Yorkshire GREEN Project

Volume three: Preliminary Environmental Information Report
Appendix 9.D Flood Risk Assessment (FRA)

October 2021

nationalgrid

Contents

Executive summary

Purpose of this report

This Flood Risk Assessment is an appendix to **Chapter 9: Hydrology and Flood Risk** of the Yorkshire Green Energy Enablement Project Preliminary Environmental Information Report (PEIR). The Flood Risk Assessment (FRA) supports the Development Consent Order (DCO) application for the Yorkshire Green Energy Enablement (GREEN) Project (hereinafter referred to as the 'Project'); a proposal by National Grid Electricity Transmission plc (National Grid) to provide a new link on the transmission system by upgrading and reinforcing the electricity transmission system in Yorkshire.

The Project will include the construction of new infrastructure consisting of approximately 7km of new overhead lines, underground cables, two substations, cable sealing end compounds, to link up two existing overhead lines, and to reinforce the system to increase the capacity of the network north of York. It would also include upgrading works to existing infrastructure, including reconductoring (the replacement of wires on an existing transmission line), steelwork strengthening and potential replacement of existing pylons along the 275kV Poppleton to Monk Fryston (XC/XCP) overhead line. It would also carry out the installation of additional equipment at Osbaldwick Substation.

1. Introduction

1.1 Context

1.1.1 This Flood Risk Assessment (FRA) accompanies an application by National Grid Electricity Transmission (plc) (National Grid) to seek powers to construct, operate and maintain the Project which will the construction of new infrastructure consisting of approximately 7km of new overhead lines, underground cables, two substations, cable sealing end compounds (CSECs), to link up two existing overhead lines, and to reinforce the system to increase the capacity of the network north of York. It would also include upgrading works to existing infrastructure, including reconductoring (the replacement of wires on an existing transmission line), steelwork strengthening and potential replacement of existing pylons along the 275kV Poppleton to Monk Fryston (XC/XCP) overhead line. It would also carry out the installation of additional equipment at Osbaldwick Substation.

1.1.2 The draft Order Limits cover the entire area within which development would take place including temporary access roads, construction compounds and laydown areas as well as the new overhead lines, substations and CSECs sealing end compounds and the works to the existing infrastructure. These are presently anticipated as the maximum extent of land in which the Project may take place.

1.1.3 A more detailed description of the Project design and construction methodology can be found on **Chapter 3: Description of the Project** of the Preliminary Environmental Information Report (PEIR) and section 3.2 of this FRA. This document is an appendix to **Chapter 9, Hydrology and Flood Risk**,

1.2 Overall scope and approach to the FRA

Scope

1.2.1 All potential elements of the Project to be put forward for the application for DCO are assessed in the FRA. This comprises all new infrastructure, plus all construction related activities including construction compounds, access tracks and water course crossings. The FRA considers flood risk associated with the construction, operation and decommissioning phases of the Project. The operational phase assessment considers all new, permanent infrastructure, excluding pylons, as outlined in **Section 4.6**. Flood risk to the Project and to third parties arising from the Project are assessed. The FRA follows a source-pathway-receptor led approach to the assessment of flood risk.

1.2.2 The construction period extends over a 4-year period from 2024 to 2028, with some elements of the Project being operational from 2027. The Project would have a design life span of 80 years before a decommissioning phase would be reached. The decommissioning of the overhead lines and substations is expected to have similar potential impacts to the flood receptors, as the construction phase. No detailed quantitative assessment will be carried out for the decommissioning phase of the Project as part of the FRA.

Approach to FRA

1.2.3 An approach to the FRA has been adopted which is proportionate to the scale and diverse nature of the Project and recognises that different elements of the Project infrastructure have different levels of sensitivity to flooding. This allows the assessment to focus on sensitive aspects of Project infrastructure or activities which need to take place in areas of higher flood risk.

1.2.4 A range of generally applicable design principles and environmental measures have been defined which should serve to reduce flood risk across the board (**Section 6**). Flood risks to, and arising from, the Project are assessed in the FRA assuming that these measures will have been implemented. In most areas and for most aspects of the Project, it is expected that these principles and measures would be sufficient to manage any flood risk related to the Project. Detailed site specific assessments within the FRA are therefore focussed on assessing risks to more sensitive aspects of Project infrastructure or activities which need to take place in areas of higher flood risk.

1.2.5 The linear nature of the overhead line infrastructure means that flood risk areas cannot be completely avoided along the route it traverses. Furthermore, although every effort has been made to sequentially locate sensitive aspects of infrastructure in areas of low flood risk, this has not always proved to be possible, due to the operational requirements of the Project, or due to the over-riding requirements of other environmental constraints. Conformance of different aspects of the Project infrastructure with the requirements of the Sequential and Exception Tests are considered in **Section 7**.

1.2.6 At the PEIR stage we have used all available data to undertake our assessment, but no new, additional modelling has been undertaken. Modelling identified as being required at PEIR, will be completed and included in the final FRA submitted in support of the DCO application. This PEIR FRA has primarily used the Environment Agency's openly available flood maps for fluvial and surface water flood risk, though the Environment Agency have provided model outputs for the four following models:

- 2010 River Ure and Tributaries Modelling Study;
- 2016 York Detailed Model;
- 2018 Ouse and Wharfe Washlands Opt Study; and
- 2002 Cock Beck.

1.3 FRA definitions

Annual Exceedance Probability (AEP)

1.3.1 In this report, the probability of a flood occurring is expressed in terms of Annual Exceedance Probability (AEP), which is the inverse of the annual maximum return period. For example, the 1 in 100-year flood can be expressed as the 1% AEP flood, i.e., a flood that has a 1% chance of being exceeded in any year.

1.3.2 **Table 1.1** is provided to clarify the use of the AEP terminology as well a description of the Flood Zone definitions as set out in the NPPF flood risk and coastal change guidance.

Table 1.1 - Flood Zone definitions and associated annual exceedance probability

Flood Zones	Probability of Flooding	AEP	Definition
Flood Zone 1	Low Probability	<0.1% AEP of river or sea flooding	Land with less than 1 in 1,000 probability of flooding from rivers or the sea, in any given year.
Flood Zone 2	Medium Probability	1% - 0.1% AEP of river flooding 0.5% – 0.1% AEP of sea flooding	Land with between a 1 in 100 and 1 in 1,000 of river flooding; or land having between a 1 in 200 and 1 in 1,000 probability of sea flooding.
Flood Zone 3	High Probability	>1% AEP of river flooding >0.5% AEP of sea flooding	Land having a 1 in 100 or greater probability of river flooding in any year; or Land having a 1 in 200 probability or greater of sea flooding in any year.
Flood Zone 3b	Functional Floodplain	The 5% AEP (or 1 in 20 annual probability) event is often used to help define Flood Zone 3b, the 'functional floodplain', but is not part of the definition	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.

1.3.3 **Table 1.2** is provided is again provided to clarify the use of the AEP terminology as well a description of the Risk of Flooding from Surface Water (RoFSW) map layers available from the Environment Agency.

Table 1.2 - Surface water flood risk category definitions and associated annual exceedance probability

Probability of Flooding	AEP	Definition
Very low risk	<0.1% AEP of surface water flooding.	Land with less than 1 in 1,000 probability of flooding from surface water, in any given year.
Low risk	0.1 – 1% AEP of surface water flooding	Land with between 1 in 1,000 and 1 in 100 probability of flooding from surface water, in any given year.
Medium risk	1 – 3.3% AEP of surface water flooding.	Land with between 1 in 100 and 1 in 30 probability of flooding from surface water, in any given year.

Probability of Flooding	AEP	Definition
High risk	>3.3% AEP of surface water flooding.	Land with more than 1 in 30 probability of flooding from surface water, in any given year.

1.4 Structure of this report

1.4.1 The rest of this report is structured as follows:

- **Section 2** establishes the planning policy context for the FRA;
- **Section 3** provides an overview of the Project site location, its characteristics and a description of the Project;
- **Section 4** comprises a screening assessment to consider the potential risk from all sources of flooding prevailing across the Project site and the surrounding area and identifies those that require detailed assessment;
- **Section 5** presents a detailed assessment of flood risks associated with the Project. This includes the identification of flood risk receptors, consideration of risks to these receptors associated with all the significant hazards identified in Section 4, and specifies mitigation measures where appropriate; and
- **Section 6** specifies flood risk management mitigation measures where appropriate, and considers residual risk**;**
- **Section 7 - Planning Policy Requirements:** applies the Sequential and Exception Tests as necessary to meet planning requirements.
- **Section 8 - Summary and Conclusions:** summarises the main points arising from the FRA.

2. Planning context and requirements

2.1 Introduction

2.1.1 The purpose of this section is to identify the key policy documents that define the scope of this assessment. The section is structured in a hierarchical order, from national policy down to local guidance.

2.2 National planning policy and supporting guidance

National Policy Statements (NPSs)

2.2.1 The Project is defined as a NSIP under Section 14(1)(b) and Section 16 of the Planning Act 2008 as it comprises the installation of an electric line above ground with a nominal voltage of more than 132kV and a length of more than 2km. Therefore, a DCO is required to authorise the Project.

2.2.2 The Planning Act 2008 requires that DCO applications must be determined in line with the requirements of the relevant National Policy Statements (NPSs) which provide the overarching principles relevant to major energy infrastructure and the policies against which applications for NSIPs should be determined.

2.2.3 In a hierarchical context, the FRA will be prepared in accordance with the Planning Act 2008, National Policy Statement (NPS) EN-1[1], which sets out planning policy with regard to NSIPs in the energy sector, and NPS EN-5[2], which covers electricity transmission and distribution. Where the respective NPSs do not provide the necessary level of detail, reference will be made to National Planning Policy Framework (NPPF)[3] and its associated Planning Practice Guidance on Flood Risk and Coastal Change (NPPF PPG)[4], as set out in the next section.

2.2.4 The 'minimum requirements for FRAs' as set out in paragraph 5.7.5 of NPS EN-1[1] are that they should:

- *"Be proportionate to the risk and appropriate to the scale, nature and location of the project;*
- *Consider the risk of flooding arising from the project in addition to the risk of flooding to the project;*
- *Take the impacts of climate change into account, clearly stating the development lifetime over which the assessment has been made;*

[1] Department of Energy and Climate Change (2011). Overarching National Policy Statement for Energy (EN-1). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf
[2] Department of Energy and Climate Change (2011). Overarching National Policy Statement for Energy (EN-5). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/37050/1942-national-policy-statement-electricity-networks.pdf
[3] Ministry of Housing, Communities and Local Government (2021). National Planning Policy Framework (last updated 20 July 2021). Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2
[4] Ministry of Housing, Communities and Local Government (2016). Planning Practice Guidance on Flood Risk and Coastal Change. Available at https://www.gov.uk/guidance/flood-risk-and-coastal-change

- *Be undertaken by competent people, as early as possible in the process of preparing the proposal;*
- *Consider both the potential adverse and beneficial effects of flood risk management infrastructure, including raised defences, flow channels, flood storage areas and other artificial features, together with the consequences of their failure;*
- *Consider the vulnerability of those using the site, including arrangements for safe access;*
- *Consider and quantify the different types of flooding (whether from natural and human sources and including joint and cumulative effects) and identify flood risk reduction measures, so that assessments are fit for the purpose of the decisions being made;*
- *Consider the effects of a range of flooding events including extreme events on people, property, the natural and historic environment and river and coastal processes;*
- *Include the assessment of the remaining (known as 'residual') risk after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular project;*
- *Consider how the ability of water to soak into the ground may change with development, along with how the proposed layout of the project may affect drainage systems;*
- *Consider if there is a need to be safe and remain operational during a worst case flood event over the development's lifetime; and*
- *Be supported by appropriate data and information, including historical information on previous events."*

2.2.5 NPS-EN1[1] also requires that the Sequential Test and Exception Test are applied. Paragraph 5.7.12 of NPS EN-1[1] states that *"The IPC* [Infrastructure Planning Commission – now replaced by the Planning Inspectorate] *should not consent development in Flood Zone 2 in England or Zone B in Wales unless it is satisfied that the Sequential Test requirements have been met. It should not consent development in Flood Zone 3 or Zone C unless it is satisfied that the Sequential and Exception Test requirements have been met*."

The Sequential Test

2.2.6 The Sequential Test is set out in EN-1[1], Paragraph 5.7.13, as follows: "*Preference should be given to locating projects in Flood Zone 1 in England or Zone A in Wales. If there is no reasonably available site in Flood Zone 1 or Zone A, then projects can be located in Flood Zone 2 or Zone B. If there is no reasonably available site in Flood Zones 1 or 2 or Zones A & B, then nationally significant energy infrastructure projects can be located in Flood Zone 3 or Zone C subject to the Exception Test.*"

2.2.7 EN-1[1] (and NPPF) also require that a sequential approach should be applied to the layout and design when allocating land for development and land use types within development sites.

The Exception Test

2.2.8 Paragraph 5.7.14 of NPS EN-1[1] states "*If, following application of the sequential test, it is not possible, consistent with wider sustainability objectives, for the project to be located in zones of lower probability of flooding than Flood Zone 3 or Zone C, the Exception Test can be applied. The test provides a method of managing flood risk while still allowing necessary development to occur.*"

2.2.9 In accordance with paragraph 5.7.16 of NPS EN-1[1], for the Exception Test to be passed:

i. "*it must be demonstrated that the project provides wider sustainability benefits to the community that outweigh flood risk [benefits to the community would include the benefits (including need), for the infrastructure];*

ii. *"the project should be on developable, previously developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously developed land subject to any exceptions set out in the technology-specific NPSs; and*

iii. *"a FRA must demonstrate that the project will be safe, without increasing flood risk elsewhere subject to the exception below and, where possible, will reduce flood risk overall."*

2.2.10 The 'exception below' mentioned in the third part of the Exception Test is set out in paragraph 5.7.17 of NPS EN-1[1]: *"Exceptionally, where an increase in flood risk elsewhere cannot be avoided or wholly mitigated, the IPC* [Infrastructure Planning Commission – now replaced by the Planning Inspectorate] *may grant consent if it is satisfied that the increase in present and future flood risk can be mitigated to an acceptable level and taking account of the benefits of, including the need for, nationally significant energy infrastructure as set out in Part 3 above. In any such case the IPC should make clear how, in reaching its decision, it has weighed up the increased flood risk against the benefits of the project, taking account of the nature and degree of the risk, the future impacts on climate change, and advice provided by the Environment Agency and other relevant bodies."*

National Planning Policy Framework (NPPF)

2.2.11 The NPPF (2016) acts as guidance for local planning authorities and decision makers, both in drawing up plans and making decisions about planning applications. This is supported by online Planning Practice Guidance[4].

2.2.12 Although the NPPF and the associated Planning Practice Guidance[4] are not directly applicable to NSIP developments, they do provide additional relevant guidance on a range of issues, including the definition of flood zones, development vulnerability classifications, compatibility of development types and flood zones, and appropriate allowances for the effects of climate change.

2.2.13 The NPPF[3] sets out requirements for FRA for new developments and describes how the Sequential (Paragraph 161 and 162) and Exception Tests (Paragraph 163 and 164) should be applied, depending on the Flood Zone that the Project is located in, and its Flood Vulnerability classification. Paragraph 164 states that, '*To pass the exception test it should be demonstrated that:*

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

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

2.2.14 Paragraph 167 of the NPPF[3] requires that new development should not increase flood risk elsewhere, and that opportunities should be sought to reduce flood risk, where possible. Paragraph 167 states '…*Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:*

- *a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;*
- *b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;*
- *c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;*
- *d) any residual risk can be safely managed; and*
- *e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.'*

2.2.15 Paragraph 169 of the NPPF[3] states "*Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:*

- *(a) take account of advice from the lead local flood authority;*
- *(b) have appropriate proposed minimum operational standards;*
- *(c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and*
- *(d) where possible, provide multifunctional benefits."*

2.2.16 There is a presumption for the use of SuDS within any development, except in rare instances that it can be demonstrated that SuDS principles cannot be feasibly incorporated within a development, as agreed with the planning authority.

Climate change guidance for FRA

2.2.17 NPS EN-1[1] and NPS EN-5[2] gives advice on accounting for climate change, to the effect that developments should be resilient and adaptive to the latest climate change projections.

2.2.18 Current Environment Agency guidance[5] will be used to determine appropriate climate change allowances to determine future flood hazard for the FRA (as updated on 27 July). Relevant allowances for the Project location are summarised in **Table 2.1**.

2.2.19 The Environment Agency guidance provides climate change allowances for extreme rainfall, one set for the whole of the UK, and river flow, set by individual operational management catchment, for the following epochs:

[5] Environment Agency (2020). Flood risk assessments: climate change allowances (last updated 22 July 2020). Available at https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

- ‘2020s’, covering the period 2015 to 2039;
- ‘2050s’, covering the period 2040 to 2069; and
- ‘2080s’, covering the period 2070 to 2115.

2.2.20 The Project crosses three Environment Agency Management Catchments which are listed below (from north to south). The climate change allowance relevant to each of the epoch’s listed above and the Management catchments listed below are set out in **Table 2.1**.

- Swale, Ure, Nidd and Upper Ouse;
- Wharfe and Lower Ouse; and
- Aire and Calder.

Table 2.1 - Climate change allowances[5]

Allowance Category	Total Potential Change Anticipated for the ‘2020s’ (2015 to 2039)	Total Potential Change Anticipated for the ‘2050s’ (2040 to 2069)	Total Potential Change Anticipated for the ‘2080s’ (2070 to 2115)
Peak river flows - Swale, Ure, Nidd and Upper Ouse Management Catchment			
Upper end	25%	30%	53%
Higher central	15%	20%	34%
Central	11%	15%	25%
Peak river flows - Wharfe and Lower Ouse Management Catchment			
Upper end	22%	29%	48%
Higher central	14%	18%	31%
Central	11%	13%	23%
Peak river flows - Aire and Calder Management Catchment			
Upper end	24%	31%	51%
Higher central	15%	18%	31%
Central	11%	13%	23%
Extreme rainfall intensity*			
Upper end	10%	20%	40%
Central	5%	10%	20%

*Rainfall intensity values are for the whole of the UK

2.3 Local planning policy

2.3.1 The Project traverses the areas of four local planning authorities (LPAs), City of York Council (CYC), Leeds City Council (LCC), Harrogate Borough Council (HBC) and Selby

District Council (SBC). Although, as an NSIP, the Project is not subject to LPA consent, LPAs are Statutory Consultees in the DCO process, and the Planning Inspectors may consider local planning guidance to be pertinent to the examination process. Local planning policies of relevance to flood risk and the Project are summarised below. Local planning policies should be aligned with the requirements of NPPF at national level, and this has generally been found to be the case.

City of York Council

2.3.2 City of York Council Local Plan (2005) Policy GP15a (Project and Flood Risk) requires an appropriate assessment to accompany a planning application where development is proposed in an area at risk of flooding or increased surface water runoff. The policy also states that proposals for new developments on previously undeveloped land (outside of defined settlements) must demonstrate that the development will not impact floodplain storage, affect water conveyance across the floodplain or increase flood risk elsewhere.

Leeds City Council

2.3.3 Leeds City Council, Core Strategy, Policy EN5 (managing flood risk) has been developed in order to manage both fluvial and pluvial sources of flooding by avoiding development in flood risk areas, where possible, by applying the sequential approach and where this is not possible by mitigating measures, in line with the NPPF.

Harrogate Borough Council

2.3.4 Harrogate Borough Council Local Plan (2020) Policy CC1 (Flood Risk and Sustainable Drainage) specifies that a site-specific flood risk assessment should accompany a planning application where the development is proposed within Flood Zone 3a.

Selby District Council

2.3.5 Selby District Council Local Plan (2021) Preferred Approach SG11 (Flood Risk) sets out the councils expectations when it comes to new developments and flood risk which broadly align with the NPPF in terms of flood resilience and risk management.

2.4 Other relevant local plans and consenting requirements

2.4.1 A number of other bodies with responsibility for management and regulation of the water environment have produced plans that are of relevance to this assessment. These bodies also have responsibilities for the regulation of activities in and around watercourses that could affect flood risk. These include the Environment Agency, Lead Local Flood Authorities (LLFAs) and Internal Drainage Boards (IDBs). Relevant plans produced by these bodies and their consenting powers are summarised below.

Environment Agency

2.4.2 The Environment Agency is the lead statutory body with responsibility for protection of the water environment. It is also responsible for flood defence and drainage for Main Rivers[6] (Main River is a statutory designation which is usually applied to larger watercourses) and estuarine and coastal areas. The Environment Agency has produced

[6] Environment Agency Main River Map. Available at https://www.arcgis.com/apps/webappviewer/index.html?id=17cd53dfc524433980cc333726a56386 (Accessed 13/08/2021)

regional management plans and policies for the water environment; the key document of relevant to this FRA is the River Ouse Catchment Flood Management Plan[i]. The draft Order Limits span three policy areas, as defined within the plan, as follows:

- Sub-area 2 The Washland.
  The adopted policy is Policy 6 '*The risk of flooding is low and property affected is dispersed throughout the area.*'
- Sub-area 4 York.
  The adopted policy is Policy 5 '*Several areas have been identified through the Ouse Strategy Study where improvements could be justifiable'* and '*… We will promote the development of a surface water management plan which will identify the scale of the risk and recommend improvements*...'
- Sub-area 6 Tidal Ouse and Wharfe.
  The adopted policy is Policy 4 '*Recent defences have reduced risk in the area but climate change has the potential to increase risk as this area can be affected by both increased fluvial flows and increased sea levels and higher tidal flows*.'

2.4.3 The Environment Agency is a statutory consultee in the DCO process and is also responsible for regulating engineering works liable to affect Main Rivers through the issuing of Flood Risk Activities Permits (FRAPs). Any works within 8m of a Main River banktop (or 8m of the landward side of a flood defence), increasing to 16m for a tidal Main River, will require Flood Risk Activity Permits (FRAP) to be applied for from the Environment Agency.

2.4.4 FRAPs are also required at different distances from the bank top/flood defence for Electrical cable service crossing over a main river. The distances vary depending on the voltage of the electric cable[7].

Lead Local Flood Authorities

2.4.5 LLFAs were defined as risk management authorities under the Flood and Water Management Act 2010 (FWMA, 2010). They are responsible for the management of local flood risk (i.e. all other flood risk except that from Main Rivers and the sea). This is done though the process of developing Preliminary Flood Risk Assessments (PFRAs) and Local Flood Risk Management Strategies (LFRMS). LLFAs are statutory consultees to the DCO process. LLFAs are also responsible for regulating engineering works likely to affect Ordinary Watercourses through issuing Ordinary Watercourse Consents outside of IDB areas. Ordinary watercourses include streams, drains, ditches and passages through which water flows that do not form the network of main rivers. The Project Order Limits traverse three LLFA areas: North Yorkshire County Council (NYCC); City of York Council (CYC) and Leeds City Council (LCC). A summary of each of the LLFAs is provided below. The consents are typically referred to as ordinary watercourse consents (OWC) by the LLFAs. OWC will need to be applied for any works within the standoff distances specified by the individual LLFAs.

North Yorkshire County Council

2.4.6 North Yorkshire County Council (NYCC) functions only relate to Ordinary Watercourses (all open watercourses that are not defined as Main River) that are outside of Internal

[7] Environment Agency (2020) Guidance: Exempt flood risk activities: environmental permits. https://www.gov.uk/government/publications/environmental-permitting-regulations-exempt-flood-risk-activities/exempt-flood-risk-activities-environmental-permits (Accessed 13/08/2021)

Drainage Districts (as is the case with all LLFAs). The NYCC Local Flood Risk Management Strategy (LFRMS) (June 2013)[ii] is of relevance to this assessment and sets out their position in relation to managing, regulating and coordinating the local flood risk, including flooding from other sources, including surface water, groundwater and the sewer network. It recognises and reinforces the findings of the Preliminary Flood Risk Assessment (PFRA; 2011) and Strategic Flood Risk Assessment (SFRA; 2016), which identifies that surface water and fluvial flooding are the primary flood sources within the region.

2.4.7 NYCC have also produced a Culverting Works and Drainage Maintenance Protocol (2019), which is also relevant to this assessment, in regard to the proposed temporary watercourse crossings. NYCC specify a standoff distance of 5m, any works closer to the water course, including access track crossings, will require an OWC.

City of York Council

2.4.8 The City of York Council (CYC) are responsible for local flood risk management within their region, which involves developing and maintaining a strategy for the management of local flood risk.

2.4.9 The LFRMS identifies key flood risks from fluvial sources, including the River Ouse and Foss, and from surface water runoff. The Strategy also notes that whilst flood defences effectively protect the area from flooding, it is vital to ensure their continued effectiveness following future climate change. The CYC LFRMS provides the principles for managing flood risk within the city of York, which supports the CYC Strategic Flood Risk Assessment (SFRA, 2011), published in 2013. CYC do not specify a standoff distance to water courses, rather they say this is to be agreed on a site-by site basis , . At the very least, access track crossings will require an OWC.

Leeds City Council

2.4.10 The Leeds City Council LFRMS notes that fluvial flooding is the primary risk within its region, with particular mention of flooding associated with the River Aire, River Nidd and River Wharfe. This reinforces the findings of the PFRA (2011) and SFRA (2007). The LCC LFRMS guides flood risk management activities within its region and is informed by the LCC SFRA (2007). LCC specify a standoff distance of 9m, any works closer to the water course, including access track crossings, will require an OWC.

Internal Drainage Boards

2.4.11 IDBs are not statutory consultees to the DCO process, but they are designated as risk management authorities under the FWMA 2010. They are responsible for manging water levels in low lying areas, with responsibilities that include managing land drainage and flood defence works on ordinary watercourses in their areas. It is IDBs, rather than LLFAs that are responsible for issuing Ordinary Watercourse Consents in IDB areas.

2.4.12 The draft Order Limits traverse three IDB areas, as summarised below.

Ainsty IDB and Foss IDB

2.4.13 The Ainsty IDB (AIDB) and Foss IDB (FIDB) are responsible for sustaining land use (including inhabitation) within their 173km^2 and 125km^2 (respective) drainage district, through water level management, land drainage and flood risk management. The AIDB constitutes five districts, which were amalgamated in 2011. The FIDB consists of two combined catchments with an overall maintained watercourse length of 215.5km. The

AIDB and FIDB Policy Statements are of relevance to this assessment, as are a number of bye-laws, including Number 10 which states:

- *'No person without the previous consent of the Board shall erect any building or structure, whether temporary or permanent, or plant any tree, shrub, willow or similar growth within 9 metres of the landward toe of the bank where there is an embankment or wall or within 9 metres of the top of the batter where there is no embankment or wall, or where the watercourse is enclosed within 9 metres of the enclosing structure*.'

2.4.14 The AIDB and FIDB are part of the York Consortium of Drainage Boards (YCDB). As such, the YCDB Policy Statement on Flood Protection and Water Level Management is of relevance to this assessment, as are a number of their byelaws that relate to management of the drainage network. The Policy Statements of the IDBs are aligned and each include the following three objectives:

- to encourage the provision of adequate and cost effective flood warning systems;
- to encourage the provision of adequate economically, technically, and environmentally sound and sustainable flood and coastal defences; and
- to discourage inappropriate development in areas at risk from flooding.

2.4.15 The policy states that the IDBs monitor the condition of its assets and watercourses, in particular those identified as critical.

Kyle Upper Ouse IDB

2.4.16 The Kyle Upper Ouse IDB is responsible for managing a 118km^2 drainage district area, with approximately 253km of managed watercourses. A number of their byelaws that relate to management of the drainage network and are relevant to this assessment, including Number 10 which, as for the equivalent Ainsty and Foss IBD bye-law, states a standoff distance for works from watercourses, though in this case this is 7m, rather than 9m.

2.5 Other technical guidance

National Grid flood design guidance

2.5.1 National Grid have produced their own flood design criteria[8] which defines their declared target standards of protection (SoP) for flood defence/resilience that should be applied to all new build electricity transmission substations and at legacy substations subjected to an expansion or a major refurbishment programme. This document effectively sets out that the minimum standard of protection (SoP) as being a 0.1%AEP plus the applicable allowances for climate change as provided in the relevant national planning guidance.

[8] National Grid (2016). General electricity and substation design manual for civil, structural and building engineering, Section No:13; Flood defences for electricity for substations (TS 2.10.13, Issue 2)

SuDS guidance

CIRIA SuDS manual (C753)

2.5.2 The CIRIA SuDS (C753) is the most up-to-date industry standard containing revised principles and technical advice for the planning, design, construction, management, and maintenance of effective SuDS. The drainage systems for new developments should be designed to align with the SuDS manual.

DEFRA Non-statutory technical standards for sustainable drainage systems, 2015

2.5.3 The Non-Statutory Technical Standards for Sustainable Drainage Systems is a national guidance document that provides a set of standards to be applied when designing SuDS systems for new developments. Standards include controls on peak flow and volume of run-off, and flood risk internal to the development and downstream. These are the flow standards to which the LLFAs generally adopt to judge any proposed surface water management system.

Lead Local Flood Authority surface water drainage advice

2.5.4 Each of the LLFAs produce guidance with regards to their requirements for drainage design and runoff estimation which are all principally based upon the non-statutory guidance set out above. They each set out and promote the same drainage hierarchy as follows:

- **Prevention** of runoff by good site design and reduction of impermeable areas.
- **Source Control:** Dealing with water where and when it falls (e.g. infiltration techniques).
- **Site Control:** Management of water in the local area (e.g. swales, detention basins).
- **Regional Control:** Management of runoff from sites (e.g. balancing ponds, wetlands).

2.5.5 The methods used to discharge surface water should be prioritised in the following order: infiltration to ground; watercourse; and combined/surface water sewer.

2.5.6 The West Yorkshire Combined Authority, which represents a number of different local planning authorities, including LCC, CYC and NYCC, produced the 'Leeds City Region Sustainable Drainage Systems Guidance[9]' in 2020. **Table 2.2** summarises the drainage/SUDS requirements for each of the LLFAs affected by the Project.

[9] West Yorkshire Combined Authority (2020). Leeds City Region Sustainable Drainage Systems Guidance. Available online: https://www.westyorks-ca.gov.uk/media/5397/lcr-suds-guidance-final-february-2020-1.pdf

Table 2.2 - Local SuDS standards[9]

Issue	York CC	North Yorkshire CC	Leeds CC
Consider connections to Highway Drains	Yes	No	Yes, subject to commuted sum
Minimum Brownfield Discharge Rate reduction	30%	30%	Majors = 50% Minors = 30%
Greenfield Discharge Rate to be used	To be modelled using IOH124 or FEH, 1.4l/s/ha	As calculated using IH124 or FEH methods. Alternatively 1.4l/s/ha where not available.	For sites < 1 ha a maximum discharge rate of 4 l/s can be used for all storms up to the 1% AEP event +CC. Alternatively IH 124, ICP SUDS and FEH methods in ICOP can be used.
Climate Change Allowance	30%	30%	Link provided to the national guidance[5]
Urban Creep Allowance	0	10%	10%
Identified Special Areas of Drainage	No	No	No
Local SuDS Guidance	City of York Council Sustainable Drainage Systems Guidance for Developers[10] (2018)	North Yorkshire County Council SuDS Design Guidance[11] (Rev. 4)	Minimum Development Control Standards for Flood Risk[12] (2017)

2.6 Summary of policy basis for FRA

2.6.1 Design standards for flood protection measures for flood vulnerable critical elements of Project infrastructure will be specified in **Section 3.2** line with the industry guidelines, with climate change allowances being taken from current Environment Agency climate change guidance, as summarised in the Section above. These design standards are broadly consistent with the requirements of planning policy. However, it is recognised that NPS EN-1 and EN-5 advise that further assessment should be made of residual risks to this type of infrastructure for events beyond the required design standard.

[10] CYC (2028) Sustainable Drainage Systems Guidance for Developers. Available at: https://www.york.gov.uk/downloads/file/2724/sustainable-drainage-systems-guidance-for-developers
[11] NYCC. SuDS Design Guidance. Available at https://geosmartinfo.co.uk/wp-content/uploads/2020/02/North_Yorkshire_County_Council_SuDS_design_guidance_Rev4.pdf
[12] LCC (2017) Minimum Development Control Standards for Flood Risk. Available at: https://www.leeds.gov.uk/docs/Minimum%20development%20control%20standards%20for%20flood%20risk.pdf

3. Site and Project description

3.1 Site characteristics

Introduction

3.1.1 The information in this section includes only information deemed of relevance to this FRA, a detailed description of the baseline conditions for each Section (A-F) of the Project is given within Section 9.5 of **Chapter 9: Hydrology** and is summarised below.

Climate

3.1.2 The average annual total rainfall is 626mm, based on the Linton on Ouse station[13] record. The highest average monthly rainfall occurs in August, determined as 62.4mm; whilst the lowest average monthly rainfall occurs in February, determined as 39.9mm. The national annual average figures suggest the average rainfall values are similar along the length of the Project.

Topography

3.1.3 The draft Order Limits boundary traverses the area from the north-west to the west of York, covering a linear distance of approximately 42km, north to south.

3.1.4 Ordnance Survey (OS) mapping indicates the area to the north-west of York is relatively low-lying and flat, with the highest point located near to Moor Lane (NGR SE580583) at 20m AOD. The topography radially surrounding this point is relatively flat at around 14-16m AOD, only falling to 10m AOD on the banks of the River Ouse and Hurns Gutter.

3.1.5 As the draft Order Limits continues southwards, past Hutton Wandesley (NGR SE506504) the topography steeply rises and there is increased variation elevation. The highest point within the draft Order Limits is at 59m AOD, located to the south-west of Stutton (NGR SE457406). However, the general elevation ranges between 20m AOD to 50m AOD. The lowest elevations are associated with the banks of the River Wharfe (10m AOD).

Geology, hydrology, and soils

3.1.6 The geology, hydrogeology and soils are described in detail in **Chapter 10 Hydrogeology and Land Quality** and **Chapter 11 Agriculture and Soils.** However, a brief summary is provided below.

3.1.7 The northern portion of the site lies upon dominant Triassic geology consisting of sandstone and conglomerates[14]. These are obscured by superficial deposits of glacial till, sand, gravel, and moraines[14]. Sandstone clay soils can be found across much of the northern portion of the site[15].

3.1.8 South of the River Wharfe the geology and underlying soils change. This area is defined in geological terms as Permian Magnesium Limestone, which forms a low but distinct

[13] See Linton on Ouse (North Yorkshire) UK climate averages - Met Office (accessed 09/07/2021)
[14] BGS (2021) Geology of Britain Viewer. Available at: https://mapapps.bgs.ac.uk/geologyofbritain/home.html (accessed 19/08/2021)
[15] Cranfield University (2021) Soilscapes. Available at: http://www.landis.org.uk/soilscapes/ (accessed 19/08/2021)

ridge of land running roughly north to south[14]. Generally, the underlying soils are loamy and free draining soils which are well suited to arable agriculture[15] . However, along the Main Rivers the soils is loamy and clayey, with impeded drainage and/or naturally high groundwater[15].

Land use

3.1.9 The land use within the draft Order Limits is predominantly agricultural; a combination of arable and pasture, with an irregular network of hedgerows and isolated areas of woodland. The draft Order Limits cross several significant transport infrastructure features including major roads and railway lines, in addition to minor roads and access routes.

Hydrology and drainage

3.1.10 The Project is located across 14 water body catchments and as a result there is potential to affect designated Main Rivers, including the River Ouse, River Nidd, River Wharfe and Cock Beck. There is also potential that the Project will interact with numerous ordinary watercourses, tributaries and IDB adopted drains, which largely fall within the Main River catchments.

3.1.11 The Project crosses areas served by extensive networks of artificial drainage channels, under the control and management of IDBs (see **Figures 9.3 A-F** which accompany **Chapter 9**: **Hydrology and flood risk** of the PEIR). Section A, including the Osbaldwick Substation, is located within the FIDB district boundary, which extends out to the north-east of York. Section B, north of the River Ouse, is situated within the KUOIDB area, which covers the area to the north-west of York. The AIDB area covers much of the land area between the River Ouse and the River Wharfe.

3.2 Project description

3.2.1 A summary of the different elements of the Project are provided below, however, a more detailed Project description is provided in **Chapter 3: Description of the Project**.

- Two new substations comprising Overton Substation to the north-west of York, sited to the north of the existing 275kV Poppleton to Monk Fryston (XC/XCP) overhead line route. The second located next to, and connecting into, the existing Monk Fryston Substation.
- Approximately 2.8km of new overhead line route (YN 400kV overhead line) between the 400kV Norton to Osbaldwick (2TW/YR) overhead line and the new Overton Substation north of York.
- Replacement of one pylon and installation of two CSECs (Shipton North and South) with a 200m section of connecting underground cable to provide a connection between the YN 400kV and the 400kV Norton to Osbaldwick (2TW/YR) overhead line routes.
- Two new sections of 275kV overhead line (two separate lines of pylons) connecting into Overton Substation from the south. To install these sections, works would be undertaken to the existing 275kV Monk Fryston to Poppleton (XC/XCP) overhead line route to form the two separate overhead lines: the XCP overhead line connecting Monk Fryston and Overton Substations and the SP overhead line connecting Poppleton and Overton Substations. Between Moor Monkton in the west and Skelton in the east the existing XC/XCP overhead line (approximately 5km in

length) would be replaced with some pylons permanently removed. The overhead line would be realigned from south-east of Moor Monkton to connect into the new Overton Substation forming the realigned XCP Overton to Monk Fryston overhead line. This would require:

  - the permanent removal of 2.35km of the existing XC/XCP overhead line and six pylons between the ECM railway and Woodhouse Farm to the north of Overton;
  - the replacement of four pylons south of the River Ouse and north of Thickpenny Farm along the same overhead line alignment, but in new locations (approximately 25 to 70m east of the existing pylon locations);
  - the replacement pylons of three pylons to the south-east of Moor Monkton and south of Redhouse Wood along a new alignment up to 230m south from the existing overhead line alignment;
  - the permanent removal of the existing pylon closest to Moor Monkton as the realigned overhead line would lie further to the south; and
  - the replacement of pylon XC429 at a location approximately 30m north of the existing pylon.

- South from Moor Monkton to the west of Monk Fryston Substation the existing XC overhead line the existing XC overhead line would be re-conductored.
- South-west of Tadcaster an existing pylon on the existing 275kV XD/PHG overhead line would be replaced. Two CSECs (Tadcaster Tee West and East) and a section of connecting underground cable would be installed.
- At Monk Fryston the existing 275kV Poppleton to Monk Fryston (XC/XCP) overhead line would be reconfigured to connect into the new Monk Fryston Substation with a section of underground cable also installed. The existing 4YS 400kV overhead line would also be reconfigured to connect into the new substation.
- At Osbaldwick Substation a new circuit breaker, gantry and isolator along with associated cabling would be installed, minor works would be implemented for one pylon and an existing gantry would be removed and dismantled to free up space for new equipment. All works would take place within existing operational land.

3.2.2 The proposed elements as a collective are known as the Project.

3.2.3 During construction compounds will be installed at Overton and Monk Fryston Substations as well as at the CSEC locations (eight compounds in total). Temporary construction accesses will be installed comprising either stone or trackway surfacing so that vehicles can access the working areas at the pylons, CSECs and substations. Temporary diversions of the existing overhead lines will be installed to maintain electricity flows whilst new overhead lines are being installed or works take place to the existing overhead lines.

3.2.4 As set out in **Section 2.2**, the NPPF and the associated PPG[4] provide guidance on vulnerability classifications for development types, based on their use/function and the compatibility of development with flood zones. A matrix is provided in **Table 3.12** that applies the NPPF flood risk vulnerability to the various elements of the Project and their compatibility with the Flood Zones.

Table 3.1 - Application of the flood risk vulnerability and Flood Zone 'compatibility' matrix to the Project

Project Type	Flood Risk Vulnerability Classification[1]	Flood Zone(s)	Flood Risk Vulnerability and Flood Zone 'compatibility'
Construction			
Temporary construction compounds (TCCs) *(office and welfare facilities)*	Less Vulnerable	1, 2 and 3	✓
Construction activity areas *(access routes and working areas)*	Less Vulnerable	1, 2 and 3	✓
Watercourse crossings	Water compatible	1, 2 and 3	✓
Operation			
OHL	Essential Infrastructure[2]	1, 2 and 3	✓ Exception Test required[2]
Substations and Cable Sealing End compounds (CSECs)	Essential Infrastructure	1, 2 and 3	✓ Exception Test required[2]

Notes:
1) Definition of flood zones is provided in **Table 1.1**
2) In Flood Zone 3a Essential Infrastructure should be designed and constructed to remain operational and safe in times of flood.

3.2.5 The TCCs, watercourse crossings, substations and CSECs are all appropriate for all Flood Zones. However, 'Essential Infrastructure' located within Flood Zones 3 is required to pass Part 2 of the exception test to be considered an appropriate for development. This means ensuring that the development will be safe for its lifetime, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

3.2.6 NPS EN-1[1] and NPS EN-5[2] gives advice on accounting for climate change, to the effect that developments should be resilient and adaptive to the latest climate change projections. Based on the proposed timescales for the Project, allowances for the '2020s' epoch will be applied to assessments carried out for the construction phase, and allowances for the '2080s' epoch will be applied to assessments for the operational phase, which would cover assets with a design lifetime of up to 80 years, given a construction start date of 2024, with the operational phase beginning in 2029, with some elements of the Project becoming operational in 2027. No detailed quantitative assessment will be carried out for the decommissioning phase of the Project as part of the FRA.

3.2.7 The guidance on climate change for Essential Infrastructure, which includes grid substations, is that they should be assessed against the Higher Central allowance, where situated in Flood Zone 2 or 3a. No Essential Infrastructure for this project is currently located within either of these flood zones.

3.2.8 The information presented above suggests that an appropriate approach that would cover the requirements of all Project infrastructure would be to use the ‘Higher Central’ allowance category as the design basis for fluvial flood protection measures and the ‘Upper end’ rainfall estimates for drainage design and impact assessments.

3.2.9 In the Environment Agency scoping opinion, it was noted that the H++ climate change allowance should be “treated as a ‘sensitivity test’. It will help you assess how sensitive your proposal is to changes in the climate for different future scenarios. This will ensure your Project can be adapted to large-scale climate change over its lifetime.” We are not proposing to undertake a H++ scenario, as we consider that application of the National Grid design criteria for flood resilience of a 1 in 1000 year flood event with an allowance for climate change (+34% to flood peaks) would yield a design standard for new infrastructure considerably in excess of H++ requirements when applied to the 1 in 100 event (+65% to flood peaks).

4. Flood risk screening

4.1 Introduction

4.1.1 The assessment will use the source-pathway-receptor approach, whereby all three of those elements must exist for these to be a risk to be assessed. The presence of a source is initially screened in **Section 4.2** below. Where a potential source is identified, the risk itself will be assessed with respect to the likelihood and consequence of flooding in the subsequent sub-sections, **Sections 4.3 to 4.5**. **Section 4.6** highlights the elements of the Project that have been scoped out of the assessment and the justification for doing this. Where a detailed assessment is required, this is provided in **Section 5**. Where necessary, appropriate flood risk management measures will be set out in **Section 6** to address the identified risks.

4.2 Screening of all potential sources of flood risk

4.2.1 **Table 4.1** provides an initial screening of all potential flood risk across the Project area. Those that are screened in as posing a potential flood risk are then considered further in subsequent sections.

Table 4.1 - Screening of all potential sources of flood risk

Source of Flooding	Risk Posed	Potential Connection to the Project Area	Screened In?
Tidal	No risk	The Project crosses the River Ouse at the point the lowest part of the of the draft Order Limits at approximately 10mAOD and approximately 20km upstream of the tidal limit. Based on the coastal flood boundary conditions for UK mainland and islands (2018) the 0.01% Annual Exceedance Probability' (AEP) sea level at Whitby and Immingham are 4.81mAOD and 5.92mAOD, respectively. Therefore, even with the application of H++ scenarios through to 2100 and extreme wave surge considerations, there remains no risk to the Project from flooding from the sea. **The risk of tidal flooding is not considered further in the FRA.**	No
Fluvial	High risk	The primary flood risk to the Project is from fluvial sources. The Project crosses several areas of Flood Zones 2 and 3. The risk posed by fluvial flooding is discussed further in **Section 4.3**	Yes
Surface water run-on	Low risk	The Environment Agency's Surface Water Flood Risk Map shows limited/very low risk of	Yes

Source of Flooding	Risk Posed	Potential Connection to the Project Area	Screened In?
		flooding from surface water run-on and ponding to the Project. There are some more significant areas within the draft order limits where it traverses smaller watercourses and drainage ditches not shown as being at risk within the fluvial Flood Zone mapping. The risk to the Project from surface water run-on is discussed further in **Section 5**. It will also be necessary to ensure that the Project does not impede the drainage management functions provided by the IDB drainage network. This is also covered in **Section 4.4**.	
Surface water run-off	Low risk	The surface water runoff originating from the Project proposals (during both construction and operational phases) will be the primary surface water consideration. Surface water runoff is considered further in **Section 4.4.**	Yes
Groundwater	Low risk	As discussed in **Section 3.1: Geology, hydrogeology and soils,** the geology encountered to the north of draft Order Limits, close the River Wharfe and River Ouse (though it is conceivable to have groundwater emergence in low-lying flood plain areas where the water table is naturally close to the surface) is unlikely to give rise to groundwater flooding. However, the limestone geology along the southern section of the Project may mean there is greater potential for groundwater flooding. The risk posed by groundwater flooding is addressed further in **Section 4.5**.	Yes
Sewer	Very low risk	Due to the rural nature of the Project location and Study Area the risk posed by sewer flooding is considered to be very low. In the event that sewer flooding occurs it is anticipated that the flood will follow the natural topography of the landscape and accumulate in low-lying areas, therefore patterns will be similar to that associated with surface water flooding. **The risk of sewer flooding is not considered further in this FRA.**	No
Artificial	Low risk	The Environment Agency's on-line mapping shows that the Main Rivers could convey floodwater originating from the failure of upstream reservoirs. Generally, the risk of flooding from reservoir extents are smaller than the fluvial Flood Zones along the same river reaches and no risk of flooding from reservoir	Yes – covered under fluvial flood risk

Source of Flooding	Risk Posed	Potential Connection to the Project Area	Screened In?
		failure is identified within any of the proposed locations for the CSEC or substation siting areas. Therefore, risk of flooding from artificial sources will be addressed under fluvial flood risk.	

4.3 Fluvial flooding

Flood Zone and modelled flood extents

4.3.1 The Environment Agency's Flood Map for Planning provides an indication of the likelihood of flooding from fluvial sources, with Flood Zones 1 to 3 indicating a Low, Medium, and High likelihood of flooding respectively, as defined in **Table 1.1**. Flood Zones extents are shown on **Figure 9.5** (**A-F**) which accompany **Chapter 9: Hydrology** (any area not highlighted/coloured blue on these maps is Flood Zone 1).

4.3.2 The approach to siting of CSECs and Substations is compliant with the NPPF and National Policy Statement for Energy (EN-1), in that the sequential approach has been taken to identify potential locations for the new infrastructure, which are preferentially located within Flood Zone 1.

4.3.3 Section A of the Project is mostly situated within Flood Zone 1 (see **Figure 9.5a**), with part of the access route and OHL crossing into Flood Zones 2 and 3 from a FIDB adopted drain running parallel to Murton Way.

4.3.4 Much of the North-west of York Area, particularly the northern part, is located within Flood Zone 1. However, there are several areas of Flood Zone 2 and 3 which intersect the draft Order Limits along Project Sections B and C (see **Figures 9.5b** and **9.5c**). The most significant areas of Flood Zones 2 and 3 are located adjacent to the Main Rivers. However, there is an area of Flood Zone 2 within the north-west of York (north of the A19) associated with Hurns Gutter. In addition, there are more localised areas of Flood Zones 2 and 3 associated with ordinary watercourses and IDB adopted drains which could potentially impact access to pylon locations.

4.3.5 Due to the raised topography to the south, Sections D-F are mainly designated as Flood Zone 1 (see **Figures 9.5d** and **9.5f**), with minor areas of Flood Zone 2 and 3 associated with the Cock Beck, Bishops Dike and Mill Dike.

4.3.6 Environment Agency Flood Modelling, provided for the Lower Ouse and Wharfe Washland and the York Detailed model, indicates that, although the site of the proposed new Overton substation is currently in Flood Zone 1, it may be at risk of flooding from the 1% AEP event in the future, based upon 1% AEP + 50% Climate Change modelling results. It is not shown to be at risk of flooding in the York Detailed model flood extents for the 1% AEP + 30% Climate Change scenario (**Figure 9.8**).

Historical flooding

4.3.7 Records of historical fluvial flooding provided by the Environment Agency are summarised below. The information provided indicates that the proposed substations and CSECs have not been affected by any of the recent flood events, however, sections

of the existing and proposed overhead lines and access routes are shown to cross areas of historic flooding (mainly associated with the River Ouse and River Wharfe). The details of the historic flood records provided by the Environment Agency are summarised below.

Date	Source	Details
24 to 26 March 1968	River Ouse	The channel capacity of the River Ouse was exceeded. There were no raised flood defences, enabling overtopping of banks along the River Ouse and partially upstream of the River Wharfe from its confluence with the Ouse at Cawood. The subsequent flooding affected approximately 150 homes[16].
1 and 31 December 1978	River Ouse, River Nidd and River Wharfe	Records show that the flood event between the, was caused by overtopping of flood defences of the River Ouse, River Nidd, and River Wharfe. Similar, flood events occurred in January 1982, February 1991 and January 1995, at gradually lesser extents.
30 October to 15 November 2000	River Ouse	The Autumn 2000 flood event is recognised as the worst recorded within the twentieth century. The River Ouse reached approximately 5.5m above its normal level, flooding around 540 properties and putting an additional 320 at serious risk[17].
2 to 15 February 2002	River Wharfe	A small flood event on the River Wharfe at Tadcaster, caused by the overtopping of flood defences.
24 to 29 September 2012	River Ouse and River Wharfe	The September flood event occurred as a result of the River Ouse and Wharfe overtopping areas with no raised flood defences, causing limited flooding in York and Tadcaster.
25 to 29 December 2015	River Ouse and Wharfe	An extensive flood event, where the River Ouse and Wharfe overtopped in areas with no raised flood defences causing widespread flooding along their reaches. The flood defence capacity was also exceeded in York which led to extensive flooding in central York requiring the evacuation of properties and businesses and resulting in major damage[18].
14 to 17 March 2019	River Ouse	Several minor flood events occurred along the River Ouse downstream of York and an isolated event in Tadcaster. The cause of the flooding remains unknown, and the impacts were limited due to the scale.

[16] See Floods - Monday 4 November 1968 - Hansard - UK Parliament (accessed 13/07/2021)
[17] See x73694 EA (publishing.service.gov.uk) (accessed 13/07/2021)
[18] York Civic Trust (2021) Flood Heights on the Ouse. Available at: https://yorkcivictrust.co.uk/heritage/civic-trust-plaques/flood-heights-on-the-ouse/ (accessed 18/08/2021)

4.3.8 It is relevant to note that records of historical flooding are rarely recorded at the time for undeveloped areas, so it is not possible to categorically confirm that the substations and CSECs in particular, have not suffered from flooding in the past.

4.4 Surface water flooding

Surface water flood risk mapping

4.4.1 Whilst much of the area within the draft Order Limits is at Very Low risk of surface water flooding, there are a number of areas at risk of surface water flooding, according to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) mapping. These are classified as being at High, Medium, Low and Very Low likelihood of surface water flooding (see **Figures 9.6 A-F** which accompany **Chapter 9: Hydrology**). The areas that indicate Medium to High surface water flood risk tend to be low-lying or correspond with the existing river floodplains.

4.4.2 There are some instances where the substation locations coincide with areas of surface water flood risk, these are summarised as follows:

- A small area of surface water accumulation/ponding is located within the Monk Fryston Substation Area towards the south (see **Figure 9.6f**), classified as High, Medium and Low RoFSW. A surface water flow path runs from west of Pollums House Farm to the north on Main Street (A63) and west of Butt's Lane across the Monk Fryston Substation Area.
- A small area of surface water accumulation is located within the Osbaldwick Substation Area, to the north-west (see **Figure 9.6a**), which is classified as Low risk.

Historical surface water flooding

4.4.3 The Environment Agency's Historical Flooding records identify a flood event spanning 15 to 17 June 2007 widespread surface water flooding. Surface water flooding was recorded at numerous locations south of Garforth, including within and adjacent to the existing Monk Fryston substation.

4.5 Groundwater flooding

4.5.1 Information on flood risk from groundwater was sourced from a review of the LLFAs PFRAs and SFRAs. City of York Council concluded there was no significant risk of flooding from groundwater, presently or future, and has no record of areas where groundwater emergence is known to be a cause of flooding[19]. NYCC report no substantial evidence of direct groundwater flooding in the majority of North Yorkshire[20]. However, it is aware of specific circumstances where groundwater emergence may exacerbate surface water flooding. For example, it is known to be a cause of flooding to a small number of properties in some areas as a result of natural springs in the hillside next to properties, and, that both groundwater and surface water flooding both pond in the same nearby low-lying areas, however these are located outside of draft Order Limits. NYCC hold no local information providing evidence of future groundwater flood risk, however it does note that should groundwater flooding occur, it is likely to be in low points and depressions where surface water flooding occurs. Therefore it is considered

[19] City of York Council (2017) Preliminary Flood Risk Assessment (addendum)
[20] North Yorkshire County Council (2017) Preliminary Flood Risk Assessment (addendum)

that true groundwater flooding is not going to occur across much of the North Yorkshire area that coincides with the Project.

4.5.2 Envirocheck Reports have been purchased for the Overton (**Annex A**) and Monk Fryston (**Annex B**) Substations. The Overton Substation is not shown to be at risk of groundwater flooding, there are some small areas to the north-west of the substation mapped with 'Limited Potential for Groundwater Flooding to occur' (**Annex A**). The only areas mapped as showing a potential for groundwater flooding in **Annex A** are associated with the riparian corridor of the River Ouse. The Monk Fryston Substation is mapped as having a 'Limited Potential for Groundwater Flooding to occur', however, there is small area at the south of the proposed Substation that is mapped as 'Potential for Groundwater Flooding of Property below ground level' (**Annex B**). However, given the relatively elevated location of the Monk Fryston Substation, relative to much the surrounding land, especially to the south and south-east, this would likely be very short in duration. There are areas of land mapped as showing a potential for groundwater flooding in **Annex B**, however these are to the south, close to the villages of Fairburn and Burton Salmon, at elevations approximately 15-20m below the substation.

4.6 Elements of the Project scoped out of the FRA

Pylons

4.6.1 The flood risk associated with overhead line pylons and conductors, during the operational phase have been scoped out from this assessment. This applies to the risk to the infrastructure itself, as well as any risks to other receptors arising from the presence of the infrastructure. This approach has been accepted on similar National Grid connection projects and was accepted by the Planning Inspectorate in its Scoping Opinion[21] : '*…on the basis that all permanent infrastructure (except pylons, which would result in minimal displacement relative to overall volumes) will be located in Flood Zone 1, and incorporation of embedded environmental measures, the inspectorate agrees that operational matters in respect of flood risk would not give rise to likely significant effects and can therefore be scoped out of the ES.*'

4.6.2 Lattice pylons, such as those proposed to be used in the Project, do not displace any significant volume of water and pose minimal obstruction to water flow. Therefore, placing of pylons in floodplain areas will not significantly affect floodplain storage or conveyance and will therefore not cause an increase in flood risk to others external receptors. Furthermore, pylons are resilient to water damage from occasional flooding, and the conductors are located well above the highest conceivable flood level (accounting for the most extreme allowances for climate change), thus ensuring that they remain operational in times of flood and do not pose a safety risk. Due to the robust nature of their construction, it is considered highly unlikely that debris carried by floodwater could cause significant damage to a pylon to the extent that the structural integrity of the pylons could not be repaired through standard maintenance activities.

4.6.3 The construction related activities, such as access tracks, construction compounds and working areas will be considered further within the assessment.

[21] The Planning Inspectorate, April 2021 Scoping Opinion: Proposed Yorskhire Green Energy Enablement (GREEN) Project, case reference EN020024 https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN020024/EN020024-000048-YGRN%20-%20Scoping%20Opinion.pdf

5. Assessment of flood risk

5.1 Introduction

5.1.1 Having outlined in broad terms the principal potential flood risks prevailing in and around the draft Order Limits in **Section 4**, this section assesses specific flood risk to receptors associated with the Project. This will include the potential for flood risks to third-party receptors to increase as a consequence of the Project during the construction and operational phases. Appropriate flood risk management measures are specified to address the identified risks in **Section 6**, most of which have been incorporated into the design of the Project through the embedded environmental measures specified in **Chapter 9, Hydrology and Flood Risk**.

5.2 Risks during the construction phase

5.2.1 In addition to the permanent elements of the project outlined in the Project description, **Section 3.2** above, there will considerable activity and temporary infrastructure required to support the construction of the Project. These include:

- temporary access tracks and their associated watercourse crossings;
- working/laydown areas (for both new and refurbished pylons);
- stockpiles and storage areas;
- scaffold areas for 'crossing protection' (where the overhead line crosses roads, railway lines and watercourses);
- eight temporary construction compounds have been identified and will be required for the duration of the Project. These will comprise areas of hardstanding and temporary office and welfare buildings. Some of the construction compounds are of a significant size, at up to 1.76ha for the works to the existing XC/XD overhead line connections at Tadcaster, 1.47ha for the new Overton Substation compound and up to 1.43ha for the remainder of the construction compounds; and
- cable stringing locations.

5.2.2 Each of these activities has the potential to impact receptors through a combination of a loss of flow conveyance, either in channel or on the flood plain, the loss of floodplain storage, where located in the floodplain, and increased surface water runoff due to increased permeable areas. These issues are discussed further below.

Fluvial flood risk

5.2.3 The construction and upgrading works will require 20 watercourse crossings. Of these, 13 will use existing crossings and seven will require new crossing construction. All of the new crossings will be temporary and will be removed following the completion of the associated construction works in the vicinity. Six of the new access crossings will require the installation of culverts. A clear span (bailey) bridge is proposed for the crossing of the Cock Beck, a Main River and WFD waterbody, thereby avoiding the need for in channel works and minimising impacts on watercourse morphology, as specified in **Chapter 9, Hydrology and Flood Risk**. The remaining crossings are

associated with IDB adopted watercourses, or other small non-IDB watercourses or ditches (See **Figure 9.4**). Flood risk management measures are set out in **Section 6** which seek to ensure no temporary or permanent changes to watercourse flow conveyance as a consequence of the Project.

5.2.4 During the construction phase of the Project there is the potential for temporary loss of floodplain storage and compartmentalisation of the floodplain in a limited number of locations where, for example access tracks pass through and across Flood Zones such as those at the downstream extent of the Hurns Gutter.

5.2.5 The potential impacts are discussed below, before this section concludes with an assessment of the consequences of these impacts on flood risk receptors.

- *Loss of floodplain storage*
  The development of permanent raised structures, such as haul roads, working areas and associated topsoil stockpiles, in the floodplain during construction works could lead to a permanent loss of floodplain storage and/or temporary change in floodplain flow conveyance.
  The construction of these features will be phased according to programme requirements and they will only cover a very small portion of the total draft Order Limits at any one time as a consequence. It is therefore concluded that the loss of flood storage capacity due to the construction of raised features associated with the Project is negligible and will not significantly increase flood risk elsewhere and that no mitigation is required.

- *Compartmentalisation of the floodplain*
  The presence of the proposed construction phase infrastructure within the floodplain has the potential to affect the conveyance of flood waters across the floodplain and thus affect flood extent and depths at the local scale.
  This effect would only occur where the flood depths are equal to or less than raised features such as access tracks and soil storage mounds.
  The additional tracks and soil storage mounds are unlikely to represent significant additional impediment to the movement of floodwater in these areas, and the specification of appropriately sized culverts at ditch crossing points will ensure that the conveyance capacity of the ditch network is maintained.
  As a consequence, in most areas of the draft Order Limits, it is considered that there would be a negligible change in flood risk due to floodplain compartmentalisation.

Risk to construction phase activities and temporary infrastructure

5.2.6 Some of the construction activities that would be carried out in floodplain areas throughout the draft Order Limits, mainly relating to the overhead lines, are considered to be at risk of fluvial flooding. This particularly involves the presence of construction personnel and plant in these areas, which will be appropriately managed through the measures set out in **Section 6**, including the requirement for a flood emergency response plan.

Risk to third party receptors

5.2.7 There are a number of third party receptors within and outside of the draft Order Limits of the Project, whose risk of flooding could be at affected during the construction phase if appropriate measures were not implemented. However, it is concluded that the implementation of the measures set out in **Section 6**, during the construction phase, including those to address watercourse crossing conveyance and floodplain storage

and compartmentalisation mean that no change to fluvial flood risk relative to the baseline is anticipated as a result of the Project during the Construction phase.

Surface water flood risk

5.2.8 Should all, or a significant proportion, of the construction compound areas become occupied by impermeable or less permeable surfaces for the duration of construction, this could lead to a significant local increase in runoff rates. The new access roads, temporary crane pads/working areas at new pylon locations are also likely to be constructed of compacted, poorly permeable aggregate material. In addition, these temporary infrastructure could potentially be raised in comparison to the adjacent land which could, if not managed, impede surface water flowpaths, either diverting flood water elsewhere or causing ponding on the upslope side.

Risk to construction phase activities and temporary infrastructure

5.2.9 The temporary and permanent changes in ground cover associated with the Project has the potential to increase the overall extent of lower permeability surfaces. In the absence of effective surface water management measures, this could lead to a temporary increase in peak runoff rates and a consequent increase in flood risk to third party receptors downstream. To address this, surface water management measures and drainage strategies, as set out in, **Section 6**, will be implemented.

5.2.10 It is concluded that the surface water flood risk to construction is minor and deemed to be no more significant than the fluvial flood risk. There are no significant areas of surface water flood risk identified as coinciding with the Project for the 1% AEP mapping (**Figure 9.6**), where there is coincidence, it is predominantly in valley bottoms adjacent to watercourses and of a similar extent the mapped fluvial flood risk (**Figure 9.5**).

Risk to third party receptors

5.2.11 Provided that the measures described in **Section 6** to manage runoff and to ensure that existing surface runoff pathways are not disrupted and are in place during construction and demolition activities, it is considered that there will be no increase in surface water flood risk to third party receptors.

Groundwater flood risk

5.2.12 There is the potential to encounter shallow groundwater, either perched in superficial deposits and possibly the main water table at shallow depth in floodplain areas. The works associated with the Project, are not expected to extend through the superficial deposits into the underlying aquifer (other than (possibly) piling).

5.2.13 It is not expected that perched groundwater will be encountered during excavations works, except for potential localised perched lenses in the Glacial Till (between XC520 and the Monk Fryston substation). In the event groundwater is encountered, there will be a need to dewater to facilitate construction of the pylon foundations. There is a potential risk to construction personnel and equipment working in excavations below water table level. This would be controlled by pumping under normal circumstances. Even in the event of pump failure, ingress of groundwater into the excavation would be relatively slow, enabling personnel and equipment to be evacuated from the excavation before any harm occurs. The risk of groundwater flooding to site construction and demolition activities is therefore considered to be negligible, and no further mitigation measures are proposed above and beyond normal construction best practice.

5.3 Risks during the operational phase

Fluvial flood risk

Operational phase infrastructure

5.3.1 No new, permanent, watercourse crossings are being proposed as part of this Project.

5.3.2 The Environment Agency's flood modelling outputs for the York Detailed model, indicates that the Overton Substation is at risk of flooding in the 1% AEP +50% climate change uplift scenario (**Figure 9.8)**. The Substation is not shown to be at risk for the 1% AEP +30% climate change uplift scenario (**Figure 9.8)**.

5.3.3 It is considered that the Overton substation is the only permanent infrastructure (except pylons, which would result in minimal displacement relative to overall volumes) that could be at risk of flooding due to increased flood flows due climate change. Based on the Planning Inspectorates response in the Scoping Opinion, noted in **Section 4.6**, it is only proposed to consider climate change impacts further with additional modelling for Overton Substation, though the other aspects of the Project will continue to be reviewed and screened as the Project design develops.

5.3.4 As noted in **Section 2.5**, the National Grid design criteria requires substations to be resilient to flooding up to and including a 0.1% AEP event with an allowance for climate change to flood peaks. The climate change allowance for Essential Infrastructure is the Higher Central allowance which is +34% in the Swale, Ure, Nidd and Upper Ouse Management Catchment (**Table 2.1**) Currently there are no modelling results for this scenario that can be used to inform the design.

5.3.5 Further modelling work is therefore required, the outcomes of which will be included in the DCO FRA for the following two key reasons:

- to identify the flood extents and depths that can be used to inform the design of the Substation to achieve the National Grid design criteria; and
- to ensure the Substation achieves the required flood resilience there may potentially need to be some land raising in the area. If this were the case, then local compensation flood storage will be required to offset the displaced flood water for the 1% AEP plus 34% climate change event so that flood risk is not increased elsewhere. The Higher Central, 34%, uplift is to be applied as the nearest flood receptors are the East Coast Mainline Railway and A19 (both Essential Infrastructure) and New Farm (more vulnerable).

Operational phase maintenance activities and associated temporary infrastructure

5.3.6 Once construction of the overhead lines is completed, annual inspections would be required take place. Personnel carrying out inspections on foot could be at risk of flooding in areas where a fluvial or surface water hazard has been identified. It is recommended that a flood response and evacuation plan similar to that proposed for the construction work is incorporated into inspection procedures to mitigate this risk.

5.3.7 As all the components of the overhead lines have a design lifetime of at least 50 years, refurbishment work would only be required very infrequently during the lifetime of the Project. Refurbishment works would be of a similar character to the proposed construction works, though they would probably be of a lesser scale. Therefore, some or all of the mitigation measures recommended above to control flood risk to

construction activities would also apply to possible future refurbishment works. These would need to consider the effects of climate change in the intervening period.

Risk to third party receptors during the operational phase

5.3.8 It is concluded that there will be no impact to third party receptors during the operational phase if the appropriate drainage measures are implemented to mitigate increased surface water runoff and compensatory storage, as outlined above, should raised flood defences or ground raising prove to be required.

Surface water flood risk

Operational phase infrastructure

5.3.9 Once construction activities are complete, all temporary access infrastructure and hardstanding will be removed and the ground re-instated to its pre-development condition. The only aspects of the permanent infrastructure that could affect surface runoff rates would be the new Substations at Overton and Monk Fryston, pylon foundations and permanent access routes.

5.3.10 The permanent changes in ground cover associated with the Project have the potential to increase the overall extent of lower permeability surfaces. In the absence of effective surface water management measures, this could lead to a temporary increase in peak runoff rates and a consequent increase in flood risk to third party receptors downstream. To address this, surface water management measures will be implemented, which is detailed in **Section 6**.

Risk to third party receptors

5.3.11 It is concluded that there will be no impact to third party receptors during the operational phase based on the adoption of the surface water management measures detailed in **Section 6**.

6. Flood risk management

6.1.1 This section sets out the drainage strategy design principles and flood mitigation measures that are to be incorporated/embedded into the Project to ensure that flood risk impacts to and from the Project are minimised and appropriately managed during the construction and operational phases. At this PEIR stage of the Project no detailed design has been undertaken for any aspect of the proposed measures discussed below, rather this PEIR sets out the design standards that will be adopted by the Project.

6.1.2 For all temporary works, the final FRA for DCO submission will set out the parameters for both watercourse crossings and drainage management measures. These will be incorporated into the CEMP but will require construction contractors to specify the detail of these measures in relevant FRAP/discharge of planning requirements documents.

6.1.3 For the permanent works, the National Grid Front-End Engineering Design (FEED) team will design the drainage measures at substations, an account of which will be provided in the DCO FRA. The DCO FRA will include a summary/review of the drainage schemes to demonstrate that they are fit for purpose and compliant with relevant planning policy requirements. The design/sizing of temporary watercourse crossings for construction access would be undertaken by the construction contractor, according to the parameters incorporated into the CEMP, prior to the submission of applications for necessary permits and consents from the Environment Agency, LLFAs or IDBs.

6.2 Drainage strategies and surface water management

Construction phase

6.2.1 For drainage schemes associated with temporary construction activities, the hydrological design will be based on a 1% AEP, critical duration rainfall, event with the upper end, 10%, climate change allowance for the 2020s change factor applied. For temporary construction drainage schemes involving SUDS, the discharge from such schemes to local watercourses will not exceed the present day 42.9% AEP (1 in 2.33 year; QBAR) greenfield runoff rate. The methods used to discharge surface water will be prioritised in the following order: infiltration to ground; discharge to watercourse following attenuation; and combined/surface water sewer following attenuation.

Operational phase

6.2.2 For permanent drainage schemes involving SUDS, the pond capacities will be designed to a 1% AEP standard with the upper end (40%) 2080s allowance for rainfall scenarios applied to drainage modelling input data. In designing the drainage scheme the principle of management of runoff by exceedance[22] will be followed; this will ensure that the exceedance of the drainage system doesn't cause flooding of sensitive aspects of the infrastructure (e.g. a substation) or third party receptors, rather, the overflow will be routed to grassed areas within the compound or adjacent agricultural land.

[22] CIRIA (2006) Designing for exceedance in urban drainage - good practice (C635). Available at https://www.ciria.org/ItemDetail?iProductCode=C635&Category=BOOK&WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91 Accessed 30/06/2021

6.2.3 For permanent drainage schemes involving attenuation ponds, the generic hydrological design measures as prescribed in the FRA will be based on the assumption that discharge from such schemes to local watercourses will not exceed the present day 42.9% AEP (1 in 2.33 year; QBAR) greenfield runoff rate for the associated area drained. Again, the methods used to discharge surface water will be prioritised in the following order: infiltration to ground; discharge to watercourse following attenuation; and combined/surface water sewer following attenuation.

6.3 Flood risk management measures

Construction and operational phases

6.3.1 The initial flood risk management measures (those identified at this PEIR stage) for all phases of the Project are set out in **Table 6.1**. Those that relate to specific elements or phases will be identified in the wording of the measures or will be identifiable by the matter being discussed (e.g., temporary measures will apply to the construction phase only).

Table 6.1 - Proposed flood risk management measures for the Project

Ref no.	Project Element	Flood Risk Management Measure	Reason
FM1	All Project construction infrastructure (e.g., substations, CSECs, access routes, overhead line pylons)	The design/planning of construction/temporary activities will consider the potential impacts to flood risk. Several measures may be implemented to avoid significant impacts to flood risk including: • Avoid siting/storing any activity/material in the floodplain. • Removing obstacles, plant and debris from watercourse pathways. • Access roads (and working areas) in the floodplain are to be as close to ground level as possible (a slight raise surface is often required to allow to for drainage). This is to minimise the loss of floodplain storage volumes associated with raised structures such as raised access roads, working areas and associated topsoil stockpiles (for example Trackway may be used). Cross drainage would be provided as necessary at topographic low points. • At specific locations, in the vicinity of identified receptors, no raised structures will be located within the floodplain. Access roads and working areas will be 'at grade' and any associated stockpiles will be located outside of the floodplain. Works will not be carried out during flood flows to avoid undue erosion of the riverbeds and/or banks, to protect construction personnel and plant, and to ensure that flood conveyance is not reduced.	Standard good practices to mitigate flood risk.
FM2	Watercourse crossings (temporary) access	Where possible, existing watercourse crossings will be used. However, in some locations may be required. Where reasonably practicable, temporary bridges will be used in preference to culverts and designed to ensure an appropriate level of flood conveyance in the construction phase. Where culverts are required, these will either be arch culverts, leaving the natural bed alone, or they would be installed with the invert set below the natural bed level for a semi natural bed to establish within the culvert. There is only one crossing of an Environment Agency Main River, the Cock Beck, which will be crossed using a clear span, bailey bridge. All construction related, temporary crossing will be designed to convey the **1% AEP flood flow with the Higher Central, 15%,** climate change uplift for the 2020 epoch. Where	Maintain existing conveyance capacity.

Ref no.	Project Element	Flood Risk Management Measure	Reason
		reasonably practicable, crossings of ordinary watercourses will use a clear span bridge, requiring no in channel works.	
FM3	Temporary access routes and working areas	Access routes and works areas (including laydown compounds and pylon working areas) will, in most cases, be constructed from compacted aggregate, which may allow some infiltration of incident rainfall.	Semi-permeable surfaces to enable infiltration wherever possible to reduce surface water accumulation.
FM4	All Project infrastructure (e.g., substations, CSECs, access routes, overhead line pylons)	A minimum stand-off distance from the edge of all watercourses of 9m (on both sides of the channel) will be provided. This applies to all construction works and permanent development. No works would be undertaken within 9 m of any watercourse (other than for watercourse crossings and drainage mitigation). All works within 8m of non-tidal Main River would be subject to a Flood Risk Activity Permit (FRAP). Any works within 9m of an Ordinary Watercourse would be subject to a consent from the relevant LLFA or, in the case of IDB adopted drains, the relevant IDB.	To minimise the risk of any impacts to watercourses, including impacting flood flow conveyance.
FM5	Substations, CSECs, construction compounds	Implementation of an appropriate Drainage Management Plan for the construction phase of the substations, CSECs and construction compounds, utilising SuDS principles, including attenuation storage where necessary to ensure any discharge into the IDB drains is limited to greenfield rates. This would be secured through a DCO Requirement, likely via the CEMP.	To ensure no increase in flood risk downstream.
FM6	New Overton Substation and extension of existing Monk Fryston substation.	Detailed drainage design for the operational substations, utilising SuDS principles, including attenuation storage where necessary. This would be secured through a DCO Requirement. The detailed design will be prepared in accordance with the Drainage Strategy for the operational substations, which will accompany the ES.	To ensure no increase in flood risk downstream.
FM7	Topsoil stockpiles	Stockpiles will be present for the shortest practicable timeframe, with materials being reinstated as the construction work progresses. Stockpiles which remain	To prevent loss of topsoil in a major flood event, thereby

Ref no.	Project Element	Flood Risk Management Measure	Reason
		present for three months or longer will be carefully managed using seeding techniques.	reducing the availability of material for reinstatement.
FM8	Temporary access routes, working areas and construction compounds	Once constructed, all temporary access route and temporary working area construction material will be removed and the ground reinstated to its pre-construction state (or similar), with the soil stockpile material used to backfill any excavations (to a level slightly above natural ground level to allow for settlement).	To return the temporary access routes, working areas and temporary construction compounds to a pre-development condition, in terms of their rainfall infiltration and runoff generation characteristics.
FM9	Areas located in, or requiring access, via the floodplain.	An Emergency Flood Response Plan would be prepared and implemented for the construction phase, including safe access and egress routes where required. The Preparation of an Emergency Flood Response Plan would be secured via a DCO Requirement, most likely the CEMP.	For the safety of site operatives who may be working within the floodplain, or may need to cross it to access/egress the part of the red line boundary they are working in.
FM10	Occupants and visitors to the new Overton Substation	An Emergency Flood Response Plan for the operational new Overton substation would be prepared and implemented for the operational phase, secured via a DCO Requirement.	To address the residual risk of flooding to the new Overton substation.
FM11	All Project infrastructure (e.g., substations, CSECs, access routes, OHL pylons)	A detailed Flood Management Plan (FMP) will be prepared and submitted to the Environment Agency and relevant LLFA for approval post grant of the DCO. The following measures will be implemented. FMPs would apply to all sources of flooding, including fluvial, surface water and groundwater, together with internal sources of flood risk as appropriate.	To ensure the safety of those on and off-site, by managing potential flooding as far as reasonably practicable.

Ref no.	Project Element	Flood Risk Management Measure	Reason
		The FMP would cover both construction and operational phases as different receptor groups would be affected during each phase. The FMP would, as a minimum include details as to how frequently weather and stream flow observations would be made, how forecasts, alerts and actions would be disseminated, signage, roles and responsibilities, emergency response procedures, including detailed evacuation plan and procedures for making safe plant and equipment. Procedures would be presented to facilitate the periodic robust assessment of any potential floodplain and surface water flow obstructions, ensuring that activities do not coincide with those areas of mapped fluvial and surface water flood risk.	

6.4 Additional flood mitigation measures

6.4.1 As was identified in **Section 5.3,** the new Overton Substation has been identified as likely being at risk of flooding with future climate change. To ensure the substation is resilient to flooding to the National Grid design standard, there may be a requirement to build raised flood defences or raise the land surface/built a platform on which the substation can be built. These flood resilience measures would likely increase the flood risk to third party receptors due to the displacement of flood water in future. The further flood modelling work outlined in **Section 5.3,** will consider how much compensatory storage will be required and where this will best be located to ensure there is no increased flood risk to third party receptors.

6.5 Summary

6.5.1 For the purposes of this PEIR FRA, it is concluded that, subject to the adherence to the guiding water management principles set out here, as supported by the Drainage Strategies, there will be no increase in flood risk arising from the DCO Project during its construction and operational phases.

6.5.2 Sufficient information/detail will be provided in the DCO application to ensure that there will be no increase in flood risk as a result of the Project, including the detailed surface water drainage design for permanent infrastructure and additional fluvial modelling to assess future flood risk at the Overton substation and adjacent flood receptors.

7. Planning policy requirements

7.1 The Sequential Test

7.1.1 A sequential approach has been taken in determining the location of the new overhead lines, substations and CSECs with flood risk being considered in the route selection process along with the numerous other technical, environmental, and socio-economic constraints. This sought to ensure that it is sited in the lowest flood risk areas, where possible, whilst acknowledging the expansive floodplains of the wider area, and the need to reach an existing substations to connect to the wider electricity network. Now that the Overton substation has been found to be at risk of flooding in future climate scenarios, there is the potential to micro-site the Substation slightly so as not to increase future flood risk, however, this can only be confirmed once the additional modelling has been completed. Furthermore, the requirements/need case and justifications for the Project are set out in **Chapter 2** of the PEIR, as well as the optioneering that has been undertaken to locate the Project and its elements in the most appropriate locations. Based on the information contained within this FRA and **Chapter 2**, the Sequential Test is considered to have been satisfied.

7.2 The Exception Test

7.2.1 The requirements of the Exception Test were set out in **Section 2.2** of this report, along with the flood risk vulnerability and flood zone 'compatibility' matrix in **Table 2.1**, which confirmed that the Exception Test needs to be passed for the Essential Infrastructure elements of the Project located in Flood Zone 3a; which for this Project is only the pylons which have, with the agreement of the Planning Inspectorate (**Section 4.6**), been scoped from this assessment.

Wider sustainability benefits

7.2.2 Part 1 of the Exception Test requires the Project to provide wider sustainability benefits to the community that outweigh flood risk. As stated in EN-1 (Department of Energy and Climate Change, 2011a), this would include the benefits (including need) for the infrastructure.

7.2.3 The Project would make a significant contribution to delivering critical energy infrastructure for the UK, in accordance with National Policy.

Flood risk

7.2.4 Part 2 of the Exception Test requires that the Project would be safe, without increasing flood risk elsewhere (subject to the exception below) and, where possible, would reduce flood risk overall. 'Essential Infrastructure' in Flood Zone 3a should also be designed and constructed to remain operational and safe in times of flood.

7.2.5 Part 2 of the Exception Test for the proposed OHL is considered to be passed, without the need for any additional mitigation on the basis that:

- The potential effects during the construction phase of the proposed overhead line are expected to be localised and not significant. It is expected that the embedded

mitigation will reduce the risk to not significant and therefore, will pose a minor risk to flood risk receptors.

- The footings of the pylons that are located in Flood Zone 3a are considered to be water compatible and will not displace significant floodplain storage volumes, compartmentalise the floodplain nor obstruct surface water or floodplain flows. As outlined in **Section 4.6**, pylons do not displace any significant volume of water and pose minimal obstruction to water flow. Therefore, placing of pylons in floodplain areas will not significantly affect floodplain storage or conveyance and will therefore not cause an increase in flood risk to others external receptors. Consequently, the pylons will not impact the flood risk to third party receptors.

7.2.6 As above, it is advised on the basis of the new Overton Substation potentially being within Flood Zone 3 in the future, that further assessment of flood risk is undertaken for this site for inclusion in the DCO FRA. This will consider any additional mitigation required to ensure the substation has been designed to be resilient to flooding whilst not increasing the risk to third party receptors.

8. Summary and conclusions

8.1 Summary

8.1.1 Wood PLC was commissioned by National Grid to undertake an FRA to support the DCO application for the proposed Yorkshire GREEN Project, seeking to construct, operate and maintain new overhead lines, underground cables, two substations, cable sealing end compounds (CSECs), to link up two existing overhead lines, and to reinforce the system to increase the capacity of the network north of York..

8.1.2 As the Project is classified as an NSIP, the FRA has been carried out in accordance with relevant National Policy Statement EN-1, which details planning policy in regard to NSIPs in the energy sector. However, reference has also been made to the NPPF and associated PPG where relevant, for additional guidance regarding flood risk and development, as appropriate. Consultation with key stakeholders, including the Environment Agency, York Consortium of IDBs (Ainsty and Foss IDB) and North Yorkshire County Council (LLFA) has also been undertaken to discuss the Project and the management of flood risk. Parts of the development must necessarily be located in areas with a medium or high likelihood of flooding (Flood Zones 2 and 3), and therefore consideration has been given to the Sequential and Exception Tests, as defined in EN-1 and NPPF.

8.1.3 This PEIR FRA considers the flood risks associated with the construction of the proposed overhead lines, substations, CSECs and associated construction infrastructure, in addition to refurbishment or removal of existing infrastructure.

8.1.4 Flood risks associated with fluvial, and surface water sources have been identified during the construction and operation phase of the Project. Flood risk receptors include construction activities themselves, operational infrastructure, maintenance and repair activities, plus third-party receptors for which flood risk could be increased because of the works.

8.1.5 The flood risk management standards, including the appropriate climate change uplifts to be applied, for all elements of the Project, during both the construction and operational phases were set out in **Section 6**. During both the phases of the Project there will be an increase in impermeable area which result in greater surface water runoff. To manage the increased runoff from these areas SUDS will be used with discharge of the prioritised in the following order: infiltration to ground; discharge to watercourse following attenuation; and combined/surface water sewer following attenuation.

8.1.6 Further modelling is required to establish the design requirements of the Overton Substation to achieve the National Grid 0.1% AEP + climate change (34%), design standard. The modelling will also consider what mitigation is required to ensure that the flood risk to adjacent Essential Infrastructure (East Coast Mainline Railway and the A19) are not at increased future flood risk due to the construction of the Substation.

8.2 Conclusions

8.2.1 Overall the permanent infrastructure associated with the Project (pylons, substations (excluding the new Overton Substation) and CSECs) are not considered to be at risk of

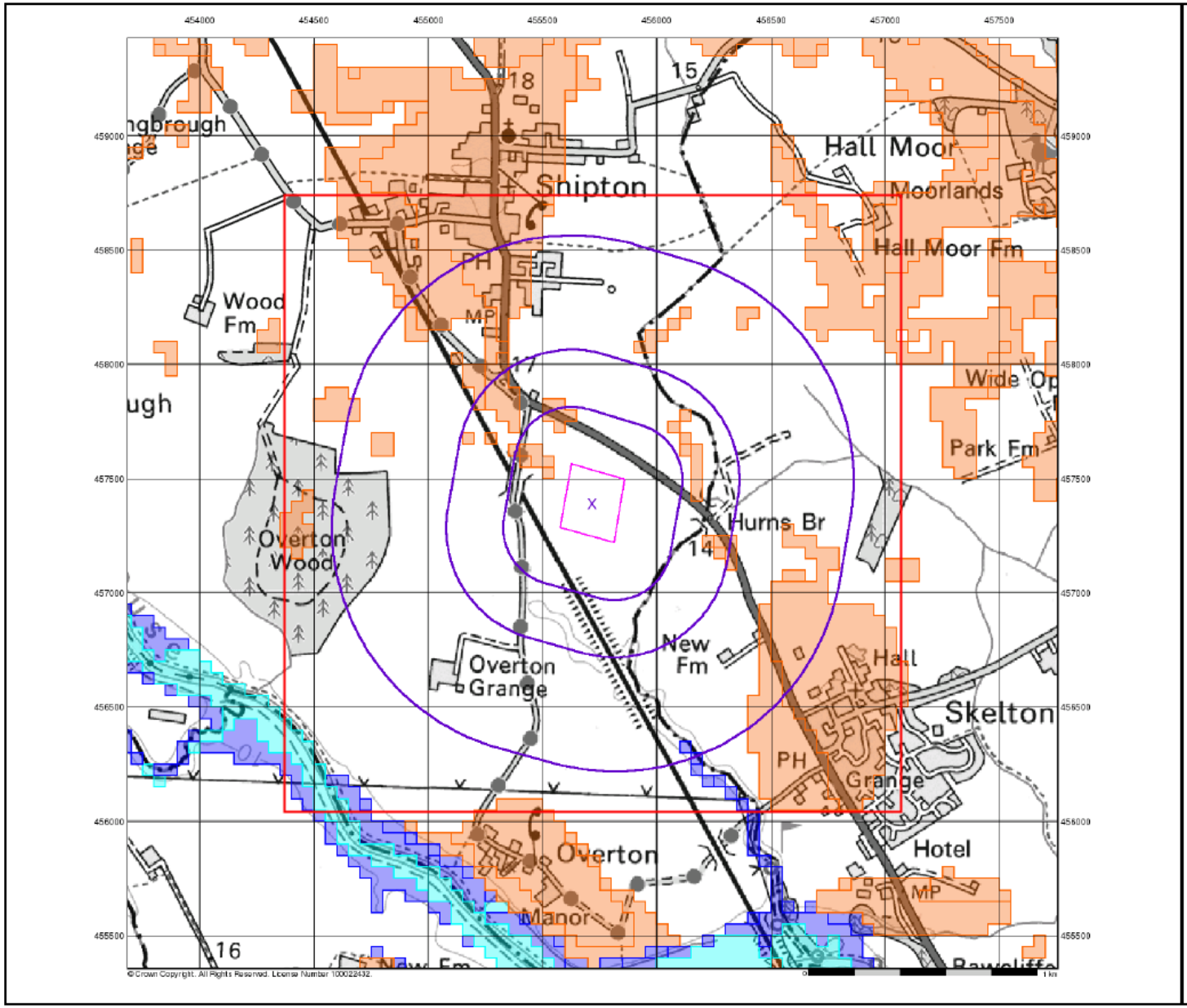
significant flooding, nor is it indicated that they pose an increased risk of flooding to third party receptors, due to management of runoff and use of SuDS for both temporary and permanent impermeable areas.

8.2.2 The flood mitigation measure detailed in **Section 6** are considered to be sufficient in mitigating the risks associated with the Project (excluding the new Overton Substation), during construction and operation. It is therefore concluded that the Project, with the mitigation measures described above in place, is not at significant risk of flooding, nor will it increase flood risk elsewhere. In this respect, it is consistent with the requirements of the Exception Test.

8.2.3 However, it is noted from this FRA that the new Overton Substation could potentially increase flood risk, based on information from the Environment Agency's York Detailed Flood Model. The York Detailed Model indicates that the site where the new substation is located within Flood Zone 2 and 3, based upon future flood forecasting (1% AEP +50% CC). On this basis it is recommended that a further FRA is undertaken for the new Overton Substation, in addition to the required Exception Test.

8.2.4 Additional flood mitigation measures that may be required for the new Overton Substation include, but are not limited to, compensatory flood storage to replace potential flood storage displacement as a result of the substation construction.

Annex A
Overton Substation – BGS Groundwater Flooding Susceptibility



MOTT MACDONALD

BGS Flood GFS Data

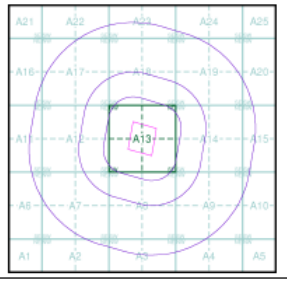
General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice

Agency and Hydrological (Flood)

- Limited Potential for Groundwater Flooding to Occur
- Potential for Groundwater Flooding of Property Situated Below Ground Level
- Potential for Groundwater Flooding to Occur at Surface

Site Sensitivity Context Map - Slice A



Order Details

Order Number:	276596223_1_1
Customer Ref:	100102545 SS03
National Grid Reference:	455720, 457390
Slice:	A
Site Area (Ha):	6.87
Search Buffer (m):	1000

Site Details

York North 275kV, Shipton, North Yorkshire

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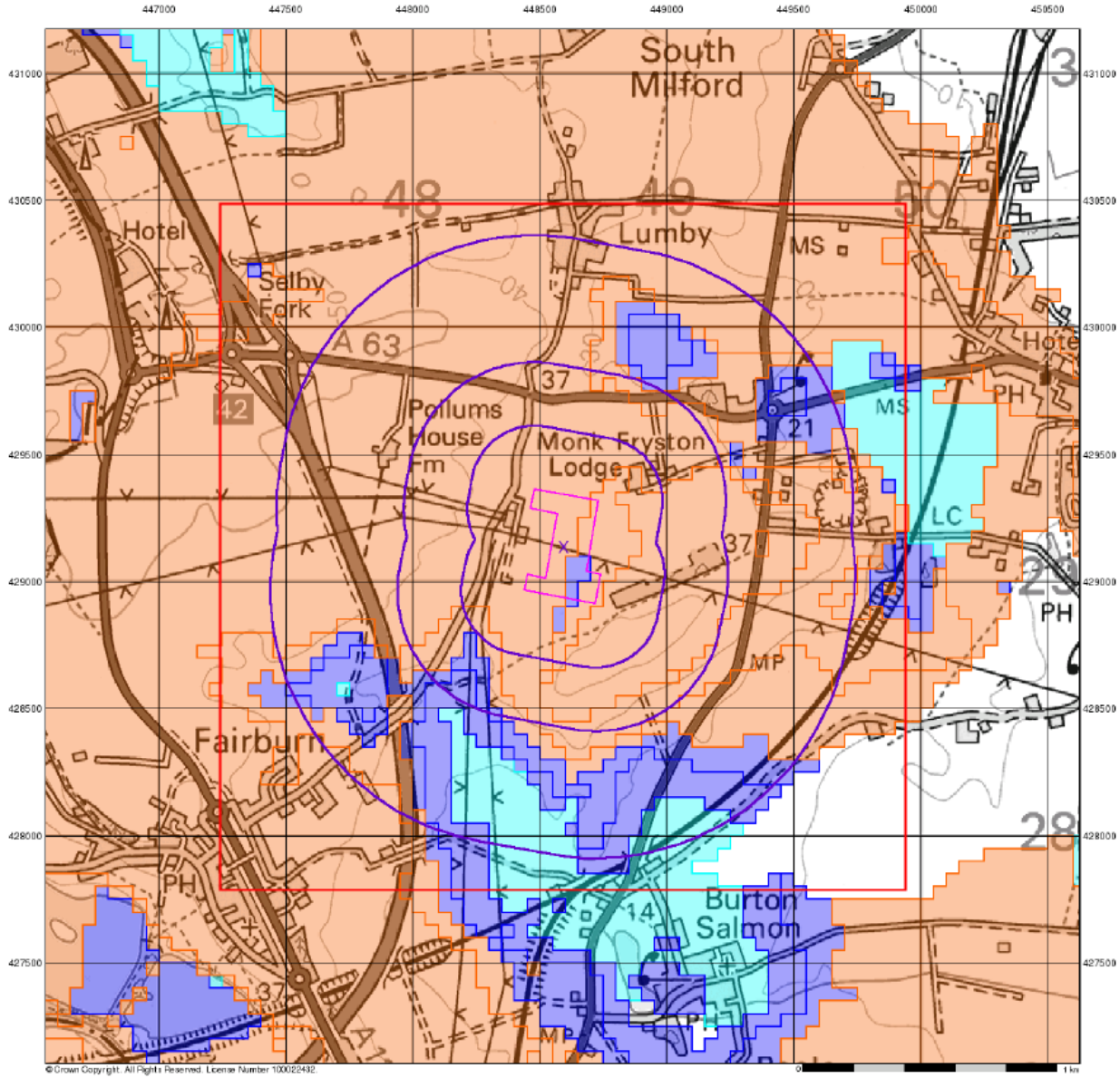
Annex B
Monk Fryston Substation – BGS Groundwater Flooding Susceptibility



MOTT MACDONALD

BGS Flood GFS Data

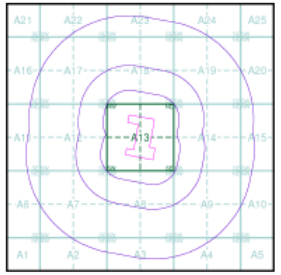
General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice

Agency and Hydrological (Flood)

- Limited Potential for Groundwater Flooding to Occur
- Potential for Groundwater Flooding of Property Situated Below Ground Level
- Potential for Groundwater Flooding to Occur at Surface

Site Sensitivity Context Map - Slice A



Order Details

Order Number:	276594815_1_1
Customer Ref:	100102545 SS03
National Grid Reference:	448590, 429140
Slice:	A
Site Area (Ha):	8.1
Search Buffer (m):	1000

Site Details

Site at, Monk Fryston 400kV, North Yorkshire

Landmark INFORMATION GROUP

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