NORTH FALLS

Offshore Wind Farm

ENVIRONMENTAL STATEMENT

Appendix 21.3 Flood Risk Assessment

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Glossary of Acronyms

AEP	Annual Exceedance Probability
AIL	Abnormal indivisible loads
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty (now known as National Landscapes)
AP	Annual Probability
AStGWF	Areas Susceptible to Groundwater Flooding
BGS	British Geological Survey
CDA	Critical Drainage Area
CFMP	Catchment Flood Management Plan
CIRIA	Construction Industry Research and Information Association
DCO	Development Consent Order
Defra	Department for the Environment and Rural Affairs
DNO	Distribution Network Operation
EIA	Environmental Impact Assessment
EN-1	Overarching National Policy Statement for Energy
ES	Environmental Statement
FRA	Flood Risk Assessment
HDD	Horizontal Directional Drilling
HDPE	High-density polyethylene
HGV	Heavy Goods Vehicle
IDB	Internal Drainage Board
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
LNR	Local Nature Reserve
MLWS	Mean Low Water Springs
NFM	Natural Flood Management
NFOW	North Falls Offshore Wind Limited
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
OCoCP	Outline Code of Construction Practice
PEIR	Preliminary Environmental Information Report
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Practice Guidance
RBD	River Basin District
RBMP	River Basin Management Plan
SAC	Special Area of Conservation
SFRA	Strategic Flood Risk Assessment
SMP	Shoreline Management Plan

SPA	Special Protection Area
SPZ	Source Protection Zones
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
TJB	Transition joint bays
UKCP18	United Kingdom Climate Projections 2018
WFD	Water Framework Directive

Glossary of Terminology

Aquifer	Geological strata that hold water.
Coastal catchment	Land which drains directly to the coastal or estuarine waters, rather than through a river water body – not part of a river water body catchment.
Coastal / tidal flooding	When high tide events overtop the shoreline to cause flooding to land behind.
Fluvial flooding	When flows within watercourses exceed the capacity of the watercourse causing out of bank flows.
Geomorphology	The study of landforms and the processes that shape them.
Groundwater	Water stored below the ground in rocks or other geological strata.
Horizontal directional drill (HDD)	Trenchless technique to bring the offshore export cables ashore at landfall. The technique will also be the primary trenchless technique used for installation of the onshore export cables at sensitive areas of the onshore cable route.
Landfall	The location where the offshore export cables come ashore at Kirby Brook.
Landfall compound	Compound at landfall within which horizontal directional drill (HDD) or other trenchless technique would take place.
Link boxes	Underground chambers or above ground cabinets next to the onshore export cables housing low voltage electrical earthing links.
Main River	Usually larger rivers and streams. The Environment Agency carries out maintenance, improvement or construction work on Main Rivers to manage flood risk.
National Grid connection point	The grid connection location for the Project. National Grid are proposing to construct new electrical infrastructure (a new substation) to allow the Project to connect to the grid, and this new infrastructure will be located at the National Grid connection point.
Onshore cable route	Onshore route within which the onshore export cables and associated infrastructure would be located.
Onshore export cables	The cables which take the electricity from landfall to the onshore substation. These comprise High Voltage Alternative Current (HVAC) cables, buried underground.
Onshore project area	The boundary within which all onshore infrastructure required for the Project will be located (i.e. landfall; onshore cable route, accesses, construction compounds; onshore substation and cables to the National Grid substation).
Onshore scoping area	The boundary in which all onshore infrastructure required for the Project will be located, as considered within the North Falls EIA Scoping Report.
Onshore substation	A compound containing electrical equipment required to transform and stabilise electricity generated by the Project so that it can be connected to the National Grid.
Onshore substation construction compound	Area set aside to facilitate construction of the onshore substation. Will be located adjacent to the onshore substation.
Onshore substation works area	Area within which all temporary and permanent works associated within the onshore substation are located, including onshore substation, construction compound, access, landscaping, drainage and earthworks.
Ordinary Watercourse	Any watercourse that is not classed as a Main River is called an 'Ordinary Watercourses'. Lead Local Flood Authorities, District Councils and Internal Drainage Boards have the powers to carry out flood risk management work on Ordinary Watercourses.
The Applicant	North Falls Offshore Wind Farm Limited (NFOW).
The Project Or 'North Falls'	North Falls Offshore Wind Farm, including all onshore and offshore infrastructure.

Temporary construction compound	Area set aside to facilitate construction of the onshore cable route. Will be located adjacent to the onshore cable route, with access to the highway where required.
Transition joint bay	Underground structures that house the joints between the offshore export cables and the onshore export cables.
Trenchless crossing	Use of a technique to install limited lengths of cable below ground without the need to excavate a trench from the surface, used in sensitive areas of the onshore cable route to prevent surface disturbance. Includes techniques such as HDD.
Surface water flooding	Surface water flooding occurs when rainwater does not drain away through normal drainage systems or soak into the ground but lies on or flows over the ground instead.

1 Introduction

1.1 Project overview

1. North Falls Offshore Wind Farm Limited (hereafter 'NFOW' or 'the Applicant') is proposing to construct an offshore wind farm off the coast of Essex, with the landfall located between Clacton-on-Sea and Frinton-on-Sea, at Kirby Brook, named the North Falls Offshore Wind Farm (hereafter 'North Falls' or 'the Project').

2. North Falls will include a number of offshore and onshore elements, including an offshore wind farm, offshore export cables to landfall, onshore export cables and an onshore substation for connection to the electricity transmission network. Environmental Statement (ES) Chapter 5 Project Description (Document Reference: 3.1.7) provides a full description of the main components of the Project, including details on construction, operation, maintenance and decommission.

3. It is noted that the North Falls Environmental Impact Assessment (EIA), reported in the ES, is based on a design envelope approach. The design envelope sets maximum and minimum parameters, where appropriate, to ensure the worst case scenario can be quantified and is assessed in the EIA. The final design of North Falls will lie within the range of parameters assessed in the EIA. For example, the siting of key elements of the Project infrastructure are limited to the locations identified in the EIA.

4. Refinements to the design of the Project have been undertaken following the release of the Preliminary Environmental Information Report (PEIR) and the subsequent receipt of comments from regulators and key stakeholders. These design refinements have been considered in this update to the Flood Risk Assessment (FRA) from that provided within the PEIR.

5. The final design and siting of the Project infrastructure will be confirmed through detailed engineering design studies that will be undertaken post-consent. In order to provide a precautionary yet robust assessment at this stage of the development process, a worst-case scenario has been considered in terms of the potential flood risk impact that may arise.

6. The following document comprises a FRA which has been developed to support ES Chapter 21 Water Resources and Flood Risk of the ES (Document Reference: 3.1.23).

1.2 Aims

7. The aim of this FRA is to provide sufficient justification to regulators and other stakeholders that the Project is appropriate and in line with planning and national policy requirements regarding flood risk. The assessment is proportionate to the scale and nature of the Project, as required by national policy.

8. The aims of this FRA are:

   - To establish whether the Project is likely to be affected by current or future flooding from any source of flood risk;

- To assess and identify the potential for the Project to increase flood risk elsewhere to off-site receptors;
- To provide recommendations on potential measures required to reduce flood risk, if applicable; and
- To provide information required to support the ES with regards to flooding, supported by the application of the Sequential Test and, where necessary, the Exception Test.

1.3 Methodology

9. This FRA has been prepared in accordance with the methodology and guidance set out in:

- EN-1 Overarching National Policy Statement for Energy (Department for Energy Security and Net Zero (DESNZ), November 2023);
- National Planning Policy Framework (NPPF) (Ministry of Housing, Communities & Local Government, December 2023);
- Planning Practice Guidance (PPG) for Flood Risk and Coastal Change (Ministry of Housing, Communities & Local Government, 2022); and
- Environment Agency Flood risk assessments: climate change allowances guidance (Environment Agency, 2022).

10. The NPS EN-1 states in Paragraph 5.8.6 and 5.8.7 that:

"The aims of planning policy on development and flood risk are to ensure that flood risk from all sources of flooding is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to steer new development to areas with the lowest risk of flooding.

Where new energy infrastructure is, exceptionally, necessary in flood risk areas (for example where there are no reasonably available sites in areas at lower risk), policy aims to make it safe for its lifetime without increasing flood risk elsewhere and, where possible, by reducing flood risk overall. It should also be designed and constructed to remain operational in times of flood."

11. Furthermore, the Environment Agency originally published its guidance on climate change allowances for FRAs in February 2016, which was subsequently updated in July 2021 and May 2022.

12. The latest climate change guidance sets out the Environment Agency's recommended climate change allowances for development when considering flood risk and coastal change for planning purposes (Environment Agency, 2022).

13. The latest Environment Agency guidance summarises the values to be used, how to apply the peak river allowances as well as the approach with regard to peak rainfall allowances. The guidance on peak river flow allowances included amendments to utilise the UK Climate Projections 2018 (UKCP18) and provides a change of approach from the use of river basin districts to the use of management catchments. Additionally, it includes guidance on how to apply peak river flow allowances whereby the Central allowance is to be adopted for

all assessments except for Essential Infrastructure, where the Higher Central allowance is to be applied.

14. The guidance on the values for peak rainfall allowance are provided for 1% annual probability (AP) events and for 3.3% AP events, as well as two future epochs rather than the three epochs outlined in previous guidance. Furthermore, the guidance on the approach to adopt for the application of peak rainfall allowances confirms the use of the Central allowance for development with a lifetime up to 2100 and the Upper End allowance for development with a lifetime from 2100 to 2125.

15. The relevance and applicability of the above policy and guidance has been considered within this FRA. In addition, the appropriate climate change allowances have been reviewed and included within Section 6 of this FRA.

1.4 Study Area

16. Due to the scale of the Project spanning an area from the East Anglian coastline to approximately 24km inland, the flood risk varies across the onshore project area.

17. Therefore, to aid in this assessment, the onshore project area has been sub-divided into key sections within this document.

18. The flood risk to the landfall, onshore cable route and onshore substation are identified separately within this FRA.

19. Furthermore, the assessment relating to flood risk connected to the onshore cable route is further sub-divided into categories based on the Water Framework Directive (WFD) Surface Water Operational Catchments (see ES Figure 21.1 (Document Reference: 3.2.17)) as outlined below:

- Landfall and Onshore Cable Route Section 1 – Holland Brook (South);
- Onshore Cable Route Section 2 – Coastal Catchment;
- Onshore Cable Route Section 3 – Holland Brook (North) and Wrabness Brook; and
- Onshore Cable Route Section 4 – Tenpenny Brook.

20. This FRA is structured to introduce all relevant polices and guidance for FRAs and identify the existing flood risk within the onshore project area for each element of the Project.

21. Following the identification of the flood risk to each element of the Project, mitigation measures related to the construction and operation of these are then discussed to ensure that there is no increase in flood risk either to, or as a result of, the Project.

2 Policy, Guidance and Consultation

2.1 Policy and guidance overview

22. Table 1 outlines all documents that are referenced in this FRA. In the following sections, the documents and their constraints related to the Project are discussed in greater detail.

Table 1 Summary of Policy and Guidance Documents

Policy or Guidance Document	Author / Produced on behalf of	Year Published
EN-1 Overarching National Policy Statement for Energy	DESNZ	November 2023
National Planning Policy Framework	Ministry of Housing, Communities and Local Government	2012, updated December 2023
Planning Practice Guidance (PPG) for Flood Risk and Coastal Change	Ministry of Housing, Communities & Local Government	2014, updated 2022
Flood risk assessments: climate change allowances guidance	Environment Agency	2016, latest update in May 2022
Essex Lead Local Flood Authority (LLFA) Design Guide	Essex County Council	Version 6, March 2019, updated 2022
Preliminary Flood Risk Assessment (PFRA)	Essex County Council	2011
Strategic Flood Risk Assessment (SFRA) Level 1 Tendring SFRA	Tendring District Council	2009
Addendum to the Level 1 Tendring SFRA	Tendring District Council	2017
Tendring Local Plan 2013 – 2033	Tendring District Council	Adopted January 2021
Core Strategy for Tendring	Tendring District Council	Adopted 2010
Essex Local Flood Risk Management Strategy (LFRMS)	Essex County Council	2018
North Essex Catchment Flood Management Plan (CFMP)	Environment Agency	2009
SMP8: Landguard Point to Two Tree Island (SMP)	East Anglia Coastal Group	2012

2.2 EN-1 Overarching National Policy Statement for Energy

23. The EN-1 Overarching NPS for Energy (November 2023) comprises an update to the EN-1 Overarching National Policy Statement (NPS) for Energy (2011)

24. It is noted that the policy set out within EN-1 Overarching NPS for Energy (November 2023) is aligned with the guidance set out in NPPF and the supporting PPG.

25. The EN-1 NPS states in Paragraph 5.8.6 and 5.8.7 that:

"The aims of planning policy on development and flood risk are to ensure that flood risk from all sources of flooding is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to steer new development to areas with the lowest risk of flooding.

Where new energy infrastructure is, exceptionally, necessary in flood risk areas (for example where there are no reasonably available sites in areas at lower risk), policy aims to make it safe for its lifetime without increasing flood risk elsewhere and, where possible, by reducing flood risk overall. It should also be designed and constructed to remain operational in times of flood."

26. It provides guidance on the decision-making process adopted by the Secretary of State, the application of the Sequential Test (and Exception Test, where required) as well as a summary on the need for appropriate mitigation measures.

27. This assessment has sought to consider the policy with regards to flood risk as set out in the EN-1 Overarching NPS for Energy (November 2023), wherever practicable, to mitigate the impact of flood risk both to and from the Project.

2.3 National Planning Policy Framework and flood risk guidance documents

28. NPPF (Ministry of Housing, Communities and Local Government, 2023), PPG for Flood Risk and Coastal Change (Ministry of Housing, Communities and Local Government, 2022) and 'Flood risk assessments: climate change allowances guidance' (Environment Agency, 2022) provide direction on how flood risk should be considered at all stages of the planning and development process. While the NPPF does not directly relate to NSIPs like the NPS EN-1, it provides useful further guidance on the management of flood risk and application of the Sequential and Exception tests.

29. The planning system should ensure that new development is safe and not exposed unnecessarily to the risks associated with flooding. This FRA sets out the planning and wider context within which the Project needs to be considered, along with the flood risk to the onshore project area.

30. The revised NPPF (December 2023) provides clarification that all strategic policies and plans should apply a sequential, risk-based approach to the location of development, taking into account all sources of flood risk. It also provides guidance on how this is to be considered in the context of the location of site-specific development.

31. Further guidance, on the application of the Sequential Test and Exception Test is provided in the supporting PPG (Ministry of Levelling Up, Communities and Local Government, 2022) in terms of all sources of flood risk, Flood Zones and the Vulnerability Classification relevant to the development.

32. Within the supporting PPG (Paragraph 027), it is noted that:

"For nationally or regionally important infrastructure the area of search to which the Sequential Test could be applied will be wider than the local planning authority boundary."

33. As is required for Nationally Significant Infrastructure Projects (NSIPs), the Project has been subject to an extensive search and site selection process, as demonstrated by ES Chapter 4 Site Selection and Assessment of Alternatives (Document Reference: 3.1.6), which included consideration of flood risk issues as part of the assessment.

34. The 2022 update to the PPG requires the Sequential Test to assess the flood risk from all sources, in terms of development vulnerability for reasonably alternative sites.

35. For the purposes of the FRA, based on the indicative flood risk issues in relation to the Project, the application of a sequential approach has been considered, specifically with regard to the onshore substation, as this will comprise the only above ground infrastructure once operational.

36. This assessment has sought to consider the potential flood risk from all sources in greater detail with the aim of sequentially locating it, wherever practicable, to avoid the risk. Further details with regard to the consideration of the Sequential Test, and where necessary the Exception Test, are provided in Section 5 of this FRA.

2.4 Tendring Local Plan 2013 – 2033

37. The Tendring Local Plan was adopted in January 2021. Of specific relevance to the Project is *Policy PPL 1 Development and Flood Risk* which states:

"All development proposals should include appropriate measures to respond to the risk of flooding on and / or off site. Within the Flood Zone (which includes Flood Zones 2 and 3, as defined by the Environment Agency) shown on the Policies Map and Local Maps, or elsewhere involving sites of 1ha or more, development proposals must be accompanied by a Flood Risk Assessment. Where development is classified as "more vulnerable" the Flood Risk Assessment (FRA) should demonstrate that there will be no internal flooding in the event of a "design event flood". The FRA should demonstrate that in the event of a breach or failure of flood defence infrastructure, refuge will be available above flood levels and that a means of escape is possible from first floor level.

All development classified as "More Vulnerable" or "Highly Vulnerable" within Flood Zone 2 and 3 should set finished floor levels 300mm above the known or modelled 1 in 100 annual probability (1% Annual Exceedance Probability (AEP)) flood level including an allowance for climate change.

All new development within Flood Zones 2 and 3 must not result in a net loss of flood storage capacity, unless there is compensation on site or, if not possible, adjacent offsite capacity. Where possible opportunities should be sought to achieve an increase in floodplain storage.

All major development proposals should consider the potential for new Blue and Green Infrastructure to help mitigate potential flood risk and include such Green Infrastructure, where appropriate.

All development proposals will be considered against the National Planning Policy Framework's 'Sequential Test', to direct development toward sites at the lowest risk of flooding, unless they involve land specifically allocated for development on the Policies Maps or Local Maps.

Where new development cannot be located in an area of lower flood risk and is otherwise sustainable, the Exception Test will be applied in accordance with the National Planning Policy Framework so that it is safe and meets wider sustainability needs."

38. The remainder of this FRA demonstrates how the Project will be delivered in accordance with the guidance set out in Policy PPL 1 above.

2.5 Preliminary Flood Risk Assessment

39. A PFRA was produced in July 2011 (Essex County Council, 2011) to assist Essex County Council in its duties to manage local flood risk and deliver its requirements under the Flood Risk Regulations 2009.

40. The PFRA provides a high-level overview of the potential risk of flooding from local sources and identifies areas at flood risk which may require more detailed studies. The PFRA was used to inform the development of the North Essex LFRMS.

41. Given the results of the PFRA are incorporated within the LFRMS, a detailed review of the PFRA was not undertaken as part of this FRA. Furthermore, this FRA has carried out an assessment of the information contained within the LFRMS in the following section.

2.6 Local Flood Risk Management Strategy

42. Essex County Council produced the LFRMS in 2018 (Essex County Council, 2018), which outlines the aims and objectives of the Council in their role as the LLFA and provides policies based on these aims.

43. The Town and Country Planning (Consultation) (England) Direction 2021 notes that flood risk areas include *"Flood Zone 1 which has critical drainage problems, and which has been notified for the purposes of article 10 of the Order to the local planning authority by the Environment Agency"*.

44. These are identified by the Environment Agency as Critical Drainage Areas (CDAs).

45. Consideration of CDAs is necessary to inform key flood risk priorities. From a review of the LFRMS, and online mapping provided by Essex County Council, none of the locations within the onshore project area appear to be within areas designated as CDAs.

2.7 Strategic Flood Risk Assessment(s)

46. A Strategic Flood Risk Assessment (SFRA) is a high-level strategic document carried out by local authorities to provide a comprehensive and robust appraisal of the extent and nature of flood risk from all sources of flooding, at present and in the future. The SFRA takes into consideration the impacts of climate change and assesses the impact that land use changes and development are likely to have on flood risk.

47. Tendring District Council produced the Tendring District Level 1 and Level 2 SFRA in 2009. In addition, an addendum to the Tendring SFRA was published in 2017. This included a review of updates to the modelling for the Holland Brook and the Kirby Brook, which are considered to be relevant to the Project.

48. The Level 1 Tendring District SFRA informs the Local Plan for development by delineating areas that are at high risk of flooding from tidal, fluvial and surface water sources. Therefore, development sites will be required to pass the

Sequential and, where necessary, Exception Tests in accordance with the NPPF.

49. The onshore substation is partially located within the area defined by the site allocation ‘3 Parcels land Newhall Farm Horsley Cross, Bromley Rd Lt Bromley Ardleigh Rd Little Bromley UC4.5 (165)’ set out within the SFRA, although the SFRA notes that there is a varying flood risk for this site allocation parcel of land.

50. In the 2017 addendum to the Tendring SFRA consideration was given to updated policy and guidance, and the site allocation ‘3 Parcels land Newhall Farm Horsley Cross, Bromley Rd Lt Bromley Ardleigh Rd Little Bromley UC4.5 (165)’.

51. This addendum confirms 60% of the site allocation is in Flood Zone 1, whilst 40% of the site allocation is in Flood Zone 2 and 3. A review of the mapping contained within the addendum confirms that the area at risk of flooding is to the south of Little Bromley Road / Ardleigh Road. The onshore substation is located outside of this area, in Flood Zone 1, and therefore is at low risk of flooding. The 2017 addendum to the Tendring SFRA also notes the presence of a surface water flow path through the site and this has been considered and discussed further within this FRA.

2.8 Catchment Flood Management Plan

52. Catchment Flood Management Plans (CFMPs) consider all types of inland flooding including from rivers, groundwater, surface water and tidal flooding. Flooding directly from the sea (coastal flooding) is covered in Shoreline Management Plans (SMPs), which is discussed further in Section 2.9.

53. CFMPs consider the likely impacts of climate change, the effects of how we manage the land and how areas can be developed sustainably to establish flood risk management policies which will deliver sustainable flood risk management for the long term.

54. The onshore project area is covered by the North Essex CFMP (2009). The onshore project area is located in Sub-area 1. Blackwater and Chelmer, Upper Reaches and Coastal Stream.

55. The policy for this Sub-area is Policy 2 which is classed as ‘*areas of low to moderate flood risk where the Environment Agency can generally reduce flood risk management activities*’.

56. The onshore project area includes the relatively small Environment Agency Main River, the Holland Brook, which drains southwards into the North Sea at Holland Haven, numerous Ordinary Watercourses which also drain into the North Sea, either at Hamford Water National Nature Reserve to the east, or into Holland Haven to the south.

57. The North Essex CFMP indicates the main source of flood risk within this Sub-area is tidal flooding from the North Sea in the southern extent of the Project, and fluvial flooding from the Holland Brook to the inland elements of the onshore cable route. The Holland Brook outfalls through coastal defences, so is prone to tidal locking, which could be exacerbated by future sea level rises.

2.9 Shoreline Management Plan

58. Shoreline Management Plans (SMPs) are non-statutory plans for coastal defence management planning. They aim to identify the best ways to manage flood and erosion risk and develop an 'intent of management' for the shoreline.

59. The onshore project area is covered by SMP8: Languard Point to Two Tree Island and specifically, the landfall is located within Policy Unit C2: Holland Haven.

60. The preferred policy for the short term (present day - 2025) and medium term (2025 – 2055) for this policy unit is 'Hold the Line'. In addition, the preferred policy for the long term (2055 – 2105) is 'Hold the Line / Managed Realignment (low lying ground at risk)'.

61. The Languard Point to Two Tree Island SMP states the following regarding Policy Unit C2:

"At Holland Haven (PDZ C2) the defences are under pressure and a landward realignment would create a more sustainable situation by reducing the pressure on defences and moving towards a more natural coastal frontage. However, the situation is complex and sensitive.

The SMP's intent of management for Holland-on-Sea is to support a long term sustainable solution and adaptation. In the short term and the medium term, the intent is to hold the existing frontline defences where they are now.

After 2055 a dual policy means that the existing frontline defences may be held where they are currently, or some form of Managed realignment may be implemented. It needs to be noted that in the long term, holding the line at this frontage will be challenging, and funding may have to come from a variety of sources. In both cases, so also if Managed realignment takes place, all dwellings and infrastructure will remain protected, which will require moving some of the defences to a more sustainable sheltered position.

Whether the policy in Epoch 3 is Hold the line or Managed realignment, all dwellings and infrastructure will remain protected, which will require moving some of the defences to a more sustainable sheltered position but this would need to be explored more fully in the future with full community consultation before finalising a policy option. The importance of protecting Holland Sewerage Treatment Works was recognised by the Elected Members Forum and this was seen as a priority for protection for the next 100 years.

This realignment would impact on the Holland Haven Country Park and the Frinton-on-Sea Golf Course. The realignment would create new intertidal habitats and opportunities for new forms of tourism and recreation. It would have some impact on heritage assets, particularly the archaeological potential within the realignment area, which would require mitigation by design and recording as part of implementation of the Plan. The footpaths on top of and toward the sea bank to be breached would need to be sustained, for example through re-routing. The impact of the potential realignment on tourism and recreation is difficult to quantify, and realignments can have both positive and negative impacts. This impact will be taken into account during project appraisal and scheme development, which would be carried out with full stakeholder involvement before any works start."

62. As the Project would make landfall in proximity to a number of the features identified within Policy Unit C2, this should be considered with regard to any long-term impacts this may have on the Project once operational.

2.10 Flood risk stakeholders and consultation

63. The onshore project area is located within the authority area of Essex County Council, as the LLFA, and Tendring District Council.

64. Under the Flood and Water Management Act 2010, LLFAs are responsible for managing flooding from surface water, groundwater and Ordinary Watercourses. Among other responsibilities they are required to deliver a strategy for local flood risk management in their areas, to investigate flooding and to maintain a register of flood risk assets.

65. As the LLFA, Essex County Council is also responsible for consenting works that affect the flow of an Ordinary Watercourse under the terms of the Flood and Water Management Act 2010, Land Drainage Act 1991 and Water Resources Act 1991.

66. The Environment Agency is also a key flood risk stakeholder to the Project, due to their management of the Main Rivers that the onshore cable route will be required to cross.

67. A review of the mapping provided by the Association of Drainage Authorities has confirmed that the onshore project area is not situated within an area subject to management or overview by an Internal Drainage Board (IDB).

68. To accurately ascertain potential flood risk to the Project, Product 4, 5 and 8 data packages[1] were requested from the Environment Agency, and information provided on 5th October 2022 for key locations related to strategic watercourse crossings along the onshore cable route, landfall and the onshore substation.

69. The Environment Agency provided a response on 1st November 2022 and the information provided as part of this data request has been considered within this FRA.

70. In addition, an email data request was submitted to Essex County Council, as the LLFA, on 5th October 2022, and a response was received on the same date (5th October 2022).

71. Within the email response, guidance was provided confirming that basic information such as flood risk, flood assets and previous flood investigations can be found on their website. On this basis, the online information has been reviewed as part of this FRA.

[1] Product 4: This product is a detailed FRA map. It shows detailed flood data, flood defence locations and attributes, data on past flood events, modelled flood levels and extents and flood defence breach hazard information, if available. The models show the model extents and modelled flood levels and flows at one or more specific points. This could either be within the river channel or, if available, in the floodplain.
Product 5: This product is a report which includes flood modelling and hydrology reports.
Product 8: Flood defence breach hazard information.

72. A summary of the consultation undertaken with key stakeholders with regards to flood risk is provided in Section 21.2 of ES Chapter 21 Water Resources and Flood Risk (Document Reference: 3.1.23).

2.11 Potential permitting / consenting requirements

73. Any works, either temporary or permanent, which will alter the flow of water along a watercourse or require the erection of a culvert, bridge or modification to the channel will require consent from the corresponding relevant authorities such as the Environment Agency or the LLFA.

74. As set out in the Environmental Permitting (England and Wales) Regulations 2016, a permit or exemption is required for any activities which will take place:

- On or within 8 metres (m) of a Main River (16m, if the Main River is tidal);
- On or within 8m of a flood defence structure or culverted Main River (16m, if Main River is tidal);
- Any activity within 16m of a sea defence structure;
- Quarrying or excavation within 16m of any Main River, flood defence (including a remote defence) or culvert; and / or
- Activities carried out on the floodplain of a Main River, more than 8m from the riverbank, culvert or flood defence structure (or 16m, if the Main River is tidal) and planning permission has not already been obtained.

75. Additionally, in accordance with the Flood and Water Management Act 2010 and Section 23 of the Land Drainage Act 1991, consent is required from the LLFA for the construction of a culvert or other structure that may affect the flow within an Ordinary Watercourse.

76. All Main Rivers and Ordinary Watercourses identified to be crossed by the Project have been identified as part of the Crossing Schedule (see ES Chapter 5 Project Description (Document Reference: 3.1.7) and provided in ES Appendix 5.1 Crossing Schedule (Document Reference: 3.3.2)).

77. The Applicant is seeking to disapply the requirement to obtain various consents within its DCO application (as is standard for NSIP projects), with the consent of the relevant consenting authority.

78. The Applicant will continue to engage in dialogue with the key stakeholders, comprising the Environment Agency and Essex County Council, to ensure flood risk related to their specific watercourses are fully considered and that permitting requirements regarding the need to cross watercourses within their administrative control are addressed. Protective provisions for the benefit of drainage authorities and for the benefit of the Environment Agency have been included within the draft DCO.

3 Baseline Environment

3.1 Hydrology

79. The review of the hydrology for the Project has been based on river water body catchments as defined by the Environment Agency and illustrated in ES Figure

21.1 (Document Reference: 3.2.17). Receptors are those river water bodies that are crossed, or their catchments are crossed, by the onshore project area, as well as those that are located downstream. Water body catchments are grouped within their respective operational catchments.

80. The onshore infrastructure associated with the Project lies within two operational catchments:

- Colne Essex operational catchment
  - Holland Brook; and
  - Tenpenny Brook.
- Stour operational catchment
  - Wrabness Brook; and
  - Coastal catchment associated with Hamford Water.

3.1.1 Holland Brook Catchment

81. Holland Brook (Main River) rises near Little Bromley and flows in a south-easterly direction to Holland Haven where it meets the sea. It is a largely rural catchment and is fed by numerous tributaries. These include Tendring Brook, Weeley Brook and Kirby Brook (all classified as Main Rivers).

82. In the lower reaches of the catchment, the Main River flows through Holland Haven Marshes Site of Special Scientific Interest (SSSI), which is an area of neutral grassland, reclaimed estuarine saltmarsh and freshwater marsh with an extensive ditch system (Natural England, 2022a). The SSSI extends upstream on Holland Brook as far as Hunter's Bridge. The main tributary watercourse in the SSSI is Kirby Brook, which flows west from Frinton-on-Sea into the Holland Brook, close to its mouth.

3.1.2 Tenpennny Brook Catchment

83. The Tenpenny Brook (Main River) rises south-west of Great Bromley, from where it flows in a southerly direction towards Mill Dam and into Alresford Creek and the Colne Estuary. The latter is designated as a SSSI for littoral sediment, inshore sublittoral sediment and neutral grassland (Natural England, 2022b).

3.1.3 Wrabness Brook

84. The Wrabness Brook is an Ordinary Watercourse, apart from a short section of Main River close to its confluence with the Stour. It rises north of the A120 near Horsleycross Street. It then flows in a north-easterly direction to join the River Stour at Wrabness Point. The catchment is rural and for most of its length the watercourse flows in a relatively narrow, confined valley. At the coast the channel is straight and is joined by other engineered ditches in a relatively wide valley, that is protected from inundation by an embankment.

85. The lower course of the Wrabness Brook overlaps with several designated sites. These are: Stour Estuary SSSI, Stour and Orwell Estuaries Special

Protection Area (SPA), Stour and Orwell Estuaries Ramsar, Suffolk Coasts Heaths National Landscape,[2] and Wrabness Local Nature Reserve (LNR).

3.1.4 Coastal catchment associated with Hamford Water

86. The coastal catchment associated with Hamford Water has an area of approximately 40km^2. The onshore project area crosses a tributary section of Main River that rises near Beaumont and flows in a southerly and then easterly direction to join Beaumont Cut near Quay Farm. Beaumont Cut joins Landermere Creek, which then flows to Hamford Water.

87. The catchment is predominantly rural and the channel flows in a relatively narrow valley before turning east towards Beaumont Bridge, where it occupies a wide and shallow east facing valley. Hamford Water is also designated as an SPA, SAC, Ramsar site and SSSI.

3.2 Existing surface water drainage system

88. In addition to the above information, it is noted that the Project will be located on predominantly rural, agricultural land, where there is likely to be limited existing formal surface water drainage systems.

89. However, as noted above there are a large number of agricultural land drains and Ordinary Watercourses that will need to be crossed along the onshore cable route.

90. In addition, Anglian Water noted the presence of a surface water sewer outfall pipe located in the landfall area to the north-east of Frinton Golf Course. This interacts with a proposed access route into the landfall, rather than the landfall itself. They also note there is a foul sewer running from Great Holland to a sewer pumping station near to Holland Haven; however, a review of mapping indicates this does not appear to directly interact with the onshore project area.

3.3 Geology and hydrogeology

91. The British Geological Survey (BGS) 1:50,000 scale solid and superficial geology geological mapping has been reviewed for the onshore project area.

92. As would be expected from a linear project of this nature, the geological conditions within the onshore project area vary. However, these can be summarised as follows:

- Superficial Deposits:
    - Alluvium Clay of sedimentary clay and silt;
    - An area of no superficial geology;
    - Kesgrave Catchment Subgroup of sand and gravel; and

[2] It is noted that this was referred to as the Suffolk Coast Heaths Area of Natural Beauty in the PEIR, as this predated the change in reference to AONB to “Natural Landscapes”.

    - Cover sand of clay, silt, and sand.
- Bedrock Geology:
    - Thames Group Clay of clay, silt, and sand.

93. Alluvium Clay formation and Kesgrave Catchment Subgroup formations are classified as Secondary A superficial aquifers. Secondary A Aquifers are composed of permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of baseflow to rivers.

94. Cover Sand formations are classified as Secondary B aquifers superficial aquifers. A Secondary B Aquifer comprises predominantly lower permeability strata which may in part have the ability to store and yield limited amounts of groundwater by virtue of localised features such as fissures, thin permeable horizons and weathering.

95. The bedrock geology of the entire onshore project area is defined as being unproductive with relation to aquifers. Although most of the onshore project area is underlain by unproductive strata, there are areas of low groundwater vulnerability near Thorpe-le-Soken and medium-low vulnerability north of the A120.

96. In addition, the northern area of the onshore cable route, close to the onshore substation, is shown to be within a Zone III Source Protection Zone.

97. The Department for Environment, Food & Rural Affairs' (Defra) MAGIC Map indicates that the onshore project area has been classified as having "Unproductive", "Low" and "Medium Low" groundwater vulnerability risk.

98. A Medium Low Groundwater vulnerability designation indicates that the soil may be able to transmit pollution to groundwater, which is characterised by medium leaching potential in soils and the absence of low permeability superficial deposits.

99. The onshore project area is underlain by a single WFD groundwater body (Essex Gravels (GB40503G000400)). The groundwater body is at Poor overall status, as assessed by the Environment Agency in 2019 which appears to be based on its Poor chemical status. Further details on this designation can be found in ES Chapter 21 Water Resources and Flood Risk (Document Reference: 3.1.23)).

3.3.1 Ground investigations

100. To aid in the understanding of flood risk and to inform the identification of potential drainage solutions for the permanent above ground infrastructure, i.e. onshore substation, initial ground investigations were undertaken in May 2023. The results of these will be considered and utilised to inform the further development of the drainage design.

101. As such, the results will be utilised to understand the potential for infiltration to be adopted, in line with the Sustainable Drainage Systems (SuDS) Hierarchy, for the operational drainage of surface water from the onshore substation and to aid in the further development of the detailed design.

4 Definition of flood hazard

102. This section explores the risk of flooding to key onshore elements of the Project (i.e. landfall, onshore cable route and onshore substation), as well as the temporary elements of the Project (i.e. temporary construction compounds and access tracks).

103. As discussed in Section 1.4, the onshore cable route has been considered in key sections based on the WFD Surface Water Operational Catchments. Where flood risk is identified, appropriate mitigation methods are discussed within Section 8.

4.1 Flood zones

104. The PPG, through the application of the Sequential Test, aims to steer development towards areas at lowest risk of flooding (Flood Zone 1) and away from Medium and High flood risk areas (Flood Zones 2 and 3).

105. Flood Zones are informed by the extent of modelling undertaken by the Environment Agency and are shown on the Environment Agency Flood Map for Planning.

106. All designated Main Rivers, as well as some of the larger Ordinary Watercourses which have been included in modelling, are considered within the Flood Zone dataset.

107. Flood Zones are defined in Table 1 of the PPG (2022) as follows:

- Flood Zone 1 – Low Probability:
  - Land having a less than 0.1% AP 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% AP of river flooding; or land having between a 0.5% and 0.1% AP of sea flooding. (Land shown in light blue on the Flood Map).
- Flood Zone 3a – High Probability:
  - Land having a 1% or greater AP of river flooding; or Land having a 0.5% or greater AP of sea. (Land shown in dark blue on the Flood Map).
- 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 AP 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% AP of flooding).

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

108. The updated PPG (2022) provides guidance on how the Sequential Test should be applied for other sources of flooding. When considering the risk of flooding from surface water, the online national mapping showing surface water flood extents has been considered alongside the above Flood Zone information for all elements of the Project.

109. It is acknowledged that there may be a flood risk associated with Ordinary Watercourses which are intercepted by the onshore cable route. However, due to the relative size and frequency of these watercourses and the associated information related to flood risk, they are considered independently from Main Rivers, as well as within the surface water flood risk section for each of the study area elements.

4.2 Watercourse crossings

110. Information provided within the Crossing Schedule (see ES Appendix 5.1 Crossing Schedule (Document Reference: 3.3.2)) indicates there are two Environment Agency Main Rivers crossed by the onshore cable route. These include two crossings over the Holland Brook, in two different locations. The first of these is behind the costal flood defences and adjacent to the North Sea frontage and the second of the crossings is over an eastern tributary of the Holland Brook, known as Tendring Brook, in a location to the south-east of Goose Green.

111. All Main Rivers will be crossed using trenchless techniques, to avoid direct interaction with these watercourses. The cable entry and exit pits will be at least 9m from the banks of the watercourse. Watercourses will be crossed at a minimum depth of 3m and no deeper than 20m. There is one location at crossing WX22-A, over the Tendring Brook, where it may be necessary to provide a haul road crossing over the Main River; however, this will be confirmed during detailed design.

112. With regard to Ordinary Watercourses, the crossing method will be considered on an individual basis, following discussion with the LLFA. However, the Crossing Schedule (see ES Appendix 5.1 Crossing Schedule (Document Reference: 3.3.2)) indicates the majority of Ordinary Watercourses will be crossed using trenchless techniques.

113. In addition, the Crossing Schedule (see ES Appendix 5.1 Crossing Schedule (Document Reference: 3.3.2)) indicates a number of locations where it may also be necessary to provide haul road crossings over Ordinary Watercourses; however, this will be confirmed during detailed design.

4.3 Landfall and onshore route section 1 – Holland Brook (South)

4.3.1 Overview of Proposed Activities

114. 'Landfall' refers to the area between Mean Low Water Springs (MLWS) and location at which the offshore export cables are brought onshore and connected to the onshore export cables within transition joint bays (TJB) of the Project's onshore transmission infrastructure. High-density polyethylene (HDPE) ducts to house the cables are proposed to be installed at landfall using horizontal directional drilling (HDD).

115. A temporary onshore construction compound will be required to accommodate the drilling rigs, ducting and welfare facilities. Further details related to the landfall location and works are provided in ES Chapter 5 Project Description (Document reference: 3.1.7).

116. Offshore export cables are then pulled through the pre-installed ducts which terminate at the TJB and are jointed to onshore export cables within the landfall compound.

117. All of the above ground elements of the Project's onshore cable route and landfall, including the landfall compound, construction compounds and all open areas required for the installation of the onshore export cables, are only required during the Project's construction phase and, once operational, will be reinstated in full. The only permanent works will comprise link boxes, which are located below ground. As such there will be minimal interaction with sources of flood risk during operation of the Project and therefore flood risk arising from the Project's landfall and onshore cable route will only occur during the construction phase. On this basis, this FRA has focused on the flood risk during the construction phase only.

118. The landfall is to be located between Clacton-on-Sea and Frinton-on-Sea, at Kirby Brook and adjacent to Frinton Golf Course. In addition, an onshore cable route has been identified within which the onshore export cables will be located. These provide the connection to the onshore substation, approximately 24km inland. In addition, a temporary landfall compound, with an area of approximately 11,250m^2, will be situated to the north-west of the landfall location.

119. This first section of the onshore cable route is located within the Holland Brook WFD Surface Water Operational Catchment, which runs from the landfall northwards for approximately 6km.

120. The onshore cable route in this section also includes the temporary construction compound for the landfall.

4.3.2 Historical flooding

121. To understand the likely risk of flooding to the Project, a review of historical flood events and their frequency has been undertaken. This review aims to provide an understanding as to the context of flooding in the onshore project area, identifying areas of focus where there are likely to be flooding issues. However, it should be noted that the absence of historical flood records does not necessarily confirm that flooding has not occurred.

122. The Environment Agency Historical Flood Extent map shows that the landfall and this section of the onshore cable route is in an area that has been previously affected by historical flooding.

123. A review of the Tendring District SFRA and the LLFA online flooding information provides no indication of historical flooding affecting the landfall and onshore cable route in this location.

4.3.3 Flood zone

124. From a review of the Environment Agency Flood Map for Planning, the landfall location is located in Flood Zone 3.

125. The areas in front of and behind the coastal frontage, between the Holland Gap to Chevaux de Frise Point Coastal Defence wall, are shown to be situated within Flood Zones 2 and 3. The extent of these flood zones vary; however, they broadly follow the alignment of the Holland Brook and extend up to approximately 1km inland from the coastal frontage.

4.3.4 Flooding from rivers

126. The Kirby Brook and Holland Brook watercourses are situated in the landfall area and both of these watercourses are identified as Environment Agency Main Rivers. It is assumed that prior to the historic construction of the sea defences in this area, these watercourses are likely to have drained directly into the sea. However, these watercourses now drain into the Holland Brook and flow to the west towards Holland Haven.

127. The Holland Brook flows into the North Sea at the coastline within this section. Given the Holland Brook's close proximity to the North Sea, the dominant source of flooding in this area is from tidal sources, as opposed to fluvial sources.

128. Therefore, there is unlikely to be a fluvial risk to the onshore export cables based on the existing limited flood risk, the use of trenchless techniques for installation and their location below ground once operational.

4.3.5 Flooding from the sea

129. The entire width of the landfall and the initial section of the onshore cable route is shown to be in Flood Zone 2 or 3.

130. In this location, the Flood Map for Planning indicates these areas benefit from the presence of defences. This is in the form of the Holland Gap to Chevaux de Frise Point Coastal Defence wall.

131. The Standard of Protection of this flood defence is unconfirmed. However, the flood defence wall has an Effective Upstream Crest Level of 4.85m AOD at its lowest point, according to the Environment Agency online mapping layers.

132. Given that much of the southern end of this section of the Project is shown by the Environment Agency Flood Map for Planning to benefit from the presence of flood defences, there is a residual risk of flooding from overtopping and / or breaching of these coastal frontage defences.

133. The Environment Agency has provided flood information for the Project. This confirms the landfall lies within the defended modelled tidal flood extent. The landfall location could be affected in all modelled present-day scenarios. Whilst the landfall is at risk from tidal flooding in the modelled present-day scenarios, it is situated behind tidal flood defences and the Environment Agency has indicated that this location benefits from a flood defence wall which has a 200 year (0.5%) standard of protection.

134. Therefore, the mapping indicates that the landfall is at residual risk from a tidal flood defence breach. During this event the area could experience flood depths of between 2.0m to 2.5m.

135. As the onshore export cables will be located below ground level, they would not be impacted by tidal breach flows once operational. During the construction phase site users should monitor weather forecasts and flood warnings and take appropriate action to avoid flood risk, as discussed in Section 8.

4.3.6 Flooding from groundwater

136. This section of the onshore cable route, associated with the southern areas of the Holland Brook WFD catchment, is located over superficial deposits of Kesgrave Catchment Subgroup and Cover Sand, which are classified as Secondary A and Secondary B Aquifers respectively.

137. The Tendring District SFRA shows the Areas Susceptible to Groundwater Flooding (AStGWF), which is a strategic scale map showing groundwater flood areas based on a 1km square grid. The data shows the proportion of each 1km grid square where geological and hydrogeological conditions show that groundwater might emerge. It should be noted that it does not show the likelihood of groundwater flooding occurring.

138. The landfall and onshore cable route in this section passes through three different 1km grid squares of the Tendring District SFRA AStGWF map, which classifies 25 - 50% of these areas to be at risk of groundwater emergence. The remainder of this section of the onshore cable route passes through 1km square grids where <25% of the area is classified as being at risk of groundwater emergence.

139. Once operational, the effect that the landfall and onshore export cables may have on existing groundwater flow routes is likely to be limited as the buried cable will be located at a target depth of at least 0.9m below ground (subject to localised variations such as limiting interaction to shallow or near surface groundwater). Given the depth of the onshore export cables, they are likely to be constructed within the superficial deposits.

140. As the construction works require earthworks in order to place the onshore export cables, it is important to note that perched groundwater may be present below areas of the onshore cable route and could be encountered during the below-ground engineering works.

141. There is a flood risk to construction activities from perched groundwater in the areas of Secondary A and Secondary B Aquifers. If perched groundwater were to be encountered, it would need to be mitigated by appropriate construction techniques and in accordance with an appropriate method statement. This is

secured within the Outline Code of Construction Practice (OCoCP) (Document Reference: 7.13).

142. Based on the above information there is likely to be a Very Low groundwater flood risk along the onshore cable route during both construction and operation and any risk during the construction phase will be mitigated, as outlined above. Once operational, the onshore export cable will be unaffected by groundwater flood risk as it will be sealed within waterproof ducting.

4.3.7 Flooding from surface water

143. The areas where the onshore cable route crosses the Ordinary Watercourses are identified as having a higher risk of surface water flooding. However, this is primarily limited to the width of the watercourse channel and relates to the lower lying area comprising the channel itself and the land draining into it.

144. The list of techniques being considered at each crossing is described in ES Chapter 5 Project Description (Document Reference: 3.1.7), ES Appendix 5.1 Crossing Schedule (Document Reference: 3.3.2). However, it is noted that the Project proposes to utilise trenchless techniques for the majority of watercourse crossings.

145. The onshore cable route crosses the Holland Brook, where it is classed as an Environment Agency Main River. It also crosses Kirby Brook and Great Holland Hall Brook which are identified as Environment Agency Main Rivers. The Holland Brook and other watercourses will be crossed at this point using trenchless techniques, in accordance with the approach to be adopted for the wider area comprising the Holland Haven Marshes SSSI. This crossing in the far south of this section of the onshore cable route is shown on the Environment Agency's Long-Term Flood Risk Information map as being primarily at high risk of surface water flooding with areas of low and medium risk further away from the Holland Brook.

146. To the south close to the coastal frontage and further north along the onshore cable route it passes over numerous unnamed channels and ditches. These are not classified as being Environment Agency Main River and are likely to be small channels or ditches classed as Ordinary Watercourses, comprising tributaries into the Holland Brook. These include areas at high risk of surface water flooding which appear to connect to and flow into the Holland Brook.

147. Any surface water flood risk to the onshore cable route will be temporary in nature and removed once construction is complete.

148. The land will be reinstated, and existing ground levels will be maintained. Mitigation during construction is discussed in Section 7 and Section 8 in relation to both surface water and Ordinary Watercourses. This will be secured within the OCoCP (Document Reference: 7.13), which will be produced to accompany the ES and submitted as part of the DCO application.

149. The risk of flooding from surface water is therefore considered to be Low for this section of the onshore cable route.

4.3.8 Flooding from sewers

150. The Tendring SFRA (2009) does not include any incidents of sewer flooding, detailed by Anglian Water through their DG5 register. The DG5 database records incidents of flooding relating to public foul, combined or surface water sewers and displays which properties suffered flooding (on a 4-5 postcode digit basis).

151. The onshore cable route is located within existing agricultural land and, therefore, it is likely that there is a limited foul sewer network within the proximity of this location. Anglian Water has provided details of some sewer infrastructure in the wider area around the landfall but these are principally outside the DCO limits.

152. The risk of flooding from sewers is therefore considered to be Low for this section of the onshore cable route.

4.3.9 Flooding from reservoirs

153. Reservoirs with an impounded volume greater than 25,000 cubic metres (m^3) are governed by the Reservoirs Act 1975 and are listed on a register held by the Environment Agency. The level and standard of inspection and maintenance required under the Reservoirs Act 1975 means that the risk of flooding from reservoirs is relatively low.

154. Recent changes to legislation under the Flood and Water Management Act 2010 require the Environment Agency to designate the risk of flooding from these reservoirs.

155. Flooding from reservoirs is defined based on the implications of a large uncontrolled release of water from registered reservoirs i.e. greater than 25,000m^3.

156. The Environment Agency Flood Risk from Reservoirs map shows the southern area of this section of the onshore cable route and the landfall are at risk of flooding from a reservoir breach. This is similar to the flood extent associated with flooding from rivers.

157. The Environment Agency mapping defines the risk of reservoir flooding in this location as being within the maximum extent of flooding when there is also flooding from rivers. As such, these areas of potential reservoir flooding appear to be associated with the Holland Brook, in the far south of this section and located immediately to the rear of the coastal frontage.

158. However, given the regulatory requirements associated with reservoirs, the risk of reservoir failure remains Low.

4.3.10 Flooding from canals and other artificial sources

159. The onshore cable route in this section is not located near to any canals or other artificial sources, with the exception of the reservoirs discussed above. As such there is no risk of flooding from canals or other artificial sources to the landfall and this section of the onshore cable route.

4.3.11 Summary of flooding

160. Overall, the landfall and this section of the onshore cable route is not at risk of flooding from fluvial sources, canals or other artificial sources. During the construction phase, there is a Very Low risk of flooding associated with groundwater sources and a Low risk of flooding from sewers and reservoir sources.

161. Furthermore, during construction the risk of flooding from tidal / coastal flooding is relatively Low due to the presence of the existing flood defences protecting this section. There is however a residual risk of flooding from overtopping and / or breaching of these coastal flood defences.

162. This section of the onshore cable route passes numerous small areas of high surface water flood risk, associated with the Holland Brook and its tributaries. However, this is limited to locations where the onshore cable route is required to pass under these watercourses or ditches and therefore during construction there is a Low risk of flooding from this source.

163. Once operational there will be no flood risk to the landfall and this section of the onshore cable route as it will be located solely below ground.

4.4 Onshore cable route section 2 – coastal catchment

4.4.1 Overview of proposed activities

164. The extent of the onshore cable route, within which the onshore export cables will be located, has been identified. At PEIR, corridors of up to 243m in width were considered depending on the degree of engineering flexibility required prior to the completion of further engineering design studies. Since the PEIR consultation, the multiple corridors have been reviewed and a single onshore cable route has been identified, within which the Project's onshore export cables construction works will take place.

165. All of the above ground elements of the Project's onshore cable route, including the construction compounds and all open areas required for the installation of the onshore export cables, are only required during the Project's construction phase and, once operational, will be reinstated in full. The only permanent works will comprise link boxes, which are located below ground. As such there will be minimal interaction with sources of flood risk during operation of the Project and therefore flood risk arising from the Project's onshore cable route will only occur during the construction phase. On this basis, this FRA has focused on the flood risk during the construction phase only.

166. The onshore cable route partially runs through the Anglian Coastal Catchment for a distance of approximately 4.2km. In this section, the onshore cable route runs through the Coastal Catchment from Thorpe Cross to south of Beaumont.

4.4.2 Historical flooding

167. To understand the likely risk of flooding to the Project a review of historical flood events and their frequency has been undertaken as outlined in Section 4.3.2 paragraph 121.

168. The Environment Agency Historical Flood Extent map shows the onshore cable route in this section is not situated within a historical flood extent.

169. A review of the Tendring District SFRA and the LLFA online flooding information provides no indication of historical flooding affecting the onshore cable route in this location.

4.4.3 Flood zone

170. This section of the onshore cable route is wholly located in Flood Zone 1 and as such the risk from fluvial or tidal flooding is considered to be Low.

4.4.4 Flooding from rivers

171. Given that the onshore cable route in this section is wholly located in Flood Zone 1 the risk of flooding from rivers during construction of the onshore cable route is considered to be Low risk.

4.4.5 Flooding from the sea

172. As noted above, the onshore cable route in this section is wholly located in Flood Zone 1. As such, the flood risk from this source to the construction of the cable route is considered to be Low.

4.4.6 Flooding from groundwater

173. This section of the onshore cable route, associated with the Coastal Catchment is located over superficial deposits of Alluvium including clay and silt, Kesgrave Catchment Subgroup, and Cover Sand, which are classified as Secondary A and Secondary B Aquifers respectively.

174. The onshore cable route in this section passes exclusively through 1km grid squares of the Tendring District SFRA AStGWF map, where <25% of the area is classified as being at risk of groundwater emergence.

175. Once operational, the effect that the onshore export cables may have on existing groundwater flow routes is likely to be limited as the buried cable will be located at a target depth of at least 0.9m below ground (subject to localised variations such as limiting interaction to shallow or near surface groundwater). Given the depth of the onshore export cables, they are likely to be constructed within the superficial deposits.

176. As the construction works require earthworks in order to place the onshore export cables, it is important to note that perched groundwater may be present below areas of the onshore cable route and could be encountered during the below-ground construction works.

177. There is a risk to the onshore export cables, during construction, from perched groundwater in the areas of Secondary A and Secondary B Aquifers. If perched groundwater were to be encountered, it would need to be mitigated by appropriate construction techniques and in accordance with an appropriate method statement. This will be secured within the OCoCP (Document Reference: 7.13).

178. Based on the above information there is likely to be a Very Low groundwater flood risk along the onshore cable route during both construction and operation and any risk during the construction phase will be mitigated, as outlined above. Once operational, the onshore export cable will be unaffected by groundwater flood risk as it will be sealed within waterproof ducting.

4.4.7 Flooding from surface water

179. The areas where the onshore cable route crosses the Ordinary Watercourses are identified as having a higher risk of surface water flooding. However, this is primarily limited to the width of the watercourse channel and relates to the lower lying area comprising the channel itself and the land draining into it.

180. The list of techniques being considered at each crossing is described in ES Chapter 5 Project Description (Document Reference: 3.1.7), ES Appendix 5.1 Crossing Schedule (Document Reference: 3.3.2). However, it is noted that the Project proposes to utilise trenchless techniques for the majority of watercourse crossings.

181. The onshore cable route in this section passes in close proximity to Landermere Creek, upstream of the point where it flows into and forms an estuary. Mapping indicates that surface water flow routes pass through the onshore cable route when the channels of Landermere Creek and its associated tributaries are subject to exceedance.

182. Any surface water flood risk to the onshore cable route will be temporary in nature and removed once construction is complete.

183. The land will be reinstated, and existing ground levels will be maintained. Mitigation during construction is discussed in Section 7 and Section 8 in relation to both surface water and Ordinary Watercourses. This will be secured within the OCoCP (Document Reference: 7.13).

184. The overall risk of flooding from surface water to the construction of the cable route is therefore considered to be Low for this section of the onshore cable route.

4.4.8 Flooding from sewers

185. The Tendring SFRA (2009) does not include any incidents of sewer flooding, detailed by Anglian Water through their DG5 register. The DG5 database records incidents of flooding relating to public foul, combined or surface water sewers and displays which properties suffered flooding (on a 4-5 postcode digit basis).

186. The onshore cable route is located within existing agricultural land and, therefore, it is likely that there is a limited foul sewer network within the proximity of this location. The risk of flooding from sewers to the construction of the cable route is therefore considered to be Low for this section of the onshore cable route.

4.4.9 Flooding from reservoirs

187. The Environment Agency Flood Risk from Reservoirs map shows no areas within this section of the onshore cable route to be at risk of flooding from reservoir sources under any situation. Therefore, there is no risk of flooding from this source.

4.4.10 Flooding from canals and other artificial sources

188. The onshore cable route in this section is not located near to any canals or other artificial sources. As such there is no risk of flooding from canals or other artificial sources to this section of the onshore cable route.

4.4.11 Summary of flooding

189. Overall, this section of the onshore cable route is not at risk from any sources of flood risk once operational.

190. During construction, the onshore cable route is not at risk of flooding from reservoirs, canals or other artificial sources, and is at Low risk from sewers. There is a Low risk of fluvial flooding from Main Rivers or tidal flooding during construction of the onshore cable route, as the onshore cable route is wholly located in Flood Zone 1. During the construction phase, there is a Very Low risk of flooding associated with groundwater sources.

191. Part of the onshore cable route is at high surface water flood risk during construction, which is associated with the Landermere Creek and its tributaries. However, this is limited to locations where the onshore cable route is required to pass under Ordinary Watercourses or where the Landermere Creek, or its tributaries, are subject to exceedance during extreme events.

192. Any surface water flood risk to the onshore cable route will be temporary in nature and removed once construction is complete.

193. The land will be reinstated, and existing ground levels will be maintained. Mitigation during construction is discussed in Section 7 and Section 8 in relation to both surface water and Ordinary Watercourses. This will be secured within the OCoCP (Document Reference: 7.13).

194. Once operational there will be no flood risk to this section of the onshore cable route as it will be located solely below ground.

4.5 Onshore cable route section 3 – Holland Brook (North)

4.5.1 Overview of proposed activities

195. The extent of the onshore cable route, within which the onshore export cables will be located, has been identified. This third section of the onshore cable route runs north-west and then west for approximately 9km in total. This is from its re-entry point into the Holland Brook WFD Surface Water Operational Catchment, to the border with the Tenpenny Brook WFD Surface Water Operational Catchment. As set out within Section 2, the width of the route has been refined since PEIR.

196. During construction of the cable route, to the southern side of the A120, the onshore works include an access track linking to a temporary construction compound, before curving westwards at Abbott's Hall.

197. Construction of the cable route also includes the Bentley Road improvement works, comprising the widening and improvement of the carriageway along Bentley Road, which is required to facilitate Heavy Goods Vehicles (HGVs) and Abnormal Indivisible Load (AIL) access to the onshore cable route and the onshore substation.

198. Overall, this section of the onshore cable route is not at risk from any sources of flood risk once operational. During operation of the Project, the onshore cable route itself will be underground, and therefore not subject to any flood risk. However, there may be the need to temporarily reinstate the construction haul road from the point of Bentley Road improvements works to the Onshore Substation. This would be to allow abnormal loads to transport replacement plant and equipment to the Onshore Substation should maintenance activities conclude the need. Given this is wholly located in Flood Zone 1 and primarily at low risk of surface water flooding, it is anticipated that the flood risk associated with this activity would be no worse than that considered during the construction stage and as such, this activity is not considered further.

199. On this basis, this FRA has focused on the flood risk during the construction phase.

4.5.2 Historical flooding

200. To understand the likely risk of flooding to the Project a review of historical flood events and their frequency has been undertaken as outlined in Section 4.3.2 paragraph 121.

201. The Environment Agency Historical Flood Extent map shows the onshore cable route in this section is not situated within a historical flood extent.

202. A review of the Tendring District SFRA and the LLFA online flooding information provides no indication of historical flooding affecting the onshore cable route in this location.

4.5.3 Flood zone

203. It is confirmed that the majority of this section of the onshore cable route is situated within Flood Zone 1.

204. Two very small sections (approximately 30m in length) of the onshore cable route are shown to be situated within either Flood Zone 2 or Flood Zone 3. These locations are where the onshore cable route crosses the eastern tributary of the Holland Brook, known as the Tendring Brook, and where it crosses the Holland Brook itself.

4.5.4 Flooding from rivers

205. Given the location where the onshore cable route crosses the Holland Brook and the Tendring Brook in this section are relatively high up in the catchment

with topographic levels of approximately 20mAOD, the dominant source of flooding is from fluvial sources, as opposed to tidal sources.

206. There is limited potential for flood risk to the onshore cable route during construction; however, the risk to the onshore export cables will be mitigated by appropriate construction techniques. As noted above, appropriate mitigation measures will be secured within the OCoCP (Document Reference: 7.13).

207. The risk of flooding to the onshore cable route will be removed upon completion of the cable laying phase, as all infrastructure will be located underground, with the cable, joint bays and link boxes sealed from water ingress.

4.5.5 Flooding from the sea

208. Given the topographic levels within this section of the onshore cable route are approximately 10m AOD at the lowest point, the dominant source of flooding to any sections of the onshore cable route within Flood Zone 2 or Flood Zone 3, where the cable route passes the Holland Brook, is likely to be from fluvial sources.

209. Therefore, there is no risk of tidal flooding to this section of the onshore cable route construction.

4.5.6 Flooding from groundwater

210. This section of the onshore cable route, associated with the northern areas of the Holland Brook WFD catchment is located over superficial deposits of Kesgrave Catchment Subgroup, and Cover Sand, which are classified as Secondary A and Secondary B Aquifers respectively.

211. The onshore cable route in this section passes exclusively through 1km grid squares of the Tendring District SFRA AStGWF map, where <25% of the area is classified as being at risk of groundwater emergence.

212. Once operational, the effect that the onshore export cables may have on existing groundwater flow routes is likely to be limited as the buried cable will be located at a target depth of at least 0.9m below ground (subject to localised variations such as limiting interaction to shallow or near surface groundwater). Given the depth of the onshore export cables, they are likely to be constructed within the superficial deposits.

213. As the construction works require earthworks in order to place the onshore export cables, it is important to note that perched groundwater may be present below areas of the onshore cable route and could be encountered during the below-ground construction works.

214. There is a risk to the construction of the onshore export cables from perched groundwater in the areas of Secondary A and Secondary B Aquifers. If perched groundwater were to be encountered, it would need to be mitigated by appropriate construction techniques and in accordance with an appropriate method statement. This will be secured within the OCoCP (Document Reference: 7.13).

215. Based on the above information there is likely to be a Very Low groundwater flood risk along the onshore cable route during construction and any risk will be mitigated, as outlined above.

4.5.7 Flooding from surface water

216. The areas where the onshore cable route crosses the Holland Brook, its associated Ordinary Watercourses and drainage ditches are identified as having a higher risk of surface water flooding during construction. However, this is primarily limited to the width of the watercourse channel and relates to the lower lying area comprising the channel itself and the land draining into it.

217. The list of techniques being considered at each crossing is described in ES Chapter 5 Project Description (Document Reference: 3.1.7), ES Appendix 5.1 Crossing Schedule (Document Reference: 3.3.2). However, it is noted that the Project proposes to utilise trenchless techniques for the majority of watercourse crossings.

218. The onshore cable route crosses the eastern tributary of the Holland Brook, known as the Tendring Brook, where it is classed as an Environment Agency Main River. In this location, it will be crossed using trenchless techniques. In addition, at crossing WX22-A, which also passes over the Tendring Brook, it may be necessary to provide a haul road crossing over the Main River; however, this will be confirmed during detailed design.

219. This crossing location in the far south of this section of the onshore cable route is shown on the Environment Agency's Long-Term Flood Risk Information map as being primarily at high risk of surface water flooding, with areas of low and medium risk further away from the Holland Brook.

220. In addition, the onshore cable route passes over numerous unnamed channels and ditches. These are not classified as Environment Agency Main River and are likely to be small channels or ditches classed as Ordinary Watercourses, comprising tributaries into the Holland Brook.

221. This includes a crossing over an Ordinary Watercourse, which appears to be the headwaters of the Holland Brook to the north of the A120. These Ordinary Watercourses also include areas at high risk of surface water flooding which appear to connect to and flow into the Holland Brook.

222. Any surface water flood risk to the onshore cable route will be temporary in nature and removed once construction is complete.

223. The land will be reinstated and existing ground levels will be maintained. Mitigation during construction is discussed in Section 7 and Section 8 in relation to both surface water and Ordinary Watercourses. This will be secured within the OCoCP (Document Reference: 7.13).

224. The overall risk of flooding from surface water during construction is therefore considered to be Low for this section of the onshore cable route.

4.5.8 Flooding from sewers

225. The Tendring SFRA (2009) does not include any incidents of sewer flooding, detailed by Anglian Water through their DG5 register. The DG5 database

records incidents of flooding relating to public foul, combined or surface water sewers and displays which properties suffered flooding (on a 4-5 postcode digit basis).

226. The onshore cable route is located within existing agricultural land and, therefore, it is likely that there is a limited foul sewer network within the proximity of this location. The risk of flooding from sewers during construction is therefore considered to be Low for this section of the onshore cable route.

4.5.9 Flooding from reservoirs

227. The Environment Agency Flood Risk from Reservoirs map shows no areas within this section of the onshore cable route to be at risk of flooding from reservoir sources under any situation. Therefore, there is no risk of flooding from this source.

4.5.10 Flooding from canals and other artificial sources

228. The onshore cable route in this section is not located near to any canals or other artificial sources. As such there is no risk of flooding from canals or other artificial sources to this section of the onshore cable route.

4.5.11 Summary of flooding

229. Overall, this section of the onshore cable route is not at risk from any sources of flood risk once operational.

230. During construction this section of the onshore cable route is not at risk from reservoirs, canals or other artificial sources and at Low risk from sewers.

231. The risk of flooding from fluvial flooding is Low and limited to points where the construction of the onshore cable route passes over the Holland Brook and its tributary, Tendring Brook.

232. There is no risk of flooding to the construction of the onshore cable route from tidal / coastal flooding given the topographical levels in this area are no lower than 10mAOD and the dominant source of flooding to the areas in Flood Zones 2 and 3 are fluvial in nature.

233. This section of the onshore cable route passes through numerous small areas of high surface water flood risk, associated with the Holland Brook and its tributaries. However, this is limited to locations where the construction of the onshore cable route is required to pass under these watercourses or ditches.

4.6 Onshore cable route section 4 – Tenpenny Brook

4.6.1 Overview of proposed activities

234. The extent of the onshore cable route, within which the onshore export cables will be located, has been identified. This fourth section of the onshore cable route runs from the northern border of the Holland Brook WFD Surface Water Operational Catchment, north-westwards for approximately 2km, through the Tenpenny Brook WFD Surface Water Operational Catchment, to Ardleigh Road.

235. The Project elements to the north of Ardleigh Road have been considered within Section 4.8 of this FRA, in relation to the onshore substation.

236. During operation of the Project, the onshore cable route itself will be underground, and therefore not subject to any flood risk. However, there may be the need to temporarily reinstate the construction haul road from the point of Bentley Road improvement works to the Onshore Substation. This would be to allow abnormal loads to transport replacement plant and equipment to the Onshore Substation should maintenance activities conclude there is a need; however, this is expected to be highly unlikely. Given this is wholly located in Flood Zone 1 and primarily at low risk of surface water flooding, it is anticipated that the flood risk associated with this activity would be no worse than that considered during the construction stage and as such, this activity is not considered further.

237. On this basis, this FRA has focused on the flood risk during the construction phase.

4.6.2 Historical flooding

238. To understand the likely risk of flooding to the Project a review of historical flood events and their frequency has been undertaken as outlined in Section 4.3.2 paragraph 121.

239. The Environment Agency Historical Flood Extent map shows the onshore cable route in this section is not situated within a historical flood extent.

240. A review of the Tendring District SFRA and the LLFA online flooding information provides no indication of historical flooding affecting the onshore cable route in this location.

4.6.3 Flood zone

241. The entire onshore cable route within this section is situated within Flood Zone 1.

4.6.4 Flooding from rivers

242. The onshore cable route in this section is not situated within 500m of any Environment Agency Main River.

243. Mapping indicates there are two Ordinary Watercourses comprising ditches along field boundaries to the south of Ardleigh Road. However, as previously noted, this section of the onshore cable route is situated entirely within Flood Zone 1. Therefore, the risk of flooding to the construction of the cable route from fluvial sources is considered to be Low.

4.6.5 Flooding from the sea

244. The entire onshore cable route in this section is situated within Flood Zone 1 and no lower than 20m AOD. Therefore, the risk of flooding during the construction of the onshore cable route from tidal sources is considered to be Low.

4.6.6 Flooding from groundwater

245. This section of the onshore cable route, associated with the southern areas of the Tenpenny Brook WFD Surface Water Operational Catchment, is located over superficial deposits of Kesgrave Catchment Subgroup, and Cover Sand, which are classified as Secondary A and Secondary B Aquifers respectively.

246. The onshore cable route in this section passes through a single 1km grid square of the Tendring District SFRA AStGWF map, which classifies 25 - 50% of the area to be at risk of groundwater emergence.

247. All the remaining squares which the onshore cable route either partially or wholly passes through, in this section, are classified as <25% of the area being at risk of groundwater flooding.

248. Once operational, the effect that the onshore export cables may have on existing groundwater flow routes is likely to be limited as the buried cable will be located at a target depth of at least 0.9m below ground (subject to localised variations such as limiting interaction to shallow or near surface groundwater). Given the depth of the onshore export cables, they are likely to be constructed within the superficial deposits.

249. As the construction works require earthworks in order to place the onshore export cables, it is important to note that perched groundwater may be present below areas of the onshore cable route and could be encountered during the below-ground construction works.

250. There is a risk to the onshore export cables, during construction, from perched groundwater in the areas of Secondary A and Secondary B Aquifers. If perched groundwater were to be encountered, it would need to be mitigated by appropriate construction techniques and in accordance with an appropriate method statement. This will be secured within the OCoCP (Document Reference: 7.13).

251. Based on the above information there is likely to be a Very Low groundwater flood risk along the onshore cable route during construction and any risk will be mitigated, as outlined above.

4.6.7 Flooding from surface water

252. In this section, the onshore cable route passes through relatively few areas highlighted as being at risk of flooding from surface water sources. Any areas of surface water flood risk which it does pass through are small and associated with Ordinary Watercourses (ditches) and hollows in the upland catchment area of the Tenpenny Brook.

253. Any surface water flood risk to the onshore cable route will be temporary in nature and removed once construction is complete.

254. The land will be reinstated and existing ground levels will be maintained. Mitigation during construction is discussed in Section 7 and Section 8 in relation to both surface water and Ordinary Watercourses. This will be secured within the OCoCP (Document Reference: 7.13).

255. The risk of flooding from surface water to the construction of the cable route is therefore considered to be Low for this section of the onshore cable route.

4.6.8 Flooding from sewers

256. The Tendring SFRA (2009) does not include any incidents of sewer flooding, detailed by Anglian Water through their DG5 register. The DG5 database records incidents of flooding relating to public foul, combined or surface water sewers and displays which properties suffered flooding (on a 4-5 postcode digit basis).

257. The onshore cable route is located within existing agricultural land and, therefore, it is likely that there is a limited foul sewer network within the proximity of this location. The risk of flooding from sewers to the construction of the cable route is therefore considered to be Low for this section of the onshore cable route.

4.6.9 Flooding from reservoirs

258. The Environment Agency Flood Risk from Reservoirs map shows no areas within this section of the onshore cable route to be at risk of flooding from reservoir sources under any situation. Therefore, there is no risk of flooding from this source.

4.6.10 Flooding from canals and other artificial sources

259. The onshore cable route in this section is not located near to any canals or other artificial sources. As such there is no risk of flooding from canals or other artificial sources to this section of the onshore cable route.

4.6.11 Summary of flooding

260. Overall, this section of the onshore cable route is not at risk from any sources of flood risk once operational.

261. During construction this section of the onshore cable route is not at risk from reservoirs, canals or other artificial sources. There is a Low risk of flooding associated with groundwater sources and sewers. Additionally, the risk of fluvial and tidal / coastal flooding is Low, since the onshore cable route in this section is located entirely within Flood Zone 1 and more than 500m from the nearest Environment Agency Main River.

262. Furthermore, the onshore cable route passes through relatively few areas highlighted as being at risk of flooding from surface water sources. Mapping indicates there are two Ordinary Watercourses comprising ditches along field boundaries to the south of Ardleigh Road and these appear to be associated with areas at increased risk of surface water flooding. Other areas of surface water flood risk are relatively small and associated with ditches and hollows in the upland catchment area of the Tenpenny Brook. There is therefore a Low Risk of flooding from surface water during construction of the onshore cable route.

263. Once operational there will be no flood risk to this section of the onshore cable route as it will be located solely below ground.

4.7 Landfall and onshore cable route – construction compounds and access roads

4.7.1 Overview of proposed activities

264. Temporary construction compounds and access roads are required to support the onshore cable installation. A maximum of eleven compounds will be required, excluding construction compounds at landfall and any associated with the HDD works.

265. Access Roads will be implemented at key locations along the onshore cable route from the landfall location to the onshore substation.

266. Indicative locations for the temporary construction compounds and access roads have been identified to date and these will be refined during the detailed design.

267. Temporary construction compounds would be required to support the cable duct installation and cable pulling works. They would act as a hub for the onshore construction works and would house the central offices, welfare facilities, and stores as well as acting as a staging post and secure storage for equipment and component deliveries.

268. Construction compounds would be fenced and be supported by temporary lighting and security where required. Construction compounds would be established in advance of the main works and would remain in situ for the duration of construction in any one location.

269. The access roads have been implemented at key locations along the onshore cable route to allow access during the construction phase. All construction accesses would be removed, and land reinstated following the completion of construction.

270. All of the above elements of the Project are required for the installation of the onshore export cables only during the construction phase and will then be removed. As such there will be no interaction with sources of flood risk once operational. On this basis, this FRA has focused on the flood risk during the construction phase.

4.7.2 Review of flood risk from all sources

271. The temporary construction compounds are located wholly in Flood Zone 1, other than the temporary construction compound located at the landfall.

272. In addition, the majority of the temporary construction compounds are considered to be at low risk from surface water flooding with minor areas at increased surface water flood risk along the edges likely to be associated with ditches and field boundaries.

273. Some of the temporary construction compounds are shown to be at greater risk of surface water flooding. These include the two temporary construction compounds at the landfall and the south-eastern corner of the temporary construction compound for section 6 of the onshore cable route (near the Bentley Road improvement works).

274. The access roads are located in Flood Zone 1, other than the access road located at the landfall location which is within Flood Zone 3.

275. In addition, some of the access roads are likely to be partially affected by surface water flooding during the modelled present day surface water events.

276. The access roads will be used during the construction phase of the onshore cable route, therefore it is recommended that site users monitor local weather forecasts and take action, as appropriate. This is discussed further in Section 8.

277. The landfall HDD compound is located in tidal / coastal Flood Zone 3. In the event of a tidal flood being forecast, mitigation measures will need to be put in place to ensure that materials remain confined to the compound and portable offices, welfare facilities and storage are secured, to prevent and minimise damages from flood waters. This will be secured within the OCoCP (Document Reference: 7.13).

278. In addition, the area identified for the landfall HDD compound is shown to be at risk from surface water flooding during the 3.3% AP (1 in 30 year) event. The compound located to the west of the landfall is situated adjacent to the Great Holland Hall Brook and mapping shows that significant surface water flooding is likely to occur to the right bank of Great Holland Hall Brook.

279. Similar to the risks associated with coastal / tidal flooding, mitigation measures will need to be put in place to ensure that materials remain confined to the compound and portable offices, welfare facilities and storage are secured, to prevent and minimise damages from flood waters. This will be secured within the OCoCP (Document Reference: 7.13).

280. The landfall HDD compound and temporary construction compounds are located within existing agricultural land and, therefore, it is likely that there is a limited foul sewer network within the proximity of their locations. The risk of flooding from sewers is therefore considered to be Low for the temporary construction compounds.

281. The Environment Agency Flood Risk from Reservoirs map shows the landfall HDD compound may be partially at risk of flooding from a reservoir breach, which is similar to the flood extent associated with flooding from rivers. As such, this area of potential reservoir flooding is associated with the Holland Brook, immediately to the rear of the coastal frontage.

282. The remaining locations for the temporary construction compounds are located in areas that are not at risk of flooding from reservoir sources under any situation. Therefore, there is no risk of flooding from this source.

283. Neither the landfall HDD compound or any of the temporary construction compounds are likely to be located near to any canals or other artificial sources. As such there is no risk of flooding from canals or other artificial sources to these elements of the Project.

4.8 Onshore substation

4.8.1 Overview of proposed activities

284. The location of the onshore substation has been defined through the Project's site selection process.

285. The onshore substation is situated to the northern end of the Tenpenny Brook WFD Surface Water Operational Catchment and north-west of the onshore cable route.

286. A new construction access and onshore substation temporary construction compound (measuring approximately 250m x 150m) will be created in advance of construction. The location of this access and any operational access will be determined during the Project's ongoing design process. The construction access will be required to facilitate access for Heavy Goods Vehicles (HGVs) as well as abnormal indivisible loads (AILs) for certain elements of the onshore substation's electrical infrastructure (e.g. transformers).

287. The 400kV cables from the onshore substation to the National Grid connection point would typically be installed by direct burial method. This method will require a trench to be excavated between the onshore substation and the grid connection for the cables to be laid directly and jointed before being installed.

288. Once operational, a maximum of area of 280m x 210m would be required for the onshore substation. A landscaping / bunding area, operational drainage and a new permanent operational access are also anticipated to be required.

4.8.2 Historical flooding

289. To understand the likely risk of flooding to the Project a review of historical flood events and their frequency has been undertaken as outlined in Section 4.3.2 paragraph 121. The Environment Agency Historical Flood Extent map shows that none of the onshore substation works area is situated within an Environment Agency historical flood extent.

290. A review of the Tendring District SFRA and the LLFA online flooding information provides no indication of historical flooding affecting the onshore substation works area.

4.8.3 Flood zone

291. The onshore substation is situated wholly within Flood Zone 1. It is also located over 1km from the closest extent of either Flood Zone 2 or 3, associated with the Tenpenny Brook, which is to the south of the onshore substation.

4.8.4 Flooding from rivers

292. The onshore substation is situated within Flood Zone 1 and approximately 1km from Flood Zones 2 or 3. It is also more than 2km from the nearest Environment Agency Main River.

293. Mapping indicates there are two Ordinary Watercourses comprising ditches along field boundaries to the south of Ardleigh Road adjacent to the entry point

for the onshore cable route into the onshore substation works area. However, this has already been considered in the preceding section.

294. As such, the risk of fluvial flooding to the onshore substation is considered to be Low.

4.8.5 Flooding from the sea

295. As noted above, the onshore substation works area is situated within Flood Zone 1, no lower than 20m AOD and over 16km inland from the nearest coastal frontage. Therefore, the risk of flooding from tidal sources is considered to be Low.

4.8.6 Flooding from groundwater

296. The onshore substation, associated with the Tenpenny Brook WFD Surface Water Operational Catchment, is located over superficial deposits of Cover Sand, which is classified as Secondary B Aquifer.

297. The onshore substation is situated within a single 1km grid square of the Tendring District SFRA AStGWF map, of which <25% of the area is shown to be at risk of groundwater emergence.

298. As the construction works require earthworks in order to place the onshore export cables and construct the onshore substation, it is important to note that perched groundwater may be present and could be encountered during the below-ground construction works.

299. After grading of the site is complete, excavations would proceed with the laying of foundations, trenches and drainage. At this stage it is not known whether the foundations would be ground-bearing or piled. This would be determined by geotechnical ground investigation post-consent that would inform the detailed design. However, for the purposes of the assessment piled foundations are assumed to be required at the onshore substation.

300. Given the depth of the onshore export cables and the construction works for the onshore substation, it is likely to be constructed within the superficial deposits. As shown previously, the superficial deposits are formed of Secondary B Aquifers.

301. However, if perched groundwater were to be encountered, especially during the installation of any piled foundations, it would need to be mitigated by appropriate construction techniques and in accordance with an appropriate method statement. This will be secured within the OCoCP (Document Reference: 7.13).

302. Once operational, the effect of onshore export cables, within the area of the onshore substation, on groundwater flows is likely to be low as the buried cables will be located at a target depth of at least 0.9m below ground (subject to localised variations such as limiting interaction to shallow or near surface groundwater).

303. Effects arising from piled foundations are likely to be minimal due to the small scale nature of the foundations, and therefore the effect on groundwater flows is considered likely to be Low.

304. Based on the above information there is a Very Low groundwater flood risk to the onshore substation and any risk will be mitigated, as outlined above.

4.8.7 Flooding from surface water

305. The onshore substation works area includes a small number of areas highlighted as being at risk of flooding from surface water sources.

306. Any areas shown to be at high or medium risk of surface water flooding are relatively localised and predominantly indicate a flow path passing from the north-west to the south-east of the onshore substation works area and in the southern section of the onshore substation works area. The southern area at increased risk appears to be linked to the two Ordinary Watercourses comprising ditches along field boundaries to the south of Ardleigh Road.

307. The Environment Agency Surface Water flood maps indicate there is a surface water flow path which flows from an area to the north-west of Grange Road through the onshore substation during a 0.1% AP (1 in 1,000 year) surface water event.

308. However, the mapping shows that the onshore substation would remain unaffected by surface water flooding during both the 3.3% AP (1 in 30 year) and 1% AP (1 in 100 year) surface water event.

309. 7.5On this basis, whilst overall the risk of flooding from surface water is considered to be Low for the onshore substation works area, there is a need to consider this flood risk in greater detail as part of the final design for the onshore substation, and it has been considered in the development of the surface water drainage design, as shown in the Outline Operational Drainage Strategy (Document Reference: 7.19).

4.8.8 Flooding from sewers

310. The Tendring SFRA (2009) does not include any incidents of sewer flooding, detailed by Anglian Water through their DG5 register. The DG5 database records incidents of flooding relating to public foul, combined or surface water sewers and displays which properties suffered flooding (on a 4-5 postcode digit basis).

311. The onshore substation works area is located within existing agricultural land and, therefore, it is likely that there is a limited foul sewer network within the proximity of this location. The risk of flooding from sewers is therefore considered to be Low.

4.8.9 Flooding from reservoirs

312. The Environment Agency Flood Risk from Reservoirs map shows no areas of the onshore substation works area to be at risk of flooding from reservoir sources under any situation. Therefore, there is no risk of flooding from this source.

4.8.10 Flooding from canals and other artificial sources

313. The onshore substation works area is not located near to any canals or other artificial sources and therefore there is no risk of flooding from these sources to the area.

4.8.11 Summary of flooding

314. Overall, the onshore substation works area is not at risk from tidal, reservoirs, canals or other artificial sources, and is at Low risk from sewers.

315. Additionally, the risk of fluvial flooding is Low, since it is located entirely within Flood Zone 1, and more than 2km from the nearest Environment Agency Main River.

316. Areas shown to be at high or medium risk of surface water flooding are relatively localised. These indicate a flow path passing from north-west to south-east through the proposed location of the onshore substation and in the southern section of the onshore substation works area, close to Norman's Farm. The southern area at increased risk appears to be linked to the two Ordinary Watercourses comprising ditches along field boundaries to the south of Ardleigh Road.

317. Whilst the areas at increased risk are relatively isolated, small in nature and associated only with the 0.1% AP event they may result in overland flow and as such these have been considered within the onshore substation Outline Operational Drainage Strategy (Document Reference: 7.19) and the attenuation features which are to be provided as part of the surface water drainage scheme (see Section 7.5).

5 Consideration of the sequential test and exception test

5.1 Overview of national guidance

318. As noted in Section 2.2 and Section 2.3, NPS EN-1 requires the application of the Sequential Test and, where necessary, the Exception Test.

319. Further guidance to support NPS EN-1, on the application of the Sequential Test is provided in NPPF and in the PPG for Flood Risk and Coastal Change, which provides criteria in relation to the appropriate allocation of development types and flood risk.

320. As stated in Paragraph 023 of the PPG:

"The aim of the sequential approach is to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. This means avoiding, so far as possible, development in current and future medium and high flood risk areas considering all sources of flooding including areas at risk of surface water flooding. Avoiding flood risk through the sequential test is the most effective way of addressing flood risk because it places the least reliance on measures like flood defences, flood warnings and property level resilience features."

321. The aim of the Sequential Test is to ensure that a sequential risk-based approach is followed to steer new development to areas with the lowest risk of flooding, taking all sources of flood risk and climate change into account. Where it is not practicable to locate development in low-risk areas, the Sequential Test should go on to compare reasonably available sites:

- Within medium risk areas; and
- Then, only where there are no reasonably available sites in low and medium risk areas, within high-risk areas.

322. As noted in Paragraph 031 of the PPG:

"The Exception Test is not a tool to justify development in flood risk areas when the Sequential Test has already shown that there are reasonably available, lower risk sites, appropriate for the proposed development. It would only be appropriate to move onto the Exception Test in these cases where, accounting for wider sustainable development objectives, application of relevant local and national policies would provide a clear reason for refusing development in any alternative locations identified."

323. NPS EN-1 provides at 5.8.10 that the Exception Test should only be applied if the Sequential Test has shown that there are no reasonably available, lower-risk sites, suitable for the proposed development, to which the development could be steered.

324. The need for the Exception Test depends on the potential vulnerability of the development proposed, based on the Flood Risk Vulnerability Classification, and the Flood Zone within which it would be located, as summarised in Table 2.

325. Furthermore, Paragraph 031 of the PPG provides the following guidance on the criteria required to pass the Exception Test, where it should be demonstrated that:

- development that has to be in a flood risk area will provide wider sustainability benefits to the community that outweigh flood risk; and
- the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where practicable, will reduce flood risk overall.

326. NPS EN-1 paragraph 5.8.11 clarifies that both elements of the Exception Test should be satisfied for development to be allocated or permitted in situations where suitable sites at lower risk of flooding are not available following application of the Sequential Test.

327. As noted above, the NPS EN-1, and the further guidance in the NPPF and PPG confirms suitable development types within each Flood Zone, as identified in Table 2, which has been considered for the Project.

Table 2 Flood Risk Vulnerability and Flood Zone 'Incompatibility' Table as specified by the PPG

	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water compatible
Flood Zone 1	**Appropriate**	Appropriate	Appropriate	Appropriate	Appropriate

	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water compatible
Flood Zone 2	**Appropriate**	Exception Test Required	Appropriate	Appropriate	Appropriate
Flood Zone 3a	**Exception Test Required†**	Not Appropriate	Exception Test Required	Appropriate	Appropriate
Flood Zone 3b (Functional Floodplain) *	**Exception Test Required***	Not Appropriate	Not Appropriate	Not Appropriate	Appropriate

"†" 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, and water-compatible uses, should be designed and constructed to:*

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

5.2 Project specific considerations

328. In terms of the Project, and based on the additional guidance in the NPPF and the supporting PPG, the Project is classed as 'Essential Infrastructure' which is defined as:

- Essential transport infrastructure (including mass evacuation routes), which has to cross the area at risk.
- 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.
- Wind turbines.
- Solar farms.

329. Based on the guidance set out in the PPG, development classed as 'Essential Infrastructure' is considered acceptable in Flood Zones 1 and 2, whilst development located within Flood Zone 3 is required to pass the Exception Test.

5.2.1 Application of the sequential test

330. With regards to applying the Sequential Test for fluvial flood risk, it is noted that, principally, the Project is to be located in Flood Zone 1, including the majority of the onshore cable route and the onshore substation.

331. Permanent above-ground structures, comprising the onshore substation, are to be located within Flood Zone 1. Therefore, this is in accordance with the Sequential Test guidance, in relation to placing development in the lowest flood risk areas.

332. The onshore cable route, comprising only below ground infrastructure once operational, is also located primarily in Flood Zone 1, with some locations in Flood Zone 2 and 3 where it is required to pass under, or in proximity to, existing watercourses.

333. Due to the large-scale nature of the works, it is acknowledged that there are locations where infrastructure associated with the Project is required to pass through or be located in Flood Zone 3. This relates specifically to the onshore cable route at key locations associated with the need to cross existing watercourses and areas adjacent to the landfall location.

334. Most of the area behind the coastal frontage is shown by the Environment Agency Flood Map for Planning to benefit from the presence of flood defences.

335. Due to the linear nature of the Project, it is not possible to avoid areas of Flood Zone 3 entirely. Subsequently, elements of the Project which are located within Flood Zone 3, including parts of the onshore cable route and landfall, require consideration of the Exception Test.

336. With regards to surface water flood risk, it is noted that the landfall, onshore cable route and onshore substation are principally located in areas at low risk of surface water flooding, although there are localised areas that are at increased risk.

337. Whilst there are areas within the footprint of the onshore substation which are likely to be at increased surface water flood risk, during the 0.1% AP event, this is relatively localised. As such, mitigation measures have been identified within the design to ensure there is no adverse impact on flood risk as a result of the Project. This includes raising and levelling the onshore substation platform so that it remains unaffected by flooding as well as in the design of the diverted existing ditches such that they do not increase flood risk to the wider area, as noted in the Outline Operational Drainage Strategy (Document Reference: 7.19).

338. Therefore, it is considered that flood risk concerns can be appropriately mitigated. On this basis, the Project is considered to be in accordance with the Sequential Text, in that areas principally at low risk have been identified over those areas at increased risk.

339. With regards to other sources of flooding, it is noted that the Project has been located such that it is at low risk of flooding from reservoirs, sewers, groundwater, canals and other artificial sources.

340. On this basis, it is concluded that the Project has been appropriately sequentially located, in accordance with the guidance set out in the PPG. In addition to this, the sequential approach has been adopted in the location of key elements of the infrastructure, wherever practicable.

5.2.2 Application of the exception test

341. As noted in the previous section, it is not possible for a Project of this scale to wholly avoid areas at increased risk of flooding from all sources.

342. Following the guidance set out in the PPG, it is therefore necessary to consider the requirements of the Exception Test for the elements of the Project which

are located in Flood Zone 3. This is of specific relevance to the onshore cable route and at the landfall location.

343. It is concluded that the Project passes the first element of the Exception Test requirements, which comprises the provision of wider sustainability benefits to the community. This is on the basis that the Project, as a NSIP, provides energy certainty utilising a sustainable and renewable source of energy at a national scale.

344. With regard to the second part of the Exception Test, it is necessary to consider the Project in the context of its scale and that the majority of the onshore cable route, as well as the onshore substation, are not located within an area considered to be at risk of fluvial or tidal flooding.

345. Elements that are likely to pass through areas at increased risk of flooding, i.e. Flood Zone 3 or high surface water flood risk, comprise the subterranean development i.e. onshore export cables.

346. For the subterranean development, it is only during the construction works that there is the potential for a temporary increase in flood risk. This will be mitigated through the use of appropriate measures, as summarised in the OCoCP (Document Reference: 7.13). As such the subterranean development will not be vulnerable to flood risk during its operational lifetime and will not increase flood risk elsewhere.

347. Once operational, the flood risk to the onshore cable route will have been removed as the TJBs and the onshore export cables will be wholly located underground, with the latter sealed through a watertight manhole cover with no interaction with the above ground Flood Zones. The only visible above ground structures will be the link boxes, providing access for inspection and maintenance at the surface.

348. In addition, it is proposed that the Landfall will be constructed through the use of HDD techniques. Therefore, during construction and once operational, there will be limited interaction with the above ground Flood Zones.

349. On the basis of the above, when applying the Exception Test, it has been demonstrated that the Project will provide wider sustainability benefits to the community associated with the provision of renewable energy, and that it can be designed such that it would be safe for its lifetime without increasing flood risk elsewhere.

6 Climate change

350. In the future, the risk of flooding from all potential sources of flood risk are likely to be amplified as a result of the predicted changes associated with climate change. In line with the information provided within ES Chapter 5 Project Description (Document Reference: 3.1.7) the Project is expected to have a design life of 30 years with operation likely to commence from approximately 2030. Therefore, flood risk up to, approximately, 2060 has been taken into consideration within this FRA.

351. Given the potential sources of flooding identified in this FRA and the nature of various elements of the Project, there are two main aspects of climate change

which are likely to impact the Project, both in terms of flood risk to infrastructure as well as increasing the potential for there to be an off-site impact on other receptors. These factors comprise an increase in peak river flows and an increase in the duration and intensity of rainfall events, which is likely to increase the magnitude of surface water flooding.

352. Whilst storm surges and waves are likely to be larger in the future and sea levels will be higher than in the present day, this is unlikely to affect the Project as the elements of the infrastructure likely to be affected by this source of flooding will be located below-ground once operational.

353. Given the Projects are NSIPs then consideration has also been given to the guidance related to the credible maximum scenario. For the credible maximum scenario, the Environment Agency guidance sets out the following key criteria, which it also notes should be used as a 'sensitivity test':

- the H++ climate change allowances for sea level rise
- the upper end allowance for peak river flow
- the sensitivity test allowances for offshore wind speed and extreme wave height
- an additional 2mm for each year on top of sea level rise allowances from 2017 for storm surge.

354. On the basis that future flood risk, taking into account climate change, will only affect the onshore substation, which is inland and not affected by coastal flooding, the only criteria above considered to be of potential relevance relates to the use of the upper end allowance for peak river flow. This is discussed further in the following section.

6.1 Peak river flow allowances

355. As noted above, the climate change allowance related to peak river flow and fluvial flooding is only likely to be relevant to the onshore substation, once operational, as the onshore export cables will be located below ground once constructed.

356. Given the onshore substation is located within Flood Zone 1 and more than 2km from the nearest Environment Agency Main River, the increase in fluvial flooding relating to climate change is unlikely to affect the onshore substation, especially given the elevated nature of the intervening ground.

357. Therefore, based on the above key factors, it is concluded that the effects of climate change on fluvial flood risk will not impact either the onshore cable route or onshore substation and therefore this element of climate change has not been considered further within this FRA.

6.2 Peak rainfall allowances

358. When considering surface water flood risk, the Essex LLFA Statutory Consultee Guidance Document requires an assessment of the lifetime of the development, the vulnerability of the proposed land use and a justification related to the choice of allowance.

359. Further to the above guidance, the Environment Agency has also issued climate change allowance guidance, specifically with regard to the application of peak rainfall allowances (Environment Agency, 2022).

360. The surface water climate change allowances are determined by the predicted increase in peak rainfall intensity. These are determined by regional variations, based on management catchments, which are sub-catchments of river basin districts. The Project is located entirely within the Essex Management Catchment and therefore the allowances for this Management Catchment have been considered further within this FRA.

361. The Environment Agency guidance setting out the appropriate climate change allowances to be adopted for different development lifetimes (Environment Agency, 2022) is summarised below:

- Development with a lifetime beyond 2100:
    - This includes development proposed in applications or local plan allocations;
    - For FRAs and SFRAs assess the upper end allowances. You must do this for both the 1% and 3.3% annual exceedance probability events for the 2070s epoch (2061 to 2125);
    - Design your development so that for the upper end allowance in the 1% annual exceedance probability event; and
    - There is no increase in flood risk elsewhere your development will be safe from surface water flooding.
- Development with a lifetime of between 2061 and 2100:
    - For development with a lifetime between 2061 and 2100 take the same approach (as for a development with a lifetime beyond 2100) but use the central allowance for the 2070s epoch (2061 to 2125).
- Development with a lifetime up to 2060:
    - For development with a lifetime up to 2060, take the same approach but use the central allowance for the 2050s epoch (2022 to 2060).

362. As noted above, the onshore substation is situated in the Essex Management Catchment and Table 3 below provides a summary of the appropriate peak rainfall allowances relevant to this Management Catchment.

Table 3 Peak Rainfall Intensity Allowance for the Essex Management Catchment

Essex Management Catchment	Central 1 in 30 year (3.3%)	Upper end 1 in 30 year (3.3%)	Central 1 in 100 year (1%)	Upper end 1 in 100 year (1%)
2050s	20%	35%	20%	45%
2070s	20%	35%	25%	40%

363. When reviewing the guidance on credible maximum scenarios for NSIPs, it is noted that there is no specific guidance on allowances to be included in relation to peak rainfall in the future. Therefore the above Environment Agency guidance, as well as the Essex LLFA Statutory Consultee Guidance Document,

has been considered within this FRA as well as within the development of the operational drainage design

364. On the basis of the above guidance, assuming 30 years of operation with commencement of operation in 2032 at the earliest, the required allowance is an increase of 25% for the 1 in 100 year (1% AP) event applying the Central allowance for the 2070s epoch. In addition, the guidance indicates sensitivity testing should be undertaken for the 1 in 100 year plus 40% allowance for climate change.

365. Within the Outline Operational Drainage Strategy (Document Reference: 7.19) it has been confirmed that the 1 in 100 year plus 40% for climate change allowance will be accommodated, as a conservative design approach, within the drainage design by increasing peak rainfall in hydraulic calculations and providing appropriate on-site attenuation and storage, in accordance with the Essex County Council Sustainable Drainage Systems Design Guide. This is secured within the Outline Operational Drainage Strategy (Document Reference: 7.19)

7 Surface water drainage

7.1 Onshore infrastructure pre-construction work

366. Prior to commencement of the construction works, detailed land drainage surveys and ground investigations will be undertaken to support the development of the detailed drainage design for all elements of the onshore infrastructure.

367. The construction drainage infrastructure will be developed and agreed with the appropriate regulators, where relevant, and implemented to minimise water within the working areas, ensure ongoing drainage of surrounding land and that there is no increase in surface water flood risk.

368. This will assess the current and proposed runoff rates, volume of storage required and the proposed approach for discharge of water from the Project.

369. In addition, a local specialist drainage contractor will undertake the above surveys to locate drains, and create drawings pre- and post-construction, to ensure appropriate reinstatement. Construction drainage will include provisions to minimise flood risk within the working area and ensure ongoing drainage of surrounding land.

7.2 Landfall location and onshore cable route surface water drainage

370. The landfall and onshore cable route will only be at risk of surface water flooding during the construction phase.

371. However, during the construction phase and once operational, there is a risk that drainage ditches and surface water flow routes could be adversely affected should the works and the ground reinstatement not be carefully managed.

372. During construction, the Project would use trenchless crossing techniques at key watercourse crossing locations, including all Main Rivers, to avoid direct interaction with these watercourses. The cable entry and exit pits will be at least

9m from the banks of the watercourse, and a minimum depth of 1.5m and maximum depth of 20m below the hard bed level. In these locations the use of trenchless techniques will be confirmed and agreed with the regulators to confirm there will be no impact on flood risk as all proposed elements will be located below ground.

373. However, it is possible that a trenched crossing may also need to be carried out on one of the Ordinary Watercourses crossed by the onshore cable route. This method has the potential to directly alter the hydrology of the watercourses. Trenched crossings involve installing temporary dams (composed of straw bales and ditching clay, or another suitable technique) or flumes placed at bed level upstream and downstream of the crossing point. The cable trench is then excavated in the dry area of river bed between the two dams or beneath the flume, with the river flow maintained using a temporary pump (or flume).

374. There is the potential for the installation techniques to affect the bed and banks of the watercourse, which could result in an impact on flows along the watercourse and indirectly a change in flood risk, which will need to be managed during construction.

375. At this location, a site-specific investigation will be carried out at detailed design stage to identify the local ground and groundwater conditions, enable a site-specific risk assessment to be undertaken and to understand the potential impact of any works on flows along the watercourse and flood risk in the local area.

376. It will also be necessary to install additional field drainage within the onshore cable route to ensure the existing drainage characteristics of the land are maintained and there is no increase in flood risk to on- and off-site receptors during and after construction. All temporary drainage would pass through a silt interceptor or soakaway drainage pits before being discharged into surrounding drainage.

377. The detailed methodology to be used for any temporary construction at crossing points over existing ditches and watercourses shall be agreed with the Environment Agency and LLFA, as appropriate. To manage this ahead of the main works, the Principal Contractor will develop the construction drainage in consultation with the landowner and other statutory stakeholders.

7.3 Temporary construction compounds surface water drainage

378. The implementation of temporary construction compounds may increase surface water run off temporarily due to an increase in impermeable area during the construction phase.

379. However, prior to construction, an appropriate surface water drainage scheme would be developed by a local specialist drainage contractor and implemented to minimise water within the cable trench and ensure ongoing drainage of surrounding land. A soakaway drainage pit may be required where infiltration rate is found suitable, if no suitable outfall to a nearby by watercourse is possible.

380. The temporary construction compounds will only be at risk of surface water flooding during construction as, following completion, the compounds and any

associated temporary access tracks along the onshore cable route will be fully reinstated and would have no operational use.

381. In addition, at the onshore substation, temporary swales are proposed along the perimeter of the compound to intercept and attenuate runoff before discharge to the temporary attenuation features. At the time of writing, the temporary attenuation features at the onshore substation will be filled in upon completion of the construction phase and the associated pipework will be removed.

7.4 Onshore cable route post-construction

382. Following construction of the landfall and onshore export cables there will be no permanent above ground infrastructure with the exception of link boxes and their access manhole covers (see ES Chapter 5 Project Description (Document Reference: 3.1.7)). Furthermore, all temporary construction compounds and temporary access tracks will be fully reinstated and would have no operational use.

383. Existing land drains along the onshore cable route will be reinstated with at least the same capacity as the pre-construction channel to prevent any potential impacts on flood risk, this will be based on the information obtained during the pre-construction survey.

384. The backfilling of material, within both construction drainage channels and along the onshore cable route itself, will prevent a conduit from forming and ensure there are no changes to the local flow rates due to permeability changes.

7.5 Onshore substation operational surface water drainage

385. During the development of this FRA the discharge of surface water from the onshore substation during operation has been considered within the context of the surface water flood risk and the need to ensure that any drainage solutions do not result in an increase in flood risk either to or from the onshore substation.

386. Surface water drainage requirements will be designed to meet the requirements of the NPPF, NPS EN-1 and the CIRIA SuDS Manual C753 (CIRIA, 2015). Runoff from the onshore substation will be limited and discharged in accordance with industry good practice.

387. Drainage options will be considered within the context of the principles of the SuDS hierarchy set out in the Essex County Council SuDS Design Guide (Essex County Council, 2020) with the aim of discharging surface water runoff as high up the hierarchy as possible.

388. A summary of the SuDS hierarchy set out in the Essex County Council SuDS Design Guidance is provided as follows:

- Rainwater re-use (rainwater harvesting / greywater recycling);
- An adequate soakaway or other infiltration system;
- Hybrid solution of infiltration and discharging to a surface water body;
- To a surface water body (e.g. an Ordinary Watercourse);
- To a surface water sewer, highway drain, or other drainage system; and

- To a combined sewer.

389. An Outline Operational Drainage Strategy (Document Reference: 7.19) provides details of the proposed surface water drainage design. It provides confirmation that sufficient storage will be provided to attenuate surface water and discharge at a controlled rate following a rainfall event.

390. An indicative volume and location for the proposed attenuation features has been provided and this will be confirmed, in accordance with the above guidance, during the development of the detailed design.

391. As further information becomes available, the operational drainage at the onshore substation will be developed in consultation with Essex County Council (as the LLFA) to ensure the runoff rates are maintained at pre-development rates. This will include confirmation of the greenfield runoff rate, proposed runoff rates, volume of storage required and the final proposed approach for discharge of water from the onshore substation.

392. The outline surface water drainage design is set out in the Outline Drainage Strategy (Document Reference: 7.19), which has been produced to accompany the ES and submitted as part of the DCO application.

393. The operational drainage at the onshore substation will consider the likely maintenance requirements of new and existing infrastructure. It is important that maintenance is also considered in the design of the drainage system to account for the requirements of undertaking maintenance work such as ease of access for personnel, vehicles or machinery.

394. A management and maintenance plan of any proposed surface water drainage infrastructure will also be agreed with relevant stakeholders and that it will remain the responsibility of the asset owner or operator for the lifetime of the development.

8 Flood risk mitigation measures

395. Residual risk is the risk that remains after flood management or embedded mitigation measures have been installed. This FRA has considered residual flood risk and whether there is a need for any additional mitigation measures to manage the residual flood risk.

8.1 Onshore design mitigation

396. Elements of the Project comprising the construction compounds and all open areas required for the installation of the landfall and onshore export cables are only required during the construction phase and once operational will be located below ground, and therefore not subject to any flood risk. On this basis, this FRA has focused on the flood risk during the construction phase only.

397. The only element of the Project located above ground, once operational, will be the onshore substation. It is within this context that the following flood risk mitigation measures have been considered.

398. As previously noted, the onshore project area is primarily located within Flood Zone 1 i.e. outside of Flood Zones 2 and 3, in areas at Low risk of flooding from

fluvial or tidal sources. In addition, the onshore project area is principally located in areas at Low risk of surface water flooding.

399. As such, the sequential approach has been adopted with regard to the location of above ground structures with infrastructure being located in Flood Zone 1 and at low risk of surface water flooding, where practicable.

400. At the landfall, where the works have the potential to affect the tidal / coastal flood risk, it is proposed to carry out the landfall works using trenchless techniques.

401. It is, however, likely that some trenched crossings will be carried out on a limited number of Ordinary Watercourses crossed by the onshore cable route.

402. At these locations, a site-specific investigation will be carried out at detailed design stage, to identify the local ground and groundwater conditions, enable a site-specific risk assessment to be undertaken and to understand the potential impact of any works on flows along the watercourse and flood risk in the local area.

403. A local specialist drainage contractor will be appointed to prepare construction surface water drainage, undertake surveys, locate drains, and create drawings pre- and post-construction, to ensure appropriate reinstatement. Construction drainage will include provisions to minimise flood risk within the working area and ensure ongoing drainage of surrounding land.

404. All Main Rivers will be crossed using trenchless techniques, which is embedded in the scheme design, to avoid direct interaction with these watercourses. The cable entry and exit pits will be at least 9m from the banks of the watercourse, and a minimum depth of 3m and maximum depth of 20m below the hard bed level. Although ground disturbance will occur at entry and exit points, there will be no direct impact on the watercourses themselves.

405. Following construction of the landfall and onshore export cables there will be no permanent above ground elements, except for the proposed link boxes.

406. Drainage will also be reinstated to match the pre-construction conditions. As such there would be no impact on surface water drainage. Furthermore, all temporary construction compounds and temporary access tracks will be fully reinstated and would have no operational use.

8.2 Flood warning and evacuation

407. While construction work is taking place on site, site workers and users will be required to monitor local weather forecasts and ensure there is an evacuation route in place in the event that either fluvial or surface water flooding takes place during the construction stages of the development. This will also need to include any works being undertaken at the landfall, in the area at risk from tidal flooding. This will be secured within the OCoCP (Document Reference: 7.13).

408. Where there are Environment Agency Flood Alerts and Flood Warnings available for a location, the Principal Contractor will be required to sign up to receive the relevant flood warnings and alerts.

409. Specific Flood Warning and Evacuation Plans should be produced for the construction phase at both the landfall and along the onshore cable route. This

is specifically relevant to construction works at watercourse crossing locations where personnel or materials may be located within Flood Zone 2 or Flood Zone 3 and at the landfall where works may, albeit temporarily, be located in Flood Zone 2 or Flood Zone 3.

410. All personnel should be made aware of any access routes, which are located within Flood Zone 2 or Flood Zone 3 and any flood warnings issued for those areas should result in the relevant access routes being cleared of all project personnel and, where practicable, all project plant and materials.

411. A site-specific Flood Warning and Evacuation Plan should include practical steps for protecting construction workers and personnel, be easy to communicate and consider delegated responsibility, or whether personnel are likely to require additional support during a flood event.

412. It is anticipated that during construction the Project will require a comprehensive Flood Warning and Evacuation Plan including the following aspects:

- A list of important contacts, including Floodline, utilities companies and insurance providers;
- A description or map showing locations of service shut off points;
- Basic strategies for protecting property, machinery or materials, including moving assets to safety where practicable, turning off or isolating services and moving to safety; and
- Safe access and egress routes.

413. As noted above, the Environment Agency provide a free Flood Alert ("*flooding is possible*") and Flood Warning ("*flooding is expected*") service. It is recommended that the Flood Warning and Evacuation Plan considers how receipt of these flood alerts or warnings may affect the Project.

414. It should be noted that large parts of the onshore cable route are in rural undeveloped areas that are not covered by flood warnings. Furthermore, it is important to note that Environment Agency flood alerts and warnings are not issued in response to surface water flooding.

415. As such the Flood Warning and Evacuation Plan will need to include independent checks (i.e. Met Office weather warnings) alongside any alerts or warnings issued by the Environment Agency. These checks will also account for risks outside of the flood alerts or flood warnings and will enable contractors and site managers to consider how this information will affect planned works, especially areas in close proximity to key watercourses.

416. During construction, contractors and management should liaise with Essex County Council, as the LLFA, and the Environment Agency so they are aware of any forecast related to heavy rainfall events. The potential for flooding can then be assessed to enable work to stop, especially in areas in close proximity to key watercourses, and the site cleared of all personnel, as required.

8.3 Access and egress

417. As the onshore substation is located within Flood Zone 1 any personnel within these areas would be at low risk of flooding from fluvial sources and therefore

access and egress during operation in this scenario is unlikely to be a flood risk concern for the Project.

418. However, there is a potential risk of surface water flooding to the onshore substation. This is associated with isolated areas of increased surface water flood risk. In addition, design measures including the raising and levelling of the onshore substation have been incorporated, which limits the surface water flood risk.

419. Once operational, requirements for personnel to access the onshore substation (being the only above ground infrastructure) will be limited and transient in nature i.e. there will be no requirement to remain on site overnight.

420. As such, the onshore substation could be evacuated, upon receipt of a warning of heavy rainfall, prior to an event. This ensures site users and operators of the onshore substation would not be placed at risk during such an event.

421. In any respect, the risk of surface water flooding at the onshore substation is low and would be localised in nature. Egress routes from the onshore substation would be readily available to areas that are similarly not identified as being at risk. As such, it is not considered that specific access or egress plans are required for this element of the Project.

422. During construction, access and egress is only likely to be an issue for personnel working in proximity to areas identified as being at flood risk earlier in this FRA. As such, appropriate access and egress routes, during construction, will need to be identified as part of the Flood Warning and Evacuation Plan, which is secured within the OCoCP (Document Reference: 7.13).

9 Conclusions

423. The Project has been considered within the context of the guidance set out in the NPS, NPPF and the supporting PPG. On this basis, all potential sources of flood risk to the onshore infrastructure within the onshore project area have been considered.

9.1 Landfall

424. Overall, the landfall is not at risk of flooding from fluvial sources, canals or other artificial sources. During the construction phase, there is a Very Low risk of flooding associated with groundwater sources and a Low risk of flooding from sewers and reservoir sources.

425. Furthermore, during construction, in terms of tidal flood risk at the landfall the onshore export cables will be required to pass under areas shown as being in Flood Zone 2 or Flood Zone 3, behind the Holland Gap to Chevaux de Frise Point Coastal Defence.

426. However, as the onshore export cables will be installed using HDD techniques and will comprise below ground infrastructure they will not be at risk from flooding once operational.

9.2 Onshore cable route

427. Overall, the onshore cable route is not at risk from any sources of flood risk once operational. On this basis, this FRA has focused on the flood risk during the construction phase.

428. A review of the flood risk along the onshore cable route has been undertaken and it will primarily be located in Flood Zone 1. However, there are some sections of the onshore cable route which are located in Flood Zone 2 and Flood Zone 3, associated with Main River and Ordinary Watercourse crossings.

429. In addition, at the locations where the onshore cable route crosses the Ordinary Watercourses there are areas of increased surface water flooding. However, this is primarily limited to the width of the watercourse channel and relates to the lower lying area comprising the channel itself and the land draining into it.

430. The use of trenchless techniques has been embedded in the scheme design for the crossing of Main Rivers and as such the impact on flood risk in these locations would be Low.

431. Trenched and trenchless crossings will be carried out on Ordinary Watercourses crossed by the onshore cable route. For the trenched crossings, any temporary damming and diversion of watercourses along the onshore cable route will be designed such that the original flow volumes and rates are maintained to ensure the flood risk is not increased.

432. Furthermore, these would be temporary impacts, as the bed and banks are to be reinstated to their original level, position and profile. At these locations, a site-specific investigation will be carried out at detailed design stage, to identify the local ground and groundwater conditions. A site-specific risk assessment would be undertaken to understand the potential impact of any works on flows along the watercourse and flood risk in the local area.

433. Once operational, there will be no flood risk to or from the onshore export cables linked to fluvial, tidal, surface or sewer flooding as they will be located wholly below ground.

434. In addition, any residual risk of flooding to the Project from groundwater shall be mitigated using suitable waterproofing of the cables, link boxes and joint bays. Any effect that the onshore export cables may have on existing groundwater flow routes is likely to be limited as the depth of the onshore export cables ensures they are likely to be constructed within the superficial deposits.

9.3 Onshore substation

435. The onshore substation is not considered to be at risk of flooding from tidal, sewers, reservoirs, canals or other artificial sources. There is also a low risk of flooding from groundwater sources.

436. In addition, the onshore substation is located within Flood Zone 1, which represents a low risk of flooding from fluvial sources.

437. With regards to the surface water flood risk, the Environment Agency Surface Water Flood Map indicates that the onshore convertor station site has areas of surface water flood risk, associated only with the 0.1% AP event, located within the proposed footprint of the onshore substation.

438. Whilst the area at increased risk is relatively small in comparison with the wider onshore substation works area, the indictive drainage design also includes measures to mitigate this risk to ensure it does not increase surface water flood risk either to the Project or to off-site receptors.

439. On this basis, whilst overall the risk of flooding from surface water is considered to be Low for the onshore substation, there is a need to consider this in greater detail as part of the final design for the onshore substation. However, it is noted that it has been considered in the development of the surface water drainage design, as shown in the Outline Operational Drainage Strategy (Document Reference: 7.19).

440. Furthermore, surface water drainage requirements for the onshore substation have taken into account the SuDS hierarchy to meet the requirements of the relevant policy and guidance.

441. The operational drainage at the onshore substation will be designed taking into account the greenfield runoff rate, proposed runoff rates, volume of storage required and the proposed approach for discharge of water from the onshore substation.

442. Once operational, access to the onshore substation will be limited and transient in nature i.e. there will be no requirement to remain on site overnight and the site can be evacuated, upon receipt of a heavy rainfall warning. This ensures operators of the site would not be placed at risk during such an event. Egress routes from the onshore substation would be readily available to areas that are similarly not identified as being at risk. As such, it is not considered that a Flood Warning and Evacuation Plan or specific access or egress plans are required for this element of the Project.

9.4 Summary of flood risk

443. In summary, this FRA has been undertaken in accordance with the NPS and NPPF and the methodology and criteria provided for the application of the Sequential Test and Exception Test contained within the PPG.

444. As noted previously, the Project is to be principally located in Flood Zone 1 and at low risk of surface water flooding, including the majority of the onshore cable route and the onshore substation. Furthermore, there is a low risk of flooding from all other sources of flood risk.

445. Permanent above-ground structures, comprising the onshore substation, are to be located within Flood Zone 1 and are therefore in accordance with the Sequential Test guidance related to placing development in the lowest flood risk areas.

446. Subterranean development is also located primarily in Flood Zone 1, with some locations in Flood Zone 2 and Flood Zone 3 where it is required to pass under, or in proximity to, existing watercourses.

447. With regards to surface water flood risk, it is noted that the Project is principally at low risk of surface water flooding.

448. Therefore, it is considered that flood risk concerns have been appropriately mitigated within the design of the Project. On this basis, the Project is in accordance with the Sequential Test in that areas principally at low risk have been identified over those areas at increased risk.

449. Due to the large-scale nature of the works, it is acknowledged that there are locations where infrastructure is required to pass through or be located in Flood Zone 3 or at increased risk of surface water flooding. This relates to the onshore cable route adjacent to the landfall and key locations along the onshore cable route (associated with the need to cross existing watercourses).

450. Due to the linear nature of the Project, it is not possible to avoid these areas entirely, and whilst they have been avoided, where practicable, this is not entirely possible. As such, it is noted that elements of the Project located within Flood Zone 3, comprising the onshore cable route and landfall location require consideration of the Exception Test.

451. Considering the two parts of the Exception Test, it is concluded that the first part comprising the provision of wider sustainability benefits to the community has been passed on the basis that the Project, as a NSIP provides energy certainty utilising a sustainable and renewable source of energy at a national scale.

452. With regard to the second part of the Exception Test, it is necessary to consider the Project in the context of its scale and that the majority of the onshore cable route, as well as the onshore substation, are not located within an area considered to be at risk of fluvial or tidal flooding.

453. Elements that are likely to pass through areas at increased risk of flooding, i.e. Flood Zone 3 or high surface water flood risk, comprise the subterranean development which, following construction, will not be vulnerable to flood risk during its operational lifetime and will not increase flood risk elsewhere.

454. For the subterranean development, it is only during the construction works that there is the potential for a temporary increase in flood risk. This will be mitigated through the use of appropriate management measures, as summarised in the OCoCP (Document Reference: 7.13).

455. Therefore, it is considered that the second part of the Exception Test has been passed, as it has been demonstrated that the infrastructure can be designed such that it would be safe for its lifetime, without increasing flood risk elsewhere.

456. On the basis of the flood risk identified both to and from the Project, and consideration of both the Sequential Test and Exception Test, it is therefore concluded that the Project is appropriate in terms of flood risk and is in accordance with the NPS, NPPF and the supporting PPG.

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