% (1 in 30), 1% (1 in 100), 0.1% (1 in 1000) AEP Central climate allowance for 2050s epoch	Design to 0.1% (1 in 1000) AEP event to 2050s Further hydraulic modelling to feed into ES

9.1.9 Raising components of the Proposed Scheme above the design flood level can displace flood waters elsewhere. Any displacement of flood water in Flood Zone 3, where shown to be unavoidable following other design and embedded mitigation, will need to be compensated on a level for level, volume for volume basis to the satisfaction of the Environment Agency. This would normally be assessed for a range of floods up to and including the 1% (1 in 100) AEP for rivers or 0.5% (1 in 200) AEP for sea, with an allowance for climate change using the Central allowance (or Higher Central if nearby receptors include essential infrastructure). In addition to mitigating the displacement, impacts on overland flow pathways over the floodplain will also need to be considered and demonstrated to not result in any localised flood impacts. This also applies to bridges or other structures across the river, during the temporary construction phase or the permanent scheme design – these will follow a similar mitigation hierarchy.

9.1.10 Further details of the drainage will be provided in the drainage strategy that will support the subsequent ES. This will show how flow rates and runoff from all hard-standing areas will be controlled, including through use of SuDS .

9.1.11 New crossings of watercourses will be avoided insofar as is reasonably practicable, with a preference to reuse existing crossing points and structures wherever possible. Appropriate crossing methods will be confirmed for the ES following reconnaissance surveys to confirm the receptor value of the watercourse and likely impact which may include clear span bridges or trenchless methods. Any new structures will be sized to convey the design flood, with an allowance for climate change and blockage risks. This may require hydraulic calculations or localised hydraulic modelling, for example to identify an appropriate soffit height for the deck of the proposed river crossing at River Fromus on the access routes to the proposed Converter Station. However,

consideration will also be given to ensure that reducing any existing constrictions would not inadvertently increase the flows downstream and cause flooding.

9.1.12 For access tracks situated in Flood Zones, it must be demonstrated that a safe and suitable means of access and egress to the Proposed Onshore Scheme will remain available during flooding events. While there are no formal flood defences on rivers or coast in this area, meaning there is no hazard associated with breaches, hazard mapping will be used to identify if there are any localised risks to staff occupying the site for operational and both scheduled and ad-hoc maintenance activities. Following the construction phase, it is not expected that staff would be on site continuously through the operational phase of the Proposed Scheme.

9.1.13 Liaison with environmental design and assessment specialists will continue to be undertaken to consider opportunities to enhance watercourse crossings and river corridors for biodiversity, fish passage and flood risk.

9.1.14 To steer the sequential approach to site layout at PEIR, the FRA has used the available flood risk information including the Environment Agency's NAFRA2 data, using suitable proxies on a precautionary basis where the available climate allowance scenarios do not align with the prescribed requirements for the Proposed Scheme. Some detailed hydraulic modelling or hydraulic calculations, such as for sizing new crossings, may be considered necessary at later stages of the design development and submitted with the ES.

10 Conclusion

10.1.1 This site-specific FRA has been prepared for the Proposed Onshore Scheme. The document accompanies the PEIR for the Proposed Scheme, and is based on the latest design information available of the route and the proposed construction.

10.1.2 While much of the Proposed Scheme has avoided locations in areas of flood risk through previous route selection, the route inevitably intersects some watercourses and flood risk areas. While essential infrastructure is considered to be acceptable in Flood zone 3, this is subject to satisfying the exception test.

10.1.3 Flood risk from all sources has been considered, both now and into the future. With the latest NAFRA2 flood risk data from the Environment Agency, flood extents for future climate scenarios are now available nationally. In most cases, the climate scenarios are compatible with the requirements in the PPG and the anticipated design life of the Proposed Scheme. The available data has been compared to the required scenarios, and have been used here as the basis for the assessment, particularly where they potentially overestimate likely flood risk on a precautionary basis. Some detailed hydraulic modelling or hydraulic calculations may be considered necessary at later stages of the design development and submitted with the ES.

10.1.4 This FRA sets out flood risk management principles that will be considered as the design of the Proposed Scheme progresses. The priority is to avoid placing components that are susceptible to disruption or damage in areas at risk of flooding from any source. Most of the Proposed Scheme is below-ground infrastructure, and beneath most river corridors will be constructed using trenchless techniques to avoid disturbance at the surface. Most of the above ground infrastructure, such as the proposed Converter Station, and Kiln Lane Substation (which may be consented and delivered by another project before the Proposed Scheme is completed) will be located outside of areas at risk from flooding from rivers or surface water. Small residual areas may need further consideration to ensure a sequential approach has been adopted to site layout. Localised measures may be required to raise critical components above the design flood level, where there are no options to avoid locating them in flood zones. These measures will ensure they remain operational in times of flood, but will avoid land raising.

10.1.5 All areas of the Proposed Scheme will require careful consideration of off-site effects. This will include assessment and mitigation of increases in the areas of impermeable surface, either temporarily during construction, or permanently during operation of the Proposed Scheme. This will be set out within the forthcoming ES. Details of the drainage management will be set out in the drainage strategy that will support the subsequent ES.

Topic Glossary

Acronym/ Phrase/ Abbreviation	Definition
AEP	Annual Exceedance Probability
AIMS	Asset Information Management System
EA1N	East Anglia One North
EA2	East Anglia Two
Flood Zone 1	Low probability. Land having a less than 0.1% AEP of river or sea flooding. (Shown as 'clear' on the Flood Map for Planning – all land outside Zones 2, 3a and 3b)
Flood Zone 2	Medium probability. Land having between a 1% and 0.1% AEP of river flooding; or land having between a 0.5% and 0.1% AEP of sea flooding.
Flood Zone 3a	High probability. Land having a 1% or greater AEP of river flooding; or Land having a 0.5% or greater AEP of sea flooding.
Flood Zone 3b	Functional floodplain. 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 AEP 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% AEP 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).
FRA	Flood risk assessment
GB	Great Britain
GIS	Gas Insulated Switchgear
GW	Gigawatts
IDB	Internal Drainage Board
kV	Kilovolts
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
NAFRA2	The second National Flood Risk Assessment, and associated flood risk mapping products

Acronym/ Phrase/ Abbreviation	Definition
NETS	National Electricity Transmission Systems
NGLLL	National Grid Lionlink Limited
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Projects
OHL	Overhead Line
PEIR	Preliminary Environmental Information Report
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Practice Guidance
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SMP	Shoreline Management Plan
SPR	Scottish Power Renewables
SuDS	Sustainable Drainage System
SWMP	Surface Water Management Plan
XLPE	Cross linked polyethylene

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