H2Teesside Project

Preliminary Environmental Information Report

Volume III – Appendices

Appendix 9A: Preliminary Flood Risk Assessment

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended)

TABLE OF CONTENTS

9A.0 FLOOD RISK ASSESSMENT 4
9A.1 Introduction 4
9A.2 Purpose and Scope of the Assessment 5
9A.3 Data Sources 6
9A.4 Site Information 19
9A.5 The Proposed Development 36
9A.6 Planning Policy 41
9A.7 Flood Risk Sources 66
9A.8 Management of Surface Water from the Site 82
9A.9 Mitigation of Residual Flood Risks and Off-Site Impacts 82
9A.10 Summary and Conclusions 96
9A.11 References 99
ANNEX A – CONSULTATION RESPONSES 103
ANNEX B – SFRA FLOOD ZONES 104

TABLES

Table 9A-1: Sources of Data 6
Table 9A-2: Summary of Environment Agency pre-application advice and the Inspectorate Scoping Opinion that has Informed the Scope and Methodology of the FRA 10
Table 9A-3: Surface Waterbodies 21
Table 9A-4: Geology 31
Table 9A-5: Hydrogeology 32
Table 9A-6: Flood Zone Definitions 48
Table 9A-7: Flood Risk Vulnerability and Flood Zone Compatibility 51
Table 9A-8: Sea Level Allowance for Each Epoch in Millimetres (mm) per year with Total Sea Level Rise for Each Epoch in Brackets (use 1981 to 2000 baseline) 52
Table 9A-9: H++ Sea Level Rise Allowance 52
Table 9A-10: Climate Change Allowances to apply based upon the Flood Zone and Development Land Use Vulnerability 53
Table 9A-11: Environment Agency Peak River Flow Climate Change Allowances for the Tees Management Catchment 53
Table 9A-12: Environment Agency Peak Rainfall Intensity Climate Change Allowances for Tees Catchment Management (3.3% annual exceedance rainfall event) 54
Table 9A-13: Environment Agency Peak Rainfall Intensity Climate Change Allowances across England for Tees Catchment Management (1% annual exceedance rainfall event) 54
Table 9A-14: Relevant RCBC Local Planning Policies 58
Table 9A-15: Relevant STBC Planning Policies 59
Table 9A-16: Relevant HBC Planning Policies 62
Table 9A-17: Records of Historical Flooding 67
Table 9A-18: Modelled Water Levels for the Tidal River Tees 71

Table 9A-19: Tidal Water Levels for the Tidal River Tees with Climate Change Allowances (m AOD).....72
Table 9A-20: Summary of Key Flood Risks 80

9A.0 FLOOD RISK ASSESSMENT

9A.1 Introduction

9A.1.1 This preliminary Flood Risk Assessment (FRA) has been prepared on behalf of H2 Teesside Ltd, a bp company (the Applicant) for the Development Consent Order (DCO) application for the construction, operation (including maintenance where relevant) and decommissioning of H2Teesside, an approximately 1.2 Gigawatt Thermal (GWth) Carbon Capture Usage & Storage (CCUS) enabled Hydrogen Production Facility and supporting associated connections (the Proposed Development Site) on land in Redcar and Cleveland, Stockton-on-Tees, and Hartlepool, on Teesside.

9A.1.2 This report describes the approach and findings of the preliminary FRA undertaken for the Proposed Development Site. The terms of reference used to describe the Proposed Development in this report are consistent with those defined within the Preliminary Environmental Information (PEI) Report.

9A.1.3 The Proposed Development Site boundary is shown on Figure 1-1: Proposed Development Site Location Plan (PEI Report, Volume II). For the purposes of this report the terms used to identify the various parts of the Proposed Development Site are outlined below and are consistent with the terms used elsewhere in the PEI Report.

9A.1.4 The Proposed Development Site is divided into the following areas (described in more detail in Chapter 3: Description of the Existing Environment and Chapter 4: Proposed Development (PEI Report Volume I)):

- The Production Facility (Main Site, also known as The Foundry);
- CO_2 Export Corridor;
- Natural Gas Connection Corridor;
- Electricity Connection Corridor;
- Other Gases Connection Corridor;
- Water Connections Corridor (including water supply and discharge); and
- Hydrogen Pipeline Corridor.

9A.1.5 The location of the Main Site, Hydrogen Pipeline Corridor and other indicative Connection Corridors are shown on Figures 4-1 to 4-8 (PEI Report, Volume II).

9A.1.6 Surface watercourses identified within the Study Area are presented on Figure 9-1: Surface Water Features and their Attributes (PEI Report Volume II), and their associated flood zone extents on Figure 9-3: Fluvial Flood Risk (PEI Report, Volume II), which specifically illustrates areas of the Proposed Development Site located within areas at risk of flooding.

9A.2 Purpose and Scope of the Assessment

Context

9A.2.1 The Environment Agency's online Flood Map for Planning (FMfP) (Environment Agency, n.d.b) (Figure 9-3: Fluvial Flood Risk (PEI Report, Volume II)) indicates that the Main Site is located entirely in Flood Zone 1. Areas located within Flood Zone 1 are defined as having a 'low risk' of flooding from fluvial or tidal sources. The definition of flood zones in accordance with the Flood Risk and Coastal Change PPG (Department for Communities and Local Government, 2022) are summarised in Table 9A-6.

9A.2.2 The Environment Agency's FMfP (Figure 9-3: Fluvial Flood Risk (PEI Report, Volume II)) indicates the connection corridors/pipelines (CO_2 Export, Other Gasses Connection, Natural Gas Connection, Water Connection, Electrical Connection and Hydrogen Pipeline) are located predominantly in Flood Zone 1, however, some sections of these connection corridors/pipelines are located within Flood Zone 2 (medium risk of flooding from fluvial or tidal sources) and Flood Zone 3 (high risk of flooding from fluvial or tidal sources). In particular, the majority of the Hydrogen Pipeline Corridor to the north of the River Tees is within Flood Zones 2 and 3 (for example the Hydrogen Pipeline Corridor crosses Flood Zones 2 and 3 at the delta of Greatham Creek flowing into the Seaton on Tees Channel). Small areas of the Electrical Connection Corridor and the Water Connections Corridor to the south of the River Tees are also located within Flood Zones 2 and 3.

9A.2.3 Works undertaken in Flood Zones 2 and 3 will be temporary in nature and will be involve either the construction of underground tunnels/pipelines or the installation of pipes on existing/extended pipe racks in existing service corridors. Where tunnels or borings are proposed for the Hydrogen Pipeline Corridor, the majority of the launch and receiving areas are outside Flood Zone 3, with the exception of the open-trench channel running to the east and alongside of the Seaton Carew Road, the trenchless channel crossing the Greatham Creek to the west of Tees Road, and the trenchless channel crossing the Greatham Creek mouth from the Seaton Carew Road.

Scope

9A.2.4 The National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2021) and the Flood Risk and Coastal Change Planning Practice Guidance (PPG) (Department for Communities and Local Government, 2022) specify that applications for development proposals greater than 1 hectare (ha) in area located in Flood Zone 1, and all development proposals located in Flood Zone 2 or 3, should be accompanied by a site-specific FRA that identifies and assesses all forms of flooding to and from the development. The FRA should demonstrate how flood risk will be managed so that the development remains safe throughout its lifetime, taking into account the vulnerability of the development and the potential impact of climate change on risk.

9A.2.5 The Overarching National Policy Statement (NPS) for Energy (EN-1), Section 5.7 (Flood Risk) (Department for Energy and Climate Change (DECC), 2011) details that

projects of 1 ha or greater in Flood Zone 1 in England and all proposals for energy projects located in Flood Zones 2 and 3 in England should be accompanied by an FRA.

9A.2.6 This preliminary FRA is proportionate and appropriate to the nature and scale of the Proposed Development, which assesses existing flood risk at the Proposed Development Site and arising from the Proposed Development Site, and, where required, recommends suitable mitigation measures.

9A.2.7 The objectives of this report are to:

- collect and review existing information relating to the flood risk posed to the Proposed Development Site from all sources (e.g. fluvial, tidal, surface water, artificial, groundwater, drain and sewer flooding);
- consult with the Environment Agency and Lead Local Flood Authorities (LLFAs) in relation to flood risk and their requirements for management of any risk;
- assess the flood risk to the Proposed Development Site under existing and post-development conditions (taking into account climate change); and
- outline any mitigation measures needed to ensure the Proposed Development Site and its occupants will be safe for the lifetime of the development and to meet the requirements of the NPS and NPPF.

9A.3 Data Sources

9A.3.1 The baseline conditions for the Proposed Development Site have been established through a desk study including a review of publicly available information and supporting modelling and hydrology study reports (where available), and via consultation with the associated Lead Local Flood Authorities (LLFAs) and the Environment Agency. Relevant consultation responses are provided in Annex A. This information has been utilised to inform the assessment made within this preliminary FRA. Data collected for this assessment is described in Table 9A-1.

Table 9A-1: Sources of Data

PURPOSE	DATA SOURCE	COMMENT
Identification of hydrological features	1:25,000 Ordnance Survey (OS) mapping	Identifies the position of the Proposed Development Site and local hydrological features.
Identification of Ground Levels	1:25,000 Ordnance Survey (OS) mapping	Provides existing Proposed Development Site levels and spot level heights along local highways.
Identification of Existing Flood Risk	Environment Agency Indicative Flood Zone Map (presented as Figure 9-4: Environment Agency Flood Risk Zones (PEI Report Volume II).	Identifies fluvial/tidal inundation extents and historical flooding.

PURPOSE	DATA SOURCE	COMMENT
	Environment Agency Long-term Flood Information Mapping (Environment Agency, no date (n.d.)b)	Provides information on the risk of flooding from fluvial, tidal, surface water and reservoirs (artificial sources).
	Redcar and Cleveland Borough Council (RCBC) Level 1 Strategic Flood Risk Assessment (SFRA) (JBA Consulting, 2016)	Assesses flood risk across the Redcar and Cleveland Borough Council (RCBC) boundary area. Includes flood risk from fluvial/tidal, sewers, overland flow and groundwater. Provides details on historical flooding, flood risk at sites allocated in the Local Plan and provides mitigation measure requirements for developments located in areas of flood risk and surface water management requirements.
	RCBC Level 2 SFRA (JBA Consulting, 2016b)	
	RCBC Preliminary Flood Risk Assessment (PFRA) (Redcar and Cleveland Borough Council, 2011)	
	Redcar and Cleveland Local Flood Risk Management Strategy (Redcar and Cleveland Borough Council, 2017)	
	Stockton-On-Tees Borough Council (STBC) Level 1 SFRA (JBA Consulting, 2018)	Assesses flood risk across the Stockton-on-Tees Borough Council (STBC) boundary area. Includes flood risk from fluvial/tidal, sewers, Overland flow and groundwater. Provides details on historical flooding, flood risk at sites allocated in the Local Plan and provides mitigation measure requirements for developments located in areas of flood risk and surface water management requirements.
	STBC Local Plan Potential Sites Assessment Level 2 SFRA - Site Screening (JBA Consulting, 2018)	
	STBC PFRA (Stockton-On-Tees Borough Council, n.d.a)	
	Stockton-on-Tees Local Flood Risk Management Strategy (Stockton-On-Tees Borough Council, 2016)	

PURPOSE	DATA SOURCE	COMMENT
	Hartlepool Borough Council (HBC) Level 1 SFRA (JBA Consulting, 2017)	Assesses flood risk across the Hartlepool Borough Council (HBC) boundary area. Includes flood risk from fluvial/tidal, sewers, overland flow and groundwater. Provides details on historical flooding, flood risk at sites allocated in the Local Plan and provides mitigation measure requirements for developments located in areas of flood risk and surface water management requirements.
	PFRA Preliminary Assessment Report for Hartlepool Borough Council (Hartlepool Borough Council, 2011)	
	Hartlepool Local Flood Risk Management Strategy (JBA Consulting, 2016)	
Catchment identification and River Basin Management Plans	Environment Agency Catchment Data Explorer (Environment Agency, n.d.a)	Provides details of watercourses and operational management catchments.
Identification of Hydrogeological features	British Geological Survey's Geological Mapping Viewer, 'Geoindex' (British Geological Society, no date (n.d).)	Provides details of geology and hydrogeology in the vicinity of the Proposed Development Site.
Identification of Historical Flooding	Relevant LLFA SFRAs and PFRAs	Gives details of historical flooding.
Details of the Proposed Works	Design from Proposed Works as outlined within Chapter 4: Proposed Development (PEI Report Volume I)	Provides alternative locations and layouts of the Proposed Development.
Surface Water Drainage	Assumed based on SuDS Principles	Principles for the management of surface water run-off and foul drainage on the Proposed Development Site.

Consultation

9A.3.2 The Environment Agency has been contacted for pre-application planning advice and a response was received on 17 March 2023.

9A.3.3 A summary of the planning advice relevant to this discipline is outlined in Table 9A-2, along with a summary of how the various points will be addressed by the assessment.

9A.3.4 An EIA Scoping Opinion was requested from the Planning Inspectorate (the Inspectorate) in April 2023. A response was received on 17 May 2023. The opinions received from the Inspectorate , the Environment Agency and Natural England which are relevant to this chapter are also summarised in Table 9A-2.

Table 9A-2: Summary of Environment Agency pre-application advice and the Inspectorate Scoping Opinion that has Informed the Scope and Methodology of the FRA

CONSULTEE COMMENTS	RESPONSE
ENVIRONMENT AGENCY PRE-APPLICATION ADVICE (MARCH 2023)	
Flood Risk: The red line boundary for the full development is located within Flood Zones 3, 2 and 1. The majority of the development site for the Main Site is situated within Flood Zone 1. However, small portions of the Main Site are situated within Flood Zone 2 and 3. Parts of the Hydrogen Pipeline Corridor are also within Flood zone 2 and 3.	Noted. This assessment is for Main Site (The Foundry) which is located entirely within Flood Zone 1. Refer to Figure 9-3 (PEI Report, Volume II) for fluvial flood risk mapping.
Flood Risk Vulnerability Classification: No information has been provided on the flood risk vulnerability classification within the provided information. Therefore, we are unable to advise on our policy position in relation to flood risk until the vulnerability of the development has been confirmed by the applicant and/or the local planning authority. It should be noted that 'highly vulnerable' uses, requiring a Hazardous Substance Consent, would not be appropriate within flood zones 3. In accordance with Table 2 of the flood risk and coastal change section of the Planning Practice Guidance (PPG), 'highly vulnerable' developments are not appropriate in flood zone 3 and should not be permitted.	The Proposed Development comprises an approximately 1.2 GWth Carbon Capture Usage & Storage (CCUS) enabled Hydrogen Production Facility and supporting associated connections. According to NPPF Annex 3 Flood Risk Vulnerability Classification, the Proposed Development is classified as 'Essential Infrastructure'. Essential Infrastructure is defined as '*Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including infrastructure for electricity supply including generation, storage and distribution systems; including electricity generating power stations, grid and primary substations storage; and water treatment works that need to remain operational in times of flood'.*
Sources of Flooding: The main source of potential flooding in the area is from the tidal stretch of the River Tees, but there could be other local sources of flooding such as groundwater and surface water. We have published a suite of interactive maps that indicate where possible flooding from different sources could occur	Noted. These sources have been interrogated during the preparation of the preliminary FRA. Further flood risk data and information has also been requested from the Environment Agency. The modelling data has been received and matches the

CONSULTEE COMMENTS	RESPONSE
Check the long term flood risk for an area in England - GOV.UK (www.gov.uk). Our maps are not suitable for a detailed Flood Risk Assessment (FRA), but they can indicate where further assessment may be needed.	data used for the NZT assessment however the data will be used during the EIA for further assessment.
Flood Risk Assessment: We would expect an FRA to be submitted in support of your DCO application. The FRA must assess flood risk from all sources of flooding and recommend the mitigation measures that will be implemented to ensure a safe development in a 1 in 200-year (tidal) flood event, taking account of climate change. It must also demonstrate that flood risk will not be increased elsewhere. Flood risk mitigations will need to be included within the development to ensure it can remain safe for its' lifetime. This includes raising the finished floor levels to the 1 in 200 year plus climate change plus a freeboard of 600mm.	The preliminary FRA assesses flood risk from all sources using the data received to date and publicly available information. The preliminary FRA will be updated for the ES as more information and data is available from the Environment Agency, and these requirements will be accounted for. Further consultation with the Environment Agency will also be sought as the Proposed Development design progresses. The Proposed Development will be located on a development platform located above the 0.5% AEP plus climate change plus a freeboard of 600 mm.
Flood Risk Information the Environment Agency holds: We have an outline for a 1 in 200-year level undefended model that can be requested. The modelling we have for this location does not include climate change allowances and therefore this will need to be calculated in accordance with the 'Flood risk assessments: climate change allowances'. As the development location is at risk from tidal flooding, sea level allowances will need to be applied to the 1 in 200-year level for the lifetime of the development using both higher central and upper end allowances. This applies to both the temporary and permanent works. The extent, speed and depth of flooding shown in the assessment should be used to determine the flood level for flood risk mitigation measures. Where assessment shows flood risk increases steadily and to shallow depths, it is likely to be more appropriate to choose a flood level lower in the range. Where assessment shows	Noted. A freedom of information request was issued to the Environment Agency in March 2023 to receive the latest baseline information relating to flood risk. The data was received in May 2023 and has been incorporated into this chapter and its appendices where relevant.

CONSULTEE COMMENTS	RESPONSE
flood risk increases sharply due to a 'cliff edge' effect caused by, for example, sudden changes in topography or defences failing or overtopping, it is likely to be more appropriate to choose a flood level higher in the range.	
Flood Alleviation Schemes: The Environment Agency are currently in the process of developing flood alleviation schemes which may have an interface with the proposed development. Attached to this letter is the scheme overview for the Greatham North East Flood Alleviation scheme.	Noted. Interfaces with the Greatham North East Flood Alleviation scheme are being considered, including pre-planning consultation advice received from the Environment Agency pertaining to the flood alleviation scheme. This was further considered in the selection of the preferred hydrogen pipeline routing at the Greatham Creek Area. Further consultation with the Environment Agency will also be sought as the Proposed Development design progresses.
Flood Risk Consents and Permits: The River Tees is a designated 'main river' and under the Environmental Permitting Regulations certain works within 16m of a tidal main river, or within 16m of any flood defence structure on a tidal main river, require a Flood Risk Activity Permit from the Environment Agency. This includes works such as directional drilling under the River Tees. You can find more information on permit requirements using the following link: Flood risk activities: environmental permits – GOV.UK (www.gov.uk). If a permit is required, it must be obtained prior to beginning the works. You may also need a Marine Management Organisation license depending on if any works will be undertaken below the mean high water springs (MHWS).	Noted. Permits and consents that are expected to be required by the Proposed Development are outlined in Chapter 9: Surface Water, Flood Risk and Water Resources (PEI Report, Volume I).
Drainage Strategy: In order to determine the water quality impacts, the following information should be submitted as part of your drainage strategy: • How rainwater will be handled and discharged from the site; and • How foul water will be handled and discharged from the site. This should include	Noted. Drainage principles for the Proposed Development are outlined in Chapter 9: Surface Water, Flood Risk and Water Resources (PEI Report, Volume I) Section 9.5 A Drainage Strategy

CONSULTEE COMMENTS	RESPONSE
if the site will be connecting to Northumbrian water's public sewer network.	will accompany the DCO Application, and its suitability assessed during the EIA and reported in the ES.
Discharge of Clean Water: Clean surface water (i.e., clean, uncontaminated rainwater from hard standing areas such as roads and car parks) can be discharged to a watercourse without a permit if the discharge passes through a maintained oil interceptor or Sustainable Urban Drainage System. If a water attenuation system is proposed it would be beneficial to see the details, methods, and maintenance of the system to ensure longevity and effectiveness.	Noted. Drainage principles for the Proposed Development are outlined in Section 9.5. A Drainage Strategy will accompany the DCO Application, and its suitability assessed during the EIA and reported in the ES.
THE INSPECTORATE SCOPING OPINION (MAY 2023)	
Flood Zones. The Scoping Report identifies Flood Zones across the Study Area however does not include sub-categories, such as an area of high probability (Flood Zone 3a) or functional floodplain (Flood Zone 3b). The ES should provide an accurate and consistent description of the baseline flood risk for each element of the Proposed Development and the description should clearly distinguish between Flood Zones, including Flood Zones 3a and 3b where relevant. The Applicant's attention is drawn to the Environment Agency's comments in Appendix 2 regarding Flood Zones; the Inspectorate notes that there is a discrepancy between information in the Scoping Report, which identifies that Main Site B is entirely within Flood Zone 1, and the Environment Agency's information, which states it is primarily within Flood Zone 1 but partially within Flood Zones 2 and 3. The Flood Zone should be confirmed within the ES and mitigation identified as required.	Noted. This assessment is for Main Site (The Foundry) which is located entirely within Flood Zone 1. Refer to Figure 9-3: Fluvial Flood Risk (PEI Report Volume II)
Scope of assessment – FRA. The FRA underpinning the ES assessment should additionally cover matters including the effect that temporary mounds of soil in the floodplain could have on flood risk, the volumes of water displacement involved and mitigation measures where necessary. The Applicant's attention is	Noted. The preliminary FRA will be updated during the EIA as more information and data is available from the Environment Agency, and these requirements will be accounted for. Further consultation with the Environment Agency will also be sought as

CONSULTEE COMMENTS	RESPONSE
drawn to the Environment Agency's comments in Appendix 2 regarding scope of the FRA and climate change allowances.	the Proposed Development design progresses. Further flood risk data and information has been requested from the Environment Agency for the EIA.
Scope of assessment. The ES should assess the potential for an increase in offsite flood risk arising from any proposed ground raising within the development boundary, including the pipeline corridors. Effort should be made to agree the scope of the assessment, including the requirement for flood modelling, with the Environment Agency. The ES should identify any mitigation required to address likely significant effects.	The preliminary FRA will be updated during the EIA as more information and data is available from the Environment Agency, and these requirements will be accounted for. Further consultation with the Environment Agency will also be sought as the Proposed Development design progresses.
ENVIRONMENT AGENCY SCOPING OPINION (MAY 2023) (Only included where different or additional to the pre-planning responses outlined above)	
Offsite Flood Risk. If ground raising is occurring within part of the development boundary, and the existing ground levels are below the design flood event, then an assessment will be required to confirm no increase in offsite flood risk. Given current topographical levels of the Main Site and if ground raising is significant which is below the design flood event, then flood modelling should be undertaken. If the pipeline is causing any ground raising, or is above ground which could impact local flood mechanisms, an assessment will be required to understand any increase in offsite flood risk and provide mitigation measures, this assessment could include modelling.	The preliminary FRA will be updated during the EIA as more information is available from the Environment Agency, and these requirements will be accounted for. Continued consultation with the Environment Agency will be maintained should modelling be required.
Hydrogen Pipeline Corridor. The proposed hydrogen pipeline corridor heading north towards the Venator Plant, could affect our flood defence assets along Greatham Creek and the Environment Agency's land holding at Marsh House Farm. In addition, all three routes (labelled R1, R2 and R3 on a document previously supplied to the Environment Agency ('All Utility Connection Corridor, Figure 1')	Noted: Continued consultation with the Environment Agency will be maintained to ensure no impacts to flood defence assets.

CONSULTEE COMMENTS	RESPONSE
could have a significant impact on Greatham Creek and its associated saltmarsh habitat - the last remaining natural area of the original Tees Estuary. In particular, R2 and R3 in particular are of significant concern to the Environment Agency. R2 runs along the line of one of our major flood defences at Cowpen Marsh. The defence lies between the Cowpen Bewley Landfill (to the West) and the Teesmouth and Cleveland Coast Special Protection Area (SPA) (to the East). As such, any work along this corridor could impact one the three current land uses. To the north of Greatham Creek, R2 then runs through Saltern Wetlands (an area of saltmarsh owned by the Environment Agency) and under the Environment Agency's flood embankment to the south of the ConocoPhillips tank farm. The Environment Agency A has concerns that this route will have an impact on the wetland area, which lies with the SPA, and flood defences. R1 crosses the no. 4 brinefield (owned by Sabic and used for hydrocarbon storage), and under the flood embankment on the south bank of Greatham Creek (Sabic Embankment). It also lies under the flood embankment on the north bank of Greatham Creek, which is to be significantly repaired as part of Environment Agency's Greatham North East Flood Alleviation Scheme (FAS). This route also crosses the redundant no. 5 brinefield (owned by Inovyn Chlorvinyl Ltd) and the ConocoPhillips oil pipeline corridor and Seal Sands Emergency Access Road. R3 crosses our land at Marsh House Farm to be used for the extraction of clay in 2024-2026 for our Greatham NE FAS. The Environment Agency is also developing a scheme (Greatham North East FAS) to improve the defences to the south of the Venator Plant. We expect to submit an application for planning permission in Spring 2024, and hope to start construction of the scheme in summer 2024. We are currently seeking contributions from beneficiaries of the scheme. As the proposed pipeline could benefit from our works, we would welcome discussions	Potential impacts and effects to habitats are considered in Chapter 12: Ecology and Nature Conservation (including Aquatic Ecology) (PEI Report, Volume I). Impacts on surface waterbodies and groundwater bodies related to the pipelines are considered in Chapter 9: Surface Water, Flood Risk and Water Resources (PEI Report, Volume I).

CONSULTEE COMMENTS	RESPONSE
with the applicant on the potential for financial contributions from DCO, if R1 is chosen as the preferred route.	
Pipelines. The Environment Agency would require the existing flood standard of protection, provided by the defences to be maintained both during the construction of the pipeline, and after completion of the scheme, whichever route is chosen. In order minimise the impact of the DCO on our flood defences, consideration should be given to the following comments: Pipeline Design • Where the pipeline crosses a flood defence structure below ground, designs for the pipeline must include a load case for the top water level. This may be different at each location. The pipeline must also be at a suitable depth to ensure the stability of the flood defence structure, this is to be demonstrated in submitted designs; • The scoping report states the pipeline will not cross our flood defence structure above ground. If this is to change, loading to our asset will need to be considered and the design must not impede access for routine maintenance and inspections of the flood defence structure; • If the pipeline crosses a watercourse above ground, it must be appropriately designed and positioned to prevent accumulation of debris and localised increases in water levels; • Where the pipeline is to utilise existing pipework that crosses watercourses, it is expected that modifications to the structure will be made where possible for improved conveyance and reduce debris accumulation; and	Noted. These considerations will be taken into account during Proposed Development design development. Final details regarding pipeline design are not known at this stage, and so worst-case assumptions have been considered in this preliminary assessment, as described in Chapter 9: Surface Water, Flood Risk and Water Resources (PEI Report, Volume I).

CONSULTEE COMMENTS	RESPONSE
• Where ground levels near a flood defence are to be disturbed on either a permanent or temporary basis, designs must not allow additional water to pond at the toe of the flood defence.	
Pipeline Construction. • Open trench methodology is not permitted when crossing a flood defence. Excavations near the footprint of a flood defence must remain a safe distance away from the toe of the defence to ensure stability of the defence. This must be demonstrated in submitted designs; and • Directional drilling would be permitted when crossing a flood defence provided: - The drilling operation does not affect the stability of the flood defence structure by inducing a geotechnical failure, including when it is retaining flood water; and - The drilling or permanent works do not provide a conduit for water seepage underneath the flood defence structure, including when it is retaining flood water.	Noted. These considerations will be taken into account during the Proposed Development design development.
Pipeline Maintenance. • Repairs or future improvement works will be subject to an Environmental Permit from the EA if taking place within 16m of a flood defence; and • Routine maintenance activities on the pipeline should be detailed within the DCO application.	Noted. Maintenance activities pertaining to pipelines will be included in the ES.
Flood Defence Maintenance. In order to maintain the standard of protection, the Environment Agency requires continued access to continue routine maintenance of the existing and planned defences. Any permissions or legal agreements to allow these works to go ahead, must be agreed in advance of pipeline construction. It	Noted. Environment Agency access will be incorporated as necessary.

CONSULTEE COMMENTS	RESPONSE
should be noted that the Environment Agency have statutory powers to carry out works on our assets.	
Drainage. In terms of SUDs, we would recommend that there is no increase in infiltration within the development area. This is to avoid the risk of contaminant mobilisation given the industrial heritage of the area. This ties into section 6.4.88 where the scope of assessment includes 'disturbance of contaminated soils and perched groundwater, and the creation of new pathways to sensitive receptors (including construction workers and controlled waters) during construction.	Noted. The drainage strategy is under development and will be assessed during the EIA and reported in the ES.

9A.4 Site Information

Location, Land Use and Topography

9A.4.1 The Proposed Development Site is located on part of the former Sahaviriya Stell Industries (SSI) site to the east of Redcar Bulk Terminal (referred to as 'the Foundry') on the south bank of the River Tees, approximately 1.6 km east from the town of Redcar and 1.4 km north-east of Dormanstown.

9A.4.2 The indicative boundary for the Main Site currently encompasses an area of approximately 42.5 ha, whilst the Proposed Development Site encompasses an area of approximately 1,391 ha.

9A.4.3 The area is coastal, being located immediately south-west of Teesmouth, at approximately 4 - 8 m above ordnance datum (AOD). Coatham Sands is immediately to the north and Bran Sands is to the west (see Figure 9-1: Surface Water Features and their Attributes (PEI Report, Volume II)). The Proposed Development Site is currently industrial, comprising former steelworks structures.

9A.4.4 The Proposed Development Site boundary extends west across the Tees Estuary at the southern extent of Bran Sands and further south close to Teesport (see Figure 9-1: Surface Water Features and their Attributes (PEI Report, Volume II)). These crossings of the Tees Estuary are included to incorporate the Hydrogen Pipeline Corridor infrastructure required by the Proposed Development.

9A.4.5 South of the Tees Estuary, the Proposed Development Site boundary extends south to Grangetown to accommodate the Electrical Connection, Water Connection Corridor and Hydrogen Pipeline Corridor.

9A.4.6 The Proposed Development Site boundary to the north of the Tees Estuary generally follows existing pipeline routes on reclaimed land to the south of the Seal Sands inter-tidal mudflats. The Hydrogen Pipeline Corridor extends west as far as Cowpen Bewley Woodland Country Park, and south into the industrial area at the eastern edge of Billingham. This whole section of the Proposed Development Site is very flat, being between 0 and 10 m AOD. The immediate surroundings include heavy industry on the banks of the Tees, mudflats to the north, marshland at Saltholme and Cowpen Marsh, and the Tees Estuary itself. There are numerous large standing bodies of water in the marshland areas as well as small watercourses draining towards Seal Sands (which is included within local Site of Special Scientific Interest (SSSI) and Special Protection Area (SPA) designations). The Main Site, together with the Electrical Connection Corridor, the Natural Gas Connection Corridor, the Nitrogen and Oxygen Connection Corridor, the Water Connections Corridor, and the CO_2 Export Corridor fall within the administrative boundary of Redcar and Cleveland Borough Council (RCBC) in the ward of South Bank. A part of the Hydrogen Pipeline Corridor crosses the River Tees and will be located in the administrative boundary of Stockton-on-Tees Borough Council (STBC) in the Billingham Ward and a small area will cross into the southern area in the administrative boundary of Hartlepool Borough Council (HBC).

Hydrology and Flood Risk Management Infrastructure

Surface Water Features

9A.4.7 For the purposes of the preliminary FRA a Study Area of 1 km from the Proposed Development Site boundary was adopted. As flood risk impact can also impact upstream and downstream, the preliminary FRA also considers a wider Study Area than 1 km outside of the Proposed Development Site boundary, where relevant. Professional judgement has been applied to identify the extent to which such features are considered.

9A.4.8 A site walkover was undertaken on 15th February 2023 in cold, dry but overcast conditions. Using observations taken on this visit, data from OS mapping and the Environment Agency Catchment Data Explorer website (Environment Agency, n.d.c), a summary list of the surface waterbodies and where relevant to the assessment, groundwater waterbodies, listed in Table 9A-3, were identified within the Study Area and are presented on Figure 9-1: Surface Water Features and Their Attributes (PEI Report, Volume II).

Table 9A-3: Surface Waterbodies

NAME	COASTAL/MAIN RIVER/ORDINARY WATERCOURSE	TRIBUTARY OF	WATERCOURSE DESCRIPTION	SITE OBSERVATIONS
Tees Bay (North Sea)	Coastal (tidal)	N/A	Tees Bay stretches from approximately 20 km south-east of Redcar at Boulby, to approximately 13 km northwest of Redcar at Crimdon. It includes a total area of 88.31 km^2.	The Tees Coastal waterbody was observed from Coatham Sands between Redcar and Teesmouth. The waterbody is backed by a wide sandy beach and sand dunes and is popular for recreation. Coatham Sands has, in places along its length, been strongly influenced by historic deposition of slag from local ironworks. This means that large parts of the dunes are a mix of slag deposits and natural marine-deposited and subsequently wind-blown sand. Within the sand dune complex are a number of ponds and wetland areas. Discharge infrastructure was not apparent and is presumably buried or only observable at very low tide. One pipe was noted across the beach emanating from the direction of Cleveland Links golf course and the area of Warrenby Industrial Estate and is likely to be for discharges to the Tees.
Tees Estuary (River Tees)	Main River (tidal)	N/A	The Tees Estuary extends from the Tees Barrage, east of Stockton-on-Tees, to Teesmouth. This is approximately 16 km. It includes a total area of 11.44 km^2.	The River Tees is approximately 1.6 km to the west of the Main Site. The River Tees is tidal at this location, with the normal tidal limit approximately 14 km upstream, at the Tees Barrage. The Tees was observed from near the Dabholm Gut on the south bank. At this point the estuary is approximately 455 m wide. The estuary is also a busy route for navigation with docks and jetties on both banks. Land either side of the waterbody is

NAME	COASTAL/MAIN RIVER/ORDINARY WATERCOURSE	TRIBUTARY OF	WATERCOURSE DESCRIPTION	SITE OBSERVATIONS
				flat, having been largely reclaimed in this area and is currently occupied by various heavy industries.
Belasis Beck	Ordinary Watercourse	Holme Fleet (Within Tees Transitional WFD Waterbody catchment)	Belasis Beck appears to rise from ponds in Belasis Hall Technology Park (NZ 47373 23267) and flows east for 2 km before its confluence with Holme Fleet within Saltholme Nature Reserve at NZ 49071 23577.	Belasis Beck was observed in the pastoral fields adjacent to Cowpen Bewley Road, where the main channel appeared to be shallow and wide (~6-7 m). Water levels were high during the site visit and overtopping slightly onto the floodplain. Here the channel flows roughly parallel with an adjacent pipeline, which cuts through the fields either side of the road. Flow was sluggish as a result of the shallow gradient and probable tidal locking. The road crossing appeared largely buried at this location, and flows appeared to be backing up upstream of the road leading to the spillage onto the floodplain.
Dabholm Beck	Ordinary Watercourse	Tees Estuary	Dabholm Beck is a drainage channel marked on mapping as flowing north-east above ground for 700 m between NZ 56161 23102 and NZ 56710 23730. It then flows north-west into the tidal Dabholm Gut.	The Dabholm Gut flows to the River Tees approximately 0.8 km south of the Proposed Development Site boundary. The Dabholm Gut is an artificial channel of around 1 km length, left following historic land reclamation. Upstream is Dabholm Beck, which is formed from the coalescence of numerous small watercourses and drains through an area of freshwater marshland to the north-west of the Wilton International Site (upstream of the tidal limit). Dabholm Beck has a single stem channel around 3-4 m wide, incised and straight being indicative of extensive past modification. There are several
Dabholm Gut	Ordinary Watercourse (tidal)	Tees Estuary	Dabholm Gut is a tidal channel on the east bank of the Tees, left when	

NAME	COASTAL/MAIN RIVER/ORDINARY WATERCOURSE	TRIBUTARY OF	WATERCOURSE DESCRIPTION	SITE OBSERVATIONS
			the land on both sides was reclaimed from the Tees estuary.	large outfalls that discharge into the channel. At the tidal limit where it becomes Dabholm Gut, the channel widens to approximately 30 m and numerous other active outfalls were observed with relatively high rates of discharge. There are numerous consented discharges here from the adjacent industry. The channel width remains constant up to the confluence with the Tees. During especially high tides anecdotal evidence suggests the channel has been known to overtop onto the adjacent access road.
Greatham Creek	Main River	Tees Estuary	Greatham Creek is the estuarine section of Greatham Beck, which flows from the north of Elwick (NZ 45077 33468) to Seal Sands (NZ 51667 25568).	Greatham Creek was observed during the site visit at Greatham Creek Bridge (A178 road crossing). Here, historic modifications are evident, particularly downstream of the road crossing, with raised stone banks and embankments containing this tidal river maintaining a straightened length through to the Tees Estuary. There are three existing structures downstream of the A178 road crossing, comprising two other bridge crossings and a series of in-channel piers that formed part of a redundant crossing. The watercourse is sinuous upstream of the A178 and forms part of a dynamic system of intertidal channels and marsh. Bed and bank sediment comprised fine material which is likely reworked with each tide. The watercourse has an approximate Mean High Water width of 60 m, although width varies considerably through the more natural length upstream

NAME	COASTAL/MAIN RIVER/ORDINARY WATERCOURSE	TRIBUTARY OF	WATERCOURSE DESCRIPTION	SITE OBSERVATIONS
				of the road crossing. There is a history of tidal flooding and breach of the defences at Greatham Creek.
Kettle Beck	Ordinary Watercourse	Tees Estuary	Kettle Beck rises at Lazenby Bank and flows approximately 4 km generally north along the edge of the Wilton International Site, beneath the A1085, beneath the Teesside Works (Lackenby), and beyond the A1053 before discharging to the Tees. The exact course of the watercourse is not clear from online mapping north of the A1085 as the watercourse is culverted.	Kettle Beck was observed at the western edge of the Wilton International Site. Here the channel was between 2 and 3 m wide, with an artificial, straightened character. The bed was dominated by fine sediment with some isolated very fine gravel accumulations. Flow was impeded by a road culvert at the observation site, which consisted of 6 small diameter (~0.5 m) pipes. The banks rose steeply from the channel bed and were incised meaning the channel is likely disconnected from the floodplain.
Holme Fleet	Main River	Tees Estuary	Holme Fleet is a marshland channel that meanders between Cowpen Marsh (NZ 50596 24732) and Port Clarence (NZ 50703 21620). It is around 5.6 km in length, and a large number of marshland channels join the Fleet, which also flows through several marshland open waterbodies and reedbeds.	Not visited during the site visit as it is outside of the Proposed Development Site boundary but still considered, where relevant, within the Study Area of the assessment.

NAME	COASTAL/MAIN RIVER/ORDINARY WATERCOURSE	TRIBUTARY OF	WATERCOURSE DESCRIPTION	SITE OBSERVATIONS
Kinkerdale Beck	Ordinary Watercourse	Tees Estuary	This watercourse is mapped as a surface waterbody for 320 m at the north-western extent of the Wilton International Site (NZ 56071 20996) and is then in culvert. As such, the source and exact course of the watercourse is not known, although it is known to outfall to the Lackenby Channel.	Kinkerdale Beck is a 2-3 m wide ditch which appears to be fed from an overflow connection from Kettle Beck. It was observed just downstream of Kettle Beck where it has an artificial, straightened character with steep banks. The bed was dominated by fine sediment. Water in this section of the channel was largely ponded. Further downstream the watercourse is largely culverted beneath the Wilton International Site.
Castle Gill	Ordinary Watercourse	Tees Estuary	Castle Gill is a short watercourse, which flows for approximately 1.5 km in a south-westerly direction within the southern extent of the Wilton International Site, from NZ 57760 20577 to NZ 56121 20500.	This watercourse was not observed during the initial site visit as it would not be expected to be directly impacted by the Proposed Development. Aerial photography indicates it is partly in culvert, straightened and heavily modified with a width of approximately 2-3 m.
Knitting Wife Beck	Ordinary Watercourse	Tees Estuary	This watercourse rises just north of the A66 in Grangetown (NZ 55172 20910), before flowing north for approximately 300 m towards the Lackenby Steelworks. The watercourse is then culverted and so the course alignment is unclear	The watercourse was visited as it emerges from an approximately 1 m wide box culvert to the north of the A66. The channel was approximately 1-1.5 m wide, and artificial in nature being straight with steep incised banks rising 2-3 m from the channel bed. Fine sediment accumulations were abundant; the channel was largely overgrown.

NAME	COASTAL/MAIN RIVER/ORDINARY WATERCOURSE	TRIBUTARY OF	WATERCOURSE DESCRIPTION	SITE OBSERVATIONS
			but is known to outfall at the Lackenby Channel.	
Lackenby Channel	Ordinary Watercourse	Tees Estuary	The Lackenby Channel is a drainage cut between the Lackenby steelworks (NZ 55305 22207) and the eastern bank of the Tees estuary (NZ 54145 23341). It is approximately 1.6 km in length and conveys flows from Knitting Wife Beck, Kinkerdale Beck and Kettle Beck to the Tees.	Lackenby Channel was not visited during the site visit, but aerial photography, available online, indicates that it is an artificial, straight channel varying between 10 and 15m in width.
Main's Dike	Ordinary Watercourse	Tees Estuary	Main's Dike watercourse rises from a spring in Wilton Wood to the south-east of the Proposed Development Site at NZ 59328 19741. The watercourse then flows north along the eastern boundary of the Wilton International Site, and into the Mill Race at NZ 57893 22824.	Main's Dike was observed along the eastern edge of the Wilton International Site where it was very straight, around 1 m in width and with steep incised banks rising around 4 m from the channel. Significant sediment accumulations were observed downstream of the Mains Dike Bridge culvert. There was also evidence of some lateral erosion of the banks and the formation of small, alternating fine gravel lateral bars, although the gradient was still shallow and the channel stable.
Mill Race	Ordinary Watercourse	The Fleet Tees Estuary	The course of the Mill Race is unclear as it is largely culverted but appears to emanate from	The Mill Race was observed within the Wilton International Site to the south of the A1085. Here the watercourse was overly wide (around 3.5-4 m wide) leading up to a circular culvert of

NAME	COASTAL/MAIN RIVER/ORDINARY WATERCOURSE	TRIBUTARY OF	WATERCOURSE DESCRIPTION	SITE OBSERVATIONS
		(S Bank WFD Waterbody)	coalescence of ditches and watercourses at NZ 57893 22824, then flows north of the Wilton International Site beneath the A1085. It remerges at NZ 57102 24152 and flows west into The Fleet.	around 2 m diameter, with artificial concrete banks in places. Banks were steep and incised. The bed was dominated by fine sediment. There are numerous service crossings of the watercourse at this location. The Mill Race was also observed downstream of the A1085 adjacent to the Trunk Road roundabout where it was 2-3 m wide, very straight, with a bed dominated by fine sediment. Road runoff appears to discharge into the channel.
Mucky Fleet / Swallow Fleet	Ordinary Watercourse	Tees Estuary	Mucky Fleet and Swallow Fleet are meandering channels draining Cowpen Marsh. A large number of marshland channels intersect these channels, which ultimately drain to the Tees Estuary.	Swallow Fleet was observed from the viewing platform on the A178. The watercourse was approximately 30 m wide at its widest point, although this varied. A network of interconnected marshland channels join Swallow fleet, along with several linear, artificial drainage channels. Fine sediment dominates in this intertidal habitat and is likely reworked with each tide.

9A.4.9 In addition to the watercourses described in Table 9A-3, there are numerous drains and ditches in the Study Area. These are predominantly related to drainage infrastructure in the industrial areas, and many are culverted beneath ground and so their exact course is unclear. In places, the drainage channels are visible above ground and are typically of the order of 0.5 to 1 m in width, ephemeral (i.e. flowing for only part of the year or only after storms), have artificial engineered and sometimes concrete channels.

9A.4.10 There is also a network of small watercourse channels throughout the saltmarsh and wetland area to the south and south-west of Seal Sands. Some of these channels were observed on site from the Saltholme RSPB Nature Reserve, and they are small (1-2 m wide) low gradient, single thread, meandering waterbodies that are closely connected to their floodplains.

9A.4.11 There are a large number of still waterbodies across the Proposed Development Site, the majority of which are small ponds or artificial standing waterbodies. The majority of these on the south-east bank of the Tees are small artificial waterbodies and ponds related to the surrounding industrial land use. To the north-east of the Tees there are further artificial and industrial waterbodies, such as the large brine reservoirs immediately north of the Proposed Development Site at Saltholme. The surrounding wetlands here also include several large, interconnecting waterbodies. The ponds within the Proposed Development Site boundary itself are predominantly very small and generally artificial, with the exception being several waterbodies within the South Gare and Coatham Dunes.

Flood Management Infrastructure

9A.4.12 The Environment Agency own and maintain a number of flood defence assets along the River Tees near the Proposed Development Site and in the wider Study Area. These include a series of embankments and walls upstream and downstream of the Tees Transporter Bridge and defences around the Greatham Creek delta flowing into Seaton on Tees Channel. (See maps provided by the Environment Agency in Annex A). There are also demountable defences that when erected create a wall with the same standard of protection as the surrounding defences. These are privately owned and maintained by Wilton International site.

9A.4.13 The tidal defences in proximity to the Main Site consist of a combination of high ground and raised defences, including floodwalls and flood banks. According to information provided by the Environment Agency they are in Very Good to Good condition and reduce the risk of flooding up to a 0.5% Annual Exceedance Probability (AEP) (1 in 200 chance in any year) event. The Environment Agency inspects these defences routinely to ensure potential defects are identified.

9A.4.14 Additional information on specific areas of flood defences has been provided by the Environment Agency and are detailed below.

Port Clarence

9A.4.15 In 2019, the Environment Agency completed a major flood defence scheme to protect Port Clarence and some of the surrounding industrial areas from tidal flooding. The works comprised the following phases:

- Phase 1 of the works involved improving the defences along the north bank of the River Tees both up and downstream of the Transporter Bridge. This involved a new flood wall through the Wilton International site, a road hump just before the access to the bridge and improvements to the flood bank downstream of the bridge. This work is now complete and is the main protection for Port Clarence.
- Phase 2 involved improving the defences along the south bank of Greatham Creek. This work has improved the protection of the industrial complexes near Seal Sands and also prevents Port Clarence flooding from the north during extreme tidal events.

9A.4.16 Flood defences along the frontage of Port Clarence comprise a combination of flood embankments and flood walls and provide a standard of protection up to and including the 0.5% AEP (1 in 200) flood event.

9A.4.17 The defence crest levels are between approximately 4.59 m – 5.2m AOD and according to the Environment Agency asset condition inspection are in Very Good to Fair condition.

Greatham South

9A.4.18 Flood defences at Greatham South are located between NGR NZ 50259 25412 and NZ 50934 25418, comprised of flood embankments. No information on the standard of protection or the defence crest levels is provided. According to the Environment Agency asset condition inspection the defences are in Good to Fair condition.

Greatham Creek

9A.4.19 Flood defences along Greatham Creek (including areas of Greatham, Greatham Marsh and Claxton Beck) comprise flood embankments and provide a standard of protection between a 20% AEP (1 in 5) and 0.65% AEP (1 in 153) flood event.

9A.4.20 The defence crest levels are between approximately 4.52 m – 6.66m AOD and according to the Environment Agency asset condition inspection are generally in Good to Fair condition.

Seal Sands (Hartlepool)

9A.4.21 Flood defences at Seal Sands comprise flood embankments and provide a standard of protection between 20% AEP (1 in 5) and 2% AEP (1 in 50) flood event.

9A.4.22 The defence crest levels are between approximately 3.44 m – 4.85m AOD and according to the Environment Agency asset condition inspection are generally in Fair condition.

Portrack (Stockton on Tees)

9A.4.23 Flood defences along the course of Lustrum Beck at Portrack comprise a combination of flood embankments and high ground. No information on the standard of protection, the defence crest levels or the condition of the defences is provided.

Greatham North East Flood Alleviation Scheme (Proposed)

9A.4.24 The Environment Agency are currently developing a flood alleviation scheme on the north bank of Greatham Creek and Seal Sands (see indicative plan presented in Annex

A). The Environment Agency are currently undertaking the detailed design of the scheme and hope to commence delivery on site in summer 2024. The flood alleviation scheme includes the following elements:

- the construction of a new flood embankment with a crest height of approximately 5.5m AOD to the north, west and south of Greenabella Marsh adjacent to the Venator Plant Site;
- breach of the existing Greenabella flood embankment in two locations. The remaining sections of the defence will be retained to act as a high tide roost. The managed realignment will see the creation of intertidal mud at Greenabella Marsh;
- the existing Greatham Creek embankment will be repaired, and a regulated tidal exchange (RTE) structure installed to enable tidal connectivity of the brinefield in future; and
- creation of habitat to the west of Marsh House Farm in a former arable field owned by the Environment Agency.

Anticipated Ground Conditions and Hydrogeology

Geology

9A.4.25 Full details on geology and groundwater are provided in Chapter 10: Geology, Hydrogeology and Contaminated Land (PEI Report, Volume I). In summary, the British Geological Survey (BGS) Geoindex viewer (BGS, 2020) indicates that the solid geology beneath the Main Site consists of strata of Triassic and Jurassic age.

9A.4.26 Immediately around the River Tees and to the south of Teesmouth the bedrock is Mercia Mudstone. To the south of the Tees, the northern section of the Proposed Development Site is also underlain by Mercia Mudstone, while the southern half of the Proposed Development Site consists of Redcar Mudstone which also stretches south to beyond the Wilton International site and includes the majority of the town of Redcar.

9A.4.27 To the north of the Tees, Mercia Mudstone underlies the Seal Sand Industrial Estate, but then gives way to Sherwood Sandstone Group which is widespread and underlies Seal Sands, Cowpen Marsh, Saltholme and the town of Billingham.

9A.4.28 The superficial deposits beneath the majority of the Proposed Development Site consist of Tidal Flat Deposits (sand, silt and clay). These are found beneath the Tees Estuary, Teesmouth, Seal Sands, Cowpen Marsh and Saltholme. To the north-east of the Proposed Development Site in the coastal area adjacent to Coatham Sands there are deposits of Beach and Tidal Flat Deposits and Blown Sand. The Lackenby Steelworks, Grangetown and Lazenby are underlain by glaciolacustrine deposits, Redcar is underlain by Devensian Till (diamicton). The north-west of the Study Area towards Cowpen Bewley is underlain by glaciolacustrine deposits. There are marine beach deposits on the coastline north of Teesmouth.

9A.4.29 Bedrock and superficial geology present beneath the Proposed Development Site is summarised in Table 9A-4.

Table 9A-4: Geology

SITE	FLOOD ZONE	ARTIFICIAL GEOLOGY	BEDROCK AND SUPERFICIAL GEOLOGY
Main Site	FZ1	Present – entire area	Tidal Flat Deposits (Estuarine Alluvium) Glaciolacustrine Deposits Till, Devensian (Glacial Till, Boulder Clay, Drift)
CO_2 Export Corridor	FZ1	Present – entire area	Blown Sand Tidal Flat Deposits (Estuarine Alluvium) Glaciolacustrine Deposits
Natural Gas Connection Corridor	FZ1	Present – entire area	Blown Sand Tidal Flat Deposits (Estuarine Alluvium) Glaciolacustrine Deposits
Water Connection Corridor	FZ1, FZ2, FZ3a	Present – north-western extent	Blown Sand Tidal Flat Deposits (Estuarine Alluvium) Glaciolacustrine Deposits Till, Devensian (Glacial Till, Boulder Clay, Drift)
Electrical Connection Corridor	FZ1, FZ2, FZ3a	Present – western extent	Blown Sand Tidal Flat Deposits (Estuarine Alluvium) Glaciolacustrine Deposits Till, Devensian (Glacial Till, Boulder Clay, Drift)
Hydrogen Pipeline Corridor	FZ1, FZ2, FZ3a	Present – central and western extent east of the River Tees and eastern extent and localised areas west of the River Tees	Blown Sand Tidal Flat Deposits (Estuarine Alluvium) Glaciolacustrine Deposits Till, Devensian (Glacial Till, Boulder Clay, Drift) Peat Alluvium
Other Gases Connection Corridor (Nitrogen and Oxygen)	FZ1, FZ2, FZ3a	Present – entire area	Blown Sand Tidal Flat Deposits (Estuarine Alluvium) Glaciolacustrine Deposits

Hydrogeology

9A.4.30 PEI Report Figures 10-13: Bedrock Aquifers and Figure 10-12: Superficial Aquifers (PEI Report, Volume II) present the designated superficial and bedrock aquifers below the Proposed Development Site, respectively. The designated aquifers have been defined by the Environment Agency below:

- Principal Aquifer: *"layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and / or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer*".
- Secondary Aquifer — A: "*permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers*".
- Secondary Aquifer — B: "*predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers*".
- Secondary Aquifer — Undifferentiated: "*has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type*".
- Unproductive Strata: "*These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow*".

9A.4.31 Hydrogeological conditions for each area of the Proposed Development Site are summarised in Table 9A-5.

Table 9A-5: Hydrogeology

RELEVANT FEATURE	DESIGNATION	STRATA
Main Site		
Superficial Aquifer	• Secondary A • Unproductive • Secondary Undifferentiated	• Tidal Flat Deposits Sand and Silt - (eastern half of the Main Site) • Glaciolacustrine Deposits • Till and Tidal Flat Deposits – Sand, Silt and Clay (western half of the Main Site)
Bedrock Aquifer	• Secondary B • Secondary B	• Mercia Mudstone • Penarth Group • Redcar Mudstone

RELEVANT FEATURE	DESIGNATION	STRATA
	• Secondary Undifferentiated	
Groundwater Vulnerability	High (Secondary Superficial)	-
Source Protection Zone	None within 1km	-
CO_2 Export Corridor		
Superficial Aquifer	• Secondary A • Secondary A • Secondary Undifferentiated • Unproductive	• Tidal Flat Deposits – Sand and Silt • Blown Sand • Till • Glaciolacustrine Deposits
Bedrock Aquifer	• Secondary B • Secondary B • Secondary Undifferentiated	• Mercia Mudstone • Penarth Group • Redcar Mudstone
Groundwater Vulnerability	High (Secondary Superficial)	-
Source Protection Zone	None within 1km	-
Natural Gas Connection Corridor		
Superficial Aquifer	• Secondary A • Secondary A • Secondary Undifferentiated • Unproductive	• Tidal Flat Deposits – Sand and Silt • Blown Sand • Till • Glaciolacustrine Deposits
Bedrock Aquifer	• Secondary B • Secondary B • Secondary Undifferentiated	• Mercia Mudstone • Penarth Group • Redcar Mudstone
Groundwater Vulnerability	High (Secondary Superficial)	-
Source Protection Zone	None within 1km	-

RELEVANT FEATURE	DESIGNATION	STRATA
Water Connection Corridor		
Superficial Aquifer	• Secondary A • Secondary A • Secondary Undifferentiated • Unproductive	• Tidal Flat Deposits – Sand and Silt • Blown Sand • Till • Glaciolacustrine Deposits
Bedrock Aquifer	• Secondary B • Secondary B • Secondary Undifferentiated	• Mercia Mudstone • Penarth Group • Redcar Mudstone
Groundwater Vulnerability	High (Secondary Superficial) Medium (Secondary Superficial) Low (Secondary Superficial) Medium (Secondary Bedrock) Low (Secondary Bedrock)	-
Source Protection Zone	None within 1km	-
Electrical Connection Corridor		
Superficial Aquifer	• Secondary A • Secondary A • Secondary Undifferentiated • Unproductive	• Tidal Flat Deposits – Sand and Silt (north-eastern extent of the Corridor) • Blown Sand • Till and Tidal Flat Deposits – Sand, Silt and Clay (for north-western and southern extend of the Corridor) • Glaciolacustrine Deposits
Bedrock Aquifer	• Secondary B • Secondary B • Secondary Undifferentiated	• Mercia Mudstone • Penarth Group • Redcar Mudstone

RELEVANT FEATURE	DESIGNATION	STRATA
Groundwater Vulnerability	High (Secondary Superficial) Medium (Secondary Superficial) Medium (Secondary Bedrock) Low (Secondary Bedrock)	-
Source Protection Zone	None within 1km	-
Hydrogen Pipeline Corridor		
Superficial Aquifer	• Secondary A • Secondary A • Secondary Undifferentiated • Unproductive	• Tidal Flat Deposits – Sand and Silt (north-eastern extent of the Corridor) • Blown Sand • Till and Tidal Flat Deposits – Sand, Silt and Clay (north-west and south-west extent of the Corridor) • Glaciolacustrine Deposits
Bedrock Aquifer	• Secondary B • Secondary B • Secondary Undifferentiated	• Mercia Mudstone • Penarth Group • Redcar Mudstone
Groundwater Vulnerability	High (Secondary Superficial) Medium (Secondary Superficial) Medium (Secondary Bedrock) Low (Secondary Bedrock)	-
Source Protection Zone	None within 1km	-
Oxygen and Nitrogen Corridor		
Superficial Aquifer	• Secondary A • Secondary A	• Tidal Flat Deposits – Sand and Silt (most of the Corridor)

RELEVANT FEATURE	DESIGNATION	STRATA
		• Blown Sand • Tidal Flat Deposits – Sand, Silt and Clay (far western and southernmost extend)
Bedrock Aquifer	• Secondary B • Secondary B • Secondary Undifferentiated	• Mercia Mudstone • Penarth Group • Redcar Mudstone
Groundwater Vulnerability	High (Secondary Superficial)	-
Source Protection Zone	None within 1 km	-

9A.4.32 Cranfield University's Soilscapes website (Cranfield University, n.d.) indicates that the majority of the Study Area either side of the Tees Estuary is underlain by loamy and clayey soils of coastal flats with naturally high groundwater. Beyond this, the Lackenby Steelworks is underlain by slowly permeable, seasonally wet, slightly acid but base-rich loamy and clayey soil. The latter is also found in the northern extent of the Study Area north of Haverton Hill and toward Billingham. However, due to past development, soil type and structure is likely to have been altered and large areas of Made Ground exist. Finally, sand dune soils are found along the coastal areas to the north of the Study Area.

9A.4.33 The Study Area is not within a drinking water safeguard zone for groundwater or surface water.

9A.5 The Proposed Development

Introduction

9A.5.1 The Proposed Development comprises the construction, operation, (including maintenance) and decommissioning of an approximately 1.2 GWth (Phase 1 600 MWth and Phase 2 600 MWth) Carbon Capture and Storage (CCS) enabled Hydrogen Production Facility located in the Teesside industrial cluster area along with the pipeline infrastructure required to supply hydrogen (H_2) to offtakers (customers) and the necessary utility connections. The Production Facility will be located within land owned by Teesworks known as 'The Foundry' (the Main Site) in Redcar and Cleveland, with the connection corridors extending further into Stockton-on-Tees and Hartlepool, all within the Tees Valley.

9A.5.2 The Production Facility at the Main Site will need a hydrogen pipeline to transport the H_2 produced to potential industrial off-takers around Teesside as well as a CO_2

export connection and other utility connections including natural gas, water and electricity.

9A.5.3 H2Teesside will have a mainly baseload production profile, with demand coming from multiple end users, including fuel switching within chemical and petrochemical industries, combined heat and power (CHP) generation and flexible power generation, amongst others. The capture technology is post-combustion amine-based absorption-regeneration with a design carbon capture rate in excess of 95%. H2Teesside will connect via a short CO_2 export connection to Northern Endurance Partnership (NEP) infrastructure to the east of the Main Site. Based on current projections, H2Teesside will have the capacity to continuously export 1.35 million tonnes (Mt) of dehydrated and compressed CO_2 per year per Phase, or 2.7 Mt/year once both phases are operational (100% utilisation) with no temporary CO_2 storage required on Main Site.

9A.5.4 At this stage in the design of the Proposed Development, there are still options being considered for various components. The design of the Proposed Development therefore incorporates a necessary degree of flexibility to allow for the future selection of the preferred layout at the Main Site, as well as routing of the hydrogen pipeline and other connections. This will evolve as the design and commercial agreements progress throughout the preparation of the DCO Application.

9A.5.5 The Rochdale Envelope approach has been adopted to ensure that a worst case in terms of design parameters, proposed development extents and options has been considered. It is expected that the current optionality will be reduced, and preferred options confirmed prior to submission of the DCO Application, and the Rochdale Envelope used and assessed will be narrowed accordingly.

9A.5.6 In addition, some of the design aspects and features of the Proposed Development cannot be confirmed until the Engineering, Procurement and Construction (EPC) Contractor has been appointed. For example, the building sizes may vary depending on the contactor selected and their specific configuration and selection of plant. However, an indicative construction programme is presented within Chapter 5: Construction Programme and Management (PEI Report, Volume I) on which the potential environmental effects of the Proposed Development have been assessed. Therefore, focused use of the Rochdale Envelope approach will continue to be adopted to define appropriate parameters for use in the environmental impact assessment (EIA).

Components of the Proposed Development

9A.5.7 This section provides a summary of the Proposed Development as described in detail in Chapter 4: Proposed Development (PEI Report, Volume I).

Main Site

9A.5.8 A new-build natural gas-fuelled blue hydrogen production facility (via auto-thermal reforming) with integrated carbon capture unit, low pressure compression, and associated utilities and buildings (Hydrogen Production Facility).

Hydrogen Pipeline Corridor

9A.5.9 A gaseous phase hydrogen pipeline network is required to connect various potential industrial off-takers across the Tees Valley to the Production Facility at the Main Site. The length of the Hydrogen Pipeline Corridor extends beyond 16 km and will require crossings of numerous watercourses.

9A.5.10 The Hydrogen Pipeline will be up to 24" in diameter and will cross the Tees Estuary and Greatham Creek (and adjacent waterbodies at Seal Sands) using trenchless technologies (Micro Bored Tunnelling (MBT) and Horizontal Directional Drilling (HDD) respectively). The Hydrogen Pipeline Corridor is shown in Figure 9-1 (PEI Report, Volume II), with a northern option and southern option for the crossing of the Tees still remaining at this PEI Report stage. The sections of the Hydrogen Pipeline that will be installed via trenchless approaches will require launch, reception, and jointing pits to be installed.

9A.5.11 Various route options and construction methodologies are being considered for the remainder of the Hydrogen Pipeline Corridor (aside from the trenchless crossings discussed above). These include an option for below ground open trench (buried), installation on existing above ground pipe racks, and repurposing and reuse of existing pipelines (where possible). However, this is subject to ongoing design work, discussions with landowners and statutory consultees, as well as being informed by environmental surveys.

9A.5.12 For the majority of the hydrogen pipeline corridor south of the River Tees, it is proposed to route along existing established pipeline corridors (generally above ground) where possible. There will be watercourse crossings of Knitting Wife Beck, the Mill Race, Mains Dike, and the Fleet. These are all assumed to be above ground crossings utilising existing pipe bridges. Belasis Beck to the south of the Tees off Cowpen Bewley Road will also be constructed above ground.

9A.5.13 The following watercourse pipeline crossings to the south of the Tees Estuary are assumed to require open cut methods for installation. These are Belasis Beck and three unnamed watercourses.

9A.5.14 The exact number of watercourse crossings and their methodology will be identified and assessed for the ES.

CO2 Export Corridor

9A.5.15 CO_2 captured and compressed at H2Teesside will be exported in a pipeline of up to 22" diameter to feed into the NEP CO_2 gathering system via a short CO_2 export connection pipeline between the H2Teesside Production Facility and the NEP development to the east, for high-pressure compression.

9A.5.16 At this stage in the design and assessment process and in applying the Rochdale Envelope approach, the land required for the CO_2 Export options for the Main Site have been depicted as broad corridors and it is expected that the extents of these will be refined further as the preparation of the DCO Application progresses. At this stage in the design development, the CO_2 export connection may be entirely above or below ground or a combination of the two.

Natural Gas Connection Corridor

9A.5.17 Natural gas will need to be imported to the Production Facility for use in the reforming process. The exact routing of this connection is to be confirmed and subject to ongoing design, however, at this stage it is anticipated that a 24" pipeline will be constructed as part of the Proposed Development which will connect the proposed Production Facility at the Main Site to the wider gas supply network at a tie in point to infrastructure constructed by NEP.

9A.5.18 At this stage in the design development, the natural gas connection may be entirely above or below ground or a combination of the two. At this stage it is assumed that below ground construction of the Natural Gas Connection will use a combination of open-trench and trenchless technologies dependent upon engineering and environmental constraints.

9A.5.19 At this stage in the design and assessment process and in applying the Rochdale Envelope approach, the potential areas required for the gas connection options have been depicted as a broad corridor. It is expected that the extent of this will be refined further, and the routing options may be reduced as the Proposed Development design progresses.

Electrical Connection Corridor

9A.5.20 There is existing electrical infrastructure in the area which comprises a combination of overhead and lower voltage underground cables that serve the local area and other industrial users located in proximity to the Proposed Development Site. Although the Production Facility can supply a proportion of its energy requirements onsite via the steam turbine generator (STG), an alternative electricity supply will also be required, likely from a nearby sub-station. The final decision on substation choice will be subject to design development and further work based on constructability and electrical network resilience and capacity.

9A.5.21 At this stage in the design development, the electrical connection may be entirely above or below ground or a combination of the two. The Electrical Connection Corridor is currently depicted as broad corridors.

9A.5.22 There is potential for watercourse crossings within these corridors depending on the final arrangement of infrastructure. The locations are not known at this stage but affected watercourses may include the Fleet, Mains Dike, Dabholm Beck, Kinkerdale Beck, the Mill Race, Cross Beck and Knitting Wife Beck. At this stage it is assumed that all of these watercourses will be crossed using open-cut techniques as a worst-case scenario.

Other Gases Connections

9A.5.23 Other gas connection pipelines may be required for the transportation of compressed O_2 and N_2 for use at the Production Facility. At this stage in the design development, the connections for other gases may be entirely above or below ground or a combination of the two. There is potential for watercourse crossings relating to the Fleet, Mains Dike and Dabholm Beck. At this stage it is assumed that all of these watercourses will be crossed using open-cut techniques as a worst-case scenario.

Water Connections Corridor

9A.5.24 The Water Connections Corridor includes a pipeline route(s) between the Main Site and Bran Sands Wastewater Treatment Works (WwTW) as well as a potential connection to the Net Zero Teesside (NZT) project (for use of the discharge outfall) and a potential route for a Demineralised Water connection between the Main Site and Wilton International. At this stage in the design development, the water connections may be entirely above or below ground or a combination of the two.

9A.5.25 At this stage in the design and assessment process and in applying the Rochdale Envelope approach, the land required for the water connection options currently proposed for the Main Site has been depicted as a broad corridor. There is potential for watercourse crossings within the corridor depending on the final arrangement of infrastructure. The locations are not known at this stage but affected watercourses may include the Fleet, Mains Dike and Dabholm Beck. At this stage it is assumed that all these watercourses will be crossed using open-cut techniques as a worst-case scenario.

Chemical Storage on Site

9A.5.26 A number of chemicals will be required to be stored and used on Main Site. The inventory of materials to be stored on Main Site will be finalised through the detailed design. However, where storage of hazardous materials — individually or in-combination — exceeds the relevant thresholds, separate permissions will be sought from the Hazardous Substances Authority, Health and Safety Executive (HSE) and Local Planning Authority (LPA) as appropriate for their storage, under the Hazardous Substance Consent and Control of Major Accident Hazards (COMAH) and Hazardous Substance Consent regimes respectively. All chemical storage will be regulated by the Environment Agency through an environmental permit that will be required for the operation of the Proposed Development.

9A.5.27 On-site storage of hydrogen may be required for the Proposed Development. Should there be a requirement for hydrogen storage on-site, it is expected that this will be more than 5 and not exceeding 11 tonnes of pressurised storage. On-Site above ground storage of hydrogen, located at the main site, will be utilised to provide resilience to the hydrogen production network.

Access

9A.5.28 Access to the Main Site during the construction phase for Heavy Goods Vehicles (HGVs) construction traffic is likely to be via the existing access road from the A1085 via the former Teeswork Steel House Gate. This route will also be used during operation for staff and other site traffic. At this stage it is assumed that all construction HGVs associated with the Main Site would arrive/depart the site from Tees Dock Road via the A1053/A66/Tees Dock Road roundabout. At the junction with the A1053/A66/Tees Dock Road, it is assumed that 50% would head west on the A66 and 50% would head south on the A1053 then west on the A174. Alternatively, HGV traffic could access the A1085 Trunk Road from the Lackenby Steelworks entrance (accessed from the Main Site via the internal Teesworks road network) from where

traffic could route via the A66 or A1053 as above. For further detail regarding access, please refer to Chapter 15: Traffic and Transport (PEI Report, Volume I).

9A.5.29 Construction access routes for the hydrogen pipeline and connection corridors are yet to be defined, however, it is assumed that laydown areas will be identified at suitable locations along the pipeline routes located north of the River Tees to ensure disturbance is kept to a minimum.

9A.5.30 It is likely that the Main Site construction laydown areas will be utilised during the construction of the sections of the Hydrogen Pipeline Corridor and other connections in proximity e.g., Water Connections, Natural Gas Connection and Electricity Connection (south of the River Tees). Currently it is proposed that laydown areas for the Main Site construction will be located on land within, to the east and west of the Main Site, thereby minimising the distance to the Main Site. Other laydown areas for pipeline construction required will be located within the connection corridors and will be identified in the DCO Application.

Lifetime of the Development

9A.5.31 The Main Site is located on the site of the former SSI Steelworks which is brownfield land that currently contains some above and below ground structures and redundant services associated with the former steelworks. The removal of those structures, clearance and any necessary remediation of Main Site will be undertaken before the construction of the main structures of the Proposed Development. The removal of current structures is the responsibility of the landowner, i.e., Teesworks, and is therefore not assessed in this PEI Report. Construction of the Proposed Development will occur over the period of 2025 to 2027 for Phase 1 and from late 2027 to mid-2030 for Phase 2.

9A.5.32 The Production Facility will have a design life of 25 years for each phase. However, the operational life could be longer subject to market conditions and plant condition. At the end of the expected design life, these elements would be assessed for ongoing viability and, only if no longer viable, be decommissioned. The PEI Report has assumed that the Proposed Development could operate for longer than a 25-year design life, and in relevant chapters has considered and assessed the potential for operational impacts and effects to continue beyond this timeframe.

9A.5.33 Given that the Proposed Development Site may operate beyond the anticipated lifetime of the development, subject to market conditions and plant viability, and in line with the lifetime of non-residential uses in the NPPF and Flood Risk and Coastal Change PPG, the lifetime of the development is assumed to be 75 years for the purpose of the preliminary FRA.

9A.6 Planning Policy

9A.6.1 The Sections below consider the planning policies and guidance of relevance to the Proposed Development Site with regards to the flood risks from all sources and appropriate mitigation measures which should be considered.

National Policy Guidance

National Policy Statements

9A.6.2 The Overarching National Policy Statement (NPS) for Energy (EN-1), 2011 is relevant to this assessment with the main sections being Section 5.7 Flood Risk, Paragraph 5.7.4 states that:

"*Applications for energy projects of 1 hectare or greater in Flood Zone 1 in England or Zone A in Wales113 and all proposals for energy projects located in Flood Zones 2 and 3 in England or Zones B and C in Wales should be accompanied by a flood risk assessment (FRA). An FRA will also be required where an energy project less than 1 hectare may be subject to sources of flooding other than rivers and the sea (for example surface water), or where the EA, Internal Drainage Board or other body have indicated that there may be drainage problems. This should identify and assess the risks of all forms of flooding to and from the project and demonstrate how these flood risks will be managed, taking climate change into account*."

9A.6.3 The minimum requirements for an FRA are also listed in Section 5.7 of EN-1, the minimum requirements for FRAs 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;
- 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 these

risks can be safely managed, ensuring people will not be exposed to hazardous flooding;

- 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;
- detail those measures that will be included to ensure the development will be safe and remain operational during a flooding event throughout the development's lifetime without increasing flood risk elsewhere;
- 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.

Revised Draft National Policy Statements

9A.6.4 The UK Government is currently reviewing and updating the Energy NPSs. It is doing this to reflect its policies and strategic approach for the energy system that is set out in the Energy White Paper (December 2020), and to ensure that the planning policy framework enables the delivery of the infrastructure required for the country's transition to net zero carbon emissions. As part of the NPS review process, the Government published a suite of revised draft of NPSs for new energy infrastructure on 6 September 2021. They are currently holding public re-consultation that support the decision on major energy infrastructure due to close on 25 May 2023. These include the following Draft NPSs:

- Draft Overarching National Policy Statement for Energy (EN-1) (Department of Energy Security and Net Zero (DESNZ), 2023b);
- Draft NPS for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (DESNZ, 2023c), and
- Draft National Policy Statement for Electricity Networks Infrastructure (EN-5) (DESNZ, 2023d).

9A.6.5 The detail of these provisions are, however, subject to consultation and thereafter implementation. The timetable for adoption of the updated NPSs is not known, however it is expected that these will be finalised and shall replace the current NPSs by the time the DCO application is submitted.

9A.6.6 Given the importance of these NPSs, the assessment approach takes account of these new emerging documents and any subsequent formal adoption of new NSPs for energy infrastructure will be considered where relevant during the production of the ES. The following summary indicates where the relevant Draft NPS contain requirements that differ from the requirements of the existing NPSs (which otherwise apply):

- identifying and securing opportunities to reduce the causes and impacts of flooding overall during the construction period should be included as a minimum

requirement for FRA as stated in EN-1 Draft 2023 Section 5.8 Flood Risk, Paragraph 5.8.15; and

- inclusion of changes to the assessment of the existing status due to the impact of climate change on rainfall patterns and consequently water availability across the water environment in EN-1 Draft 2023 Section 5.16 Water Quality and Resources, Paragraph 5.16.13.

9A.6.7 The Draft NPS for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (DESNZ, 2023c) also addresses flood risk in relation to climate change resilience in Chapter 2.3 Climate Change Adaptation.

9A.6.8 As climate change is likely to increase risks to some of this infrastructure, from flooding or rising sea levels for example, applicants should in particular set out how the proposal would be resilient to:

- increased risk of flooding;
- effects of rising sea levels and increased risk of storm surge;
- higher temperatures;
- increased risk of earth movement, coastal erosion, or subsidence from increased risk of flooding and drought; and
- any other increased risks identified in the applicant's assessment.

9A.6.9 The resilience of a project to climate change should be assessed in an Environmental Statement (ES) accompanying an application. For example, future increased risk of flooding should be covered in the flood risk assessment.

UK Marine Policy Statement

9A.6.10 The Marine Policy Statement (MPS) (Department for Environment, Food & Rural Affairs (DEFRA), 2011a) is the framework for preparing Marine Plans and taking decisions affecting the marine environment. It establishes a vision for the marine environment, which is for '*clean, healthy, safe, productive, and biologically diverse oceans and seas*'. The MPS underpins the process of marine planning, which establishes a framework of economic, social, and environmental considerations in that will deliver these high-level objectives and ensure the sustainable development of the UK marine area.

9A.6.11 Section 2.6.8 of the MPS is relevant to the flood risk and drainage. In particular, paragraph 2.6.8.4 states, amongst other things, that "*Marine plan authorities should be satisfied that activities and developments will themselves be resilient to risks of coastal change and flooding and will not have an unacceptable impact on coastal change...*". In addition, paragraph 2.6.8.6 notes that *"the impacts of climate change throughout the operational life of a development should be taken into account in assessments".*

9A.6.12 The North East Inshore and North East Offshore Marine Plans (DEFRA, 2021) establishes the plan led system for the marine area in which the riverine parts of the Proposed Development Site are located. It provides a framework that will shape and

inform decisions over how the areas' waters are developed, protected and improved over the next 20 years.

9A.6.13 Section 3.5 states *"The East marine plan areas have a role to play in realising national ambitions with regard to climate change. Adaptation involves modifying infrastructure to better deal with climate change conditions and helping people to determine how to adjust their behaviour/ decisions to enable them to adapt to the challenges of a changing climate."* (Paragraph 230)

9A.6.14 Policy CC1 states that *"Proposals should take account of:*

- *How they may be impacted upon by, and respond to, climate change over their lifetime; and*
- *How they may impact upon any climate change adaptation measures elsewhere during their lifetime.*

  Where detrimental impacts on climate change adaptation measures are identified, evidence should be provided as to how the proposal will reduce such impacts."

9A.6.15 Policy CC1 is consistent with, and adds marine planning context to, the NPPF (see below) in seeking that new development should be planned to avoid increased vulnerability to the range of impacts arising from climate change. The combination of a low-lying topography, isostatic change, a rise in sea levels and the possibility of an increase in tidal surges in the North Sea are particularly significant for the East Coast.

National Planning Policy Framework

9A.6.16 Published by the Ministry of Housing, Communities and Local Government, the NPPF (Ministry of Housing, Communities and Local Government, 2021) was updated in July 2021. The NPPF has three overarching objectives to contribute to the achievement of sustainable development, one of which is the `environmental objective'. This objective includes the requirement of *"improving biodiversity, using natural resources prudently, and minimising waste and pollution"* (Paragraph 8c).

9A.6.17 The NPPF contains several statements which are relevant to flood risk. These include:

- Strategic policies should set out an overall strategy for the pattern, scale, and quality of development, and make provision for:
  - housing, employment, retail, leisure, and other commercial development (paragraph 20a);
  - infrastructure for transport, telecommunications, security, waste management, water supply, wastewater, flood risk and coastal change management, and the provision of minerals and energy (including heat) (paragraph 20b); and
  - conservation and enhancement of the natural, built and historic environment. This includes landscapes and green infrastructure and

planning measures to address climate change mitigation and adaptation (paragraph 20d).

- Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure (paragraph 153).
- New development should be planned for in ways that: (a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure (paragraph 154).
- Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere (paragraph 159).
- Strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards (paragraph 160).
- All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property (paragraph 161). And
- When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific FRA. 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:
  - 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;
  - 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;

  - it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
  - any residual risk can be safely managed; and
  - safe access and escape routes are included where appropriate, as part of an agreed emergency plan (paragraph 167); and

- Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:
  - take account of advice from the lead local flood authority;
  - have appropriate proposed minimum operational standards;
  - have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
  - where possible, provide multifunctional benefits (paragraph 169).

9A.6.18 The requirements of the NPPF with regards flood risk have been taken into account in the assessment.

National Planning Policy Guidance

9A.6.19 The PPG (Department for Communities and Local Government, 2022) provides guidance for local planning authorities on assessing the significance of water environment effects of proposed developments. The guidance highlights that adequate water and wastewater infrastructure is needed to support sustainable development.

9A.6.20 The NPPF (Ministry of Housing, Communities and Local Government, 2021) and the Flood Risk and Coastal Change NPPG (Department for Communities and Local Government, 2022) recommend that Local Plans should be supported by a SFRA and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as LLFAs and Internal Drainage Boards (IDBs). Local Plans should apply a sequential, risk-based approach to the location of development to avoid, where possible, flood risk to people and property and manage any residual risk, taking account of the impacts of climate change, by:

- applying the Sequential Test;
- applying the Exception Test, if necessary;
- safeguarding land from development that is required for current and future flood management;
- using opportunities offered by new development to reduce the causes and impacts of flooding; and
- where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to

facilitate the relocation of development, including housing, to more sustainable locations.

9A.6.21 All sources of flooding should be considered in order to steer development at the planning stage to areas at the lowest risk of flooding in order to satisfy the Sequential Test. This includes assessing the risk of flooding from Main Rivers and the Sea. The predicted flood risk from these sources is shown on the Environment Agency's Fluvial and Coastal Map, also known as the Flood Map for Planning (FMfP), which outlines three main zones of risk.

9A.6.22 The Flood Zone definitions used in both the NPS and NPPF, as presented in Table 1 of the PPG, are defined in Table 9A-6.

Table 9A-6: Flood Zone Definitions

FLOOD ZONE	DEFINITION	PROBABILITY OF FLOODING
Flood Zone 1	Land that has a low probability of flooding (less than 1 in 1,000 annual probability of river or sea flooding (<0.1%)).	Low
Flood Zone 2	Land that has a medium probability of flooding (between 1 in 100 and 1 in 1,000 annual probability of river flooding (0.1-1%), or between 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.1-0.5%).	Medium
Flood Zone 3a	Land that has a high probability of flooding (1 in 100 year or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%).	High
Flood Zone 3b (Functional Floodplain)	This zone comprises land where water has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise: • land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or • land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).	Very High

FLOOD ZONE	DEFINITION	PROBABILITY OF FLOODING
	Please note, this zone is not usually included within the FMfP and is calculated where necessary during detailed hydraulic modelling.	

9A.6.23 As discussed in Section 9.2, the Environment Agency's FMfP identifies that the Proposed Development Site is located predominantly within Flood Zone 1 with some sections of the Connection Corridors located in Flood Zones 2 and 3.

Vulnerability of the Proposed Development

9A.6.24 According to NPPF Annex 3 Flood Risk Vulnerability Classification, the Proposed Development is classified as 'Essential Infrastructure'. Essential Infrastructure is defined as *"Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including infrastructure for electricity supply including generation, storage and distribution systems; including electricity generating power stations, grid and primary substations storage; and water treatment works that need to remain operational in times of flood".*

Sequential Test

9A.6.25 The Sequential Test ensures that a sequential, risk-based approach is followed to steer new development to areas with the lowest risk of flooding, taking all sources of flood risk and climate change into account. Where it is not possible to locate development in low-risk areas (i.e. Flood Zone 1), the Sequential Test should go on to compare reasonably available sites:

- within medium risk areas (i.e. Flood Zone 2); and
- then, only where there are no reasonably available sites in low and medium risk areas, within high-risk areas (i.e. Flood Zone 3).

9A.6.26 The Proposed Development is a Nationally Significant Infrastructure Project (NSIP). Requirements and restrictions in relation to the location of an NSIP within Flood Zone 3 are set out in pars 5.8.15 of NPS EN-1. which states: "*Preference should be given to locating projects in areas of lowest flood risk. The Secretary of State should not consent development in flood risk areas (Flood Zone 2 and Flood Zone 3 in England), accounting for all sources of flooding and the predicted impacts of climate change unless they are satisfied that the sequential test requirements have been met. However, when seeking development consent on a site allocated in a development plan through the application of the Sequential Test, informed by a strategic flood risk assessment, applicants need not apply the Sequential Test, provided the proposed development is consistent with the use for which the site was allocated and there is no new flood risk information that would have affected the outcome of the test. Consideration of alternative sites should take account of the policy on alternatives set out in Section 4.2 of the NP S EN-1. All projects should apply the sequential approach to locating development within the site".*

9A.6.27 The Main Site is entirely located within Flood Zone 1, the flood zone of lowest risk. The location of the Main Site within the former SSI Steelworks utilises previously developed land and specifically avoids the need for new built development in Flood Zone 2 or 3 therefore meets the requirements of the sequential test.

9A.6.28 The site selection process for the location of the Proposed Development Site is set out in Chapter 6: Alternatives and Design Evolution (PEI Report, Volume I). In summary, the analysis of potential sites focussed on identifying a site that supports the development that facilitates local regeneration industrial connectivity and the path to decarbonisation.

9A.6.29 Some of the criteria that were considered as part of the site selection process are outlined below:

- proximity to the east coast and NEP infrastructure – to enable high pressure CO_2 export to be quickly directed offshore and specifically to the Endurance storage facility and to separate high pressure systems from residential areas;
- dimensionality – ensuring there is sufficient space for the Proposed Development and its constructability and expansion potential;
- utilising brownfield land where possible;
- proximity to industrial offtakers that could connect into the H_2 Network;
- proximity to necessary connections including gas network, electricity transmission network, water supply; and
- minimising environmental/social effects or risks.

9A.6.30 As part of the site selection process, the Main Site is deemed the most appropriate site for the hydrogen production facility, given its location on brownfield land, being relatively distant from residential areas, of sufficient area to enable construction, having proximity to the necessary connections, and of being accessible for construction including from port and jetty facilities.

9A.6.31 In addition, the Main Site is directly adjacent to the NEP onshore facilities at NZT, thereby simplifying the CO_2 connection corridor routing. The Main Site also presents an opportunity to consider locating other proposed bp projects in Teesside (such as HyGreen, a proposed green hydrogen project), adjacent to the Proposed Development Site, allowing synergies between the projects to be explored.

9A.6.32 In the STBC Local Plan (STBC, 2019) Policy SD4 - Economic Growth Strategy states *"The Seal Sands, North Tees and Billingham Chemical Complex areas are the main growth locations for hazardous installations including [...] carbon capture and storage"*. Much of the land within the Site connection corridors that lies in Flood Zone 3 is within the boundary of STBC.

9A.6.33 Any construction works within Flood Zones 2 and 3 will be temporary in nature in terms of construction activities, and any permanent fixtures (required for the life of the Proposed Development) will only comprise a potential above ground installation (AGI) at the eastern end of the Dabholm Gut and include buried pipelines or pipelines fixed to existing pipe-rack infrastructure.

Given the evidence provided above it is, therefore, considered that the Sequential Test is satisfied. Information supporting the Sequential Test will be provided in the ES.

Exception Test

9A.6.34 Table 2 of the PPG provides a Flood Risk Vulnerability and Flood Zone Compatibility matrix (replicated in Table 9A-7) identifying which vulnerability classifications are appropriate within each Flood Zone.

9A.6.35 As shown in Table 9A-7, whilst essential infrastructure is appropriate in Flood Zones 1 and 2, application of the Exception Test is required for the elements of the Proposed Development located in Flood Zone 3. As illustrated on Figure 9-3: Fluvial Flood Risk (PEI Report, Volume II), some of the Connection Corridors are partially located within Flood Zones 2 and 3. The available detailed maps presented within the LLFAs SFRAs (see Annex B) for STBC (Map 10,11,16,17 and 18) and RCBC (Map 1,2,14,15,16 and 17) show the differentiation of Flood Zone 3 to Flood Zone 3a and Flood Zone 3b. This mapping confirms that the parts of the Proposed Development located within Flood 3, as shown on Figure 9-3, are all within Flood Zone 3a.

Table 9A-7: Flood Risk Vulnerability and Flood Zone Compatibility

FLOOD RISK VULNERABILITY CLASSIFICATION	ESSENTIAL INFRASTRUCTURE	WATER COMPATIBLE	HIGHLY VULNERABLE	MORE VULNERABLE	LESS VULNERABLE
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception test required	✓	✓
Zone 3a	Exception test required	✓	×	Exception test required	✓
Zone 3b (Functional Floodplain)	Exception test required	✓	×	×	×

Key
✓ *Development is appropriate.*
× *Development should not be permitted.*

9A.6.36 The detail of the Exception Test required for a NSIP is set at Paragraph 5.7.16 of the NPS EN-1 which states: *"Both elements of the test will have to be passed for development to be consented. For the Exception Test to be passed:*

- *the project provides wider sustainability benefits to the community that outweigh flood risk; and*
- *the project reduces flood risk overall, where possible."*

9A.6.37 Further information regarding the Exception Test will be provided in the ES.

9A.6.38 The Proposed Development will bring sustainability benefits, such as contributing to the UK's greenhouse gas (GHG) emissions reduction targets, supporting the decarbonisation of natural gas in Teesside for use in industrial applications and thus helping to achieve national targets in relation to carbon net zero. It will also be a key contributor to restoring manufacturing jobs in the Tees Valley.

Environment Agency Climate Change Guidance (2022)

9A.6.39 The Environment Agency published updated climate change allowances in May 2022 (Environment Agency, 2022) to support the NPPF, which supersede all previous allowances written in the PPG: Flood Risk & Coastal Change and EA Climate Change Guidance 2019 (EA, 2019) and are predictions of anticipated change for:

- peak river flow by River Basin District;
- peak rainfall intensity;
- sea level rise; and
- offshore wind speed and extreme wave height.

9A.6.40 There are allowances for different climate scenarios over different epochs, or periods of time, over the coming century. They include figures for extreme climate change scenarios, known as High++ (H++) allowances.

9A.6.41 To increase resilience to flooding these should be considered within an FRA in regard to future impacts from climate change on site specific planning applications. The Environment Agency's guidance outlines how and when allowances should be applied for FRAs.

Tidal Climate Change Allowances

9A.6.42 Table 9A-8 is an extract replicated from Table 3 of the Environment Agency guidance detailing the revised anticipated rise in sea levels up to 2125.

Table 9A-8: Sea Level Allowance for Each Epoch in Millimetres (mm) per year with Total Sea Level Rise for Each Epoch in Brackets (use 1981 to 2000 baseline)

RIVER BASIN DISTRICT	ALLOWANCE	2000 TO 2035	2036 TO 2065	2066 TO 2095	2096 TO 2125	CUMULATIVE RISE 2000 TO 2125 (M)
Northumbria	Higher central	4.6 (161 mm)	7.5 (225 mm)	10.1 (303 mm)	11.2 (336 mm)	1.03 m
	Upper end	5.8 (203 mm)	10.0 (300 mm)	14.3 (429 mm)	16.5 (495 mm)	1.43 m

9A.6.43 As the Proposed Developments is defined as Essential Infrastructure and a NSIP it is appropriate to apply the single H++ allowance. Table 9A-9 replicated from Table 4 of the Environment Agency guidance shows the H++ allowance total sea level rise to 2100.

Table 9A-9: H++ Sea Level Rise Allowance

CHANGE TO RELATIVE MEAN SEA LEVEL	TOTAL SEA LEVEL RISE TO 2100*
H++	1.9 m

**There is no H++ value beyond 2100*

Fluvial Climate Change Allowance

9A.6.44 For proposed developments in areas of fluvial flood risk, the flood risk vulnerability classification, flood zone and lifetime of development are of particular importance to determine the correct climate change allowance as detailed in Table 9A-10.

Table 9A-10: Climate Change Allowances to apply based upon the Flood Zone and Development Land Use Vulnerability

	WATER COMPATIBLE	LESS VULNERABLE	MORE VULNERABLE	HIGHLY VULNERABLE	ESSENTIAL INFRASTRUCTURE
Flood Zone 2	CA	CA	CA	CA	HCA
Flood Zone 3a	CA	CA	CA	X	HCA
Flood Zone 3b	CA	X	X	X	HCA
CA = Central Allowance, HCA = High Central Allowance; X = Development not permitted					

9A.6.45 As the Proposed Development is classified as 'Essential Infrastructure' from the vulnerability classifications in Annex 3 of the NPPF, the corresponding percentages that should be assessed at sites within the Tees Management Catchment are listed in Table 9A-11. The guidance states that for *"Essential Infrastructure located in Flood Zone 2 or Flood Zone 3 the Higher Central Allowance should be assessed".* Therefore a +40% allowance for climate change is applicable to the Proposed Development based on the lifetime of the development, assessed in line with the NPPF (i.e., 75 years).

Table 9A-11: Environment Agency Peak River Flow Climate Change Allowances for the Tees Management Catchment

	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE '2020S'	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE '2050S'	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE `2080S'
Upper End Allowance	32%	41%	61%
Higher Central Allowance	23%	27%	40%
Central Allowance	19%	21%	32%

Pluvial Climate Change Allowance

9A.6.46 To account for the anticipated changes in rainfall intensity, the Environment Agency's guidance (as shown in Tables 9A-12 and 9A-13) states that *"a FRA for an expected development with a lifetime up to 2100 assess the upper end allowances. You must do this for both the 1% and 3.3% annual exceedance probability events for the 2070s epoch (2061 to 2125)".*

Table 9A-12: Environment Agency Peak Rainfall Intensity Climate Change Allowances for Tees Catchment Management (3.3% annual exceedance rainfall event)

	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE '2050S' (UP TO 2060)	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE '2070S' (2061 TO 2125)
Upper End Allowance	35%	40%
Central Allowance	20%	30%

Table 9A-13: Environment Agency Peak Rainfall Intensity Climate Change Allowances across England for Tees Catchment Management (1% annual exceedance rainfall event)

	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE '2050S' (UP TO 2060)	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE '2070S' (2061 TO 2125)
Upper End Allowance	40%	45%
Central Allowance	25%	30%

9A.6.47 Therefore, a +45% allowance for climate change is applicable to the Proposed Development Site. This will be taken into account in the calculations of surface water runoff rates and volumes in the Drainage Strategy for the Proposed Development Site.

9A.6.48 When assessing a range of allowances for peak tidal, river flow or rainfall intensity, the following must be considered:

- likely depth, speed and extent of flooding for each of the assessed climate change allowances;
- vulnerability of the proposed development types or land use allocations to flooding;
- 'built in' resilience measures used, for example, raised floor levels; and

- capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach.

National Design Guide

9A.6.49 The NPPF makes clear that creating high quality buildings and places is fundamental to what the planning and development process should achieve. The National Design Guide (Ministry of Housing, Communities and Local Government, 2019b), published on 1st October 2019, illustrates how well-designed places that are beautiful, enduring and successful can be achieved in practice. It forms part of the Government's collection of planning practice guidance and should be read alongside the separate planning practice guidance.

9A.6.50 Sections of the guidance relevant to the Proposed Development include:

- N2 Improve and enhance water management which states, *''Well designed places integrate existing, and incorporate new natural features into a multifunctional network that supports quality of place, biodiversity and water management, and addresses climate change mitigation and resilience"*; and
- R3 Maximise resilience which states "*Well designed places contribute to community resilience and climate adaptation by addressing the potential effects of temperature extremes in summer and winter, increased flood risk, and more intense weather events such as rainstorms."* R3 also states *"Well designed places have sustainable drainage systems to manage surface water, flood risk and significant changes in rainfall. Urban environments make use of green sustainable drainage systems and natural flood resilience wherever possible. Homes and buildings also incorporate flood resistance and resilience measures where necessary and conserve water by harnessing rainfall or grey water for re-use on-site."*

Non-Statutory Sustainable Drainage Systems (SuDS) Guidance

9A.6.51 Defra published their Sustainable Drainage Systems: Non-Statutory Technical Standards (NSTS) in March 2015 (DEFRA, 2015) setting the requirements for the design, construction, maintenance and operation of SuDS. The NSTS are intended to be used alongside the NPPF and PPG.

9A.6.52 The NSTS of relevance in relation to the consideration of surface water flood risk to and from development relate to runoff destinations, peak flow control and volume control. Additional guidance is provided for structural integrity, designing for maintenance considerations and construction.

Regional Policy

Northumbria River Basin District Flood Risk Management Plan

9A.6.53 Flood Risk Management Plans (FRMPs) are prepared by the Environment Agency for six-year cycles and set out how organisations, stakeholders and communities will work together to achieve the objectives and measures (actions) needed to manage flood risk at a national and local level. The most recent plans were published in 2022 and will remain in place until after 2027. The Study Area is located within the

Northumbria River Basin District Flood Risk Management Plan (Environment Agency, 2022).

9A.6.54 The Northumbria River Basin District FRMP (Environment Agency, 2016) has been published by the Environment Agency and sets out objectives to manage flood risk for the region for the period 2015 to 2021. The Proposed Development is located within the Tees Management Catchment. The following relevant objectives are to be met in the Tees Catchment:

- Social Objectives
  - reduce the number of people exposed to each category of flood hazard particularly high and extreme hazard;
  - ensure that critical infrastructure remains operational during flood events; and
  - reduce the social impact of flooding on communities at risk, especially in areas where there are high proportions of properties and social assets at risk.
- Economic Objectives
  - reduce the direct economic damages to property and agriculture from flooding; and
  - ensure that FRM expenditure follows the level of flood risk in the catchment.
- Environmental
  - protect heritage sites from the effects of flooding and where possible use FRM activities to enhance the landscape;
  - maintain and where possible improve the ecological function of designated sites through FRM activities;
  - allow river channel processes to operate naturally within the catchment; and
  - no adverse impact on water quality as a result of flooding.

Tees Catchment Flood Management Plan

9A.6.55 The role of Catchment Flood Management Plans (CFMP) is to identify flood risk management policies which will assist all key decision makers in the catchment to deliver sustainable flood risk management for the long term. The Tees CFMP (EA. 2009) considers all types of inland flooding, from rivers, ground water, surface water and tidal flooding, but not flooding directly from the sea (coastal flooding).

9A.6.56 The CFMP splits the Tees catchment into eight sub-areas which have similar physical characteristics, sources of flooding and level of risk. The most appropriate approach

to managing flood risk for each of the sub-areas is identified and one of six generic flood risk management policies is allocated to the area.

9A.6.57 The Proposed Development is located in Sub-area 4 — Eastern and identifies that flooding from rivers and surface water flooding problems from the drainage systems are the main sources of flood risk in the sub-area.

9A.6.58 The key factors affecting Sub-area 4, which contains Stockton-On-Tees, include future coastal flood risk as a result of sea level rise, high urban flood risk due to increasing use of culverts and channel straightening, and increasing development pressure in the sub-area. Because of this, the CFMP policy is to take further action to reduce flood risk there by actions such as investigating flood storage options, developing a Surface Water Maintenance and Management Plan (SWMP) and developing an asset management plan for flood defences and channel maintenance.

River Tyne to Flamborough Head Shoreline Management Plan

9A.6.59 The purpose of a Shoreline Management Plan is to identify the most sustainable approach to managing the flood and coastal erosion risks to the coastline in the short-term (0 to 20 years), medium term (20 to 50 years) and long term (50 to 100 years).

9A.6.60 In the River Tyne to Flamborough Head SMP (Royal Haskoning, 2007), the Proposed Development Site location falls into 'Policy Development Zone 5 - Hartlepool Headland to Saltburn Scar and Management Area 13 (MA13) - Little Scar to Coatham Sands.

9A.6.61 The report identifies MA13 to be an area of low to high flood risk where the LLFA and the Environment Agency are already working towards managing the risk (the Proposed Development Site itself is located in an area shown to be at low risk of flooding from tidal sources). However, it is also an area that will be affected by climate change due to the low-lying land and its coastal location, and so will need ongoing maintenance and defence improvements. Overall, the policy for MA13 is to *"hold the line/ maintain the structure - maintain or change the level of protection provided by defences. This would include work or operations carried out in front of the existing defences or where, while maintaining existing defences, policies involve operations to the back of defences (such as secondary flood defences) as an essential part of maintaining the current defence system"*. To the south and east of the Estuary, where the Site is located), the policy is for *"no active intervention allowing natural development of the Coatham Sands and potential enhancement of habitat behind"*.

Local Policy

Redcar and Cleveland Local Plan (May 2018)

9A.6.62 The Proposed Development is predominantly within the administrative area of RCBC. RCBC has published a Local Plan which was adopted in 2018 and which outlines the Council strategy up to the year 2032.

9A.6.63 Policies specific to flood risk are highlighted in Table 9A-14.

Table 9A-14: Relevant RCBC Local Planning Policies

DOCUMENT	POLICY
Redcar & Cleveland Local Plan	Policy SD1 — Sustainable Development When considering development proposals, the Council will take a positive approach that reflects the presumption in favour of sustainable development contained in the NPPF.
	Policy SD2 - Locational Policy Development will be directed to the most sustainable locations in the borough. The majority of development will be focused in the urban and coastal areas. The location of new development will avoid areas at risk of flooding in line with the requirements set out in PPG25. (NB. PPG25 is now superseded by the PPG).
	Policy SD4 — General Development Principles In assessing the suitability of a site or location. development will be permitted where it; f. will not increase flood risk either on site or downstream of the development; and I. be sustainable in design and construction, incorporating best practice in resource management_ energy efficiency and climate change adaptation.
	Policy SD7 — Flood and Water Management Flood risk will be taken into account at all stages in the planning process to avoid inappropriate development in areas at current or future risk. Development in areas at risk of flooding, as identified by the EA flood risk maps, will only be granted where all the following criteria are met: a) the proposal meets the sequential and exception tests (where required) in relation to the NPPF; b) a site-specific flood risk assessment demonstrates that the development will be safe, including the access and egress, without increasing flood risk elsewhere. and, where possible, will reduce flood risk overall: and c) new site drainage systems are well designed. taking account of events that exceed normal design standard (e.g. consideration of flood flow routing and utilising temporary storage areas). All development proposals will be expected to be designed to mitigate and adapt to climate change, taking account of flood risk by: d) ensuring opportunities to contribute to the mitigation of flooding elsewhere are taken; e) prioritising the use of sustainable drainage systems (SuDS)

DOCUMENT	POLICY
	f) ensuring the full separation of foul and surface water flows; and g) ensuring development is in accordance with the Redcar and Cleveland SFRA. A site-specific flood risk assessment will be required to be carried out to demonstrate that the development is not at risk from flooding and that it does not increase flood risk downstream in the following circumstances: h) proposals of 1 ha in size or greater in Flood Zone 1; or i) proposals for new development (including minor development and change of use) in Flood Zones 3a or Flood Zone 2; or j) proposals for new development in areas susceptible to surface water flooding; or k) proposals situated in an area currently benefitting from defences; or I) proposals within 20 m of a bank top of a main river; or m) proposals over a culverted watercourse or where development will be required to control or influence the flow of any watercourse; or n) where the Proposed Development may be subject to other sources of flooding. Surface water runoff not collected.

Stockton-on-Tees Borough Council Local Plan (January 2019)

9A.6.64 The elements of the Proposed Development to the north of the Tees Estuary (i.e. the Natural Gas Connection and CO_2 Gathering Network) are located within the STBC administrative area. STBC published a Local Plan in 2019 which outlines the Council's strategy up to the year 2032.

9A.6.65 Policies specific to flood risk are highlighted in Table 9A-15.

Table 9A-15: Relevant STBC Planning Policies

DOCUMENT	POLICY
Stockton on Tees Local Development Plan (2019)	Strategic Development Policy SD5 — Natural, Built and Historic Environment To ensure the conservation and enhancement of the environment alongside meeting the challenge of climate change the Council will 2). Meet the challenge of climate change, flooding and coastal change through a variety of methods including:

DOCUMENT	POLICY
	• Supporting sustainable water management within development proposals; • Directing new development towards areas of low flood risk (Flood Zone 1) ensuring flood risk is not increased elsewhere. and working with developers and partners to reduce flood risk; • Ensuring development takes into account the risks and opportunities associated with future changes to climate and are adaptable to changing social, technological and economic conditions such as incorporating suitable and effective climate change adaptation principle; and • Ensuring development minimises the effects of climate change and encourage new development to meet the highest feasible environmental standards.
	Policy EG4 – Seal Sands, North Tees, and Billingham Development proposals in the North Tees and Seal Sands are required, as appropriate, to be supported by a site-specific FRA which considers, amongst other matters, emergency access/egress in the event of tidal flooding.
	Policy SD2 - Locational Policy will be directed to the most sustainable locations in the borough. The majority of development will be focused in the urban and coastal areas. The location of new development will avoid areas at risk of flooding in line with the requirements set out in PPG25. (NB. PPS 25 as referenced in objective 1 is now superseded as discussed in Section 15.2).
	Policy ENV4 — Reducing and Mitigating Flood Risk All new development will be directed towards areas of the lowest risk to minimise the risk of flooding from all sources and will mitigate any such risk through design and implementing sustainable drainage (SuDS) principles. Development on land in Flood Zones 2 or 3 will only be permitted following: a) The successful completion of the Sequential and Exception Tests (where required); and b) A site-specific flood risk assessment, demonstrating development will be safe over the lifetime of the development, including access and egress, without increasing flood risk elsewhere and where possible reducing flood risk overall. Site specific flood risk assessments will be required in accordance with national policy.

DOCUMENT	POLICY
	All development proposals will be designed to ensure that: a) Opportunities are taken to mitigate the risk of flooding elsewhere; Foul and surface water flows are separated; b) Appropriate surface water drainage mitigation measures are incorporated, and Sustainable Drainage Systems are prioritised; and c) SuDs have regards to Tees Valley Authorities Local Standards for Sustainable drainage (2015) or successor document. Surface water runoff should be managed at source wherever possible and disposed of in the following hierarchy of preference sequence: a) To an infiltration or soak away system; then b) To a watercourse open or closed: then c) To a sewer. For developments which were previously developed. the peak runoff rate from the development to any drain, sewer or surface water body for the 1-in-1 rainfall event and the 1-in-100 year rainfall event should be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event. Within critical drainage areas or other areas identified as having particular flood risk issues the Council may: a) Support reduced runoff rates; and b) Seek contributions, where appropriate, towards off-site enhancements directly related to flow paths from the development, to provide increased flood risk benefits to the site and surrounding areas. SuDS should be provided on major development unless demonstrated to be inappropriate. The incorporation of SuDS should be integral to the design process and be integrated with green infrastructure. Where SuDS are provided, arrangements must be put in place for their whole life management and maintenance. Through partnership working the Council will work to achieve the goals of the Stockton on Tees Local Flood Risk Management Strategy and the Northumbria Catchment Flood Management Plan.

DOCUMENT	POLICY
	To reduce the risk of flooding the Council is working in partnership with the Environment Agency to deliver a Flood Alleviation Scheme on Lustrum Beck.

Hartlepool Local Plan (May 2018)

9A.6.66 A small section of the Proposed Development Site extends into HBC administrative area. HBC published a Local Plan in 2018 which outlines the Council's strategy up to the year 2032.

9A.6.67 Policies specific to flood risk are highlighted in Table 9A-16.

Table 9A-16: Relevant HBC Planning Policies

DOCUMENT	POLICY
Hartlepool Local Plan (2018)	Policy SUS1: The Presumption in Favour of Sustainable Development When considering development proposals, the Borough Council will take a positive approach that reflects the presumption in favour of sustainable development contained in the National Planning Policy Framework. It will always work proactively with applicants jointly to find solutions which mean that proposals can be approved wherever possible, and to secure development that improves the economic, social, and environmental conditions in the area. Planning applications that accord with the policies in this Local Plan (and, where relevant, with policies in neighbourhood plans) will be approved without delay, unless material considerations indicate otherwise. Where there are no policies relevant to the application or relevant policies are out of date at the time of making the decision then the Borough Council will grant permission unless material considerations indicate otherwise – taking into account whether: a) Any adverse impacts of granting permission would significantly and demonstrably outweigh the benefits, when assessed against the policies in the National Planning Policy Framework taken as a whole; or b) Specific policies in that Framework indicate that development should be restricted.
	Policy LS1: Locational Strategy Development will be focused in areas of lower flood risk where possible and must comply with policy CC2.

DOCUMENT	POLICY
	Policy CC1: Minimising and adapting to climate change The Borough Council will work with partner organisations, developers and the community to help minimise and adapt to climate change by: 1) Locating development in areas of low flood risk wherever possible and incorporating appropriate measures to minimise flood risk, such as sustainable drainage systems and the use of porous materials along with water retention and recycling.
	Policy CC2: Reducing and mitigating flood risk All new development proposals will be required to demonstrate how they will minimise flood risk to people, property and infrastructure from all potential sources by: 1) Avoiding inappropriate development in areas at risk of flooding and directing the development away from areas at highest risk, applying the Sequential Test and if necessary, the Exceptions Test, in accordance with national policy and the Hartlepool Strategic Flood Risk Assessment; 2) Site Specific Flood Risk Assessments will be required in accordance with national policy; 3) Ensuring that the development will be safe over its lifetime, taking account of climate change, will not increase flood risk in vulnerable locations elsewhere and where possible, will reduce flood risk overall; 4) Assessing the impact of the development proposal on existing sewerage infrastructure and flood risk management infrastructure, including whether there is a need to reinforce such infrastructure or provide new infrastructure; 5) Ensuring that development proposals are resilient to flood risk, in accordance with national policy and the findings and recommendations of the Hartlepool Strategic Flood Risk Assessment; 6) Requiring that all development proposals include provision for the full separation of foul and surface water flows; 7) Ensuring that development proposals separate, minimise and control surface water run-off, with Sustainable Drainage Systems being the preferred approach. 8) Surface water should be managed at source wherever possible, ensuring that there is no net increase in surface

DOCUMENT	POLICY
	water runoff for the lifetime of the development. Surface water should be disposed of in accordance with the following hierarchy for surface water run-off: a) to a soak away system, unless it can be demonstrated that this is not feasible due to poor infiltration with the underlying ground conditions; b) to a watercourse, unless there is no alternative or suitable receiving watercourse available; c) to a surface water sewer; d) disposal to combined sewers should be the last resort once all other methods have been explored. 9) Where Greenfield sites are to be developed, the surface water run-off rates should not exceed, and where possible, should reduce the existing run-off rates. Where previously developed (brownfield) sites are to be developed, surface water run-off rates should seek to achieve greenfield equivalent run off rates or be reduced by a minimum of 50% of the existing site run-off rate.

Other Relevant Policy and Guidance

Local Flood Risk Management Strategies

9A.6.68 The vision of the Stockton-on-Tees Local Flood Risk Management Strategy (FRMS) (STBC, 2015), the Redcar and Cleveland FRMS (RCBC, 2017) and the Hartlepool FRMS (HBC, 2016) is "*To work with our partners in the Borough of Stockton-On-Tees to reduce the risk of flooding to residents and businesses and ensure that flood risk is managed in the most effective and sustainable way*".

9A.6.69 The strategies assess local flood risk (from surface water, groundwater and ordinary watercourses) within the boroughs and set objectives for managing this risk. The strategies detail mechanisms for achieving the objectives and seeks to reduce the risk of flooding to residents in both boroughs.

Strategic Flood Risk Assessments

9A.6.70 A Strategic Flood Risk Assessment (SFRA) provides the central source of all relevant flood risk information. An SFRA is required to initiate the sequential risk-based approach to the allocation of land for development in the Councils Local Plans and to identify whether the application of the Exception Test is likely to be necessary.

9A.6.71 The STBC Level 1 SFRA (JBA Consulting, 2018) indicates that the majority of fluvial flood risk comes from the River Tees. The tidal flood risk is particularly extensive, placing large parts of the industrial area on the north bank of the Tees Estuary and other, more central parts of the borough, at risk. Tide locking (prevention of fluvial flow discharging due to high tide levels) is also a contributing flood risk factor on many watercourses that flow into the tidal Tees.

9A.6.72 The available detailed maps presented within the STBC SFRA (Map 10,11,16,17 and 18, see Annex B) confirm that the parts of the Proposed Development Site located within Flood 3 are all located within Flood Zone 3a.

9A.6.73 In the Level 2 SFRA (JBA Consulting, 2018) three allocation sites have been taken forward from the Level 1 SFRA for a more detailed Level 2 screening assessment.

9A.6.74 The RCBC Level 1 SFRA (Redcar and Cleveland Borough Council, 2016) notes that fluvial flood risk in the borough is low and tidal risk mainly comes from the Tees Estuary in the west of the borough though is confined to the Docklands area. The Level 2 SFRA (JBA Consulting, 2016) provides a detailed assessment of flood hazards for the area at risk of tidal flooding and how this risk impacts on allocated development sites and available employment land. The study has identified three areas in the Borough which have critical drainage problems. These are Redcar, Eston and Guisborough.

9A.6.75 The available detailed maps presented within the RCBC SFRA (Map 1, 2, 14, 15, 16 and 17 - see Annex B) confirm that the parts of the Proposed Development Site located within Flood 3 are all located within Flood Zone 3a.

9A.6.76 The HBC Level 1 SFRA (JBA Consulting, 2017) notes that fluvial flood risk in the borough is low in the area around Greatham Beck, and tidal risk mainly comes from two coastal areas, currently protected by flood defences. The SFRA (JBA Consulting, 2017) provides a detailed assessment of flood hazards for the area at risk of tidal flooding and how this risk impacts on allocated development sites and available employment land. The study has identified three areas in the Borough which have critical drainage problems. These are the Stell, Middle Warren and Valley Drive.

Preliminary Flood Risk Assessments

9A.6.77 In their roles as LLFAs, STBC, RCBC, and HBC have produced Preliminary Flood Risk Assessment (PFRA) reports to meet their statutory duties to manage local flood risk and deliver the requirements of the Flood Risk Regulations 2009. The Regulations require LLFAs, through the PFRA process, to determine whether there is a significant risk in their area based on local flooding (surface water, groundwater, ordinary watercourses and canals) and to identify the part of the area affected by these risks.

9A.6.78 The purpose of a PFRA report is to provide a strategic assessment of flood risk from local sources including surface water, groundwater, ordinary watercourses and canals. The reports are high-level screening exercises using readily available data held by the Councils and partnering organisations. The reports look at historical flood events and consider the potential future flood events that may have a significant consequence on human health, economic activity and the environment including cultural heritage.

9A.6.79 The STBC PFRA (STBC, 2011) identifies six locations which have been subject to historical flooding. Of these locations Port Clarence and Lustrum Beck, although located outside the proposed Site boundary, fall within the Study Area.

9A.6.80 The RCBC PFRA (RCBC, 2011) notes that there are a number of locations across Redcar and Cleveland that are subject to frequent flooding from local sources, particularly from surface water.

9A.6.81 The HBC PFRA (HBC, 2011) identifies three locations which have been subject to historical flooding, which were then further investigated within a Level 2 SFRA.

Tees Valley Authorities Local Standards for Sustainable Drainage

9A.6.82 The Tees Valley Authorities (i.e., the local authorities of Hartlepool, Middlesbrough, Redcar and Cleveland, Stockton-on-Tees, and Darlington Borough Councils) produced a supplementary planning guidance (SPG) document entitled 'Sustainable Drainage Systems (SuDS) Guidance: Design Guide and Local Standards' in 2019 (The Tees Valley Authorities, 2019). Volume 1 provides an overview into SuDS techniques and policy requirements. Volume 2 highlights the Tees Valley specific local standards intended to provide clarity to the national standards.

9A.6.83 The document strongly promotes the use of sustainable drainage systems to help manage increased surface water runoff from new developments and help mitigate flood risk. It outlines the minimum standards to ensure a satisfactory scheme is constructed but are not intended to preclude any requirement for a higher standard that may be deemed necessary.

9A.6.84 It is stated that when designing and using SuDS, consideration should be given to ensuring that they: reduce damage from flooding, improve water quality, protect, and improve the environment, protect health and safety and ensure stability and durability of drainage.

9A.7 Flood Risk Sources

9A.7.1 Both the NPS and NPPF require the effects of all forms of flood risk, both to and from the Proposed Development, to be considered within an FRA. There should be demonstration of how these should be managed so that the development remains safe throughout its lifetime, taking into account current climate change predictions.

9A.7.2 This section discusses these potential risks in relation to tidal, fluvial, surface water runoff, groundwater and man-made/artificial sources.

Historical Flooding Incidents

9A.7.3 The history of tidal flooding from the Tees Estuary dates back as far as 1836, according to the online BHS Chronology of British Hydrological Events (University of Dundee, 2020). There was severe tidal flooding of Stockton on Tees in this year and then again in Middlesbrough in 1903.

9A.7.4 STBC hold no records of historical flooding for Ordinary Watercourses in the vicinity of the Proposed Development Site.

9A.7.5 The main source of historic flooding in RCBC is from the other local sources e.g. surface water sewers, water authority combined sewers, smaller (ordinary) watercourses and drains. All the main urban areas in RCBC have been subject to this type of local flooding at different times. In total, nearly 800 flooding incidents have been recorded by the different data holders, affecting around 10 main locations. The main local flood risk locations, identified in the SFRA are Eston, Guisborough and Redcar. These have been classed as Critical Drainage Areas (CDAs) within the SFRA.

9A.7.6 Records of historical flooding taken from the BHS Chronology of British Hydrological Events and LLFAs SFRAs are summarised in Table 9A-17.

Table 9A-17: Records of Historical Flooding

DATE	FLOODING SOURCE	OVERVIEW
1953	Tidal	An area of low pressure, in conjunction with North Westerly winds and a high spring tide, caused a large tidal surge and flooding of Port Clarence to a depth of 1.2 m. the peak water level was 4.01m AOD at the Tees Estuary. There were two breaches of the embankments at Greatham Creek on both the North and South embankment, in the vicinity of the A178. Other areas affected include Billingham Reach Industrial Estate, Tees Marshalling Yard, along with many of the lower reaches of the tidal River Tees.
January 1978	Tidal	A breach of the Greatham Creek defences where both the North and South banks were breached downstream of the A178.
1983	Tidal	A breach of the Greatham Creek Southern flood defence embankment both upstream and downstream of the A178, with a peak tide level of 3.65 m AOD.
March 1999	Fluvial	Substantial flooding occurred due to heavy rain and peak flows unable to pass through Holme Fleet culvert, which is located to the north of Port Clarence. It was reported that the culvert was blocked at the time by material which had entered the access chambers.
8th November 2000	Fluvial	Between 2 - 4am an intense storm hit the area of Port Clarence. approximately 16 properties suffered from internal flooding with flood water reaching ground floor level. It was reported that the flooding occurred due to Holme Fleet Beck overtopping due to heavy rainfall.
Unknown	Groundwater	Flooding to the south of Marske, directly below Errington Wood.

DATE	FLOODING SOURCE	OVERVIEW
25th/26th September 2012	Fluvial and Surface Water	24 hours of persistent heavy rain followed the wettest summer on record, resulting in fluvial and surface water flooding of several communities. The most severely affected were those along Lustrum Beck, and those in Norton near Billingham Beck. Traffic disruption also occurred following flooding of the A19/A66 trunk road. The report estimates that 150 properties and businesses were flooded internally.
5th December 2013	Tidal	Tidal flooding occurred within the Stockton borough due to a combination of a high spring tide and a low-pressure system causing a positive tidal surge. The total tide height was 4.09 m AOD. which surpassed the recorded historic events in the area. 32 residential properties were internally flooded at Port Clarence, as well as 20 businesses across Port Clarence. Billingham Reach Industrial Estate and Seal Sands. There was significant infrastructure damage, including the closure of the A19 Portrack interchange and partial closure of the A66 trunk road at Teesside Park. Breach of the flood defences at Greatham Creek flooded a large area of land.
1st April 2017	Fluvial/Surface Water/Drainage Infrastructure	Cross Beck catchment in Eston and Spencer Beck catchment in Teesville affected. Met Office confirmed that 1 weeks' worth of rain fell in 1 hour and Northumbrian Water Limited confirmed the event was a 1 in 197-year storm. Ground conditions were very dry prior to the event which exacerbated the speed of run off from land to watercourses. Intensity of rainfall resulted in all drainage systems being inundated and overwhelmed.

Tidal Sources

9A.7.7 The Main Site is situated in a coastal location, with the North Sea approximately 0.6 km to the north.

9A.7.8 The River Tees is classified as an Environment Agency Main River on the Digital Mapping Network and is located approximately 1.6 km to the west of the Proposed

Development Site. The River Tees is tidal at this location, with the normal tidal limit approximately 14 km upstream (at the Tees Barrage).

9A.7.9 Greatham Creek, an Environment Agency Main River, is a tidal watercourse which flows in a westerly direction, following the STBC boundary, and discharges into the Tees at Seal Sands. Its tidal limit extends to a weir, which is 300 m upstream of the confluence with Cowbridge Beck, outside of Stockton Borough. The Creek is crossed by bridges which carry the A178 trunk road and the emergency access road to Seal Sands. There is a history of tidal flooding and breach of the defences at Greatham Creek.

9A.7.10 The STBC SFRA states *"The tidal flood risk is particularly extensive, placing large parts of the industrial area on the north bank of the Tees Estuary and other, more central parts of the Borough, at risk. In addition, tide locking (prevention of fluvial flow discharging due to high tide levels) is also a contributing flood risk factor on many watercourses that flow into the tidal Tees".*

9A.7.11 Flood defence and artificial ground raising protect much of STBC from tidal flooding. There is the potential for some defences to be outflanked, notably those at Port Clarence, Old River Tees and at Greatham Creek.

Flood Map for Planning

9A.7.12 The Environment Agency's FMfP (available to view on their website and Figure 9-3: Fluvial Flood Risk, PEI Report, Volume II) identifies areas subject to fluvial/tidal flood risk for the present day but does not include the benefits or impacts of any existing flood defences or climate change respectively.

9A.7.13 In addition to the FMfP, the available detailed maps presented within the SFRAs for STBC (Map 10, 11, 16, 17 and 18) and RCBC (Map 1, 2, 14, 15, 16 and 17) presented in Annex B, confirm that the parts of the Proposed Development Site located within Flood Zone 3 are all within Flood Zone 3a. There is no land within the Proposed Development Site boundary located in Flood Zone 3b (Functional Floodplain) in relation to tidal flood sources.

9A.7.14 Flood zone definitions are summarised in Table 9A-6 and the supporting flood risk mapping is presented on Figure 9-3: Fluvial Flood Risk (PEI Report, Volume II).

Main Site

9A.7.15 The FMfP illustrates that the entirety of the Main Site is located within Flood Zone 1 (low risk of flooding from fluvial and/or tidal sources).

Pipeline Corridors

9A.7.16 The FMfP indicates that to the south of the River Tees the Pipeline Corridor is predominantly located in Flood Zone 1 (low risk of flooding from fluvial and/or tidal sources). The exceptions to this are small sections of the Electrical Pipeline, Water Connection, Hydrogen Pipeline and Other Gases connection corridors which extend into Flood Zone 2 (medium risk of flooding from fluvial and/or tidal sources) and Flood Zone 3a (high risk of flooding from fluvial and/or tidal sources) as they cross or are in proximity to Dabholm Gut.

9A.7.17 Flooding is more extensive to the north bank of the River Tees with flooding predominantly associated with Greatham Creek, Mucky Fleet and Swallow Fleet. The section of the Hydrogen Pipeline Corridor that extends out towards Billingham is located in Flood Zone 1 (low risk), Flood Zone 2 (medium risk) and Flood Zone 3a (high risk) with the main area at risk located to the north of Port Clarence.

Flood Defences

9A.7.18 In accordance with the NPPF, the requirements are to ensure any proposed developments are designed to manage tidal flooding up to a 0.5% AEP (1 in 200 chance) event, taking into account the potential impacts of climate change.

9A.7.19 It is noted in the STBC SFRA that *"flood defence and artificial ground raising protect much of STBC from tidal flooding".*

9A.7.20 Consultation with the Environment Agency (see Annex A) identifies that the Environment Agency own and maintain a number of flood defence assets along the River Tees near the Proposed Development Site. The tidal defences protecting this Site consist of a combination of high ground and raised defences, including floodwalls and flood banks and reduce the risk of flooding up to a 0.5% AEP (1 in 200 chance in any year) event. The Environment Agency inspects these defences routinely to ensure potential defects are identified. Further details on flood management infrastructure is provided in Section 9.4.

Modelled Tidal Water Levels

9A.7.21 The Environment Agency provided modelled tidal peak water levels for the tidal Tees area for the NZT development for the 0.5% AEP (1 in 200 year), 0.1% AEP (1 in 1000 year) and 0.1% AEP with climate change scenario flood events to inform the NZT FRA (see Annex A).

9A.7.22 The outputs are from the 2020 Greatham and Port Clarence model update report, the 2011 Tidal Tees Integrated Flood Risk Modelling Study and the 1,000-year plus climate change levels are from the 2015 Tidal Tees Integrated Flood Risk Modelling Study.

9A.7.23 The 1,000-year plus climate change events were not provided in the 2020 updated modelling, however, for the NZT assessment, the 2015 results were deemed appropriate as climate change uplifts have not changed in the assessment time period and current day levels had slightly decreased in the new modelling. This means that the 2015 estimates still accurately represent flood risk in the area. Running the 1,000 year plus climate change scenario, the maximum water levels along the reach are presented in Table 9A-18. These are the current best estimate for extreme tidal water levels in the vicinity of the Proposed Development Site.

9A.7.24 The Environment Agency's model demonstrated that during a 0.1% AEP (1 in 1000 chance) event based upon the existing (2019) scenario, tidal levels in the Tees Estuary could rise up to 4.33m AOD at the mouth of the estuary and up to 4.40m AOD where the A19 crosses the Tees near Portrack.

Table 9A-18: Modelled Water Levels for the Tidal River Tees

LOCATION	RETURN PERIOD UNDEFENDED SCENARIO WATER LEVELS (M AOD)			RETURN PERIOD DEFENDED SCENARIO WATER LEVELS (M AOD)		
	0.5%	0.1%	0.1% + CC	0.5%	0.1%	0.1% + CC
NZ 55096 28427 (Teesmouth)	4.0810	4.33	5.25	4.08-	4.33-	
NZ 54455 26362 (opp. RBT)	4.0811	4.33	5.26	4.0811	4.33	5.26
NZ 54745 24769 (app. Dabholm Gut)	4.0911	4.33	5.27	4.0912	4.34	5.26
NZ 51605 20997 (app. Clarence Wharf)	4.12	4.36	5.29	4.12	4.37	5.27
NZ 50618 21103 (app. Port Clarence)	4.13	4.36	5.30	4.13	4.37	5.26
NZ 47863 19935 (Newport Bridge)	4.15	4.40	5.32	4.15	4.40	5.29
NZ 47539 19485 (Portrack)	4.16	4.40	5.33	4.15	4.40	5.29

Source: 2011 Tidal Tees Integrated Flood Risk Modelling Study and 2015 Tidal Tees Integrated Flood Risk Modelling Study: Running the 1,000-year + climate change 2020 Greatham and Port Clarence model update report. (Environment Agency Consultation - Annex A)

9A.7.25 The 0.1% AEP (1 in 1000 chance) including climate change modelled water levels taken from the 2015 Tidal Tees Integrated Flood Risk Modelling Study demonstrate that during a 0.1% AEP event based upon the future 2115 scenario, tidal levels in the Tees Estuary could rise up to 5.25m AOD at the mouth of the estuary and up to 5.33m AOD where the A19 crosses the Tees near Portrack.

9A.7.26 The Environment Agency climate change guidance was recently updated with revised sea level allowances (see Table 9A-8) up to the year 2125. Applying these sea level allowances to the existing (2019) scenarios indicates water levels along the estuary could increase by 0.94 m using the Higher Central allowance and 1.32 m using the Upper End allowance.

9A.7.27 Table 9A-19 shows the water levels for a 0.5% AEP and 0.1 % AEP flood event when the Higher Central Upper End and H++ allowances are applied. The table also shows the potential sea level rise for the lifetime of the development, taken to be 75 years, in line with NPPF/PPG recommendations.

Table 9A-19: Tidal Water Levels for the Tidal River Tees with Climate Change Allowances (m AOD)

LOCATION	HIGHER CENTRAL				UPPER END				H++ (1.9M INCREASE TO 2100)	
	TOTAL INCREASE 0.94M TO 2125		TOTAL INCREASE 0.66M TO 2105 (75 YR LIFETIME)		TOTAL INCREASE 1.32M TO 2125		TOTAL INCREASE 0.904 M TO 2105 (75 YR LIFETIME)			
	0.5% AEP	0.1% AEP	0.5% AEP	0.1% AEP	0.5% AEP	0.1% AEP	0.5% AEP	0.1% AEP	0.5% AEP	0.1% AEP
NZ 55096 28427 (Teesmouth)	5.02	5.27	4.74	4.99	5.40	5.65	4.99	5.23	5.98	6.23
NZ 47539 19485 (Portrack)	5.10	5.34	4.82	5.06	5.48	5.72	5.06	5.30	6.06	6.30

9A.7.28 For coastal flooding, the Environment Agency climate guidance states to use:

- Higher Central Allowance: as a design allowance;
- Upper End Allowance: to test sensitivity to severe climate change and any required mitigation;
- H++/Credible Maximum: to test the project under more extreme climate change and exceedance events – but does not have to be used to inform mitigation.

9A.7.29 In reality, based on an expected lifetime of 25 years for each phase of the development, the maximum flood water levels would be significantly less than those shown in Table 9A-19.

Residual Flood Risk- Overtopping and/ or breach of Flood Defences
Overtopping of Flood Defences

9A.7.30 Existing flood defences along both banks of the River Tees generally comprise high ground and provide protection against flooding up to and including the 0.5% AEP (1 in 200) flood event.

9A.7.31 Historically, flood defences comprising flood walls and flood banks have been known to overtop in the Port Clarence area flooding land to the north of the River Tees, however, a new flood defence scheme has recently been constructed to a minimum standard of 0.5% AEP to protect against the risk of flooding in this area.

9A.7.32 There is no overtopping scenario hazard mapping data available from the Environment Agency to inform this assessment, therefore it is assumed that overtopping of the flood defences. as a worst-case scenario, would result in a similar

flood extent to the undefended Flood Zone 2 and Flood Zone 3a flood extents provided by the Environment Agency.

9A.7.33 In accordance with the NPPF, the assessment of overtopping should be undertaken using the 0.5% AEP (1 in 200 year event) plus climate change design tidal event. Based on Table 9A-19, maximum flood water levels for a 0.5% AEP Upper End climate change flood event are between 4.99 – 5.06m AOD for the lifetime of the development (assessed as 75 years).

9A.7.34 The Main Site is located in Flood Zone 1 and the Proposed Development will be sited at a level no lower than a minimum ground level of 6.83m AOD, a level derived from the 0.1% AEP H++ flood level of 6.23m AOD (as presented in Table 9A-19) with an additional freeboard of 600mm added. The current site is relatively flat with ground levels at 7m AOD, ±0.4m. The level of 6.83m AOD would be the minimum ground level once site clearance and remediation has been undertaken. In addition, the topography across the Proposed Development Site, extending south and southwest of the Main Site in the areas of the Hydrogen Pipeline Corridor rises slightly to the south and west, reaching 25m AOD at Lazenby and 30m AOD in Grangetown.

9A.7.35 The 0.5% AEP climate change water level (adjusted using the Upper End allowance) is calculated as 5.40m AOD at the mouth of the Tees Estuary and therefore significantly below the site levels in this area. Even if the assessment were to be undertaken using the H++ water level of 5.98m AOD (for a 0.5% AEP tidal event) and 6.23m AOD (for a 0.1% AEP tidal event) the risk of tidal flooding to the Main Site would remain at low (i.e. within Flood Zone 1) should overtopping of the high ground occur.

9A.7.36 The Proposed Development located to the south and south-west of the Main Site (the Hydrogen Pipeline Corridor, Water Connections Corridor, CO_2 Export Corridor, Natural Gas Connection Corridor, and the Electrical Connection Corridor) will, wherever possible, use existing above ground pipe racking networks, existing culverts and overbridges, will remain at low risk of flooding, with the exception of watercourse crossings.

9A.7.37 In the Port Clarence area, should overtopping occur for the present day scenario along the River Tees or Greatham Brook, the Hydrogen Pipeline Corridor, to the east of Billingham, which will use an existing above ground pipe racking network, existing culverts and overbridges, will be flooded and assuming a worst case scenario, the area flooded will be similar to the Flood Zone 3a extent shown on the current Environment Agency flood map.

9A.7.38 Overtopping of the flood defences in this area for the Upper End and H++ scenarios result in an increase in flood depth and an increase in flood extents meaning a greater area of the Hydrogen Pipeline Corridor i.e. the area currently located within Flood Zone 1 to the east of Billingham, would be at risk of flooding.

Breach/Failure of Flood Defences

9A.7.39 Existing flood defences along both banks of the River Tees generally comprise high ground and raised defences, including floodwalls and flood banks, and provide protection against flooding up to and including the 0.5% AEP (1 in 200) flood event.

High ground is generally not susceptible to breach and/or failure therefore the main residual tidal flood risk along the Tees Estuary is from overtopping, as outlined above. According to information provided by the Environment Agency they are in 'very good to good' condition. The Environment Agency inspects these defences routinely to ensure potential defects are identified.

9A.7.40 Historically, flood defences at Port Clarence (flood walls and flood banks) and flood embankments along Greatham Creek have breached, flooding land between the two watercourses where ground levels are between 0 to 10 m AOD. In 2019 a major flood defence scheme to protect Port Clarence and some of the surrounding industrial areas from tidal flooding was completed. This included improving defences along the north bank of the River Tees and along the south bank of Greatham Creek, providing a 0.5% AEP standard of protection.

9A.7.41 There is no breach scenario hazard mapping data available from the Environment Agency to inform this assessment. It is assumed that a breach or failure of the flood defences, (present day scenario) as a worst-case, would result in a similar flood extent to the undefended Flood Zone 2 and Flood Zone 3a flood extents provided by the Environment Agency. The Hydrogen Pipeline Corridor, to the east of Billingham, which will use an existing above ground pipe racking network, existing culverts and overbridges, would be flooded under this scenario. A breach in the flood defences for the Upper End and H++ scenarios would result in an increase in flood depth and an increase in flood extents meaning a greater area of the Hydrogen Pipeline Corridor i.e. the area currently located within Flood Zone 1 to the east and south of Billingham, would potentially be at risk of flooding.

Risk of Flooding

9A.7.42 Based on the information provided by the Environment Agency, it has been determined that the Main Site and the majority of the connection corridors (the Water Connections Corridor, the Electrical Connection Corridor, the Natural Gas Connection Corridor, CO_2 Export Corridor and the Hydrogen Pipeline Corridor are located within Flood Zone 1 on the north and south banks of the River Tees) are at a 'low' risk of flooding from tidal sources.

9A.7.43 Both options for the section of the Hydrogen Pipeline Corridor crossing the River Tees and the section to the east of Billingham (located in Flood Zone 3a on the north bank of the River Tees) is at 'high' risk of tidal flooding.

9A.7.44 The Main Site, with ground elevations no lower than 6.83m AOD (see Paragraph 9A.1.200), will remain at low risk of flooding from overtopping of the high ground (informal flood defences) during events that exceed a 0.5% AEP (1 in 200 chance) of flooding, during a 0.1% AEP (1 in 1000 chance) event taking into account climate change, including the H++ climate change scenario.

9A.7.45 If the defences adjacent to Port Clarence and along the southern bank of Greatham Creek were to overtop or fail/breach the Hydrogen Pipeline Corridor, located between the two watercourses, would be at 'high' residual risk of flooding from both the existing scenario 0.5% and 0.1% AEP (1 in 1000 chance) events and future climate change scenarios, including the H++ scenario.

Fluvial Sources

9A.7.46 A review of OS mapping identified that the nearest watercourse to the Main Site is The Fleet, located approximately 273 m to the south-east of the Main Site and Dabholm Gut, located approximately 1.1 km to the south.

9A.7.47 Numerous ordinary watercourses intersect the connection corridor routes including Mains Dike, The Mill Race, Kinkerdale Beck and Knitting Wife Beck to the south of the River Tees and Belasis Beck, Mucky Fleet and Swallow Fleet to the north of the River Tees near Billingham. These watercourses all pose a potential risk of fluvial flooding to the connection corridors.

Flood Map for Planning

9A.7.48 The online Environment Agency FMfP illustrates that the Main Site is located entirely in Flood Zone 1 (low risk of flooding from fluvial sources). Small areas of the Electrical Connection Corridor and the Water Connection Corridor are also located within Flood Zones 2 and 3 to the south of the River Tees.

9A.7.49 Flooding is more extensive to the north bank of the River Tees and a significant amount of the Hydrogen Pipeline Corridor is located within Flood Zones 2 (medium risk of flooding) and 3 (high risk of fluvial flooding), however, flooding in this area is predominantly from tidal sources. There are, however, ordinary watercourses, such as the Mucky Fleet, Swallow Fleet and Belasis Beck that could pose a risk to small sections of the Hydrogen Pipeline Corridor, predominantly where the connection corridor passes over a watercourse/drain.

9A.7.50 Flood zone definitions are summarised in Section 9.6, Table 9A-6 and the supporting flood risk mapping is presented on Figure 9-3: Fluvial Flood Risk (PEI Report, Volume II).

Flood Defences

9A.7.51 The Environment Agency FMfP indicates that the Proposed Development Site is not located in an area benefitting from flood defences. The FMfP shows small sections of raised tidal flood defences located along the River Tees to the west and south west of the Main Site, however; there is no information regarding fluvial flood defences along the smaller watercourses in the area. Further information on flood management infrastructure is presented in Section 9.4.

Modelled Fluvial Water Levels

9A.7.52 No modelled fluvial flood level data is available for the smaller watercourses in the Study Area.

9A.7.53 It is known that tide locking (prevention of fluvial flow discharging due to high tide levels) is a contributing flood risk factor on many watercourses that flow into the tidal Tees.

9A.7.54 Smaller watercourses have no associated hydraulic model or modelled flood water data available to inform the assessment. As a proxy, for catchment areas less than 3 km^2, the Environment Agency Risk of Flooding from Surface Water (RoFSW) maps, primarily used to represent surface runoff; can also be used to identify flooding from

Ordinary Watercourses. Analysis of the mapped flood extents associated with ordinary watercourses indicates that for the present -day flooding is not significant, and should a flood occur the area of inundation remains local to the watercourse.

Risk of Flooding

9A.7.55 It considered that during the existing scenario the Main Site and the majority of the connection corridors to the north and south of the River Tees are at `low' risk of flooding from fluvial sources.

9A.7.56 Climate change is assessed using the +40% higher central allowance for areas of the Site located in Flood Zone 1, as required by the Environment Agency climate change guidance. The Main Site, with levels no lower than 6.83m AOD will remain at low risk of flooding from the 1% AEP with a 40% allowance for climate change flood event.

9A.7.57 For areas of the Proposed Development Site located in Flood Zones 2 and 3a, where connection corridor routes cross watercourses, the Environment Agency guidance is that for essential infrastructure the upper end climate change allowance (61%) is used to assess climate change from fluvial sources as the H++ scenario.

9A.7.58 Taking the climate change scenarios into account, the risk of flooding to the Main Site itself will remain low as high ground levels ensure that the site remains in Flood Zone 1.

9A.7.59 For the H++ climate change scenario the risk of flooding from The Fleet and Dabholm Gut will increase with the depth and extent of flooding increasing across a larger area. The Connection Corridors will, wherever possible, use existing above ground pipe racking networks, existing culverts and overbridges and therefore these elements of the Proposed Development will be at increased risk of fluvial flooding over the lifetime of the development.

9A.7.60 On the north bank of the River Tees, both climate change scenario will have a similar impact on flooding from the Mucky Fleet, Swallow Fleet and Belasis Beck. An increase in the extent and depth of flooding is likely to increase the flood risk to the sections of the Hydrogen Pipeline Corridor located in proximity to these ordinary watercourses.

9A.7.61 Given the short-term nature of the construction period it is not expected that fluvial flooding associated with climate change will affect this phase of the development.

Groundwater Sources

9A.7.62 Groundwater flooding can occur when groundwater levels rise above ground surface levels. The underlying geology has a major influence on where this type of flooding takes place: it is most likely to occur in low-lying areas underlain by permeable rocks (aquifers).

9A.7.63 Both the RCBC SFRA and the PFRA state that the overall risk of groundwater flooding in Redcar and Cleveland is low. It is noted, however, that the majority of the borough may be subject to very wet ground conditions as a result of winter waterlogging.

9A.7.64 The Tees CFMP states that there is little documented evidence of groundwater flooding in the Tees catchment and groundwater flooding is not known to be a major

problem due to the geology of the catchment. This is particularly true for STBC as the main geology is of sandstone and mudstone. There are no sources of groundwater flooding as the aquifers within these sandstones are not artesian, even in very wet conditions.

9A.7.65 STBC hold no records of groundwater flooding problems in the area.

9A.7.66 The Environment Agency's 'Areas Susceptible to Groundwater Flooding' map is illustrated in the RCBC and STBC PFRA reports. The Areas Susceptible to Groundwater Flooding map is divided into 1 km^2 grid-squares in which a percentage is given for what proportion of the 1 km^2 is considered to be susceptible to groundwater emergence.

9A.7.67 Within the RCBC, STBC, and HBC areas, the map shows the Main Site lies predominantly in an area with a 75% or greater chance of groundwater emergence.

9A.7.68 The Environment Agency have no groundwater level monitoring sites either inside the search area or within 2 km of the search area (the closest groundwater level data held is from a site approximately 8.2 km north-north-west of the Proposed Development Site boundary) however, the Environment Agency have indicated that the bedrock groundwater level is expected to be around Ordnance Datum given the proximity to the coast.

9A.7.69 Based on the above available information, the risk of flooding from groundwater sources is assessed as a medium risk. The Parties also agree that an assessment of groundwater flooding risk will be undertaken in advance of any intrusive works in Saltholme and secured by requirement.

Surface Water Runoff

Overland Flow of Rainfall Runoff

9A.7.70 Overland flow results from rainfall that fails to infiltrate the surface and travels over the ground surface; this is exacerbated where the permeability of the ground is low due to the type of soil and geology (such as clayey soils) or urban development with impermeable surfaces.

9A.7.71 Surface water flooding is the main source of flood risk in RCBC with regular flooding in Eston, Redcar and Guisborough. This flooding is due to insufficient surface water, combined sewer and culverted watercourse capacity. The RCBC PFRA states *''In general, this local flooding occurs regularly but it is not particularly hazardous and individual incidents do not affect a large number of properties''.*

9A.7.72 STBC have confirmed that flooding did affect parts of the Proposed Development Site following the September 2012 rainfall event, however, there are no official recorded locations.

9A.7.73 The Environment Agency 'Risk of Flooding from Surface Water' maps available on the Environment Agency website and presented on Figure 9-4: Surface Water Flood Risk (PEI Report, Volume II) indicate areas at risk from surface water flooding, when rainwater does not drain away through the normal drainage systems or soak into the ground, but instead lies on or flows over the ground.

9A.7.74 The maps delineate risk into the four following categories:

- Very Low - each year, this area has a chance of flooding of less than 1 in 1,000 (<0.1 %);
- Low - each year, this area has a chance of flooding of between 1 in 1,000 (0.1 %) and 1 in 100 (1 %);
- Medium - each year, this area has a chance of flooding of between 1 in 100 (1 %) and 1 in 30 (3.3 %): and
- High - each year, this area has a chalice of flooding of greater than 1 in 30 (3.3 %).

9A.7.75 Environment Agency mapping indicates that the Main Site and the associated connection corridors within STBC, RCBC, and HBC are generally at very low risk (<0.1% AEP event) of flooding from surface water. There are isolated areas of high, medium and low flood risk where water is seen to pond during more significant rainfall events, however, these areas are constrained to low spots in the local topography within the Proposed Development Site boundary.

9A.7.76 The main locations of identified surface water flooding are:

- approximately 275 m to the south east of the Main Site where water is seen to flood around the A1085/Broadway East roundabout junction. Land in this area is identified at low to high risk of surface water flooding; and
- land located to the west between the A1085 and Cowpen Bewley Road, approximately 8 km to the west of the Main Site. Land in this area is identified at low to medium risk of surface water flooding.

9A.7.77 There are no surface water flow routes identified on the 'Risk of Flooding from Surface Water' maps therefore the risk of surface water flooding both to and from the Main Site area and the Connection Corridors is therefore considered to be ‘low' to 'very low'.

9A.7.78 Climate change must be taken into account when considering surface water runoff generated by development sites. This is usually represented by increasing the peak rainfall intensities. An increase in intensity will increase surface water rates and volumes. Additional surface water drainage will be required to allow increased surface water to be contained and managed.

9A.7.79 Drainage principles for the Proposed Development are outlined in Section 9.8. A Drainage Strategy will accompany the DCO Application, and its suitability assessed during the EIA and reported in the ES.

9A.7.80 The conceptual drainage strategy for surface water management will include an increase in peak rainfall intensity, in line with Environment Agency climate change guidance, summarised in Section 9.8. As a result, surface water runoff increasing over the lifetime of the development as a result of climate change is expected to be managed and not increase flood risk to the Proposed Development Site or elsewhere.

Existing Drainage Infrastructure

9A.7.81 No information was available regarding the private drainage within the Main Site boundary at the time of preparing the PEI Report. It is assumed the existing surface

water drainage system collects runoff from the buildings, hardstanding areas and gullies, which then discharge into the surrounding sewer network and/ or watercourses.

9A.7.82 The Northumbrian Water Bran Sands wastewater treatment works (to the immediate south of the Redcar Steelworks site) discharges into the Dabholm Gut.

9A.7.83 In total, there are 234 records of historic sewer flooding incidents in RCBC. Information provided in the RCBC SFRA indicates that no historical sewer flooding has occurred in close proximity to the Main Site and connection corridors to the south of the River Tees. Flooding from drainage infrastructure within RCBC tends to occur in predominantly residential areas with Eston, located to the southwest of the Main Site, and is identified as a critical drainage area.

9A.7.84 Based on the available records and information, the Proposed Development Site is considered to be at low risk of flooding from drainage infrastructure.

Artificial Waterbodies

9A.7.85 Artificial flood sources include raised channels such as canals or storage features such as ponds and reservoirs.

Flood Risk from Canals

9A.7.86 There are no canal systems within close proximity to the Main Site and connection corridors.

Flood Risk from Reservoirs

9A.7.87 The risk of flooding associated with reservoirs is residual and is associated with failure of reservoir outfalls or dam breaching. This risk is reduced through regular inspections and maintenance by the operating authority. Reservoirs in the UK have an extremely good safety record with no incidents resulting in the loss of life since 1925.

9A.7.88 The Environment Agency is the enforcement authority for the Reservoirs Act 1975 in England and Wales. All large reservoirs must be regularly inspected and supervised by reservoir panel engineers. Local Authorities are responsible for coordinating emergency plans for reservoir flooding and ensuring communities are well prepared.

9A.7.89 The Environment Agency's Long-term Flood Risk Mapping shows the largest area that might be flooded if a reservoir were to fail and release the water it holds but do not give any information about the depth or speed of the flood waters.

9A.7.90 The mapping shows that the Hydrogen Pipeline Corridor, located to the north of the River Tees, crosses an area at residual risk of reservoir flooding when river levels are normal and when there is also flooding from rivers. This area includes Cowpen Marshes in proximity to the Holme Fleet, Swallow Fleet and Belasis Beck (to the east of Billingham), and to a lesser extent along the course of Greatham and Claxton Becks to the north.

9A.7.91 To the south and south-east of the Main Site, the Hydrogen Pipeline Corridor, Water Connections Corridor, and the Electrical Connection Corridor all pass over areas at residual risk of reservoir flooding. This area includes the Wilton International Site and

land off the A1053/Tees Dock Road (at residual risk when river water levels are normal) and areas adjacent to the Mill Race, The Fleet and Dabholm Gut (at residual risk when river levels are normal and when there is also flooding from rivers).

9A.7.92 The RCBC Level 1 SFRA states that *"the reservoirs within the borough do not receive flow from river catchments and would therefore not be subject to large inflows of water during storm conditions. The risk is therefore perceived to be low and further assessment not required".*

9A.7.93 Based on the information above the current risk of flooding from artificial sources is low.

Summary of Flood Risks to the Site

9A.7.94 Table 9A-20 presents a summary of key flood risks to the Proposed Development.

Table 9A-20: Summary of Key Flood Risks

FLOOD RISK	RISKS TO THE SITE	NOTES	MITIGATION REQUIRED
Tidal	Main Site — Low Connection Corridors —Low with areas of medium to high risk identified to the north of the River Tees	The Proposed Development Site is predominantly located in Flood Zone 1 and the Main Site and the majority of the connection corridor routes also remain in Flood Zone 1 when relevant climate change allowances are applied for tidal and fluvial flooding. Localised areas of the Connection Corridors are located within Flood Zone 2 and 3 and the application of climate change allowances will increase the risk of flooding from tidal and fluvial sources in these areas. There is also a high residual risk of flooding should overtopping or breach of flood defences occur, predominantly to the north of the River Tees.	Yes
Fluvial	Main Site — Low Connection Corridors —Low with areas of high risk identified to the north and south of the River Tees		Yes
Surface Water	Low/Very low across the Proposed Development Site	Areas of surface water flooding are associated with low topographical areas where surface water pools rather than draining away. Very few flood flow routes are	Yes

FLOOD RISK	RISKS TO THE SITE	NOTES	MITIGATION REQUIRED
		present within the Proposed Development Site boundary. When climate change is considered surface water runoff both to and from the Proposed Development Site will increase over the lifetime of the development.	
Groundwater	Medium	There is limited information on ground levels in the area, however it is expected that given the proximity to the coast, groundwater levels will be at OS datum. Excavations during the construction phase and the below ground development associated with the Connection Corridors may be at risk.	Yes
Drainage Infrastructure	Low to Medium	Historical flood records in the SFRAs suggest the risk of flooding is low to medium.	No
Artificial Sources	South Bank of the Tees – Low residual risk North Bank of the Tees - High residual risk	No canals are located in close proximity to the Proposed Development Site. The Main Site is not located in an area at residual risk of reservoir flooding, however the Hydrogen Pipeline Corridor to the north of the River Tees and the Connection Corridors to the south/south east of the Main Site pass through areas at risk of reservoir flooding should a failure or breach of a reservoir occur. However. the probability of a failure/ breach occurring is very low.	No

9A.8 Management of Surface Water from the Site

9A.8.1 A new surface water drainage network and management system will be provided for the Main Site that will provide adequate interception, conveyance and treatment of surface water runoff from buildings and hard standing. This will be separate to foul systems for welfare facilities and process wastewater generated by the operation of the Site. The connection corridors will not require additional drainage as they will be using existing pipe racks, pipe bridges or, culverts or otherwise installed underground.

9A.8.2 The drainage strategy will be defined in consultation with the LLFA (RCBC and STBC) and the Environment Agency. The principles of the drainage strategy are as follows:

- segregate hazardous and non-hazardous effluent;
- contain leaks and accidental spills via carefully designed collection system;
- establish requirement to segregate collection and to eliminate cross contamination prior to recovery and disposal;
- identify recovery and recycle interfaces for the drained fluids;
- ensure safe design with access for maintenance and inspection; and
- account for normal operations, maintenance draining and drainage during an emergency.

9A.8.3 The proposed drainage system once developed is assumed to include the use of SuDS where possible, to enable attenuation of surface water flows due to increases in the impermeable area as a result of the Proposed Development. SuDS will also provide treatment of runoff to ensure potential adverse effects on water quality are avoided. SuDS and the treatment train will be selected with reference to the Simple Index Approach of the SuDS Manual (CIRIA, 2016), although a more precautionary approach may be taken due to the industrial land use, which may increase the risk.

9A.8.4 Water discharged from the Main Site will be limited to the greenfield runoff rate when discharged into a Main River or an Ordinary Watercourse, and water storage (e.g., within an attenuation pond) will be appropriately sized to accommodate the 1% AEP event with 45% allowance for climate change. Water discharged into the Tees Bay via the NZT outfall will be discharged freely and without limitations.

9A.8.5 The key objectives of the site drainage system are to provide a drainage system which is inherently safe and protects the local environment and the anticipated outfall in Tees Bay from accidental discharges of oil, chemicals or run-off from firefighting effluent. Clean water, storm water and firewater drainage would be segregated from contaminated water through the minimisation of paved areas and use of rain shelters. Gravity drainage will be used wherever practicable.

9A.9 Mitigation of Residual Flood Risks and Off-Site Impacts

9A.9.1 Consideration should be given to measures that protect the Proposed Development from the residual risk of flooding in the event that the existing tidal defences overtop or fail in the vicinity of the Proposed Development Site, or in the event of heavy

rainfall that could result in surface water flooding at the Main Site if the design capacity of the drainage network is exceeded.

9A.9.2 This Section therefore provides recommendations for the construction and operation phases of the Proposed Development in accordance with the guidance provided in the NPS, SFRAs and by Environment Agency guidance on how the Proposed Development can be designed to withstand predicted flood risks and mitigate the impact.

Construction

Construction Environmental Management Plan

9A.9.3 Prior to construction starting on Site, a Final Construction Environmental Management Plan (CEMP) will be prepared The Final CEMP will be standard procedure for the Proposed Development and will describe the principles for the protection of the water environment during construction. Within the Final CEMP as a technical appendix will be a Water Management Plan (WMP). The WMP will outline the mitigation measures necessary to avoid, prevent and reduce adverse effects where possible upon the local surface water (and groundwater) environment during construction. A Framework CEMP will be prepared as part of the ES.

9A.9.4 The Framework CEMP will need to be reviewed, revised and updated as the project progresses towards construction to ensure all potential impacts and residual effects are considered and addressed as far as practicable, in keeping with available good practice at that point in time. The principles of the mitigation measures set out below are the minimum standards that the contractor will implement. However, it is acknowledged that for some issues, there are multiple ways in which they may be addressed.

- topsoil and other construction materials will be stored outside of the 0.5% AEP (1 in 200-year) floodplain extent and only moved to the temporary works area immediately prior to use;
- connectivity will be maintained between the floodplain, the River Tees and Greatham Creek, with no changes in ground levels within the floodplain;
- the construction laydown areas, site office, and supervisor will be notified of any potential flood occurring by use of the Environment Agency 'Floodline Warnings Direct' service;
- the Contractor will be required to produce a Flood Risk Management Action Plan/ Method Statement which will provide details of the response to an impending flood and include:
  - a 24-hour availability and ability to mobilise staff in the event of a flood warning;
  - the removal of all plant, machinery and material capable of being mobilised in a flood for the duration of any holiday close down period;
  - details of the evacuation and site closedown procedures; and

- arrangements for removing any potentially hazardous material and anything capable of becoming entrained in floodwaters, from the temporary works area.

9A.9.5 Finally, where not disapplied through the DCO (albeit it is the Applicant's intention to disapply where agreed), there may be the need for a number of secondary permissions for temporary and potentially some permanent works affecting watercourses or groundwater (e.g., flood risk activity permits, water activity permits, land drainage consents, and abstraction/impoundment licences). At this stage it is reasonable to assume that all temporary works will be carried out under the necessary consents/permits and that the contractor will comply with any conditions imposed by any relevant permission, or otherwise the matters covered by these secondary consents will be dealt with pursuant to the DCO.

Good Practice Guidance

9A.9.6 The following relevant Guidance for Pollution Prevention (GPPs) have been released to date on the NetRegs website (NetRegs, n.d.) and are listed below. While these are not regulatory guidance in England, it remains a useful resource for best practice. The best practice approaches will be secured through the Framework CEMP:

- GPP 1: Understanding your environmental responsibilities – good environmental practices;
- GPP 2: Above ground oil storage;
- GPP 3: Use and design of oil separators in surface water drainage systems;
- GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul sewer;
- GPP 5: Works and maintenance in or near water;
- GPP 8: Safe storage and disposal of used oils;
- GPP 13: Vehicle washing and cleaning;
- GPP 19: Vehicles: Service and Repair;
- GPP 20: Dewatering underground ducts and chambers;
- GPP 21: Pollution Incident Response Plans;
- GPP22: Dealing with spills;
- GPP26: Safe storage – drums and intermediate bulk containers; and
- GPP 27: Installation, decommissioning and removal of underground storage tanks.

9A.9.7 Where new GPPs are yet to be published, previous Environment Agency Pollution Prevention Guidance (PPGs) still provide useful advice on the management of construction to avoid, minimise and reduce environmental impacts, although they should not be relied upon to provide accurate details of the current legal and regulatory requirements and processes. Construction phase operations would be carried out in accordance with guidance contained within the following PPG:

- PPG6: Working at construction and demolition sites (Environment Agency, 2012);
- PPG7: Safe storage – the safe operation of refuelling facilities (Environment Agency, 2011); and
- PPG18: Managing fire water and major spillages (Environment Agency, 2000).

9A.9.8 Additional good practice guidance for mitigation to protect the water environment can be found in the following key CIRIA documents and British Standards Institute documents:

- British Standards Institute (2009) BS6031:2009 Code of Practice for Earth Works (British Standards Institute, 2009).
- British Standards Institute (2013) BS8582 Code of Practice for Surface Water Management of Development Sites (British Standards Institute, 2013a);
- C753 (2015) The SuDS Manual (second edition) (CIRIA, 2015a);
- C744 (2015) Coastal and marine environmental site guide (second edition) (CIRIA, 2015b);
- C741 (2015) Environmental good practice on site guide (fourth edition) (CIRIA, 2015c);
- C648 (2006) Control of water pollution from linear construction projects, technical guidance (CIRIA, 2006);
- C609 (2004) Sustainable Drainage Systems, hydraulic, structural and water quality advice (CIRIA, 2004);
- C532 (2001) Control of water pollution from construction sites – Guidance for consultants and contractors (CIRIA, 2001); and
- C736F Containment systems for prevention of pollution (CIRIA, 2014).

Construction of Hydrogen Pipeline Corridor – Trenchless Crossings

9A.9.9 A gaseous phase hydrogen pipeline network is required to connect various potential industrial off-takers across the Tees Valley to the Production Facility at the Main Site. This will require crossings of numerous watercourses.

9A.9.10 The Hydrogen Pipeline will be up to 24” in diameter and will cross the Tees Estuary and Greatham Creek (and adjacent water features at Seal Sands) using trenchless technologies (e.g. HDD or MBT). The Hydrogen Pipeline Corridor is shown in Figure 9-1 (PEI Report, Volume II), with a northern option (approximate NGR NZ 54687 24776) and southern option (approximate NGR NZ 53789 23211) for the crossing of the Tees Estuary still under consideration at this PEI Report stage. The Greatham Creek crossing would be at an approximate NGR of NZ 51436 25546.

9A.9.11 The use of trenchless technologies will minimise direct impact to the estuary bed and any flood defences present. Drilling will be a sufficient depth beneath the estuary bed to ensure that there is no risk of exposure, and this buffer distance will be agreed with the Marine Management Organisation (MMO). For the purposes of assessment this is assumed to be 10 - 15 m below the bed level.

9A.9.12 The sections of the Hydrogen Pipeline that will be installed via trenchless approaches will require launch, reception and jointing pits to be installed. It is assumed for the purposes of the assessment that the pit excavations for drilling/boring will be located at least 10 m from the watercourse edge, as measured from the top of bank, under which they will be directional drilled.

Construction of Hydrogen Pipeline Corridor – Above Ground and Open-Cut Crossings

9A.9.13 Various route options and construction methodologies are being considered for the remainder of the Hydrogen Pipeline Corridor (aside from the trenchless crossings discussed above). These include an option for below ground open trench (buried), installation on existing above ground pipe racks, and repurposing and reuse of existing pipelines (where possible). However, this is subject to ongoing design work, discussions with landowners and statutory consultees as well as being informed by environmental surveys.

9A.9.14 For the majority of the hydrogen pipeline corridor south of the River Tees, it is proposed to route along existing established pipeline corridors (generally above ground) where possible. There will be watercourse crossings of:

- Knitting Wife Beck (approximate NGR NZ 54580 23003);
- The Mill Race (approximate NGR NZ 57329 23682);
- Mains Dike (approximate NGR NZ 58121 22905); and
- The Fleet (approximate NGR NZ 56765 23730).

9A.9.15 These are all assumed to be above ground crossings utilising existing pipe bridges.

9A.9.16 Belasis Beck (approximate NGR NZ 48313 23194) to the south of the Tees off Cowpen Bewley Road will also be constructed above ground (NZ 48313 23194).

9A.9.17 The following watercourse pipeline crossings to the south of the Tees Estuary are assumed to require open cut methods for installation:

- Belasis Beck (at approximate NGR NZ 49397 23941); and
- Unnamed watercourses at NZ 51111 24826, NZ 49147 24367 and NZ 51221 26296.

9A.9.18 The exact number of watercourse crossings and their methodology will be known, and assessed fully, during the EIA and reported in the ES. Where open-cut installation of pipelines is required, the following mitigation will be in place:

- a pre-works morphology survey of the channel of each watercourse to be crossed will be undertaken prior to construction. The pre-works survey is to ensure that there is a formal record of the condition of each watercourse prior to commencement of works to install cables beneath the channel. The survey is a precautionary measure so that should there be any unforeseen adverse impacts there is a record against which any remedial action can be determined;
- at this stage it is assumed that where open-cut crossings are required that water flow would be maintained by damming and over pumping or fluming. Works will be carried out in the drier months where possible as this would reduce the

probability of a flood event occurring. It will be a requirement that the watercourses are reinstated as found. Regular observations of the watercourses will also be required post-works during vegetation re-establishment of the banks, especially following wet weather, to ensure that no adverse impacts have occurred. These requirements will be secured in the WMP, that will form a technical appendix of the Final CEMP.

Construction of Water Connection Corridor.

9A.9.19 Raw water will be supplied via the existing NWL raw water supply to the Teesworks site. There would also be a connection to NZT for use of the discharge outfall (for Case 2A and Case 2B) and a potential route for a Demineralised Water connection between the Main Site and Wilton International. At this stage in the development design, the water connections may be entirely above or below ground or a combination of the two. Agreements with NWL and the NZT project will be sought through the ongoing DCO process where required.

9A.9.20 Applying the Rochdale Envelope approach, the land required for the water connection options currently proposed for the Main Site has been depicted as a broad corridor. There is potential for watercourse crossings within the corridor depending on the final arrangement of infrastructure.

9A.9.21 For the majority of the Hydrogen Pipeline Corridor south of the River Tees, it is proposed to route along existing established pipeline corridors (generally above ground) where possible. There may be a need to cross the following watercourses:

- The Mill Race (approximate NGR NZ 57329 23682);
- Mains Dike (approximate NGR NZ 58121 22905 and NZ 57448 23552); and
- The Fleet (Tees Estuary S Bank WFD waterbody) (approximate NGR NZ 56765 23730).

9A.9.22 These are all assumed to be above ground crossings utilising existing pipe bridges. Belasis Beck (approximate NGR NZ 48313 23194) to the north of the Tees off Cowpen Bewley Road will also be constructed above ground (NZ 48313 23194).

9A.9.23 The following watercourse pipeline crossings to the north of the Tees Estuary are assumed to require open cut methods for installation:

- Belasis Beck (at approximate NGR NZ 49397 23941); and
- Unnamed watercourses at NZ 51111 24826, NZ 49147 24367 and NZ 51221 26296.

9A.9.24 The exact number of watercourse crossings and their methodology will be fully assessed during the EIA and reported in the ES. Where open-cut installation of pipelines is required, the following mitigation will be implemented.

Construction of Other Gases Connections

9A.9.25 Other gas connection pipelines may be required for the transportation of compressed O_2 and N_2 for use at the Production Facility. At this stage in the design development, the connections for other gases may be entirely above or below

ground or a combination of the two. There is potential for watercourse crossings relating to the Fleet (Tees Estuary S Bank), Mains Dike and Dabholm Beck. At this stage, and applying a precautionary worst-case scenario, it is assumed that all these watercourses will be crossed using open-cut techniques, following the mitigation outlined above with regard to the Hydrogen Pipeline Corridor.

Construction of Electrical Connection Corridor

9A.9.26 There is existing electrical infrastructure in the area which comprises a combination of overhead and lower voltage underground cables that serve the local area and other industrial users located in proximity to the Proposed Development Site. The final decision on substation choice will be subject to design development and further work based on constructability and electrical network resilience and capacity.

9A.9.27 At this stage in the design development, the electrical connection may be entirely above or below ground or a combination of the two. The Electrical Connection Corridor is currently depicted as broad corridors.

9A.9.28 There is potential for watercourse crossings within these corridors depending on the final arrangement of infrastructure. The locations are not known at this stage but affected watercourses may include:

- The Fleet (Tees Estuary S Bank);
- Mains Dike;
- Dabholm Beck;
- Kinkerdale Beck;
- The Mill Race;
- Cross Beck; and
- Knitting Wife Beck.

9A.9.29 At this stage, and applying a precautionary worst-case scenario, it is assumed that all these watercourses will be crossed using open-cut techniques, following the mitigation outlined above with regard to the Hydrogen Pipeline Corridor.

Management of Flood Risk

9A.9.30 All construction materials and temporary compounds associated with the construction of the Proposed Development will be located in Flood Zone 1 where possible. During the construction phase, the contractor will monitor weather forecasts and plan works accordingly. In addition, the Contractor will sign up to Environment Agency flood warning alerts and describe in the Emergency Response Plan the actions it will take in the event of a possible flood event. These actions will be hierarchal meaning that as the risk increases the contractor will implement more stringent protection measures. This is important to ensure all workers, the construction site and third-party land, property and people are adequately protected from flooding during the construction phase.

9A.9.31 The contractor will be required to produce a Flood Risk Management Action Plan/ Method Statement which will provide details of the response to an impending flood and include:

- a 24-hour availability and ability to mobilise staff in the event of a flood warning;
- the removal of all plant, machinery and material capable of being mobilised in a flood for the duration of any holiday close down period;
- details of the evacuation and site closedown procedures; and
- arrangements for removing any potentially hazardous material and anything capable of becoming entrained in floodwaters, from the temporary works area.

9A.9.32 If water is encountered during below ground construction, suitable de-watering methods will be used with reference to a Construction Dewatering Strategy. Any significant groundwater dewatering that is required (i.e. more than 20 m^3 per day) will be undertaken in line with the requirements of the Environment Agency (under Water Resources Act 1991 as amended) and Environmental Permitting Regulations (2016).

9A.9.33 Safe egress and exits are to be maintained at all times when working in excavations. When working in excavations a banksman is to be present at all times.

Works in Proximity to Flood Defences

9A.9.34 The Hydrogen Pipeline Corridor will cross the Tees Estuary and Greatham Creek (and adjacent water features at Seal Sands) using trenchless technologies (e.g. HDD or MBT). Dependent on the final corridor route, construction of the corridor would include sections in proximity to the following Environment Agency flood defences:

- defences along Greatham Creek (running north towards the Venator Plant);
- a flood embankment on the north bank of Greatham Creek, which is to be significantly repaired as part of Environment Agency's Greatham North East Flood Alleviation Scheme (FAS);
- Cowpen Marsh (between the Cowpen Bewley Landfill (to the west) and the Teesmouth and Cleveland Coast Special Protection Area (SPA) (to the east);
- a flood embankment to the south of the ConocoPhillips tank farm (north of Greatham Creek); and
- a flood embankment on the south bank of Greatham Creek (Sabic Embankment).

9A.9.35 The Environment Agency require the existing flood standard of protection, provided by the defences to be maintained both during the construction of the pipeline, and after completion of the scheme, whichever route is chosen.

9A.9.36 Continued consultation with the Environment Agency will be maintained to ensure no impacts to flood defence assets. In order minimise the impact of the Proposed Development Site on the flood defences, consideration will be given to the following (with details able to be agreed pursuant to Protective Provisions for the EA within the DCO):

- where the pipeline crosses a flood defence structure below ground, designs for the pipeline must include a load case for the top water level. This may be different at each location. The pipeline must also be at a suitable depth to ensure the stability of the flood defence structure, this is to be demonstrated in submitted designs;
- should the pipeline cross a flood defence structure above ground loading to flood defence asset will need to be considered and the design must not impede access for routine maintenance and inspections of the flood defence structure;
- if the pipeline crosses a watercourse above ground, it must be appropriately designed and positioned to prevent accumulation of debris and localised increases in water levels;
- where the pipeline is to utilise existing pipework that crosses watercourses, it is expected that modifications to the structure will be made where possible for improved conveyance and reduce debris accumulation;
- where ground levels near a flood defence are to be disturbed on either a permanent or temporary basis, designs must not allow additional water to pond at the toe of the flood defence, and
- excavations near the footprint of a flood defence must remain a safe distance away from the toe of the defence to ensure stability of the defence. This must be demonstrated in submitted designs.

9A.9.37 Directional drilling is permitted when crossing a flood defence provided:

- the drilling operation does not affect the stability of the flood defence structure by inducing a geotechnical failure, including when it is retaining flood water; and
- the drilling or permanent works do not provide a conduit for water seepage underneath the flood defence structure, including when it is retaining flood water.

9A.9.38 In order to maintain the standard of protection, the Environment Agency requires continued access to continue routine maintenance of the existing and planned defences. Any permissions or legal agreements to allow these works to go ahead, would be agreed in advance of pipeline construction.

Operation

9A.9.39 A number of mitigation features will be incorporated into the design of the Proposed Development design in order to avoid, minimise and reduce potential adverse impacts on flood risk, and these are described in the following sections.

9A.9.40 The following mitigation measures are considered to protect the Proposed Development at the Main Site in accordance with the legislative and regulatory authority requirements:

- flood resistance and resilience measures;
- flood Emergency Response Plans
- Flood Warnings and Alerts;

- emergency access and egress; and
- design capacity exceedance.

Flood Resistance and Resilience Measures

9A.9.41 The following flood resilience and resistance mitigation measures were considered to ensure the operation of the development is maintained during inundation, and to ensure the safety of people:

- raising external ground levels; and
- elevating critical plant equipment and/or internal finished floor levels above the peak flood inundation level.
- flood resistant/resilient design.

Raising External Ground Levels

9A.9.42 The predicted (undefended) peak flood level for the Main Site during a 0.1% AEP (1 in 1,000 chance) H++ climate change flood scenario up to 2105 is calculated to be 6.23m AOD. This estimation is based on the updated Environment Agency climate change sea level allowances (UKCIP18) and the 2019 existing baseline water level information. To protect all critical equipment assets on site ground levels at the Main Site a +600mm freeboard is added to the flood level resulting in the development platform for the Production Facility being no lower than 6.83m AOD following site clearance and remediation. Not only does this ensure the Proposed Development will remain elevated above the estimated H++ peak flood level, the raised ground levels, will also allow sufficient depth for installation of the drainage system with gravity discharge and connection to NEP.

9A.9.43 Although the elevation of the Main Site will be at a minimum level of 6.83m AOD following site clearance and remediation, there are no proposals to raise land in Flood Zones 2 and 3a for the purposes of protecting the Proposed Development. Therefore, flood water will not be displaced, and this will not pose an increased risk of flooding off-site to adjacent land uses. No flood volume compensation is therefore required.

Critical Plant Equipment

9A.9.44 Relevant pieces of critical equipment include:

- electrical equipment, switchboards and control panels;
- transformers;
- main boiler feed pumps;
- condensate extraction pumps; and
- primary air fan and induced draught fan.

9A.9.45 As the Main Site will be located on a development platform above the H++ climate change scenarios water level, critical equipment will remain in Flood Zone 1, at low risk of flooding.

9A.9.46 If required, identification will also be undertaken of items of critical plant along the Pipeline Corridors for which spares can be kept on the Main Site, and storage of those items on the

Main Site will be implemented to reduce the potential recovery time in the event of a major flood event.

Flood Resistant and Resilient Design

9A.9.47 CIRIA Report C688 'Flood Resilience and Resistance for Critical Infrastructure' (CIRIA, 2010), states that *"Flood resilience involves designing an infrastructure asset or adapting an existing infrastructure asset so that although it comes into contact with floodwater during floods, no permanent damage is caused, structural integrity is maintained and, if operational disruption does occur, normal operation can resume rapidly after a flood has receded. Flood resistance involves designing an infrastructure asset or adapting an existing infrastructure asset so that floodwater is excluded during flood events and normal operation can continue with no disruption occurring to the essential services the asset provides".*

9A.9.48 The following measures are also considered appropriate and have been included within the design and layout of the Proposed Development:

- pipelines and storage tanks designed to withstand the water pressures associated with high return period event flooding;
- tanks (if required) securely tethered in such a way to ensure the infrastructure remains secure should flooding occur;
- protecting wiring for operational control of the Proposed Development, telephone, internet and other services by suitable insulation in the distribution ducts to prevent damage;
- materials with low permeability up to 0.3 m and accept water passage through building at higher water depths;
- flood proofing including the use of flood resistant building materials, use of water-resistant coatings, use of galvanised and stainless-steel fixings and raising electrical sockets and switches;
- utilising floor materials that are able to withstand exposure to floodwater without significant deterioration and that can be easily cleaned e.g. concrete-based or stone;
- incorporating water resistant services within the buildings i.e. avoid services using ferrous materials;
- design development to drain water away after flooding;
- provide access to all spaces to permit drying and cleaning;
- carefully considering the type of usage and layout of ground floor areas to minimise the potential impact on business operations following a flood; and
- suitable waterproofing measures to development located below ground i.e. tanking below ground storage areas etc.;
- pollution control will be implemented to prevent/ reduce the chance of any fuel/ material stored on site leaking;

- landscaping of the Site or building curtilage will be designed to direct or divert floodwater away from buildings; and
- SuDS will be designed to manage surface water flood risk and water quality.

Flood Warnings and Alerts

9A.9.49 The Environment Agency operates a Flood Warning Service for many areas at risk of fluvial and tidal flooding. The service currently consists of three stages:

- Flood Alert - flooding is possible and that you need to be prepared;
- Flood Warning - flooding is expected and that you should take immediate action. Action should be taken when a flood warning is issued and not wait for a severe flood warning; and
- Severe Flood Warning - there is severe flooding and danger to life. These are issued when flooding is posing significant risk to life or disruption to communities.

9A.9.50 Each code gives an indication of the expected level of danger. Although some members of the public find Flood Watches useful, they are predominantly targeted towards professional partners, alerting them to expected flooding of low-lying land and roads.

9A.9.51 All stages of warning are disseminated via the 'Floodline Warnings Direct', which is a free service that provides warnings to registered customers by telephone, mobile, email, SMS text message and fax. Local radio, TV, loudhailers, sirens and Floodline are also used to deliver flood warning messages. The Floodline number is 0845 988 1188, and it is always kept up to date with the Environment Agency's latest flooding information.

9A.9.52 More detailed information on the likely extent and time scale of these warnings can be obtained by request from the Environment Agency, by their 'Quick dial' recorded information service, or via their website.

9A.9.53 For any proposed commercial or industrial developments within a designated floodplain (as in the case of some areas of the Proposed Development Site), a system for monitoring flood warnings should be developed with designated responsible persons (site managers) able to monitor and disseminate the warnings. This will provide more time to enable emergency access and egress of staff occupants away from the local area which may become flooded during a flood event (including routes for egress) prior to inundation. They should also enable sufficient time to implement protection measures for any equipment on site. This is particularly relevant to the construction phase.

9A.9.54 The Proposed Development Site is located within a designated Environment Agency Flood Alert Area (short code 121WAT926 covering low lying land surrounding Tidal River Tees, downstream of the Tees Barrage, including areas of Middlesbrough and Billingham).

9A.9.55 The connection corridors at Seal Sands and Saltholme are located within a designated Environment Agency Flood Warning Area (FWA) (short code name 121FWT565 covering industrial properties on Seal Sands, Southern Graythorp and Billingham Fire Station). Due to the 24 hour a day nature of the operations at the Proposed Development Site, the Proposed Development Site will be registered with the Environment Agency's Flood Warnings Direct service and monitoring of the warnings is adopted at the Site to mitigate

the residual risk of tidal/fluvial flooding in the event of overtopping or defence failure in the vicinity.

Flood Emergency Response Plan

9A.9.56 It is recommended that a Flood Emergency Response Plan be developed for the Proposed Development to ensure the residual risk to the site over the lifetime of the development is sufficiently managed and mitigated. A management system will be implemented to respond to a variety of emergency situations both during normal hours (24/7) and over holiday periods.

9A.9.57 A Flood Emergency Response Plan will be prepared in consultation with the Environment Agency and LLFAs. This will define access and egress routes from the Main Site, which will include recommendations on the best route, signage strategy in and around the area and congregation points. It will ensure that the development is registered to receive flood warnings from the Environment Agency's 'Floodline Warnings Direct' service to inform if there is a risk of flooding from a tidal storm surge type event which could result in overtopping or breach of defences. This will include the recommendation of at least one Flood Warden for the plant.

9A.9.58 As the Flood Emergency Response Plan will be set up to manage the residual risk of flooding, careful consideration will be undertaken as to what action will be taken at each level of warning. The plan will define how occupants of the Site will be evacuated to an appropriate safe place of refuge should there be a real risk of flooding, as the safety of all occupants is essential. However, it is also important to ensure that the site is only evacuated when necessary.

Emergency Access and Egress to/from the Proposed Development Site

9A.9.59 An emergency access and egress route is a route that is 'safe' for use by occupiers without the intervention of the emergency services or others. A route can only be completely (safe' in flood risk terms if it is dry at all times.

9A.9.60 For developments located in areas at flood risk, the Environment Agency consider 'safe' access and egress to be in accordance with paragraph 039 of the NPPF PPG, and FRA Guidance for new Developments FD2320 (DEFRA and Environment Agency, 2005), where the requirements for safe access and egress from new developments are as follows in order of preference:

- safe, dry route for people and vehicles;
- safe, dry route for people;
- if a dry route for people is not possible, a route for people where the flood hazard in terms of depth and velocity of flooding) is low and should not cause risk to people; and
- if a dry route for vehicles is not possible, a route for vehicles where the flood hazard (in terms of depth and velocity of flooding) is low to permit access for emergency vehicles.

9A.9.61 For 'essential infrastructure' development, it is considered that dry access and egress from the site will be desirable during times of extreme floods.

9A.9.62 Surface water flood maps indicate the access road to and from the Main Site is affected by surface water flooding during higher return period events. Mapping shows flooding to a depth of 300 to 900mm at the A1085/West Coatham Lane roundabout junction. Should flooding occur in this location appropriate access/egress will be required on the access road to and from the Main Site in case flooding occurs. Alternatively, staff could be evacuated from the Site, via the northern gate from the PCC Site onto South Gare Road and then east to Redcar via Warrenby.

Place of Safe Refuge

9A.9.63 Safe places of refuge are generally considered an acceptable approach to flood risk management in areas adjacent to sea defences as in the event of a defence breach, inundation is likely to be rapid and therefore evacuation from the Main Site and local area can sometimes be an unsafe option.

9A.9.64 The Main Site is located within Flood Zone 1 for both the current flood risk and all climate change scenarios, including the H++ allowance for the 0.5% AEP and 0.1% AEP flood events therefore a place of safe refuge is unlikely to be required.

Exceedance Flows

9A.9.65 Following the completion of the Proposed Development, an additional residual risk relates to maintenance of the on-site drainage infrastructure. Failure, blockage and capacity exceedance above that of the design events for the drainage system are a potential risk to the Main Site and the surrounding area.

9A.9.66 To reduce the risks, maintenance of the system will be incorporated in general site management and remains the responsibility of the operator. A manual will be prepared detailing each drainage feature on site, the maintenance required, timescales for maintenance and who is responsible for undertaking the maintenance. It is expected the Site owners will ultimately be responsible for maintenance of the site drainage system including all pipes, discharge structures and any SUDS implemented on site in accordance with the recommendations in the SuDS Manual.

9A.9.67 CIRIA 0635 (CIRIA, 2005) provides guidance on measures that can be incorporated into the detailed design of developments to steer surface water that has exceeded the capacity of the drainage system away from buildings and route it towards the intended point of discharge (for example along swales and roads using raised kerbing and through parking areas).

Decommissioning

9A.9.68 At the end of its design life decommissioning of the Proposed Development will see the removal of all above ground equipment down to ground level and the ground remediated to enable future re-use.

9A.9.69 It is assumed that all underground infrastructure will remain in-situ; however, all connection and access points will be sealed or grouted to ensure disconnection. At this stage it is assumed that decommissioning impacts are expected to be limited and will be the same/similar to the construction impacts, as discussed above.

9A.9.70 A Decommissioning Environmental Management Plan (DEMP) will be produced and agreed pursuant to a DCO Requirement. The DEMP will consider in detail all potential

environmental risks and contain guidance on how risks can be removed, mitigated or managed. This will include details of how flood risk and surface water drainage should be managed at the Proposed Development Site during decommissioning and demolition.

Permits and Consents

9A.9.71 Various water-related permissions may be required where it is not agreed with the relevant regulating authority to disapply them through the DCO. These permissions may include:

- Land drainage consent(s) under section 23 of the Land Drainage Act 1991for works affecting the flow in ordinary watercourses;
- Flood risk activity permit(s) from the Environment Agency under the Environmental Permitting Regulations (England and Wales) 2016 in connection with works to main rivers (e.g. Greatham Creek, River Tees);
- Water activity permit(s) from the Environment Agency under the Environmental Permitting Regulations (England and Wales) 2016 for temporary construction and permanent operational discharges;
- Full or temporary water abstraction licence(s) under section 24 of the Water Resources Act 1991 (if more than 20 m3/d is to be dewatered/over-pumped and exemptions do not apply); and
- Temporary water impoundment licence under section 25 of the Water Resources Act 1991 in connection with the laying of cables.

9A.10 Summary and Conclusions

Flood Risk Summary

Tidal Sources

9A.10.1 Flooding from tidal sources is the predominant flood risk to the Proposed Development.

9A.10.2 Based on the Environment Agency FMfP, it has been determined that during the existing scenario the Main Site and the majority of the connection corridor routes are at a 'low' risk of flooding from tidal sources (River Tees and Greatham Creek) during events that exceed a 0.5% AEP (1 in 200 chance) flood event.

9A.10.3 During a future scenario resulting from climate change up to 2125 and a H++ scenario to 2100, the Main Site remains at 'low' risk of flooding during events that exceed a 0.5% AEP (1 in 200 chance) of flooding and the 0.1% AEP (1 in 1000 chance) event when mitigation comprising a minimum site elevation of 6.83m AOD is included.

9A.10.4 To the north of the River Tees, the Hydrogen Pipeline corridor located between the tidal River Tees and Greatham Creek is at high risk of flooding from tidal sources during events that exceed a 0.5% AEP (1 in 200 chance) flood event and the climate change flooding scenarios. This section of the Proposed Development Site is also at high residual risk of flooding should a failure or breach of the flood defences occur. However, works in this area comprise either underground pipework or installation of

pipelines on existing pipe racking. The need to develop the pipelines in this location is essential to connect to existing industrial sources seeking to decarbonise through the proposed CO_2 Export Corridor and export infrastructure.

9A.10.5 Elements of the Proposed Development Site that are located within Flood Zone 3a will not result in a loss of floodplain storage volume and will not result in a change in flood routes, therefore, flood risk to third parties will not increase.

9A.10.6 Appropriate mitigation measures are proposed for the construction phase in this area of higher flood risk. These measures will be secured through the CEMP (to be discharged by DCO requirement), best practice and in consultation with the Environment Agency with regards maintaining the integrity of the flood defences.

Fluvial Sources

9A.10.7 The information provided by the Environment Agency FMfP identifies the Main Site to be at 'low' risk of fluvial flooding from Ordinary watercourses located in proximity to the Proposed Development Site boundary.

9A.10.8 During a future scenario resulting from climate change up to the year 2125 the Main Site remains at 'low' risk of fluvial flooding therefore appropriate mitigation measures are not required to be implemented at the Proposed Development Site to mitigate this risk.

9A.10.9 Where the risk of flooding from fluvial sources is currently assessed as high, the risk category of flooding to the Proposed Development Site is not likely to increase due to climate change. If a flood event did occur, the impact of climate change would result in an increase in the depth and extent of floodwater across the areas of the site affected by flooding from this source during a 1% (1 in 100 chance) event.

9A.10.10 The connection corridors to the south and south-west of the Main Site will generally be located above ground and will remain at low risk of flooding from fluvial sources, including all climate change scenarios. The only exception is the proposed open-trench channels for the Hydrogen Pipeline Corridor, running to the east and alongside of the Seaton Carew Road.

9A.10.11 Flood risk from fluvial sources (ordinary watercourses) on the north bank of the River Tees, between Billingham and Seal Sands, will increase for all climate change scenarios. Therefore, the Hydrogen Pipeline Corridor will be at risk of flooding over the lifetime of the development. However, most of it will be located underground and in an existing unattended service corridor and is therefore considered acceptable development within Flood Zone 3a. Any maintenance work (e.g., pigging) will be undertaken in accordance with the Flood Emergency Response Plan.

9A.10.12 Appropriate mitigation measures are proposed for the construction phase in this area of higher flood risk. These measures will be secured through the CEMP (to be discharged by DCO requirement), best practice and in consultation with the Environment Agency with regards maintaining the integrity of the flood defences.

9A.10.13 The Main Site will be constructed at a level no lower than 6.83m AOD (derived from the 6.23m AOD flood level for a 0.1% AEP H++- plus 600mm freeboard). The

operational development remains above the maximum flood level and no further mitigation is required.

Surface Water Runoff to the Site

9A.10.14 The risk of surface water flooding within the Proposed Development Site from elsewhere or generated within the Site is considered to be 'low to very low'.

Groundwater

9A.10.15 The risk of groundwater flooding within the Proposed Development Site is considered to be 'medium'. However, should the Proposed Development comprise below ground development within strata where groundwater is recorded as present, mitigation measures, including those outlined in British Standard 8102 (BS8102) will be required to reduce the risk of groundwater flooding to underground structures.

Drainage Infrastructure

9A.10.16 The Proposed Development Site is not located in an area defined as a CDA and there are no historic records of flooding from drainage infrastructure sources for the Study Area in the LLFA SFRAs. Areas associated with flooding from sewerage infrastructure are concentrated in residential areas such as Eston. The risk of flooding from drainage infrastructure is therefore assessed as low.

Artificial Sources

9A.10.17 There are no canals located in close proximity to the Proposed Development Site, however, land between the north bank of the River Tees and the south bank of Greatham Creek is located in an area at residual risk of flooding should a failure or breach of a reservoir occur.

Management of Surface Water Runoff from the Site

9A.10.18 A new surface water drainage network and management system will be provided for the Main Site that will provide adequate interception, conveyance and treatment of surface water runoff from buildings and hard standing. This will be separate to foul systems for welfare facilities and process wastewater generated by the operation of the Proposed Development Site. The connection corridors will not require additional drainage as they will be using existing pipe racks, pipe bridges or, culverts or otherwise installed underground.

Residual Risk Mitigation Measures

9A.10.19 A number of mitigation measures are proposed in areas of the Proposed Development Site where construction will take place in Flood Zone 3a as set out in this assessment. These measures will be secured through the Final CEMP to be discharged by requirement of the draft DCO and will be considered during the design process for the Proposed Development to ensure the operation of the Main Site is maintained in the event of an extreme flood.

9A.11 References

- BEIS (2011a). National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines: EN-4. London: The Stationery Office.
- BEIS (2011b). National Policy Statement for Electricity Networks Infrastructure: EN-5. London: The Stationery Office.
- BEIS (2021). Overarching National Policy Statement for Energy: EN-1. London: The Stationery Office.
- DESNZ (2023a). National Policy Statement for Natural Gas Electricity Generating Infrastructure: EN-2. London: The Stationery Office.
- DESNZ (2023b). Draft Overarching National Policy Statement for Energy: EN-1. London: The Stationery Office.
- DESNZ (2023c). Draft National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines: EN-4. London: The Stationery Office.
- DESNZ (2023d). Draft Overarching National Policy Statement for Electricity Networks Infrastructure: EN-5. London: The Stationery Office.
- British Geological Survey (n.d.). *Onshore 'GeoIndex'* [Online] Available at: https://mapapps2.bgs.ac.uk/geoindex/home.html.
- British Standards Institute (2009). BS6031:2009 Code of Practice for Earth Works. London: British Standards Institute.
- British Standards Institute (2013a). BS8582 Code of Practice for Surface Water Management of Development Sites. London: British Standards Institute.
- CIRIA (2004). C609 Sustainable Drainage Systems, hydraulic, structural and water quality advice. London: CIRIA.
- CIRIA (2006). C635 Designing for exceedance in urban drainage - good practice. London: CIRIA.
- CIRIA (2010). 0688 Flood Resilience and Resistance for Critical Infrastructure. London: CIRIA.
- CIRIA (2015a). *C753 The SuDS Manual. London: CIRIA*. [Online]. Available at: https://www.ciria.org/ItemDetail?iProductCode=C753&Category=BOOK&WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91v
- CIRIA (2015b). C744 Coastal and marine environmental site guide (second edition). London: CIRIA. CIRIA (2015c). C741 Environmental good practice on site guide (fourth edition). London: CIRIA
- Cranfield University (n.d.). *Soilscapes* [Online] Available at: http://vvvvw.landis.ord.ukisoilscapes.
- Department for Communities and Local Government (2022). *Flood Risk and Coastal Change Planning Practice Guidance* [Online]. Available at: http://planninddduidance.plannindportal.dov.uk.

- DEFRA (2011a) *UK Marine Policy Statement*. Available at: https://www.gov.uk/government/publications/uk-marine-policy-statement
- DEFRA (2015). Sustainable Drainage Systems: non-statutory technical standards. London: The Stationery Office.
- DEFRA (n.d.). *Multi-Agency Geographic Information for the Countryside (MAGIC)* [Online]. Available at: https://magic.defra.gov.uk/MagicMap.aspx .
- DEFRA and Environment Agency (2005). Framework and Guidance for Assessing and Managing Flood Risk for New Development FD2320 R&D Technical Report 2. London: DEFRA.
- Department of Energy and Climate Change (2011). The Overarching NPS for Energy (EN-1). London: The Stationery Office.
- Agency (2009a). Tees Catchment Flood Management Plan. Summary Report. Leeds: Environment Agency.
- Environment Agency (2016). Northumbria River Basin District Flood Risk Management Plan 2015 — 2021. Bristol: Environment Agency.
- Environment Agency (2023). *Flood risk assessments: climate change allowances* [Online]. Available at: https://vvwwdov.ukiduidanceiflood-risk-assessments-climate-chande-allowances.
- Environment Agency (n.d.a). *Flood Map for Planning* [Online]. Available at: httbs://flood-map-for-biannind.service.dov.ukisummarv/525904/410996.
- Environment Agency (n.d.b). *Long-term Flood Risk Information* [Online]. Available at: https://flood-warning-information.service.gov.ukilong-term¬flood-risk.
- Environment Agency (n.d.c) *Catchment Data Explorer* [Online]. Available at: http://environment.data.dov.ukicatchnnent-plannindi.
- Environment Agency (2001). *Pollution Prevention Guidance* [Online]. Available at: https://www.gov.uk/government/collections/pollutionhttps://www.gov.uk/government/collections/pollution-prevention-guidance-ppg
- Environment Agency (2016). Di*scharges to surface water and groundwater: environmental permits* [Online]. Available at: https://www.gov.uk/guidance/discharges-to-surface-water-and-groundwaterhttps://www.gov.uk/guidance/discharges-to-surface-water-and-groundwater-environmental-permitsenvironmental-permits.
- Flood and Water Management Act 2010 (c.29)(s.4). London: The Stationery Office.
- Hartlepool Borough Council (2010). *Strategic Flood Risk Assessment Level 1* [online]. Available at: https://www.hartlepool.gov.uk/download/downloads/id/2951/hlp03_34_strategic_flood_risk_assessment_level_1_vol_2_2010pdf.pdf

- Hartlepool Borough Council (2016). *Local Flood Risk Management Strategy* [online]. Available at: https://www.hartlepool.gov.uk/download/downloads/id/2469/local_flood_risk_management_strategypdf.pdf
- HM Government (2015). The Building Regulations 2010 Approved Document H, Drainage and Waste Disposal (2015 Edition). London: The Stationery Office.
- JBA Consulting (2017). *Hartlepool Borough Council Level 1 Strategic Flood Risk Assessment* [Online] Available at: https://www.hartlepool.gov.uk/download/downloads/id/3344/ex_hbc_26_sfra_level_1_reportpdf.pdf
- Ministry of Housing, Communities and Local Government (2021). *National Planning Policy Framework* [Online]. Available at: National Planning Policy Framework (publishing.service.gov.uk)
- Ministry of Housing, Communities and Local Government (2019b). *National Design Guidance* [Online]. Available at: https://www.gov.ukigovernmentipublicationsinational-design-guide.
- NetRegs (n.d.). *Environmental Guidance for your Business in Northern Ireland and Scotland* [Online]. Available at: http://www.netregs.org.uk/environmental-topics/pollution-preventionguidelines-ppgs-and-replacement-series/guidance-for-pollutionhttp://www.netregs.org.uk/environmental-topics/pollution-preventionguidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/prevention-gpps-full-list/
- Redcar and Cleveland Borough Council (2010). Redcar & Cleveland Borough Council Level 2 Strategic Flood Risk Assessment Update. Final Report August 2016. Prepared by JBA Consulting.
- Redcar and Cleveland Borough Council (2011). *Redcar and Cleveland BC Preliminary Flood Risk Assessment* [Online]. Available at: https://webarchive.nationalarchives.clov.uk/20140328094438/http://vvwvv.environment-aciencv.gov.ukiresearchiplannincril35528.aspx#1 Prepared by JBA Consulting.
- Redcar and Cleveland Borough Council (2016). *Redcar & Cleveland Borough Council Level 1 Strategic Flood Risk Assessment Update* [Online]. Available at: https://wvvwsedcar-clevelandsiov.ukiresidentiplanninq-and-buildinciilocal-planiLocal%20Plan%20Documents/Redcar%20and%20Cleveland%20Strateqic%20Flood%20Risk%20Assessment%20(Level%201)/RCBC%20Level%201%20SFRA%20Update%202016.pdf.
- Stockton-on-Tees Borough Council (2018a). *Stockton-On-Tees Borough Council Level 1 Strategic Flood Risk Assessment. Final Report, March 2018* [Online]. Available at: https://wvvw.stocktonsiov.ukimedia/1585590/sfra-level-1-2018.pdf Prepared by JBA Consulting.
- Stockton-on-Tees Borough Council (2018b). *Stockton-On-Tees Borough Council Local Plan Potential Sites Assessment Level 2 Strategic Flood Risk Assessment -*

Site Screening April 2018 [Online]. Available at: https://www.stockton.aov.ukimedia/1585589/sfra-level-2-2018.pdf Prepared by JBA Consulting.

- Redcar and Cleveland Borough Council (2017). *Redcar & Cleveland Borough Council Local Flood Risk Management Strategy* [Online]. Available at: https://www.redcar-cleveland.qov.ukfresidentifloodinci/Documents/Redcar%20%26%20Clevela nd%20Boroucrh%20Council%20Flood%20Risk%20Stratecry.pdf.
- Royal Haskoning. (2007). *Shoreline Management Plan 2 River Tyne to Flamborough Head. Final, February 2007* [Online]. Available at: http://www.northeastsmp2.om.ukidocsifinalsmp2/SMP2-FinalV2.pdf.
- Stockton-on-Tees Borough Council (2011). *Preliminary Flood Risk Assessment* (online]. Available at: https://www.stocktonsiov.ukimediai5452/preliminary-flood-risk-assessment lodf.
- Stockton on Tees Borough Council (2015) *Stockton on Tees Borough Council Local Flood Risk Management Strategy* [Online]. Available at: https://wmv.stockton.gov.ukimedia/5525/local-flood-risk-strategy-oct-15.pdf.
- Stockton-on-Tees Borough Council (2019.) *Stockton-on-Tees Borough Council Local Plan* [Online]. Available at: https://wwwstockton.ciov.ukimediail585775/localplanmainrenortcontents.p df.
- The Tees Valley Authorities (2015). *Local Standards for Sustainable Drainage* [Online]. Available at https://wmv.hartlepool.clov.ukidownloadsifile/2472/tees valley authorities I oval standards for suitable drainage.
- University of Dundee (2020). *Chronology of British Chronological Events* [Online]. Available at: http://cbhe.hydrology.org.uki.

ANNEX A – CONSULTATION RESPONSES

creating a better place
for people and wildlife

Environment Agency

Catriona Scobie
AECOM
1 New York Street
Manchester
Lancashire
M1 4HD

Our ref: NA/2023/116167/01-L01
Your ref: H2 Teesside

Date: 17 March 2023

Dear Catriona

CHARGED PLANNING ADVICE (ENVPAC/1/NEA/00127): REQUEST FOR ADVICE FOR A 1.2GW BLUE HYDROGEN PRODUCTION FACILITY WHICH DERIVES HYDROGEN (H2) FROM NATURAL GAS, WITH THE CARBON DIOXIDE (CO2) RELEASED FROM THE PROCESS BEING CAPTURED, TRANSPORTED AND STORED OFFSHORE. THE PROPOSED DEVELOPMENT WILL BE BUILT OVER 2 PHASES WITH PHASE 1 BEING OPERATIONAL BY 2027 AND PHASE 2 BY 2029/30. FLOOD RISK, WASTE, WFD, AND WQ ADVICE REQUESTED. FOUNDARY, SOUTH GARE ROAD, REDCAR, TS10 5NX

We are pleased to provide planning advice on the above development to proposal.

Environment Agency Comments
We have reviewed the information submitted below and have the following comments/advice to offer:

- All utility connection corridor map; and.
- Charged request form

Reuse of Made Ground
Use of made ground in development projects is often undertaken using the CL:AIRE Definition of Waste Code of Practice (DoWCoP). This allows waste materials to be used outside of waste legislation, providing four key factors are met relating to certainty of use, quantity used, suitability for use and the environment and human health is protected.

Reuse of the made ground on this development site is unlikely to be suitable for use under the DoWCoP. This is because the material is likely to consist of blast furnace slag and other historic contaminants. As such, reuse of the material would not be considered low risk for use under the DoWCoP as it presents a risk of causing pollution to the environment. We would therefore recommend that an Environmental Permit is sought to authorise and condition any proposed reuse of the made ground. We would also encourage the developer to request pre-application advice to discuss permitting options.

Further information is available at: Get advice before you apply for an environmental permit - GOV.UK (www.gov.uk)

Landfill Sites

The proposed Development Consent Order (DCO) boundary includes interaction with several areas of historic landfill. Historic landfill sites are sites where an environmental permit or waste management licence is no longer in place. They generally operated prior to the onset of key pieces of legislation such as the Control of Pollution Act (1974) or the Waste Management Licencing Regulations (1994). They operated under regimes which required less assessment around waste acceptance and little or no engineering or monitoring requirements. As such, known reliable information relating to these sites is not available.

Specifically, the DCO boundary will interact with the following sites:

- West of Wolviston to Seal Sands Link Road (NGR: NZ 49303 23674). The site operated in 1981 and 1982 and is believed to contain incinerator residues and construction wastes.
- South of Seal Sands Road (NGR: NZ 52147 23893). The site operated between 1973 and 1978 and is believed to contain incinerator residues and construction wastes.
- Seal Sands (NGR: NZ 52332 24719). The period of operation for this site is unknown but is believed to have begun in the late 1970s. It is believed to have accepted medical wastes.
- Seal Sands, North Bank (NGR: NZ 52034 25149). This site operated between 1978 and 1989 and is understood to have accepted construction and industrial wastes, including blast furnace slag.
- Sea Banks Lagoon No.4 (NGR: NZ 51552 25447). This site operated between 1978 and 1979 and is understood to have accepted industrial wastes.
- Billingham Process Pack Site A (NGR: NZ 48145 22199). This site operated in 1992 and is believed to have accepted construction wastes.
- Haverton Hill Landfill (NGR: NZ 48621 22583). This site began operating in 1990 and consisted of serval screening mounds, formed of construction wastes. In situ gas monitoring was undertaken at this site with no appreciable landfill gas recorded. This licence (reference EAWML 60225) was deemed suitable for licence surrender in 2012 following an assessment of environmental risk.
- Teesport Eston Tip (NGR: NZ 56334 23873). This site operated between 1977 and 1993 and is understood to have accepted construction wastes and blast furnace slag.
- Redcar Trunk Road Landscaping (NGR: NZ 56890 23000). This site operated between 1977 and 1979 and is believed to contain general industrial wastes, soils and blast furnace slag.

The DCO boundary also includes some overlap with the currently permitted Warrenby landfill (NGR: NZ 57723 24753). This site is currently licensed under a Waste Management Licence (reference; EAWML 60138) and contains blast furnace slag. The site is closed to waste acceptance.

Caution must be exercised when looking to excavate in and around these areas of historic landfill. A risk assessment should be undertaken which adequately addresses the risks posed to the wider environment from disturbing these waste masses. Leachate or gas present within the waste mass could become mobile if disturbed. Should any excavated material from these sites be reused within the development plot, this must be done so as a waste material and Environmental Permitting requirements will be

Cont/d..

required.

The DCO boundary also runs alongside several currently operation landfill sites – Port Clarence landfills, Cowpen Bewley landfill, Teesport No 2 and No 3 landfills and Bran Sands landfill (this site is closed to waste acceptance). These sites will contain a network of perimeter boreholes around their boundary which are used to monitor gases and groundwaters. The DCO must ensure these boreholes are not disturbed during construction.

Flood Risk
The red line boundary for the full development is located within flood 3, 2 and 1. The majority of the development site for the Main Site is situated within flood zone 1. However, small portions of the Main Site are situated within flood zone 2 and 3. Parts of the Hydrogen Pipeline Corridor are also within flood zone 2 and 3.

Flood Risk Vulnerability Classification
No information has been provided on the flood risk vulnerability classification within the provided information. Therefore, we are unable to advise on our policy position in relation to flood risk until the vulnerability of the development has been confirmed by the applicant and/or the local planning authority.

It should be noted that 'highly vulnerable' uses, requiring a Hazardous Substance Consent, would not be appropriate within flood zones 3. In accordance with Table 2 of the flood risk and coastal change section of the Planning Practice Guidance (PPG), 'highly vulnerable' developments are not appropriate in flood zone 3 and should not be permitted.

Sources of Flooding
The main source of potential flooding in the area is from the tidal stretch of the River Tees, but there could be other local sources of flooding such as groundwater and surface water. We have published a suite of interactive maps that indicate where possible flooding from different sources could occur Check the long term flood risk for an area in England - GOV.UK (www.gov.uk). Our maps are not suitable for a detailed Flood Risk Assessment **(**FRA), but they can indicate where further assessment may be needed.

Flood Risk Assessment
We would expect a FRA to be submitted in support of your DCO application. The FRA must assess flood risk from all sources of flooding and recommend the mitigation measures that will be implemented to ensure a safe development in a 1 in 200-year (tidal) flood event, taking account of climate change. It must also demonstrate that flood risk will not be increased elsewhere.

Flood risk mitigations will need to be included within the development to ensure it can remain safe for its' lifetime. This includes raising the finished floor levels to the 1 in 200 year plus climate change plus a freeboard of 600mm.

Flood Risk Information the Environment Agency (EA) holds
We have an outline for a 1 in 200-year level undefended model that can be requested. The modelling we have for this location does not include climate change allowances and therefore this will need to be calculated in accordance with the 'Flood risk assessments: climate change allowances'. As the development location is at risk from tidal flooding, sea level allowances will need to be applied to the 1 in 200-year level for the lifetime of the development using both higher central and upper end allowances.

Cont/d..

This applies to both the temporary and permanent works.

The extent, speed and depth of flooding shown in the assessment should be used to determine the flood level for flood risk mitigation measures. Where assessment shows flood risk increases steadily and to shallow depths, it is likely to be more appropriate to choose a flood level lower in the range. Where assessment shows flood risk increases sharply due to a 'cliff edge' effect caused by, for example, sudden changes in topography or defences failing or overtopping, it is likely to be more appropriate to choose a flood level higher in the range.

Requests for data should be sent to northeast-newcastle@environment-agency.gov.uk. Please note that requests for data can take up to 20 working days to process. Your local planning authority should have undertaken a Strategic Flood Risk Assessment (SFRA) which will also include local flood risk information to inform your FRA.

Flood Alleviation Schemes
The Environment Agency are currently in the process of developing flood alleviation schemes which may have an interface with the proposed development. Attached to this letter is the scheme overview for the Greatham North East Flood Alleviation scheme.

Flood Risk Consents and Permits
The River Tees is a designated ‘main river’ and under the Environmental Permitting Regulations certain works within 16m of a tidal main river, or within 16m of any flood defence structure on a tidal main river, require a Flood Risk Activity Permit from the Environment Agency. This includes works such as directional drilling under the River Tees. You can find more information on permit requirements using the following link: Flood risk activities: environmental permits - GOV.UK (www.gov.uk). If a permit is required, it must be obtained prior to beginning the works.

You may also need a Marine Management Organisation license depending on if any works will be undertaken below the mean high water springs (MHWS).

Water Framework Directive (WFD) Assessment
Your development proposal should have regard to the objectives the Water Environment (Water Framework Directive) Regulations 2017, and the Northumbria River Basin Management Plan, which requires the restoration and enhancement of water bodies to prevent deterioration and promote recovery of water bodies.

We would expect a WFD assessment to be submitted in support of your DCO application. Your WFD assessment should consider the impact of the proposed development on the WFD status of the receiving waterbody Tees estuary (GB510302509900) and ensure that there is no deterioration resulting from their activities. Information about the status of the waterbody is available at TEES | Catchment Data Explorer | Catchment Data Explorer

As well as water quality impacts, your WFD assessment consider impacts to fisheries, ecology and the marine environment, both from the proposed activity once operational and during the construction phase. Any impacts identified need to be minimised and/or mitigated against. These mitigation measures should go above and beyond simply preventing deterioration and should work to create a better environment.

Applicants may not need to proceed to all stages of the WFD assessment process depending on the circumstances of the project. Guidance on how to assess the impact to WFD is available at: Water Framework Directive assessment: estuarine and coastal

Cont/d..

waters - GOV.UK (www.gov.uk)

Construction Environmental Management Plan
A Construction Environmental Management Plan (CEMP) should be submitted in support of your DCO application. With respect to water quality, the CEMP should address the following points:

- Treatment and removal of suspended solids from surface water run-off during construction works;
- Management of fuel and chemical spills during construction and operation, including the process in place to ensure the environment is not detrimentally impacted in the event of a spill; and
- Construction runoff could contain hazardous chemicals and elements due to the site's location. Contaminated land is likely to be present on site, and a scheme would be required to manage the associated risks, and minimise mobilisation of hydrocarbons, heavy metals, and any other hazardous pollutants into the water environment during construction and site operation.

Drainage Strategy
In order to determine the water quality impacts, the following information should be submitted as part of your drainage strategy:

- How rainwater will be handled and discharged from the site; and
- How foul water will be handled and discharged from the site. This should include if the site will be connecting to Northumbrian water's public sewer network.

Reclaimed Water Supply
The applicant seeks to utilise reclaimed water to supply water for the proposed development. However, limited information has been provided on this matter. We recognise that reusing water will provide a substitute for either a new abstraction or increase the utilisation of existing abstractions. This will limit the environmental impact of the proposal and protect the flow regime of sources of supply. We are unable to provide further comments on the opportunities or constraints that could be associated with effluent reuse, as it is assumed that these sources of water are regulated discharges and are therefore controlled under a separate regulatory regime.

Discharge of Trade Effluent
Effluent discharged from any premises carrying on a trade or industry, and effluent generated by a commercial enterprise where the effluent is different to that which would arise from domestic activities in a normal home is considered to be trade effluent. If you are not able to discharge effluent, it will be classed as waste, and you must then comply with your duty of care responsibilities.

Any effluent discharging into the Tees estuary or the adjacent coastal waterbody will need to be assessed as part of the DCO application. This may involve a standalone water quality assessment along with hydrodynamic modelling. Depending on the nature of the discharge, additional chemical or thermal plume modelling may be required.

If proposing to discharge to non-mains:
If you wish to discharge effluent, after appropriately treating it, to groundwater or surface water a permit under the Environmental Permit Regulations will be required. Full characterisation of the effluent will be required, and modelling may be required at the planning stage to determine the impact of the effluent on the receiving watercourse.

If proposing to discharge to mains:

Cont/d..

A trade effluent consent or a trade effluent agreement with your water and sewerage company (in this case likely to be Northumbrian Water) must be obtained before you discharge trade effluent to a public foul sewer or a private sewer that connects to a public foul sewer. Further guidance is available at Pollution prevention for businesses - GOV.UK (www.gov.uk).

The below timescales apply if a discharge permit is needed:

Application Type	**Current estimated time to produce water quality permit (Allocation and determination time)**
Simple Bespoke	286 working days
Complex Bespoke	365 working days

Some applications may be considered for prioritisation if it meets the Environment Agency's National Permitting Service's prioritisation criteria.

Discharge of Clean Water
Clean surface water (i.e., clean, uncontaminated rainwater from hard standing areas such as roads and car parks) can be discharged to a watercourse without a permit if the discharge passes through a maintained oil interceptor or Sustainable Urban Drainage System. If a water attenuation system is proposed it would be beneficial to see the details, methods, and maintenance of the system to ensure longevity and effectiveness.

Guidance about discharges to surface water and groundwater, including when you do and do not need a permit to discharge water can be found at https://www.gov.uk/guidance/discharges-to-surface-water-and-groundwater-environmental-permits).

Construction Dewatering (Discharge)
Discharge from temporary excavations can occur if the discharge can meet all of the conditions of the Regulator Position Statement "Temporary dewatering from excavations to surface water". This is available at https://www.gov.uk/government/publications/temporary-dewatering-from-excavations-to-surface-water/temporary-dewatering-from-excavations-to-surface-water). If any discharge cannot meet all the conditions, a Bespoke Environmental Permit would be required, this would follow the same timeline as other water quality permits stated under the discharge of trade effluent section of this response.

Water Resources (Abstraction and Impoundment)
The proposals may require Water Resource Licences in respect of the construction activities required and the eventual operation of the site. Water Resource (Impoundment and Abstraction) Licences are issued by the Environment Agency under the terms of the Water Resources Act 1991, and the provisions of the Water Resources (Abstraction and Impounding) Regulations 2006. The current estimated time to receive a water resources licence permit is between 6 and 9 months. Therefore, applications should be made at the earliest opportunity.

Abstraction Licence
If you intend to abstract more than 20 cubic metres of water per day from a surface water source e.g. a stream or from underground strata (via borehole or well) for any particular purpose then you will need an abstraction licence from the Environment Agency. There is no guarantee that a licence will be granted as this is dependent on available water resources and existing protected rights.

Cont/d..

Impounding licence
If you intend to impound a watercourse then you are likely to need an impounding licence from the Environment Agency. An impoundment is any dam, weir or other structure that can raise the water level of a water body above its natural level. ‘On-line’ impoundments hold back water in rivers, stream, wetlands and estuaries, and consequently affect downstream flows, sediment transport and migration of fish. Impoundments could be created through works to modify or change existing watercourses. An Impoundment Licence could also be required if you amend, modify or remove existing in channel structures.

Construction Dewatering (Abstraction)
Dewatering is the removal/abstraction of water (predominantly, but not confined to, groundwater) in order to locally lower water levels near the excavation. This can allow operations to take place, such as mining, quarrying, building, engineering works or other operations, whether underground or on the surface.

The dewatering activities on-site could have an impact upon local wells, water supplies and/or nearby watercourses and environmental interests. This activity was previously exempt from requiring an abstraction licence. Since 1 January 2018, most cases of new planned dewatering operations above 20 cubic metres a day will require a water abstraction licence from us prior to the commencement of dewatering activities at the site.

Nutrient Neutrality
Nutrient Neutrality applies to developments and discharges in this area. Please ensure liaison with Natural England is undertaken as this issue may have implications on your WFD assessment and technical assessments.

Please do not hesitate to contact me if you have any questions regarding this letter.

Yours sincerely

Lucy Mo
Planning Technical Specialist - Sustainable Places

Direct dial 020847 46524
Direct e-mail lucy.mo@environment-agency.gov.uk

End

creating a better place
for people and wildlife

Environment Agency

Mr Tim Jones
Sent via email: Timothy.jones1@aecom.com

Our ref: 307252
Your ref: 60689030 H2Teesside
Date: 19 May 2023

Dear Mr Jones

RE: Request for information under the Freedom of Information Act 2000 (FOIA)/ Environmental Information Regulations 2004 (EIR)

Thank you for your request dated 19 April 2023 for information/data to assist with the completion of the Environmental Impact Assessment for H2Teesside.

We respond to requests for information that we hold under the Freedom of Information Act 2000 (FOIA) and Environmental Information Regulations 2004 (EIR).

For ease of reference, we have structured our response below in a similar lay out to your request.

Please download the information found in the share file links before they expire in 20 days.

Flood Risk Assessment Data

P5-8 Port Clarence 2020 FM-TUFLOW Model and Report
FRA Data: https://ea.sharefile.com/d-sc736b792890a4e2d85cf4b04c571d67b
Report: https://ea.sharefile.com/d-s4d9cfed5d667446d8298bd466ed8c2dc
Model: Share file to be provided shortly.

Areas susceptible to Surface Water – extent maps for 1/30, 1/100 and 1/1000 and the SW suitability map:
https://data.gov.uk/data/search?sort=&q=Risk+of+Flooding+from+Surface+Water+Extent
FZ2: https://data.gov.uk/dataset/flood-map-for-planning-rivers-and-sea-flood-zone-2
FZ3: https://data.gov.uk/dataset/flood-map-for-planning-rivers-and-sea-flood-zone-3

Critical drainage areas:
https://data.gov.uk/dataset/areas-with-critical-drainage-problems

LiDAR data is open data available to download from the website:
https://data.gov.uk/data/search?q=lidar+data

You will be aware that we are developing a flood alleviation scheme on the north bank of Greatham Creek and Seal Sands – see indicative plan attached. We are currently undertaking the detailed design of the scheme and hope to commence delivery on site in summer 2024.

Following examination of our records of historic flooding, we have no record of flooding in the area. This does not necessarily mean that the area of the property / site has never flooded, only that we do not currently have records of flooding in this area.

The Environment Agency is the relevant risk management authority for flood risk on 'main rivers'. Local Authorities now take the lead for local flood risk, including 'ordinary watercourses', surface water and ground water flooding. We recommend that you contact the Lead Local Flood Authority for further information. Regarding flood risk from sewers please contact Northumbrian Water Group.

For general advice about assessing flood risk when completing planning applications, and in particular how to complete a flood risk assessment (FRA) as part of a planning application go to https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications

If your request is in relation to a planning application, the supplied data may not assess climate change using the most recent allowances. To find out which allowances to use go to www.gov.uk/guidance/flood-risk-assessments-climate-change-allowance

Our Sustainable Places Team can give more detailed advice although there is a charge for this. Here is the link to the standard terms and conditions that apply to our charged planning advice service https://www.gov.uk/government/publications/planning-advice-environment-agency-standard-terms-and-conditions. The standard charge is £100 per hour.

Any works near a main river may require approval from the Environment Agency. You may need to apply for a Flood Risk Activity Permit if:
- the works are within 8 metres(m) from a non-tidal Main river and from any flood defence structure or culvert.
- the works are within 16m from a tidal Main river and from any flood defence structure or culvert.
- the works are within 16m from a sea defence structure.

To determine whether you actually need a permit please visit https://www.gov.uk/guidance/flood-risk-activities-environmental-permits Or you can send a brief explanation of what works you plan to do (and where) so we can confirm.

Water Quality, Resources, Water Framework Directive and Biological Data

WFD investigations & mitigation measures: https://ea.sharefile.com/d-s376bb07bb2224ff182d79f85469fd58b

Water quality data/WFD classification information can be found using the below links:

- Water Quality data: Open WIMS data
- WFD Classification information: England | Catchment Data Explorer

Abstraction Licences: https://ea.sharefile.com/d-s99dffa6c886d445bb40567ab622990cf

Please find the above link containing the licences within a 10km radius from NGR NZ5066723691. We only regulate abstractions over 20 cubic meters per day, so if information is required for abstractions under this volume, please contact the Local Authority about the private water supplies in the area. Please note there are some duplicate licence numbers which represents that there are multiple purposes/uses.

We are unable to comment on third party intentions for water resource licences and would recommend that licence holders are contacted directly if you are interested in information about the licence holders plans for a specific licence. We can confirm that the Environment agency is not seeking to review any licence in the study area beyond the routine catchment review which will be undertaken in 2027.

We can confirm that we do not hold any groundwater level data for within the site area.

Information on management issues regarding water resources is available within the Abstraction Licence Strategy for the Tees Management Catchment. This is available on gov.uk at Tees abstraction licensing strategy - GOV.UK (www.gov.uk). Further information on specific proposals would be available through the Environment Agency's Water Resources Pre-Application service. We would also recommended that any significant developments in the Tees Estuary seek to engage with Water Resources North East (Water Resources North) in respect of ongoing catchment based water resource planning.

Discharge Consents: Defra Data Services Platform

Category 3 water pollutions incidents: Data is still being collated and will follow shortly.

Climate/Weather Data:
https://www.data.gov.uk/search?q=weather&filters%5Bpublisher%5D=&filters%5Btopic%5D=&filters%5Bformat%5D=&sort=best

River Flow Data: https://ea.sharefile.com/d-s89c562a32b4b4b78b6e6cfaa17db0f20

We have provided daily mean stage data from level gauges at Tees Barrage (NGR: NZ46200 19000) and Stockton (NGR:44775 18809). Unfortunately, there is no flow data available within the study area, however, we have supplied daily mean flow data from the nearest flow gauge upstream at Low

Moor (NGR:NZ 36442 10549). We have also provided hourly tidal data and monthly tidal max data from the tidal gauge at Tees Dock (NGR: NZ 43112 23508).

Ecological/Estuarine Habitat Data:

Although the below information has not specifically been requested, it has been included in the hopes that it is useful for your needs.

Ecology and fish data explorer: https://environment.data.gov.uk/ecology/explorer/
The new **Saltmarsh Change** and **Saltmarsh Extent and Zonation** data layers are available to download
The new **Seagrass Extent** data layer is available to download
The **Restoration Potential Maps** are available to download
The **Habitat Restoration Handbook series** are available to download
The **Infographics** developed for the habitat restoration handbook series are available to download
Restoring Meadow, Marsh and Reef (ReMeMaRe) | Estuarine & Coastal Sciences Association (ecsa.international)

Abstracts

FRA products 5-8

Name	Products 5, 6 and 7
Description	P5-8 Port Clarence 2020 FM-TUFLOW Model and Report
Licence	The information provided is not available under the Open Government Licence but we may be able to license it to you under the Environment Agency Conditional Licence: Environment Agency Conditional Licence However, you MUST first check the supporting information below and the above link to determine if the conditions on use are suitable for your purposes. If they aren't, this information is not provided with a licence for use, and the data is provided for read right only. Environment Agency Conditional Licence
Conditions	1.0 You may use the Information for your internal or personal purposes and may only sublicense others to use it if you do so under a written licence which includes the terms of these conditions and the agreement and in particular may not allow any period of use longer than the period licensed to you. 2.0 Notwithstanding the fact that the standard wording of the Environment Agency Conditional Licence indicates that it is perpetual, this Licence has a

	limited duration of 5 years at the end of which it will terminate automatically without notice. 3.0 We have restricted use of the Information as a result of legal restrictions placed upon us to protect the rights or confidentialities of others. In this instance it is because of third party data. If you contact us in writing (this includes email) we will, as far as confidentiality rules allow, provide you with details including, if available, how you might seek permission from a third party to extend your use rights. 4.1 The Information may contain some data that we believe is within the definition of "personal data" under the Data Protection Act 1998 but we consider that we will not be in breach of the Act if we disclose it to you with conditions set out in this condition and the conditions above. This personal data comprises names of individuals or commentary relating to property that may be owned by an individual or commentary relating to the activities of an individual. 4.2 Under the Act a person who holds and uses or passes to others personal data is responsible for any compliance with the Act and so we have no option but to warn you that this means you have responsibility to check that you are compliant with the Act in respect of this personal data. 5.0 The location of public water supply abstraction sources must not be published to a resolution more detailed than 1km2. Information about the operation of flood assets should not be published. 6.1 Where we have supplied model data which may include model inputs or outputs you agree to supply to the Environment Agency copies of any assessments/studies and related outputs, modifications or derivatives created pursuant to the supply to you of the Information, all of which are hereinafter referred to as "the Data". 6.2 You agree, in the public interest to grant to the Environment Agency a perpetual royalty free non-exclusive licence to use the Data or any part thereof for its internal purposes or to use it in any way as part of Environment Agency derivative products which it supplies free of charge to others such as incorporation into the Environment Agency's Open Data mapping products.

Information Warnings	Please be aware that model data is not raw, factual or measured but comprises of estimations or modelled results based on the data available to us.
Attribution	Contains Environment Agency information © Environment Agency and/or database rights. May contain Ordnance Survey data © Crown copyright 2017 Ordnance Survey 100024198.
Name	Product 8
Description	P5-8 Port Clarence 2020 FM-TUFLOW Model and Report
Licence	Open Government Licence
Information Warnings	1.0 This map shows the level of flood hazard to people (called a hazard rating) if our flood defences are breached at certain locations, for a range of scenarios. The hazard rating depends on the depth and velocity of floodwater, and maximum values of these are also mapped. 2.0 The map is based on computer modelling of simulated breaches at specific locations. Each breach has been modelled individually and the results combined to create this map. Multiple breaches, other combinations of breaches, different sized tidal surges or flood flows may all give different results. 3.0 The map only considers the consequences of a breach, it does not make any assumption about the likelihood of a breach occurring. The likelihood of a breach occurring will depend on a number of different factors, including the construction and condition of the defences in the area. A breach is less likely where defences are of a good standard, but a risk of breaching remains. 4.0 Please contact the Environment Agency for further information on emergency planning associated with flood risk in this area.
Information Warning - OS background mapping	*The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply to this background mapping. You are granted a non-exclusive, royalty free, revocable licence solely to view the Licensed Data for non-commercial purposes for the period during which the Environment Agency makes it available. You are not permitted to copy, sub-license, distribute, sell or otherwise make available the Licensed Data to third parties in any form. Third party rights to enforce the terms of this licence shall be reserved to OS.*

Attribution	Contains Ordnance Survey data © Crown copyright 2017 Ordnance Survey 100024198. Contains Environment Agency information © Environment Agency and/or database rights.

In respect of water abstraction information:

This information is not available with the Open Government Licence but we may be able to license to you under the Environment Agency Conditional Licence:

- **Water Abstractions (AfA135)** – detailed information about this dataset including conditions can be found on the Register Licence Abstract (you will need to download this spreadsheet to access the information about AfA135 – see below).

You MUST first check the supporting information available online to determine if the conditions on use are suitable for your purposes. If they aren't, this information is not provided with a licence for use, and the data is provided for read right only.

In respect of all other information:

Where we have provided links to data already available online, full details of supporting information and licensing are available when you access the data online. For all other information please refer to the Open Government Licence which explains the permitted use of this information. **Information Warnings**: **(i)** Personal Data in the Information is exempt from the Open Government Licence. **(ii)** It is the responsibility of the licensee to ensure that data they hold is accurate and up to date.

Information not held

EIR Regulation 3(2) states that information is held if it is in our possession and has been produced or received by us, or it is held by another person on our behalf at the time the request is received.

Some information/data is not held by the Environment Agency, and we are therefore refusing these parts of your request on the grounds that there is no information we can provide.

Where a request is for environmental information, the Regulations allow us to refuse to disclose it if the exception at EIR Regulation 12(4)(a) applies. The regulation states that a public authority may refuse to disclose environmental information to the extent that it does not hold that information when an applicant's request is received.

It is not possible for us to conduct a public interest balancing test because the reason for non-disclosure is that the information is not held.

Personal Data

We have redacted personal data from any non-public register data/reports. The reason for this refusal is explained below.

Relevant exceptions

The Environment Agency is not able to disclose the names of individuals as this is personal data under the Data Protection Act 2018 (DPA 2018) and to disclose it would breach the First Data Protection Principle of the DPA 2018.

The information requested is therefore exempt due to Regulation 13(1) of the Environmental Information Regulations 2004, which explains that:

"To the extent that the information requested includes personal data of which the applicant is not the data subject, a public authority must not disclose the personal data if—
(a) the first condition is satisfied…"

The 'first condition' referred to above is further explained in Regulation 13(2A):
"The first condition is that the disclosure of the information to a member of the public otherwise than under these Regulations—
(a) would contravene any of the data protection principles…"

The First Data Protection Principle requires that we are fair to individuals when we collect and use their personal data. In this case it would be unfair to disclose information relating to an identifiable individual as such individuals have a reasonable expectation that any information held about them by the Environment Agency would remain confidential.

The Public Interest Test

There is no requirement to conduct a public interest test when withholding personal data.

Rights of appeal
If you are not satisfied you can contact us within 2 calendar months to ask for our decision to be reviewed.

Yours sincerely,

Charlotte Drayton
Customers and Engagement Officer
Environment Agency | Tyneside House, Skinnerburn Road, Newcastle Business Park, Newcastle upon Tyne, NE4 7AR

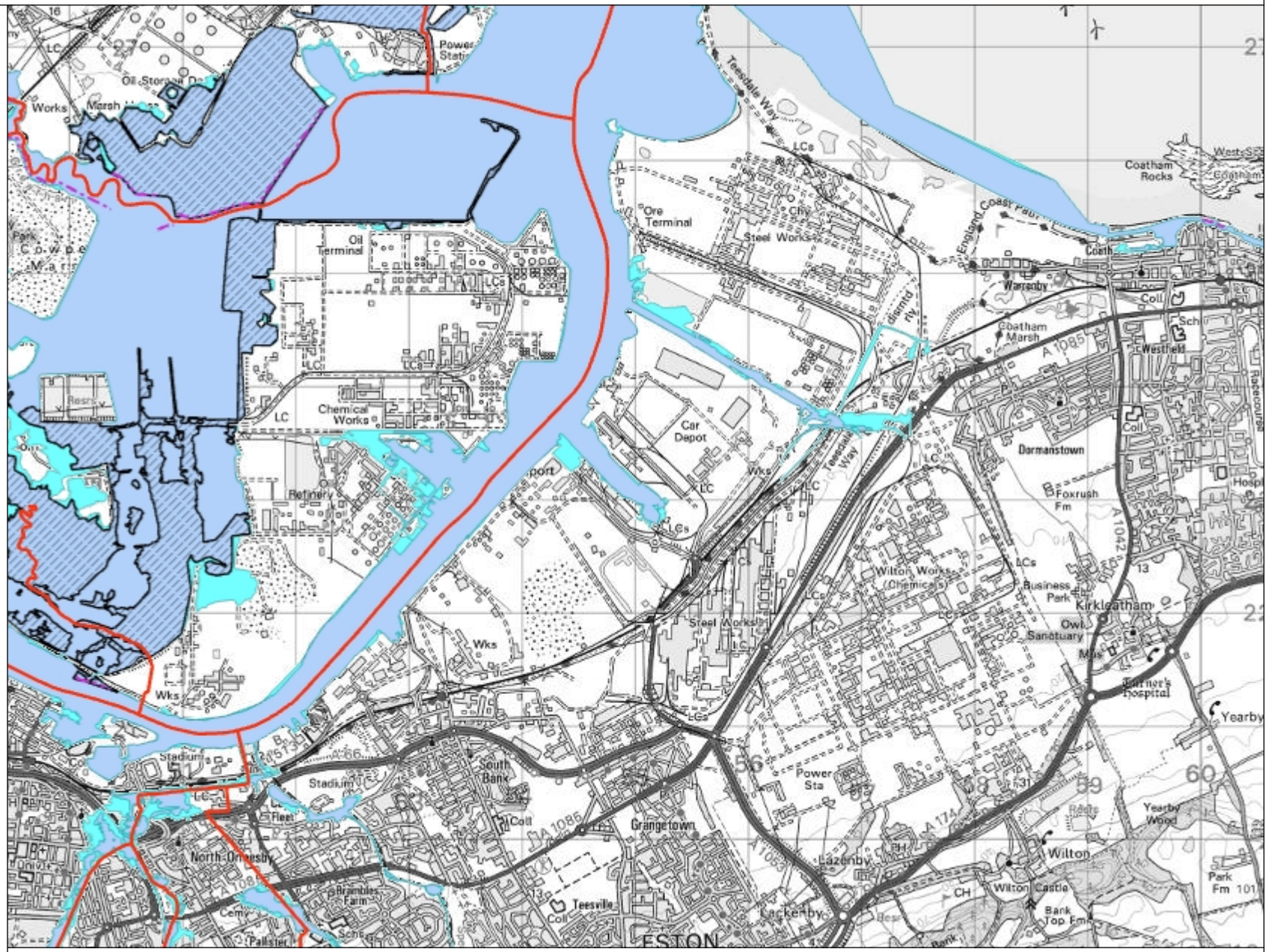
northeast-newcastle@environment-agency.gov.uk

Flood Map for Planning

Environment Agency

Legend

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



1: 50,000

0 1,250

Metres

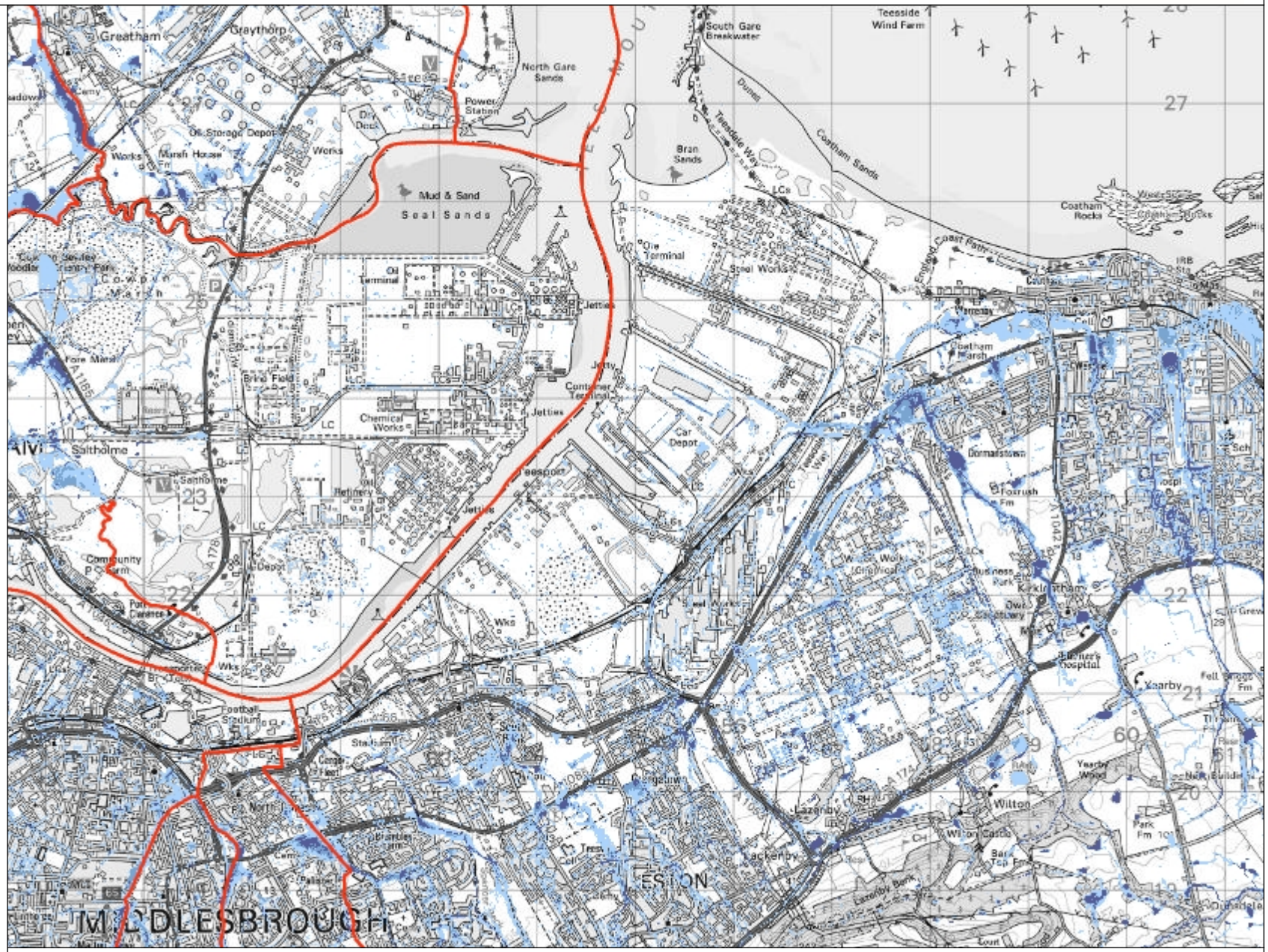
N W E S

Surface Water Flood Risk

Environment Agency

Legend

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



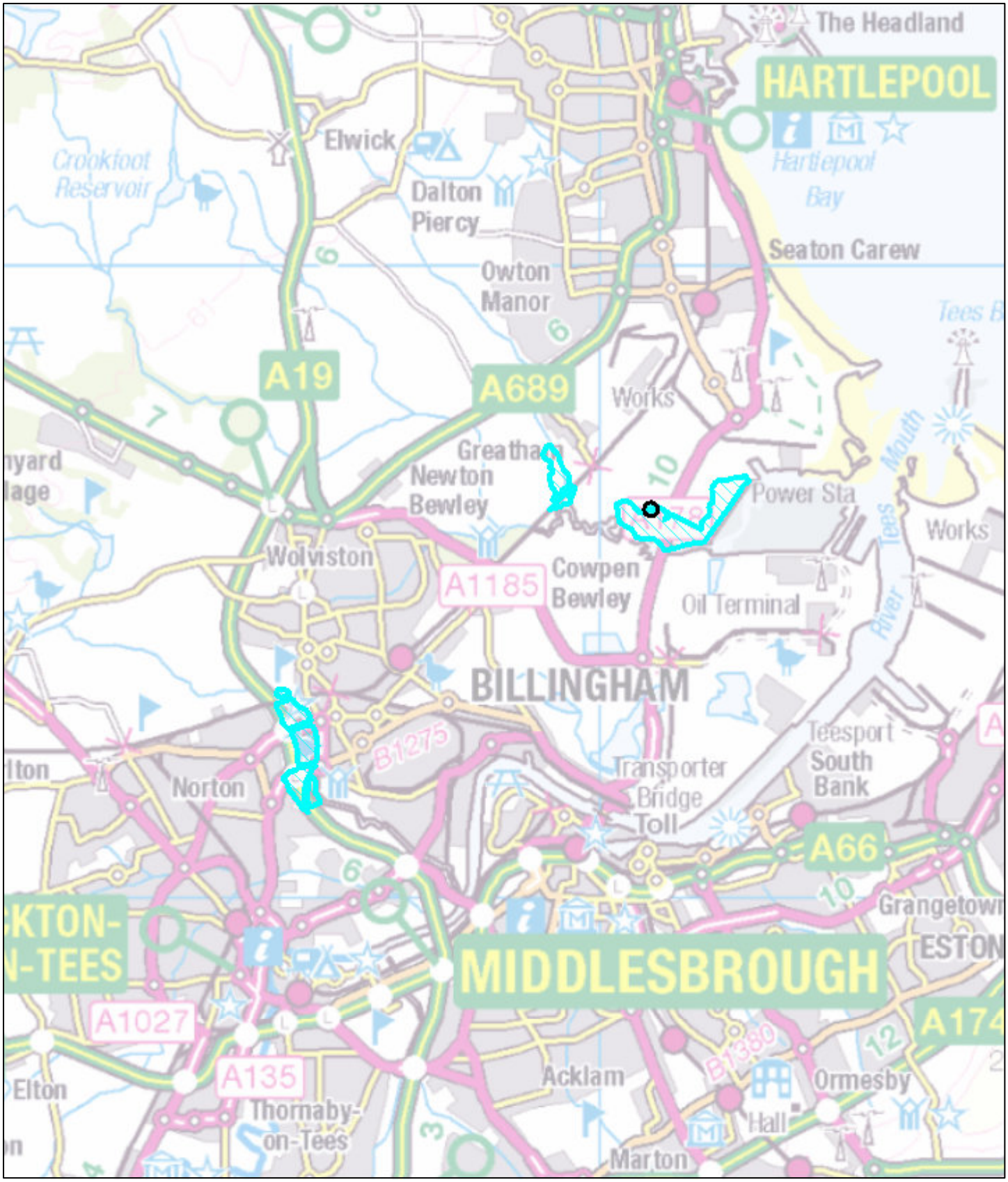
1: 57,569

0 1,439

Metres

N W E S

11/01/1978 Flood Event



April 26, 2023

1:83,368

0 0.5 1 2 mi

0 1 2 4 km

FLOOD INFORMATION LOCATIONS

RECORDED FLOOD OUTLINES

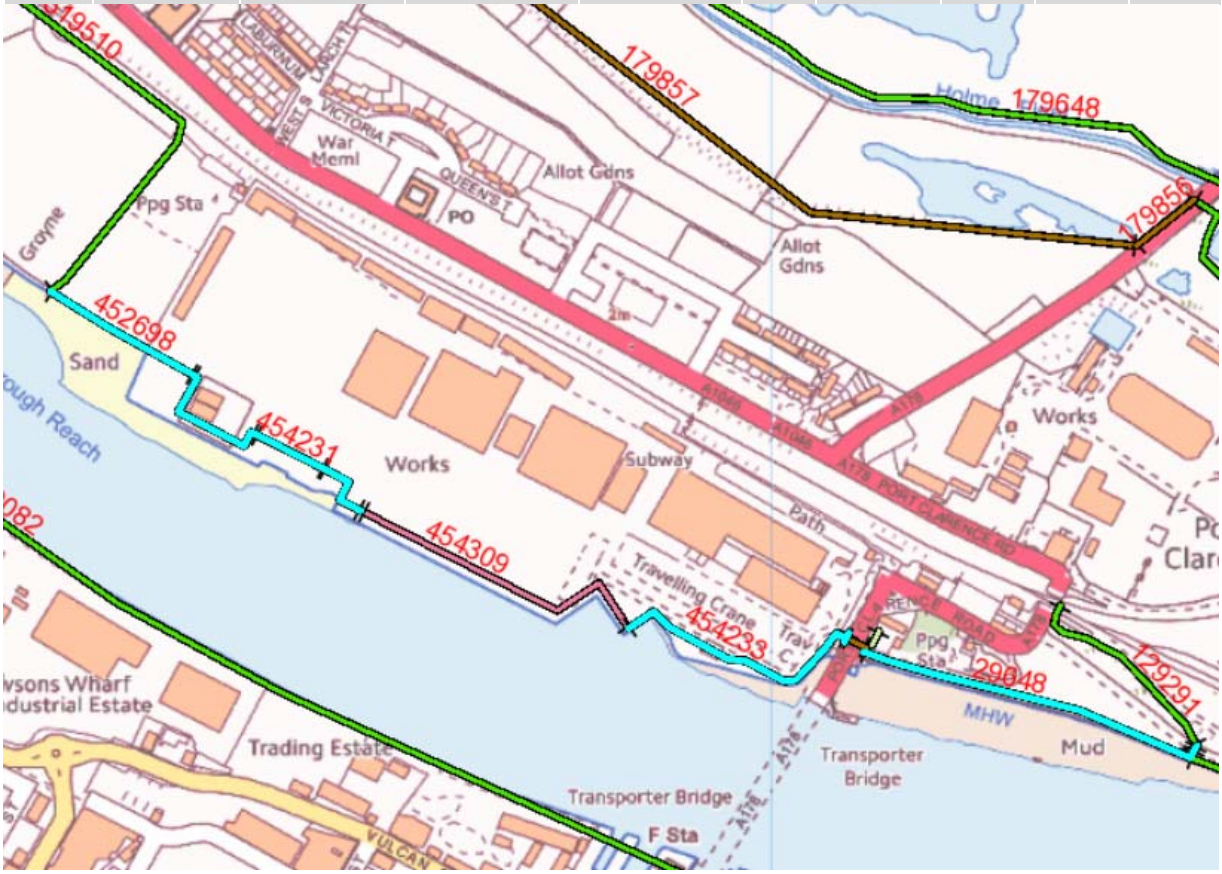
OS Traditional Maps

FCRM/DDTS/Data & Systems 2019

Environment Agency Flood Defence Information

Port Clarence

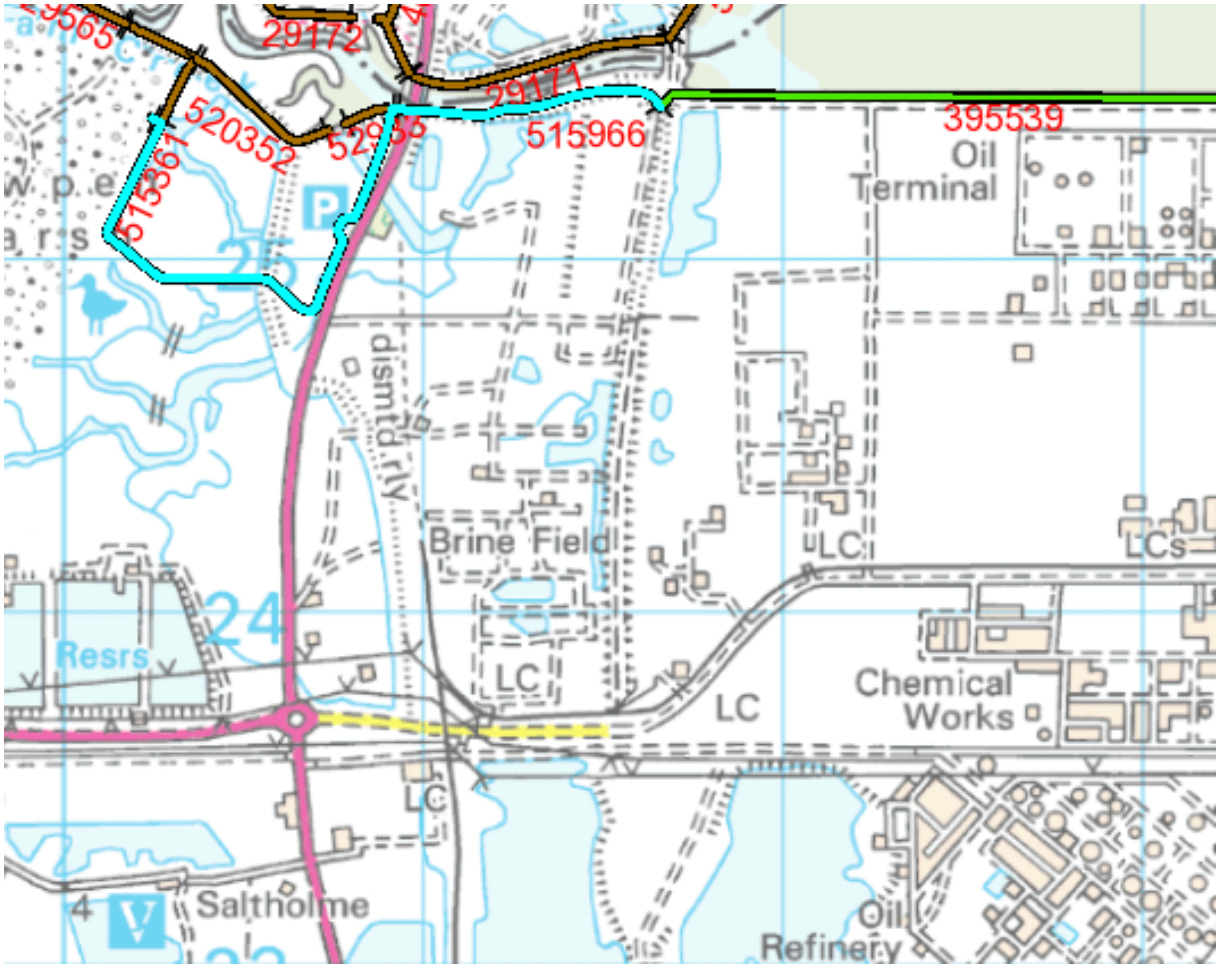
Asset Ref	Asset Type	Description	Location	Upstream National Grid Ref.	Condition*	Standard of Protection (Return period, 1 in x Years)	Upstream Crest Level (m)**	Downstream Crest Level (m)**	Length (m)
29648	Flood Defence	Embankment	Port Clarence	NZ 50078 21419	3	200	4.59	4.59	301.60
416350	Flood Defence	Embankment	Port Clarence	NZ 50360 21331	1	200	4.60	4.59	6.90
452698	Flood Defence	Embankment	Port Clarence	NZ 49379 21733	3	200	5.20	5.20	143.40
454231	Flood Defence	Embankment	Port Clarence	NZ 49554 21607	2	200	5.10	5.10	65.80
454219	Flood Defence	Flood Wall	Port Clarence	NZ 49503 21661	2	200	5.05	5.00	120.30
454233	Flood Defence	Flood Wall	Port Clarence	NZ 49875 21440	2	200	4.95	4.91	228.70
454290	Flood Defence	Flood Wall	Port Clarence	NZ 49614 21580	1	200	4.93	4.90	62.50
454311	Flood Defence	Flood Wall	Port Clarence	NZ 50060 21427	1	200	TBC	TBC	9.10



*The condition grades provided are from a visual inspection only based on the Environment Agency's Condition Assessment Manual.
Descriptions are as follows:
1 Very Good – Cosmetic defects that will have no effect on performance.
2 Good – Minor defects that will not reduce the overall performance of the asset
3 Fair – Defects that could reduce performance of the asset
4 Poor – Defects that would significantly reduce the performance of the asset. Further investigation needed
5 Very Poor – Severe defects resulting in complete performance failure.
**The Crest Levels are metres Above Ordnance Datum (Newlyn).

Environment Agency Flood Defence Information

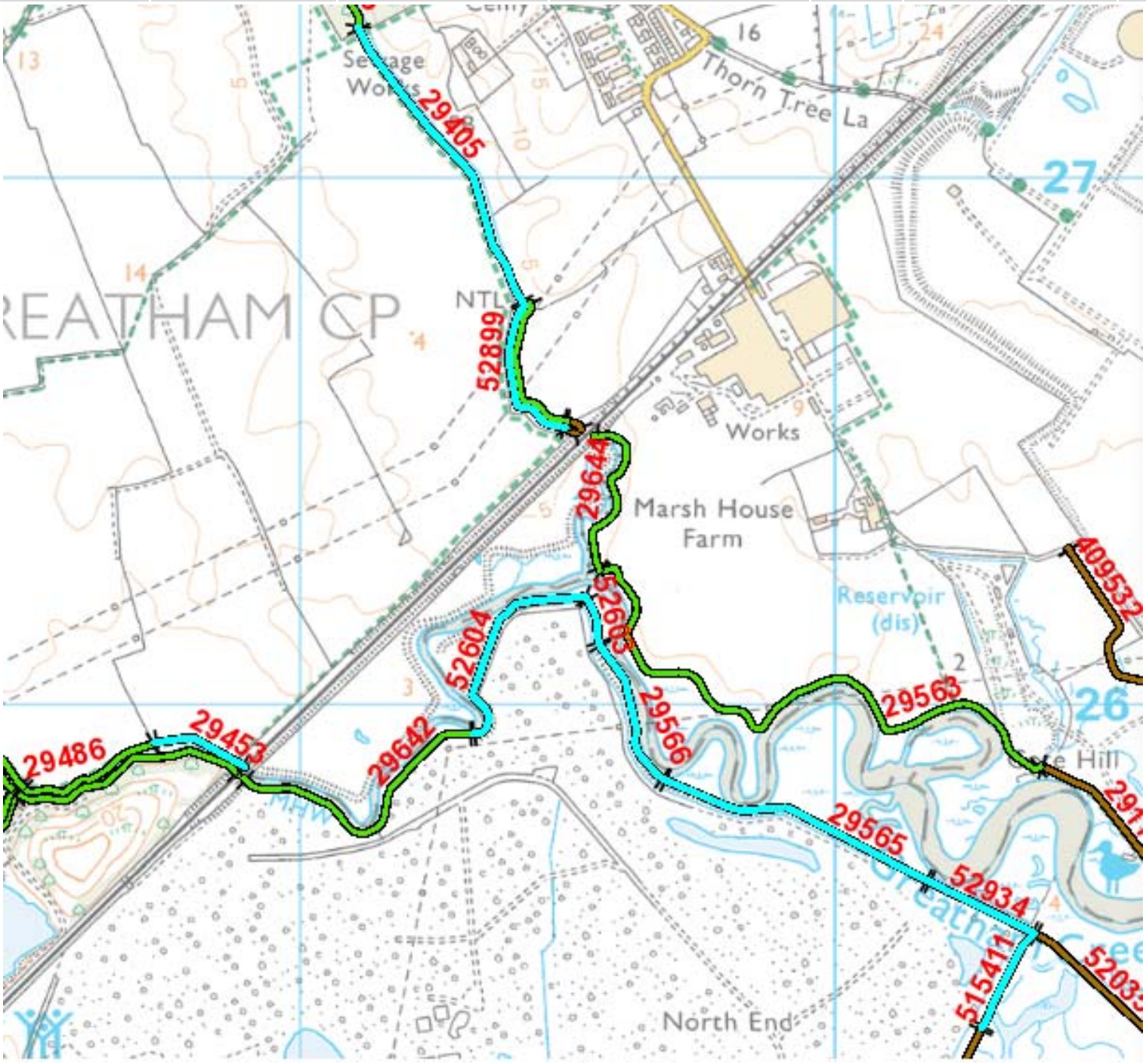
Asset Ref	Asset Type	Description	Location	Upstream National Grid Ref.	Condition*	Standard of Protection (Return period, 1 in x Years)	Upstream Crest Level (m)**	Downstream Crest Level (m)**	Length (m)
515361	Flood Defence	Floodbank	Greatham South	NZ 50259 25412	2	tbc	tbc	tbc	1671.40
515966	Flood Defence	Floodbank	Greatham South	NZ 50934 25418	3	tbc	tbc	tbc	760.40



*Descriptions are as follows:
1 Very Good – Cosmetic defects that will have no effect on performance.
2 Good – Minor defects that will not reduce the overall performance of the asset
3 Fair – Defects that could reduce performance of the asset
4 Poor – Defects that would significantly reduce the performance of the asset. Further investigation needed
5 Very Poor – Severe defects resulting in complete performance failure.
**The Crest Levels are metres Above Ordnance Datum (Newlyn).

Environment Agency Flood Defence Information

Asset Ref	Asset Type	Description	Location	Upstream National Grid Ref.	Condition*	Standard of Protection (Return period, 1 in x Years)	Upstream Crest Level (m)**	Downstream Crest Level (m)**	Length (m)
29405	Flood Defence	Floodbank	Greatham	NZ 49107 27288	4	5	3.970	3.690	616.67
52899	Flood Defence	Floodbank	Greatham Marsh	NZ 49414 26762	5	5	4.260	4.520	304.49
29453	Flood Defence	Floodbank	Claxton Beck	NZ 48727 25929	3	50	3.900	3.480	183.58
52604	Flood Defence	Floodbank	Greatham Creek	NZ 49324 25942	3	5	4.850	3.900	431.27
52603	Flood Defence	Floodbank	Greatham Creek	NZ 49538 26209	3	5	3.890	4.720	92.56
29566	Flood Defence	Floodbank	Greatham Creek	NZ 49558 26114	3	5	4.720	3.850	295.31
29565	Flood Defence	Floodbank	Greatham Creek	NZ 49680 25860	3	10	3.440	3.610	540.18
52934	Flood Defence	Floodbank	Greatham Creek	NZ 50170 25664	3	50	3.790	4.130	222.37
515411	Flood Defence	Floodbank	Greatham Creek	NZ 50279 25388	2	tbc	tbc	tbc	205.96



*Descriptions are as follows:
1 Very Good – Cosmetic defects that will have no effect on performance.
2 Good – Minor defects that will not reduce the overall performance of the asset
3 Fair – Defects that could reduce performance of the asset
4 Poor – Defects that would significantly reduce the performance of the asset. Further investigation needed
5 Very Poor – Severe defects resulting in complete performance failure.
**The Crest Levels are metres Above Ordnance Datum (Newlyn).

Environment Agency Flood Defence Information

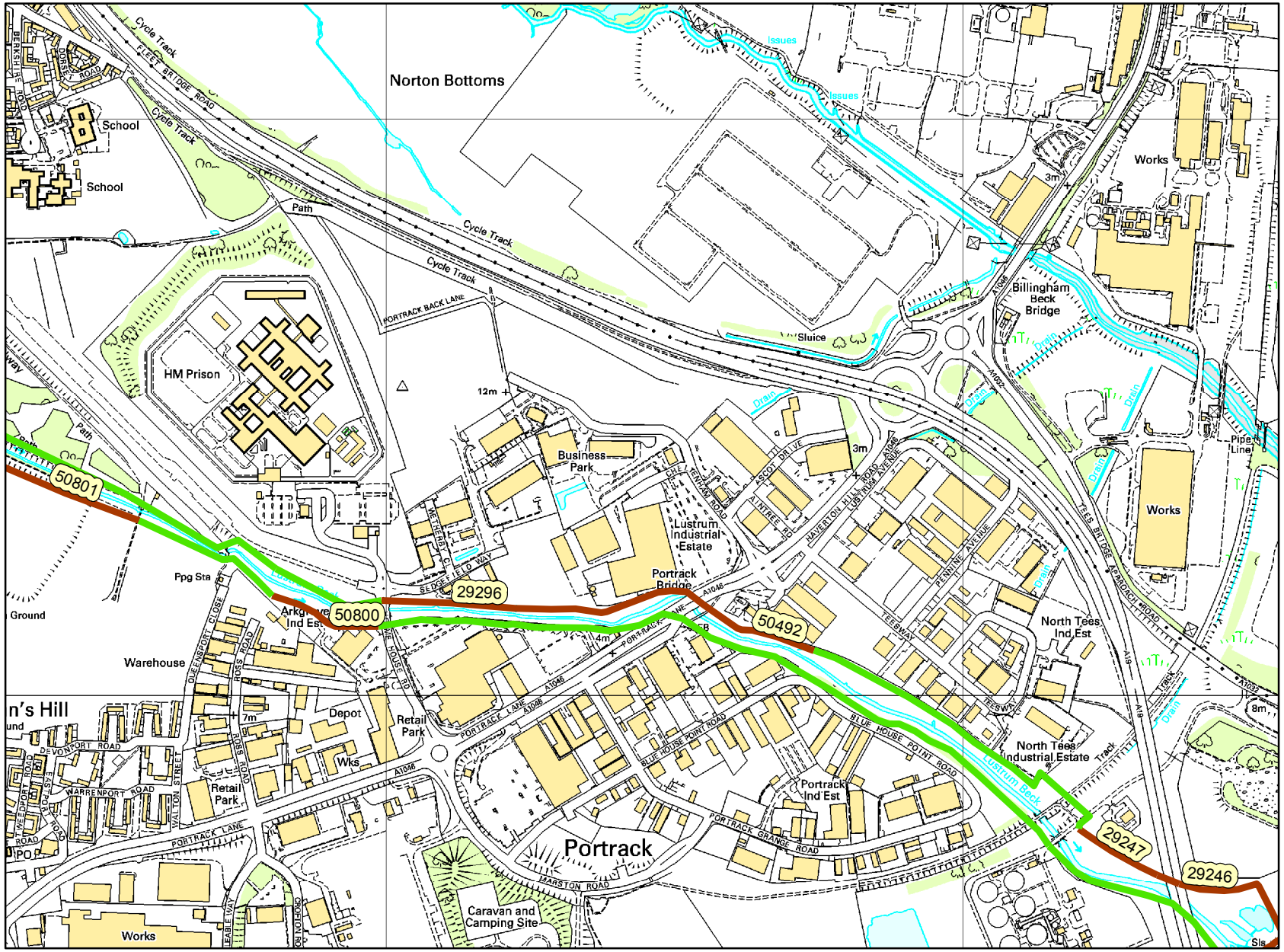
Hartlepool

Asset Ref	Asset Type	Description	Location	Upstream National Grid Ref.	Condition*	Standard of Protection (Return period, 1 in x Years)	Upstream Crest Level (m)**	Downstream Crest Level (m)**	Length (m)
52943	Flood Defence	Floodbank	Seal Sands	NZ 51685 25651	4	153	5.560	4.678	1006.41
409532	Flood Defence	Floodbank	Seal Sands	NZ 50346 26426	3	TBC	4.519	4.727	1617.19
29171	Flood Defence	Floodbank	Seal Sands	NZ 50964 25515	3	25	6.663	5.560	751.89

*The condition grades provided are from a visual inspection only based on the Environment Agency's Condition Assessment Manual.
Descriptions are as follows:
1 Very Good – Cosmetic defects that will have no effect on performance.
2 Good – Minor defects that will not reduce the overall performance of the asset
3 Fair – Defects that could reduce performance of the asset
4 Poor – Defects that would significantly reduce the performance of the asset. Further investigation needed
5 Very Poor – Severe defects resulting in complete performance failure.
**The Crest Levels are metres Above Ordnance Datum (Newlyn).

Environment Agency Owned and Maintained Flood Defences - Portrack, Stockton-on-Tees

Environment Agency



Legend

- High Ground
- Embankment

0 0.1 0.2 0.3 km

N

Greatham North East Flood Alleviation Scheme

(Indicative plan for illustrative purposes only)

Extraction of class 2 clay for new flood embankment from borrow pits within the area edged in blue. Estimated volume needed 129,000 m³.

Haulage route for class 2 clay from borrow pits. A stone haul road will be constructed. Plant crossing of A178 using traffic management.

Creation of habitat in former arable field owned by EA.

Emergency access road

Construction of new flood embankment. Crest height 5.5 mOD.

Breach existing Greenabella embankment in 2 locations. Retain remaining section to act as a high tide roost. The managed realignment will see the creation of intertidal mud at Greenabella Marsh.

Repair existing Greatham Creek embankment. Install RTE structure to enable tidal connectivity of the brinefield in future.

N W E S

1: 10,000

0 250 Metres

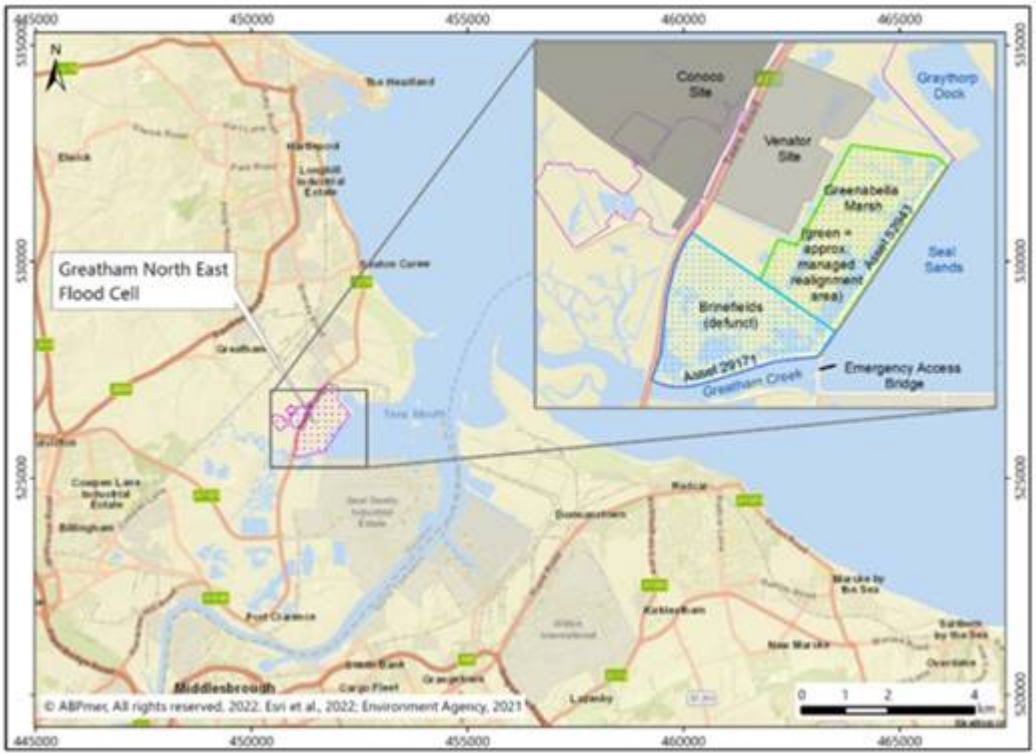
Somerton, Jo

From: Stuart Edwards <Stuart.Edwards@hartlepool.gov.uk>
Sent: 16 March 2023 12:55
To: Somerton, Jo
Subject: RE: Flood Risk Information Request:H2 Teesside
Attachments: Hartlepool Local plan_Library_16_April_2018.pdf

Hello Jo,

In response to your request for information:

• Details of Ordinary Watercourses in the area, including flood level/ model information where available;
We would refer to publicly available mapping for watercourse location and we do not hold flood level/model information for watercourses in the area.
• Any detailed maps of historical flood extents at the Proposed Development Site and details of any other flood level or flood extent data related to the Proposed Development Site that may be relevant, including any photographs, other anecdotal information and climate change scenarios;
We don't have any detailed maps of historical flood events in the area.
• Details of any existing or planned flood defences/flood alleviation schemes in the area, their condition, anticipated lifetime and statutory flood defence levels;
We don't have works planned in the area. However, Greatham Creek that runs through the area you have highlighted is Main River and as such is regulated by the Environment Agency (EA) who will be able to provide details of that asset. Furthermore, The EA are proposing to implement a flood alleviation scheme at the Greatham North East flood cell. Please see map extract below:



This may overlap with the area you have highlighted in your enquiry. Please contact chris.hood@environment-agency.gov.uk I understand that AECOM have already been in touch with the EA.

• Details of any known surface water flooding problems in the area and confirmation of any designated Critical Drainage Areas (CDAs);

Please see attached Local Plan Examination Library that mainly on page 4 lists our Strategic Flood Risk Assessment documents for your information.

• Mapping showing the Areas Susceptible to Surface Water Flooding (AStSWF) and the Updated Flood Mapping for Surface Water (uFMfSW);

Please refer to Environment Agency flood risk mapping.

• Confirmation of the assessment approach for the above ground elements of the pipeline corridors (entry and exit points) and preferred construction methodology for pipeline watercourse crossings; and

These matters will need to be assessed on a case by case basis with a focus on no increased flood risk. Underground watercourse crossings will likely be preferable.

• Surface water drainage requirements for the Main Site and the above ground elements of the pipelines, including Sustainable Drainage Systems (SuDS).

Surface water drainage requirements can be found in the Tees Valley SuDS Design Guide and Local Standards which is available via the internet. This will provide consistency in requirements across local authority boundaries in the Tees Valley.

Regards
Stuart

Stuart Edwards **BEng(Hons) PGCert MCIWEM** Flood Risk Officer
Hartlepool Borough Council
Tel: 01429 523932
Email: stuart.edwards@hartlepool.gov.uk

Web: www.hartlepool.gov.uk
Facebook: /hartlepoolcouncil
Twitter: @HpoolCouncil

HARTLEPOOL BOROUGH COUNCIL

CONSTRUCTING EXCELLENCE delivered with bre AWARDS 2022 WINNER
ice Awards 2022 Winner North East
ice Award Winner 2019 Robert Stephenson Awards
CONSTRUCTING EXCELLENCE IN THE NORTH EAST AWARDS 2019 HIGHLY COMMENDED
CONSTRUCTING EXCELLENCE IN THE NORTH EAST AWARDS 2019 WINNER
CONSTRUCTING EXCELLENCE delivered with bre NATIONAL AWARDS WINNER 2019
CONSTRUCTING EXCELLENCE NORTH EAST AWARDS 2022 WINNER

From: Somerton, Jo [mailto:joanne.somerton@aecom.com]
Sent: 14 March 2023 08:59
To: Jim Ferguson <Jim.Ferguson@hartlepool.gov.uk>
Cc: H2 Teesside Correspondence <H2TeessideCorrespondence@aecom.com>; Kearns, Laura <laura.kearns@aecom.com>; Stevenson, Katherine <katherine.stevenson@aecom.com>; Sperlova, Zuzana <Zuzana.Sperlova@aecom.com>
Subject: Flood Risk Information Request:H2 Teesside

Jim,

AECOM has been commissioned to prepare an Environmental Impact Assessment (EIA), including a Flood Risk Assessment (FRA) and Water Framework Directive (WFD) Assessment , to support a Development Consent Order (DCO) application for the construction, operation (including maintenance where relevant) and decommissioning of a 1.2 Gigawatt thermal (GWth) Hydrogen Production Facility with associated Carbon Capture and Storage (CCS) and hydrogen transport pipeline network and other connections on land in Redcar and Cleveland, Stockton-on-Tees, and Hartlepool on Teesside.

To support development of these assessments we would like to request data from Hartlepool Council in relation to flood risk. Please see attached our full information request which includes all details including a map of the study area.

If there are any queries regarding the information request then please do let me know.

Many thanks for your help.

Kind regards,

Jo

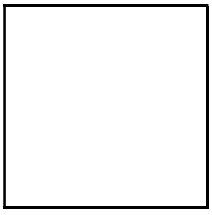
Jo Somerton

Joanne Somerton MSc

Principal Flood Risk Consultant, Water: EUR - UK & Ireland
M +44 (0)7917 503 650
joanne.somerton@aecom.com

AECOM
2 City Walk
Address Line 2
LEEDS, United Kingdom
T +44 (0)113 3018400
aecom.com

Delivering a better world
微信WeChat | LinkedIn | Twitter | Facebook | Instagram



ANNEX B – SFRA FLOOD ZONES

North

528000

527000

526000

455000

456000

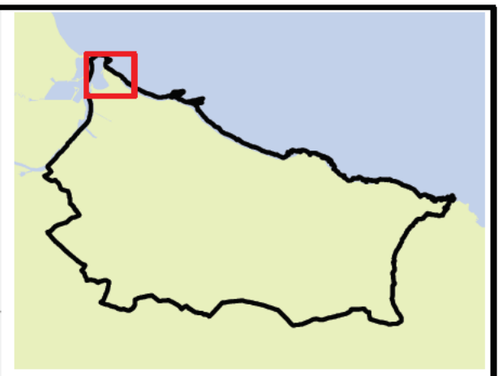
457000

Scale 1:10,000

ELD14

I3

ELD64



LEGEND

Choose Option Flood Zones

Show Labels

Council boundary

Detailed River Network

Potential Development Sites

Residential (SHLAA 2015)

Employment Land Available (ELA)

Employment Land Developed (ELD)

Industrial estate

Mixed use

Traveller

Flood Zones

Flood Zone 3b

Flood Zone 3a

Flood Zone 2

JBA consulting

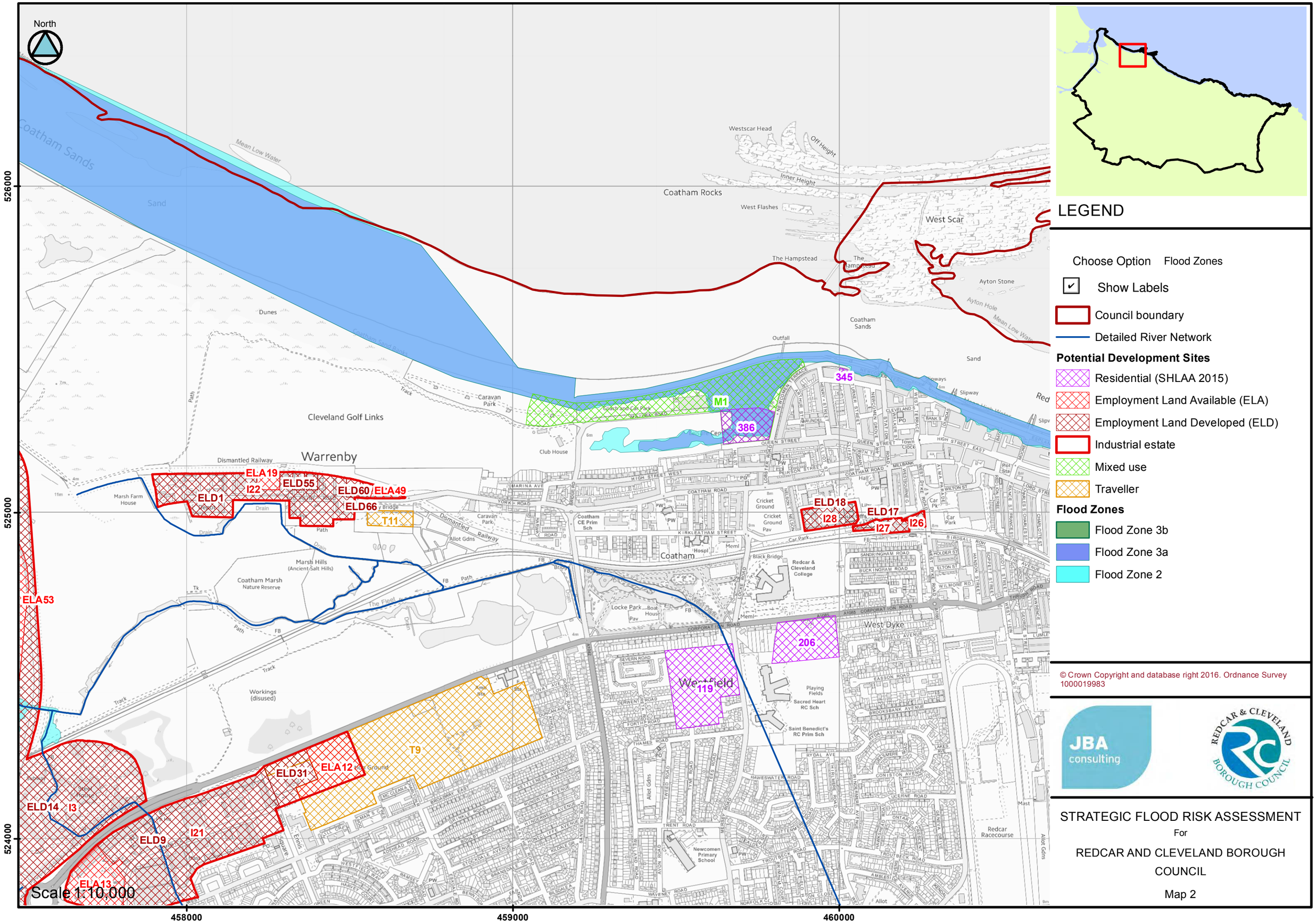
REDCAR & CLEVELAND BOROUGH COUNCIL

STRATEGIC FLOOD RISK ASSESSMENT

For

REDCAR AND CLEVELAND BOROUGH COUNCIL

Map 1



LEGEND

Choose Option — Flood Zones

☑ Show Labels

- Council boundary
- Detailed River Network

Potential Development Sites

- Residential (SHLAA 2015)
- Employment Land Available (ELA)
- Employment Land Developed (ELD)
- Industrial estate
- Mixed use
- Traveller

Flood Zones

- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

JBA consulting

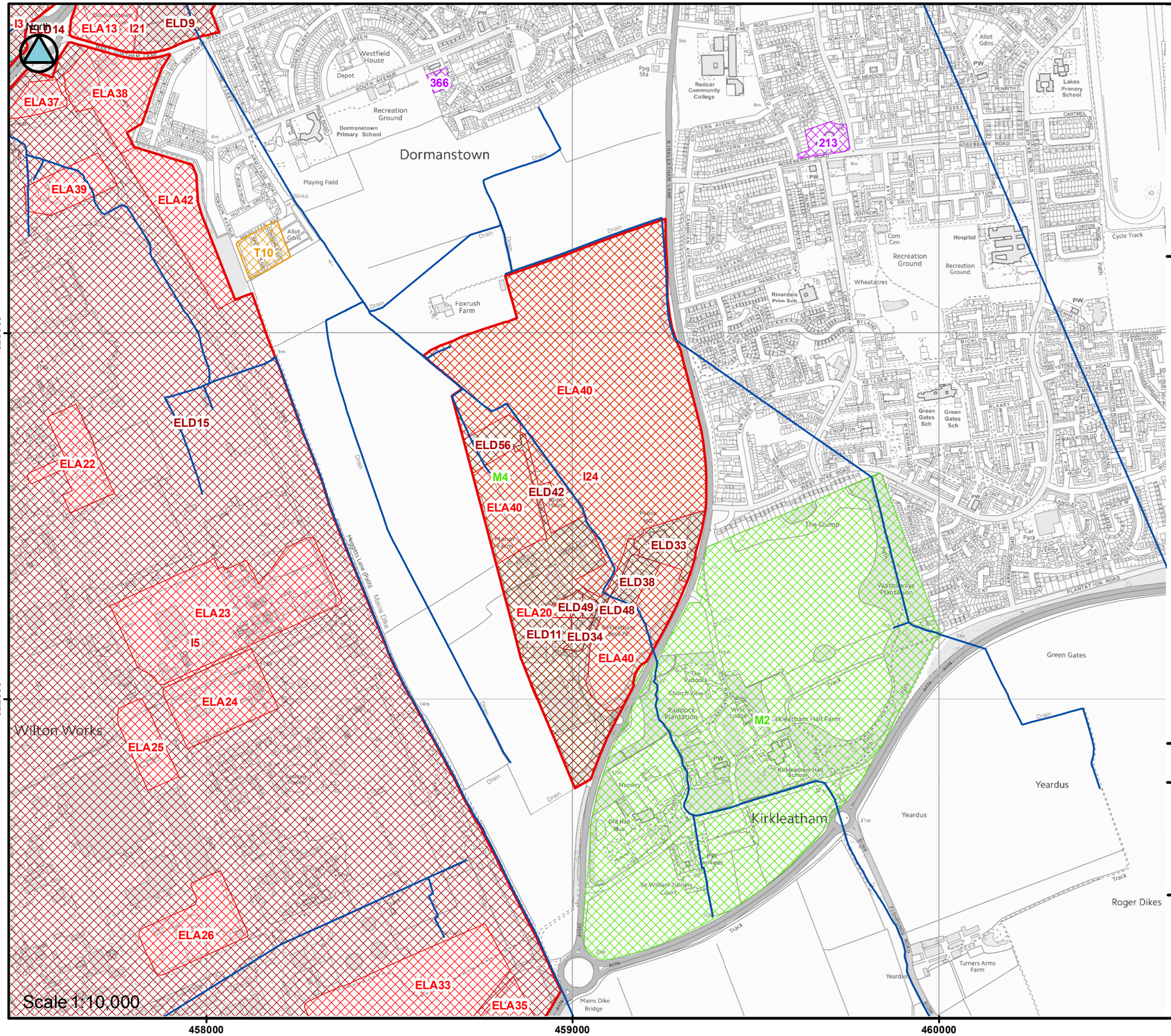
REDCAR & CLEVELAND BOROUGH COUNCIL

STRATEGIC FLOOD RISK ASSESSMENT

For

REDCAR AND CLEVELAND BOROUGH COUNCIL

Map 2



LEGEND

Choose Option — Flood Zones

Show Labels

- Council boundary
- Detailed River Network

Potential Development Sites

- Residential (SHLAA 2015)
- Employment Land Available (ELA)
- Employment Land Developed (ELD)
- Industrial estate
- Mixed use
- Traveller

Flood Zones

- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

JBA consulting

REDCAR & CLEVELAND BOROUGH COUNCIL

STRATEGIC FLOOD RISK ASSESSMENT

For

REDCAR AND CLEVELAND BOROUGH COUNCIL

Map 14

North

525000

524000

455000

456000

457000

Scale 1:10,000

Teesside Works, Redcar

Teesside Works Redcar

ELD64

ELD14

I3

I4

ELA53

I6

ELD13

I2

ELA45

ELA37

ELA39

ELD15

I5

Dabholm Gut

Mean High Water

Container Terminal

Potash Terminal

Depot

Sewage Works

Landing Stage

Pipe Lines

Trav C

BOULBY ROAD

DABHOLM ROAD

KIRKLEATAM ROAD

Tees Dock

LEGEND

Choose Option Flood Zones

Show Labels

Council boundary

Detailed River Network

Potential Development Sites

Residential (SHLAA 2015)

Employment Land Available (ELA)

Employment Land Developed (ELD)

Industrial estate

Mixed use

Traveller

Flood Zones

Flood Zone 3b

Flood Zone 3a

Flood Zone 2

JBA consulting

REDCAR & CLEVELAND BOROUGH COUNCIL

STRATEGIC FLOOD RISK ASSESSMENT

For

REDCAR AND CLEVELAND BOROUGH COUNCIL

Map 15

North

524000

523000

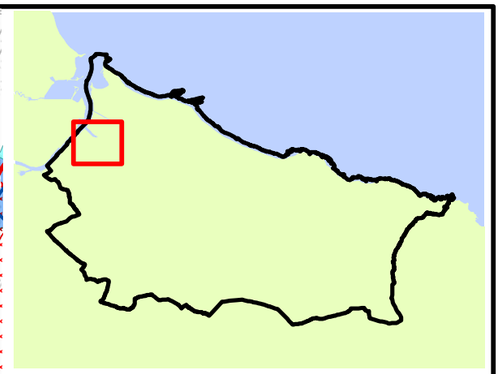
522000

454000

455000

456000

Scale 1:10,000



LEGEND

Choose Option Flood Zones

Show Labels

Council boundary

Detailed River Network

Potential Development Sites

Residential (SHLAA 2015)

Employment Land Available (ELA)

Employment Land Developed (ELD)

Industrial estate

Mixed use

Traveller

Flood Zones

Flood Zone 3b

Flood Zone 3a

Flood Zone 2

JBA consulting

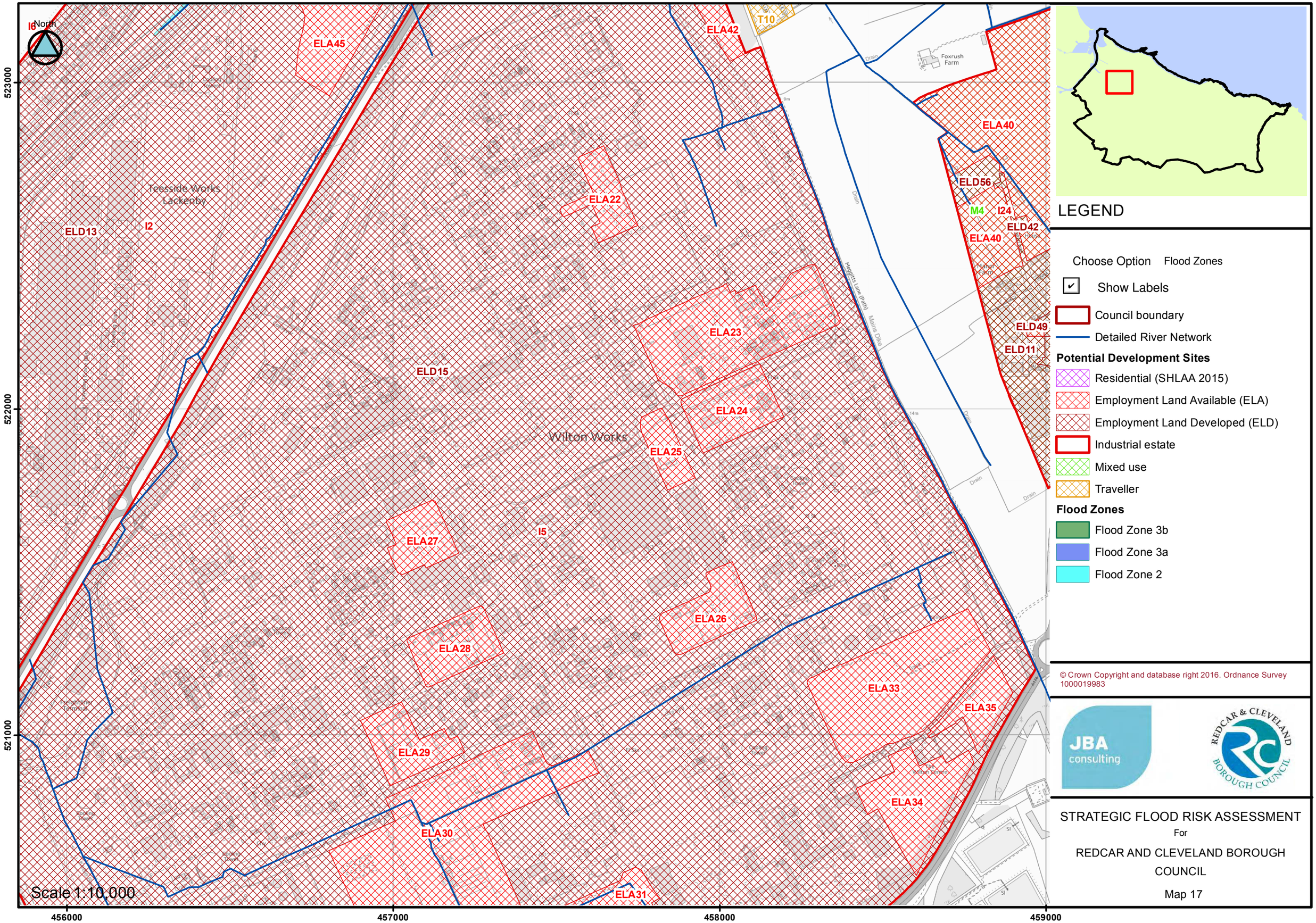
REDCAR & CLEVELAND BOROUGH COUNCIL

STRATEGIC FLOOD RISK ASSESSMENT

For

REDCAR AND CLEVELAND BOROUGH COUNCIL

Map 16



JBA consulting

REDCAR & CLEVELAND BOROUGH COUNCIL

STRATEGIC FLOOD RISK ASSESSMENT

For

REDCAR AND CLEVELAND BOROUGH COUNCIL

Map 17

North

525000

524000

523000

451000

452000

453000

0 0.25 0.5 0.75 1 Kilometres

Ground Flares

Ground Flare

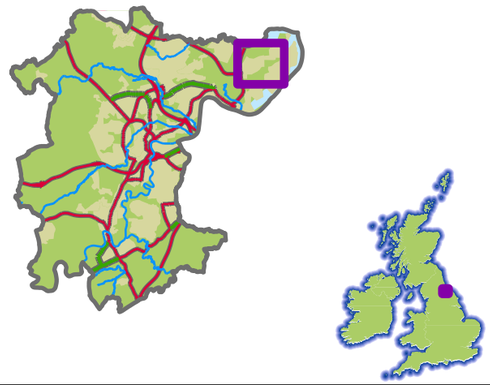
SS

NT

Bone Field

Fire Station

Detailed Map 10



LEVEL 1
STRATEGIC FLOOD RISK ASSESSMENT
For
STOCKTON ON TEES BOROUGH COUNCIL

Please select a data type from the dropdown menu below that you wish to view:

Flood Zones

Development Sites

Proposed Use

- Residential
- Employment
- Mixed Use

SBC Boundary

Detailed River Network

Flood Zones

- Flood Zone 3b
- Flood Zone 3
- Flood Zone 2

☑ Show Site Reference Labels

JBA consulting

Stockton-on-Tees BOROUGH COUNCIL

North

Seal Sands

Ground Flares

Ground Flare

EMERGENCY ACCESS ROAD

SS

526000

525000

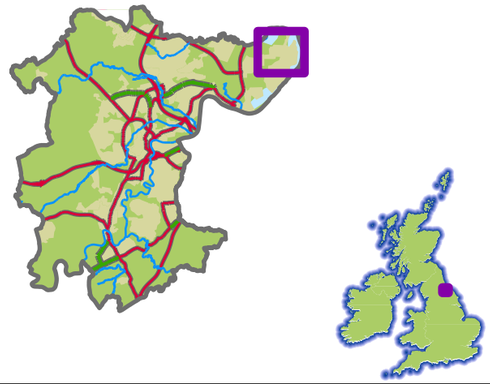
524000

452000

453000

454000

0 0.25 0.5 0.75 1 Kilometres



LEVEL 1
STRATEGIC FLOOD RISK ASSESSMENT
For
STOCKTON ON TEES BOROUGH COUNCIL

Please select a data type from the dropdown menu below that you wish to view:

Flood Zones

Development Sites

Proposed Use
- Residential
- Employment
- Mixed Use

SBC Boundary

Detailed River Network

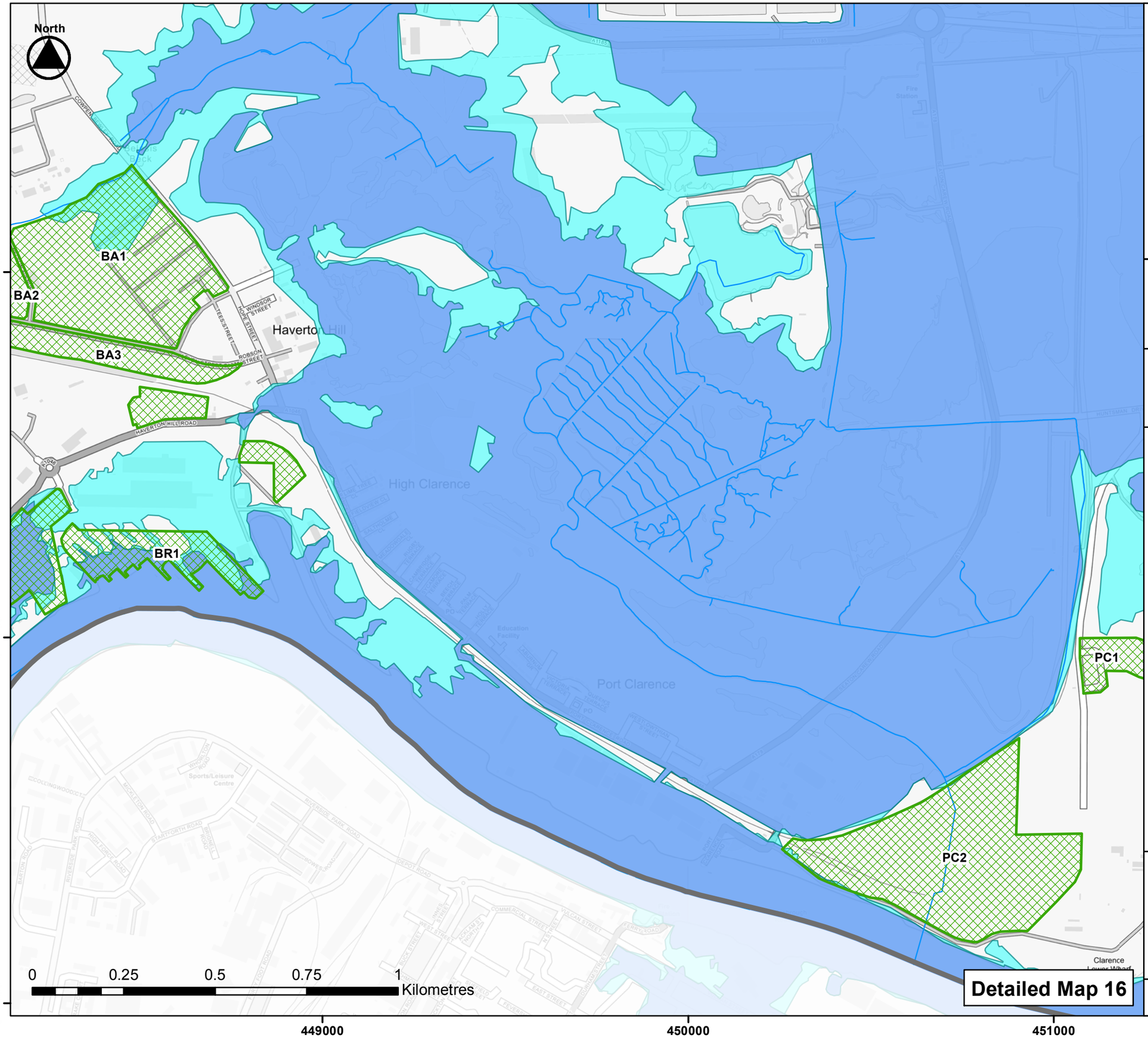
Flood Zones
- Flood Zone 3b
- Flood Zone 3
- Flood Zone 2

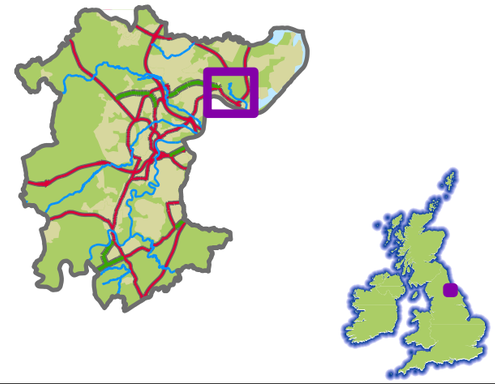
☑ Show Site Reference Labels

JBA consulting

Stockton-on-Tees BOROUGH COUNCIL

Detailed Map 11





LEVEL 1
STRATEGIC FLOOD RISK ASSESSMENT

For

STOCKTON ON TEES BOROUGH COUNCIL

Please select a data type from the dropdown menu below that you wish to view:

Flood Zones

Development Sites

Proposed Use

- Residential
- Employment
- Mixed Use

SBC Boundary

Detailed River Network

Flood Zones

- Flood Zone 3b
- Flood Zone 3
- Flood Zone 2

☑ Show Site Reference Labels

Detailed Map 16

JBA consulting

Stockton-on-Tees BOROUGH COUNCIL

H2Teesside Project

Nutrient Neutrality Screening Report

Volume III – Appendices

Appendix 9B: Nutrient Neutrality Screening Report

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended)

TABLE OF CONTENTS

1.0 INTRODUCTION 4
1.1 Overview 4
1.2 The Issue of Nutrient Neutrality 4
1.3 Teesmouth & Cleveland Coast SPA/Ramsar Site 7
2.0 ENGAGEMENT 8
3.0 THE PROPOSED DEVELOPMENT 8
3.1 Overview 8
3.2 Water Cycle Overview 10
3.3 Water Demand 14
3.4 Surface Water Drainage 14
3.5 Process Wastewater 16
3.6 Foul Wastewater 18
3.7 Atmospheric Deposition of Nitrogen 18
4.0 SCREENING ASSESSMENT 19
5.0 NEXT STEPS: NUTRIENT NEUTRALITY ASSESSMENT 21
5.1 Nutrient Neutrality Assessment 21
5.2 Dispersion Modelling of Effluent 23
5.3 Determine Mitigation Requirements 24
6.0 SUMMARY 24
7.0 REFERENCES 27
ANNEX A TEESMOUTH AND CLEVELAND COAST SPA/RAMSAR CATCHMENT AS DEFINED BY NATURAL ENGLAND 28
ANNEX B ECOLOGICAL DESIGNATIONS SURROUNDING THE PROPOSED DEVELOPMENT 29
ANNEX C NATURAL ENGLAND NUTRIENT NEUTRALITY ASSESSMENT DECISION TREE (MARCH 2022) 30

TABLES

Table 1: Summary of the four Cases being considered by the Proposed Development 11
Table 2: Raw water requirement for the Proposed Development 14
Table 3: Nutrient Neutrality Screening 19
Table 4: Comparison of Natural England Nutrient Neutrality Generic Methodology Stages and Steps and Bespoke Approach from NZT 22

PLATES

Plate 1a: Flow diagram to summarise the water cycle for the Proposed Development for Case 1A 12
Plate 1b: Flow Diagram to Summarise the Water Cycle for the Proposed Development for Case 1B 12
Plate 1c: Flow Diagram to Summarise the Water Cycle for the Proposed Development for Case 2A 13
Plate 1d: Flow Diagram to Summarise the Water Cycle for the Proposed Development for Case 2B 13

1.0 INTRODUCTION

1.1 Overview

1.1.1 On 16 March 2022, Natural England published advice to a number of Local Planning Authorities (LPAs), including Redcar and Cleveland Borough Council (RCBC), Stockton-on-Tees Borough Council (STBC) and Hartlepool Borough Council (HBC) and the Planning Inspectorate ('the Inspectorate'), to indicate that as a Competent Authority under the Habitats Regulations the LPA (or Secretary of State (SoS) in the case of a Development Consent Order (DCO)), must carefully consider the nutrient impacts of any new plans and projects on habitats sites and whether those impacts may have an adverse effect on the integrity of a habitats site that requires mitigation, including through nutrient neutrality (Natural England, 2022a). In the case of RCBC, STBC and HBC, the affected habitats site is the Teesmouth & Cleveland Coast Special Protection Area (SPA)/Ramsar site, for which excessive nitrogen is contributing to unfavourable status.

1.1.2 The H2Teesside project (hereafter 'The Proposed Development') is located within the catchment of the Teesmouth and Cleveland Coast SPA/Ramsar site. Therefore, this screening report considers the potential nutrient impacts of the Proposed Development, whether the issue of nutrient neutrality is invoked, and assesses whether (or not) a detailed nutrient neutrality assessment may be required, and if so, what the next steps for addressing the issue would be within the DCO process.

1.1.3 The catchment of the Teesmouth and Cleveland Coast SPA/Ramsar site as defined by Natural England is shown in Annex A.

1.1.4 The Habitats Regulation Assessment (HRA) that is to be prepared for the Proposed Development, in line with the Inspectorate's Advice Note 10 (Planning Inspectorate, 2022), will take into account the outcomes of the nutrient screening and any further nutrient assessment and will be submitted with the DCO Application.

1.2 The Issue of Nutrient Neutrality

1.2.1 In many designated estuarine and freshwater habitats sites, poor water quality due to nutrient enrichment is one of the main reasons for sites being in an unfavourable condition. Excessive levels of nutrients can cause the rapid growth of certain plants and excessive oxygen consumption (this process is called eutrophication). This in turn can lead to reduced biodiversity, and the condition of a site being considered 'unfavourable'. To improve the water quality in these sites, reductions in nutrients are required.

1.2.2 Nutrient neutrality has become an issue in many areas of the country, such as the Solent, Somerset Levels, the Wye catchment in Herefordshire, the Camel catchment in Cornwall, the Stour catchment in Kent, and the Poole Harbour and Chesil and The Fleet catchments in Dorset, amongst others. The issue has reached legislative control by virtue of the ruling of the European Court of Justice (ECJ) in combined cases C-293/17 and C-294/17 (the Dutch Nitrogen case). That judgment was about atmospheric nitrogen but in the process of making their ruling the judgment refined the definition of plans and projects to include operations such as agriculture,

confirming that agricultural inputs of nutrients (either from atmosphere or runoff) need to be covered in the 'in combination' requirements of the Habitats Regulations Assessment (HRA) process.

1.2.3 In addition, the ruling reaffirmed that if a European protected nature conservation site is in a deteriorating condition (such as due to excess nutrient levels that may also be forecast to increase) there are very limited circumstances under which further discharges of nutrients to a site can legally be permitted. This is covered in paragraph 79 of Advocate-General Kokott's opinion, written to inform the court: 'Where total damage is reduced, but the integrity of the protected site concerned is nevertheless adversely affected [by which she means where the total nitrogen deposition still exceeds the critical load], Article 6(3) of the Habitats Directive does not in any case permit any additional damage of this kind'.

1.2.4 As a result, in the absence of any empirically derived threshold by which additional aquatic inputs of nitrogen and phosphorus can be deemed nugatory or de minimis, it must be concluded that all new development within the affected habitats site catchment has the potential to increase nitrogen and phosphate deposition into the protected sites above consented levels and thus interfere with the ability of a site to achieve its conservation objectives and thus the integrity of the European protected nature conservation site, and that therefore all development proposals should consider whether this will be the case. This is relevant because under Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended) an LPA or the SoS (competent authority) cannot legally consent a plan or project that will have an adverse effect on the integrity of any European protected nature conservation site without imperative reasons of overriding public interest being proved and sufficient compensatory measures being provided.

1.2.5 One way that the potential impact of new development can be determined is by using nutrient neutrality calculations to create a nutrient budget. A calculation methodology covering both nitrogen and phosphorus (where applicable) has been developed by Natural England, originally in 2020, using the most up-to-date scientific evidence base at the time of publication. This methodology has since been updated and published as the 'Nutrient Neutrality Generic Methodology' (latest version November 2022) (Natural England, 2022b).

1.2.6 In March 2022, Natural England identified further habitats sites that are in unfavourable status due to excess nutrients and to which the nutrient neutrality process will now apply. This now includes over 70 local authority areas including RCBC, STBC and HBC (where only nitrogen is affected). Natural England also published locally amended nutrient calculators alongside their guidance.

1.2.7 Should a derived nutrient budget for a development demonstrate that there will be a nutrient surplus (i.e., is not nutrient neutral) then in the absence of any strategic solution or local credit scheme, the Applicant must identify suitable mitigation that allows neutrality to be achieved. There are a range of nutrient mitigation approaches that can be adopted.

1.2.8 Improvements to wastewater treatment works (WwTWs) are one such area, for instance by incorporating tertiary treatment phosphate stripping. However, this approach is largely outside of developer control and can take years to implement and so does not generally enable nutrient neutrality to be demonstrated in the short term. However, the draft Levelling-Up and Regeneration Bill that is progressing through the House of Lords at the time of writing (August 2023) does outline new nutrient effluent targets to be achieved by WwTWs by 2030 based on Technically Achievable Limits (TAL), and this is expected to reduce the future burden that developers need to mitigate. However, amendments to the draft Bill that are currently being debated would restrict TAL upgrades to only WwTWs serving 2000 or more people and in areas currently affected by nutrient neutrality requirements. For WwTWs that serve between 250 and 2000 people, upgrades may be needed at the discretion or direction of the SoS. There will also be improvements to WwTWs relating to Water Company PR24 Business Plans.

1.2.9 Strategic scale mitigation solutions, such as large wetlands, are under development by various LPAs and Natural England to enable developers to buy nutrient credits to offset development. Such solutions can have multiple benefits including Natural Flood Management (NFM), biodiversity improvements and potential for recreation. They can also be located to minimize the loss of farmland needed for food production. A notable example of a strategic solution is the Solent Nutrient Market Pilot scheme (Partnership for South Hampshire, 2023). However, for most LPA areas, strategic solutions are not yet in place and mitigation approaches often involve changing land use, for instance from agricultural land to woodland or greenspace (that is not treated with fertilisers) to reduce nutrient uptake, although this may be unfeasible for developments with a substantial nutrient load. Wetland creation for nutrient treatment of foul water or abstracted river water and use of sustainable drainage systems (SuDS) to treat surface water runoff is another commonly applied mitigation approach. Overall, a key consideration with regard to mitigation is that it must be in place from the point of operation of a development and must be maintained for the lifetime of that development.

1.2.10 In the UK Government's Spring 2023 budget (March 2023) it was announced that the Department for Levelling Up, Housing and Communities would launch "*a call for evidence for locally led nutrient neutrality credit schemes*" and provide "*funding to support clearer routes for housing developers to deliver 'nutrient neutral' sites, in line with their environmental obligations"*.

1.2.11 In a further development in August 2023, the UK Government announced proposed amendments to the draft Levelling-Up and Regeneration Bill to the effect that urban wastewater developments would no longer need to consider nutrient flows as part of HRA for planning decision making and plan-making in nutrient neutrality catchments. However, HRA considerations for developments which generate nutrient loads outside of urban wastewater, such as agricultural and certain industrial developments, are unchanged and neutrality requirements will remain. As such, it is understood that the Proposed Development would still require a nutrient neutrality assessment.

1.3 Teesmouth & Cleveland Coast SPA/Ramsar Site

1.3.1 The Teesmouth and Cleveland Coast SPA / Ramsar (Joint Nature Conservation Committee, 1995) is a 12,211 ha estuarine and coastal site located on the north-eastern coast of England as shown in the Annex B.

1.3.2 The designated sites comprise a range of coastal habitats, such as sand- and mudflats, rocky shore, saltmarsh, freshwater marsh and sand dunes. The SPA / Ramsar lies along a stretch of coast that has been significantly modified by human activity. The site provides feeding and roosting opportunities for a significant number of waterfowl in winter and the passage period.

SPA Qualifying Features

1.3.3 The site qualifies as a SPA under Article 4.1 of the Birds Directive (79/409/EEC) by supporting populations of the following features, as per the conservation objectives for the SPA updated in May 2020:

- *Recurvirostra avosetta*; Pied avocet (Breeding);
- *Calidris canutus*; Red knot (Non-breeding);
- *Calidris pugnax*; Ruff (Non-breeding);
- *Tringa 7etanus*; Common redshank (Non-breeding);
- *Sterna sandvicensis*; Sandwich tern (Non-breeding);
- *Sterna hirundo*; Common tern (Breeding);
- *Sterna albifrons*; Little tern (Breeding); and
- Waterbird assemblage.

1.3.4 An extension to the Teesmouth and Cleveland Coast SPA / Ramsar was made in 2020 to improve seabird protection within the SPA network.

Ramsar Qualifying Features (Ramsar Sites Information Service 2020):

- Criterion 5 – Assemblages of international importance; species with peak counts in winter are 26,786 waterfowl (5-year peak mean 2011/12-2015/16); and
- Criterion 6 – Species/populations occurring at levels of international importance; qualifying species/populations (as identified at designation); species with peak counts in spring / autumn – common redshank *Tringa 7etanus*; 1,648 individuals representing an average of 1.1% of the East Atlantic population (1987-91); Species with peak counts in winter – red knot Calidris *Canutus islandica*; 5,509 individuals representing an average of 1.6% of the Canada/Greenland/Iceland/ UK population (5 year peak mean 1991/92-1995/96), and Sandwich tern *Thalasseus sandvicensis* – 1,900 individuals representing an average of 4.3% of the GB population (1988-1992).

1.3.5 The following threats / pressures to the site integrity of the Teesmouth and Cleveland Coast SPA have been identified in Natural England's Site Improvement Plan (Natural England, 2014):

- physical modification;
- public access / disturbance;
- direct land take from development;
- water pollution;
- fisheries: commercial marine and estuarine;
- fisheries: recreational marine and estuarine;
- undergrazing;
- inappropriate water levels;
- predation;
- coastal squeeze;
- change to site conditions; and
- air pollution: impact of atmospheric nitrogen deposition.

2.0 ENGAGEMENT

2.1.1 A pre-application consultation meeting was held on nutrient neutrality screening and Water Framework Directive (WFD) Screening with Natural England and the Environment Agency on 12th June 2023. At this meeting an overview of the Proposed Development was provided, with preliminary details presented regarding possible raw water supply, management principles for surface water runoff, options for foul discharge and process water discharge rates and nitrogen concentration.

2.1.2 Natural England will be further consulted on the outcomes of this screening report, the scope of proposed dispersion modelling and next steps agreed for ensuring suitability of the proposed nutrient neutrality assessment.

3.0 THE PROPOSED DEVELOPMENT

3.1 Overview

3.1.1 The Proposed Development comprises the construction, operation (including maintenance where relevant) and decommissioning of an approximately 1.2-Gigawatt Thermal (GWth) Lower Heating Value (LHV) Carbon Capture and Storage (CCS) enabled Hydrogen Production Facility ('the Production Facility') located in the Teesside industrial cluster area.

3.1.2 The Hydrogen Production Facility elements of the Proposed Development are comprised of two 'phases' of plant, each comprising a single autothermal reform (ATR) unit and associated CCS and utilities. The first phase would be constructed, commissioned, and operated initially, with the second phase developed once the first unit is operational and when required by demand. It is anticipated that Phase 2 would be identical to Phase 1. The Production Facility and associated infrastructure to that

facility which form part of the Proposed Development will be located on the 'Main Site'.

3.1.3 To operate, the Hydrogen Production Facility requires the following elements:

- hydrogen distribution pipelines to supply hydrogen to various offtakers on Teesside and within the surrounding area, such pipelines to be utilised in association with the H2 production plant;
- an Air Separation Unit (ASU) to supply oxygen for the hydrogen production process;
- oxygen and nitrogen supply pipelines (as an alternative to the ASU) to supply oxygen and nitrogen for the hydrogen production process;
- carbon dioxide capture and compression facilities and a connection to the Northern Endurance Partnership (NEP) pipeline on the adjacent Net Zero Teesside (NZT) site for onward transport to the Endurance storage facility beneath the North Sea.
- a natural gas supply connection for the supply of gas to the hydrogen production plant;
- an electricity grid connection to provide power to the Proposed Development;
- water supply and treatment infrastructure;
- wastewater treatment and disposal infrastructure;
- other utilities connections, telecommunications, and other associated and ancillary infrastructure; and
- temporary construction and laydown areas.

3.1.4 H2Teesside demand will come from multiple end users, including fuel switching within process heat, steam raising and power generation applications.

3.1.5 The proposed capture technology is pre-combustion amine-based absorption-regeneration with an anticipated design carbon capture rate in excess of 95%. The capture rate is anticipated to be secured through the Environmental Permit. H2Teesside will connect via a short carbon dioxide export connection to NEP infrastructure on the Net Zero Teesside site. Based on current projections, H2Teesside will have the capacity to continuously export 1.42 Mt of dehydrated and compressed carbon dioxide per year per phase, or 2.84 Mt/year once both phases are operational (100% utilisation) with no temporary carbon dioxide storage required on Site.

3.1.6 At this stage in the design of the Proposed Development, there are still options being considered for various components. The design incorporates a necessary degree of flexibility to allow for the future selection of the preferred layout at the Main Site, as well as routing of the hydrogen pipeline and other connections. This will evolve as the design and commercial agreements progress throughout the preparation of the Application.

3.1.7 In order to ensure a robust assessment of the likely significance of the environmental effects of the Proposed Development, the Environmental Impact Assessment (EIA) is being undertaken adopting the principles of the 'Rochdale Envelope' approach where appropriate. This involves assessing the maximum (or where relevant, minimum) parameters for the elements where flexibility needs to be retained. Refer to Chapter 4: Proposed Development (PEI Report, Volume I), for a full list of Rochdale Envelope parameters relating to the water environment.

3.1.8 The following sections provide further information regarding water supply and discharge for the Proposed Development as well as the Rochdale Envelope parameters, where they are relevant to the nutrient neutrality screening. Further details regarding the Proposed Development are outlined in Chapter 4: Proposed Development (PEI Report, Volume I).

3.2 Water Cycle Overview

3.2.1 The initial source of water to supply the Proposed Development will be the existing Northumbrian Water Limited (NWL) raw water pipeline feed, which is an existing licensed abstraction from the River Tees.

3.2.2 The effluent streams from the Proposed Development will include process water (e.g., process condensate from the reforming process, cooling tower blowdown water and demineralisation plant rejects), foul water and surface water runoff. Plates 1a-1d below show flow diagrams summarising the Proposed Development's water balance for both Case A and Case B of the Proposed Development (for process and foul water, but not including surface water runoff which is described further below). As set out in Chapter 4: Proposed Development (PEI Report, Volume I), the two 'cases' reflect different technology options for blue hydrogen production, autothermal reforming technology (ATR) and low carbon hydrogen (LCH) technology, respectively. Each of the approaches have different water demands and produce different qualities of process returns.

3.2.3 In addition, two further 'cases' are under consideration in terms of process effluent management. Case 1 is based on Minimalised Liquid Discharge (MLD) from the Proposed Development's Effluent Treatment Plant. In this scenario treated wastewater from the Effluent Treatment Plant will be reused as makeup water in the Proposed Development's Water Treatment Plant. A low-volume liquid waste stream containing salts and nutrients would be taken offsite for disposal. Case 2 is an alternative to MLD and requires discharge of process effluent to the Net Zero Teeside (NZT) project outfall at Tees Bay.

3.2.4 Surface water runoff from the Proposed Development will be partially used to feed the process but will have an alternative disposal route to Dabholm Gut. This is described further later.

3.2.5 The various 'cases' for the Proposed Development are summarised in Table 1.

Table 1: Summary of the four Cases being considered by the Proposed Development

	CASE 1A	CASE 1B	CASE 2A	CASE 2B
Technology	Autothermal reforming technology	Low carbon hydrogen - Gas Heated Reformer - ATR combination process	Autothermal reforming technology	Low carbon hydrogen - Gas Heated Reformer - ATR combination process
Process Wastewater Disposal	Minimalised Liquid Discharge – treated wastewater from the Effluent Treatment Plant will be reused as makeup water in the Proposed Development's Water Treatment Plant. A low-volume liquid waste stream containing salts and nutrients would be taken offsite for disposal	Minimalised Liquid Discharge – treated wastewater from the Effluent Treatment Plant will be reused as makeup water in the Proposed Development's Water Treatment Plant. A low-volume liquid waste stream containing salts and nutrients would be taken offsite for disposal	NZT Outfall to Tees Bay	NZT Outfall to Tees Bay

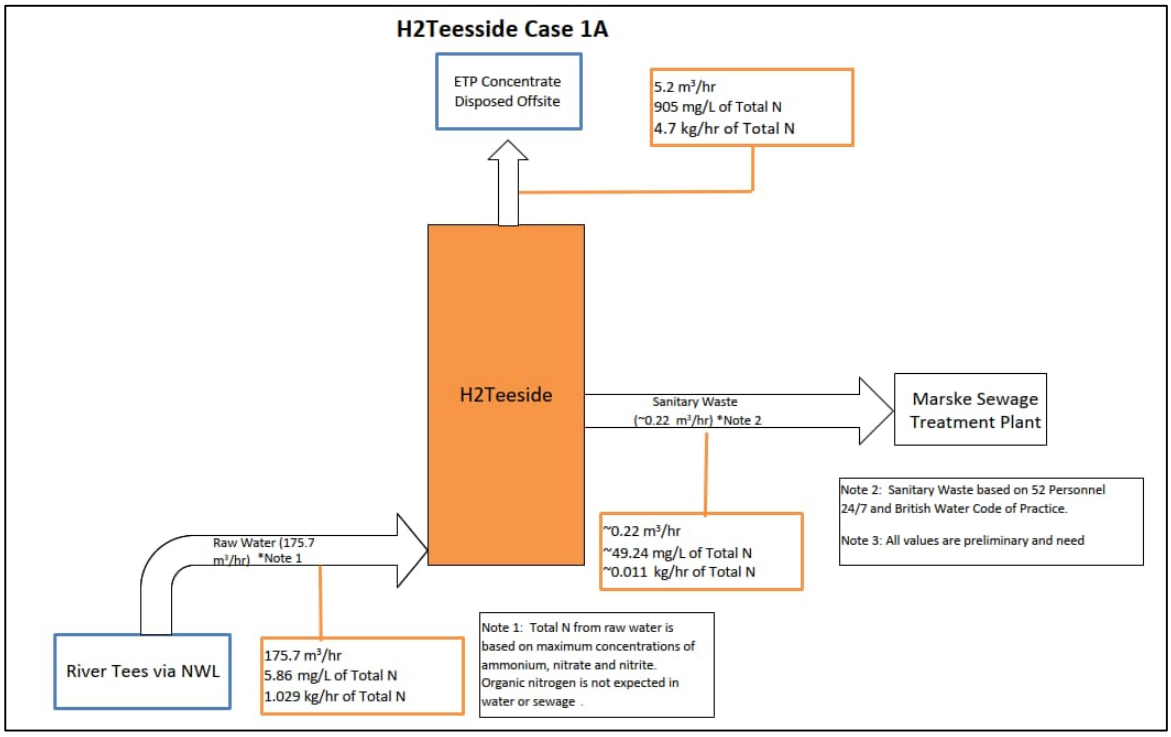


Plate 1a: Flow diagram to summarise the water cycle for the Proposed Development for Case 1A[1]

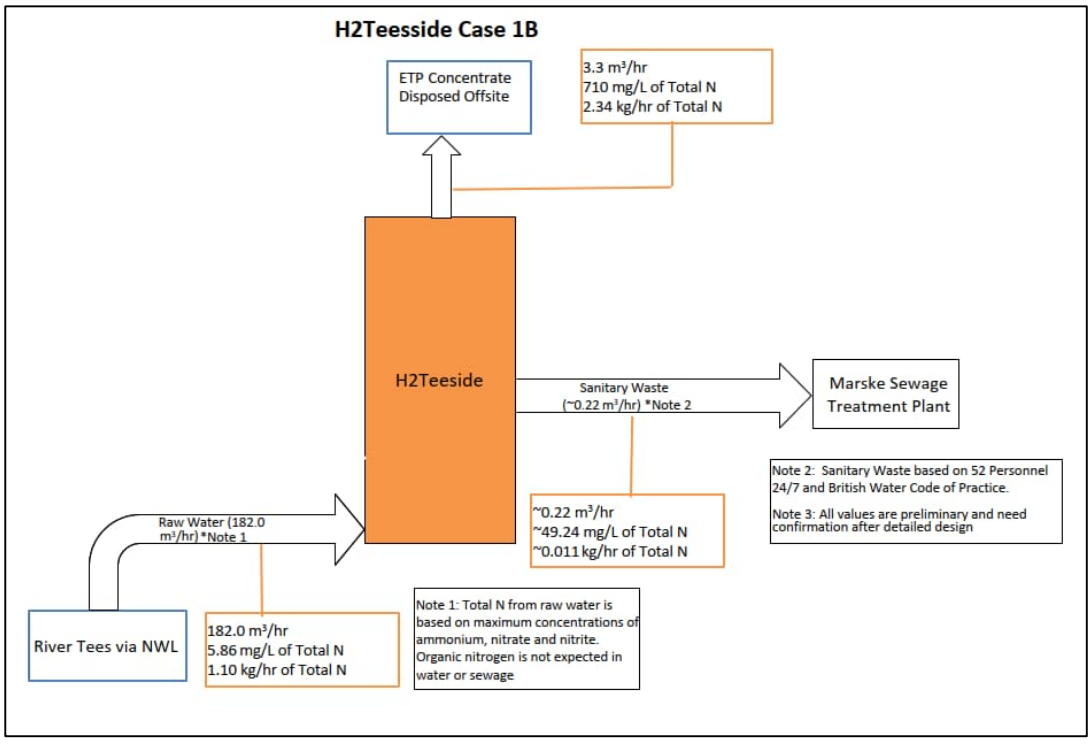


Plate 1b: Flow Diagram to Summarise the Water Cycle for the Proposed Development for Case 1B

[1] Sanitary wastewater volume presented in Plate 1a to 1d is based on a 52 personnel peak during weekday shifts. However, it should be noted that operations staffing will be on a shift basis to be spread over a 24-hour period and so personnel numbers will vary.

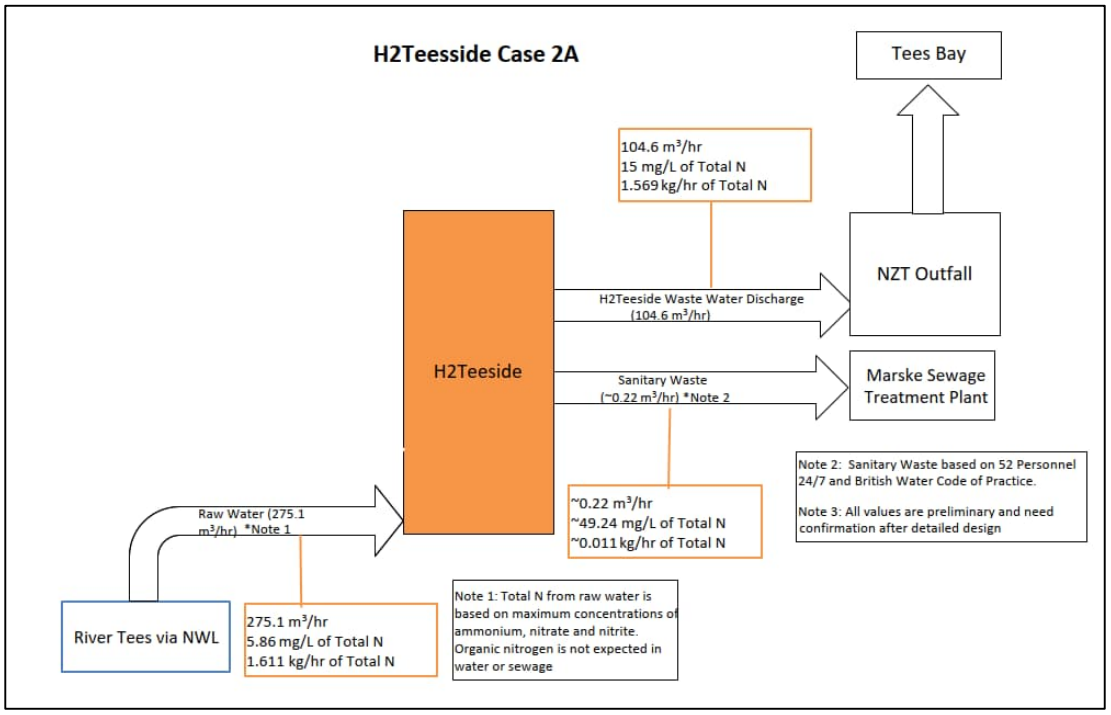


Plate 1c: Flow Diagram to Summarise the Water Cycle for the Proposed Development for Case 2A

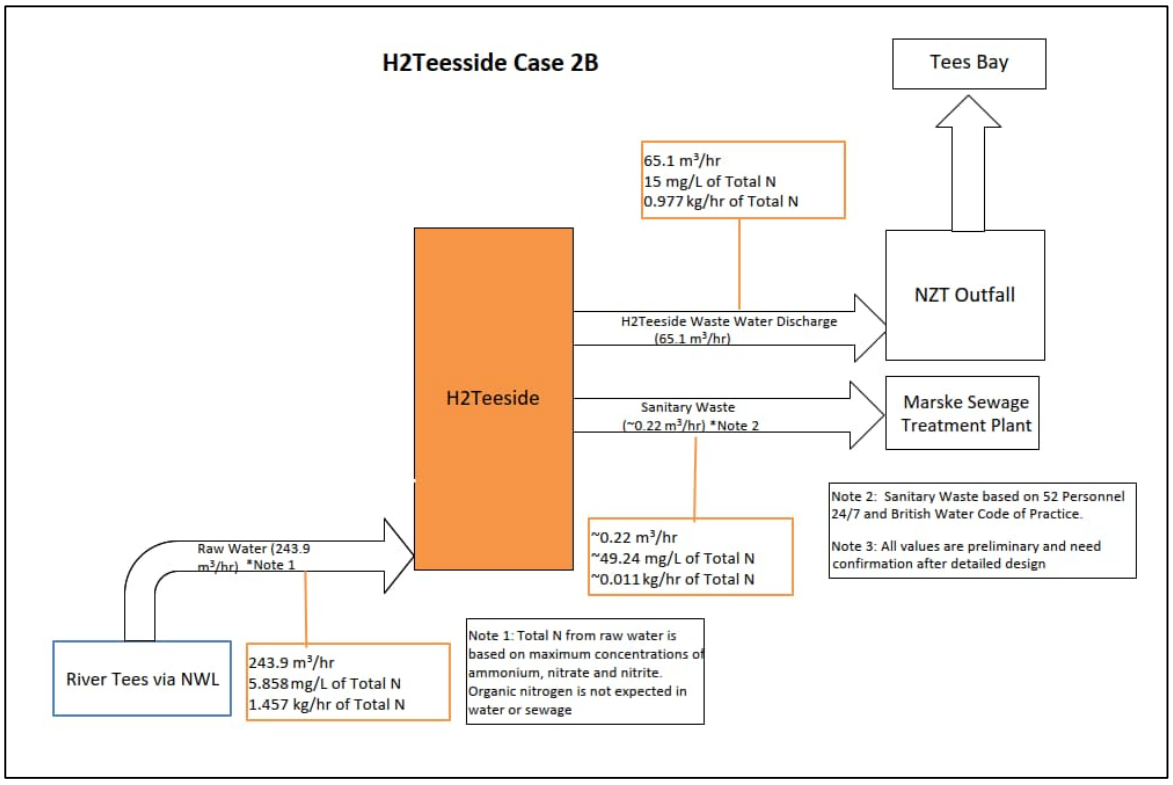


Plate 1d: Flow Diagram to Summarise the Water Cycle for the Proposed Development for Case 2B

3.3 Water Demand

3.3.1 The raw water requirement for the Proposed Development comprises the elements listed in Table 2.

Table 2: Raw water requirement for the Proposed Development

WATER REQUIREMENT	CASE 1A & 2A (M^3/HR) (PHASE 1&2)	CASE 1B & 2B (M^3/HR) (PHASE 1&2)
Cooling water make-up	144	114
Utility water	10	10
Firewater make up	Normally no flow	
Demineralised water for boiler feed water make-up, chemicals, carbon dioxide absorber and hydrochloric acid scrubber	220	104

3.3.2 Water is to be supplied via the existing NWL raw water pipeline feed from the River Tees. Treatment is required to the supplied water to produce the desired water quality for utility water/cooling water make-up, firewater and for producing demineralised water.

3.3.3 The abstraction of water from the Tees would remove a certain amount of nitrogen from the estuary, and so when returned 'downstream' does not add an additional nitrogen load, except where there is any additional load generated in the hydrogen production process.

3.4 Surface Water Drainage

3.4.1 A new surface water drainage network and management system will be provided for the Main Site that will provide adequate interception, conveyance, and treatment of surface water runoff from buildings and hard standing. This will be separate to foul systems for welfare facilities and process effluent generated by the operation of the Proposed Development. The Connection Corridors will not require additional drainage as they will be using existing pipe racks, pipe bridges, culverts or otherwise installed underground.

3.4.2 Surface water drainage will discharge to Tees Estuary via Dabholm Gut or Tees Bay. There are three options for this route: 1) direct feed to Dabholm Gut (with any new pipework and outfall to be consented under a subsequent planning application); 2) discharge to Dabholm Gut via the existing Brans Sands discharge pipeline (but not requiring treatment at Brans Sands WwTW as this is surface water runoff); or 3) discharge via the NZT pipeline to Tees Bay.

3.4.3 Due to the nature of the Proposed Development, it is likely that a range of different diffuse pollutant types (including nutrients) may be present in surface water runoff, with concentrations varying depending on many factors. However, this risk will be

offset by the fact that the Proposed Development Site is a brownfield site that is currently not operating (i.e., surface water from the Proposed Development Site may already contain diffuse chemical pollutants).

3.4.4 A Surface Water Drainage Strategy will be defined in consultation with the Environment Agency, the Lead Local Flood Authorities (RCBC, STBC and HBC) and other statutory agencies. The drainage principles adopted at this stage are as follows:

- segregate hazardous and non-hazardous effluent, and also contaminated and un-contaminated water;
- contain leaks and accidental spills via carefully designed collection system (including bunding of controlled areas with a volume of 110% of storage capacity);
- establish requirement to segregate collection and to eliminate cross contamination prior to recovery and disposal;
- identify recovery and recycle interfaces for the drained fluids;
- ensure safe design with access for maintenance and inspection; and
- account for normal operations, maintenance draining and drainage during an emergency.

3.4.5 The proposed surface drainage system will include the use of sustainable drainage systems (SuDS) where possible, to enable attenuation of surface water flows due to increases in the impermeable area as a result of the Proposed Development. SuDS will provide a degree of treatment of surface water runoff to reduce potential adverse effects on water quality in receiving watercourses. This would include some treatment for nutrients depending on the approach adopted, and a Construction Industry Research and Information Association (CIRIA) guide providing detail on treatment efficiencies of SuDS specifically for nitrogen is expected to be published in 2023. The SuDS treatment train will be selected with reference to the Simple Index Approach of the SuDS Manual (CIRIA, 2016), although a more precautionary approach may be taken due to the industrial land use, which may increase the risk. It should also be noted that SuDS are not formal treatment measures and therefore contaminated water formal treatment and/or proprietary measures are likely to be needed.

3.4.6 The key objectives of the site surface water drainage system are to provide a drainage system which is inherently safe and protects the local environment and the anticipated outfall in Dabholm Gut or Tees Bay from accidental discharges of oil, chemicals, or run-off from firefighting effluent. Clean, uncontaminated storm water will be segregated from potentially contaminated water. Gravity drainage will be used wherever practicable. Spillage containment measures such as penstocks will also be included in the drainage design.

3.4.7 Process operations on site will require the storage and use of a range of potentially polluting chemicals. These may be associated with washdown water, tank water draw-offs, pump equipment drips and drains, draw-offs from sample connections,

instruments, drain cocks and similar equipment fittings and other routinely contaminated wastewater streams. The surface water drainage system for areas of site drainage that may contain chemical pollutants from minor leaks and spills (i.e., surface water drainage near chemical storage tanks or overlying pipework etc.) will therefore need to be separated from the main 'clean' surface water drainage system using appropriate methods such as kerbs, bunds and sumps. It is assumed that some areas may also be covered with rain shelters to reduce the ingress from rainfall to minimise the volume of potentially contaminated runoff that needs to be managed on the site. Bunded areas may contain valves that can remain closed until the water stored in the bunded area has been tested. Where water is contaminated, this will be directed to the on-site package treatment plant and will be subject to a requirement of an Environmental Permit.

3.4.8 In addition to the above sources of surface water, under exceptional circumstances firewater may be generated. Fire-fighting water may contain chemicals that can be harmful to the water environment. Therefore, the surface water drainage system will include a retention basin to intercept fire-fighting water and divert it away from the existing surface water SuDS system. The contaminated fire water would then be stored prior to being pumped out for appropriate off-site disposal at a licensed waste facility. The storage requirements and the method by which fire-fighting water is diverted (i.e. an automatic or manual operated system) will be further determined in consultation with the EA, LLFAs and the Fire Service post-DCO consent during detailed design.

3.4.9 A Surface Water Drainage Strategy will be developed which will outline the consequences for the drainage system should the Proposed Development close or be decommissioned. At this stage it is also envisaged that a Surface Water Maintenance and Management Plan will also be provided by the future site operator. This will detail the requirements of access and frequency for maintaining all drainage systems proposed on the Proposed Development Site. The maintenance regime must be properly implemented to ensure all treatment measures and processes operate as intended for the lifetime of the Proposed Development. It is anticipated that this will be prepared during the detailed design stage.

3.5 Process Wastewater

3.5.1 Process wastewater will be generated on the Proposed Development Site as follows:

- boiler blowdown (Case 1A, 1B and 2A, 2B) – this will generally be of good quality with some residual Total Dissolved Solids (TDS) that will need removal for use as demineralisation water;
- process condensate (Case 1A and 2A) - this has residual methanol and ammonia that requires removal to prevent a source of organics and nutrients that can lead to biological growth and biofouling;
- process condensate (Case 1B and 2B) - this has high ammonia, methanol, carbon dioxide, methane and hydrogen that need removal before it can be discharged; and

- hazardous liquid wastes – to be taken off-site (e.g., amine).

Biotreatment Plant

3.5.2 Process condensate will be treated by a dedicated on-site Water Treatment Plant. It has been confirmed that the plant will be designed for a total nitrogen (TN) of 15 mg/l annual average from both Case A and Case B from all process water sources. The treated process condensate will be reused as makeup water in the Water Treatment Plant and so will not be discharged.

Effluent Treatment Plant

3.5.3 Other wastewater streams (cooling tower blowdown and demineralisation plant rejects) will be treated in an Effluent Treatment Plant (ETP). Case 1A and 1B is based on Minimalised Liquid Discharge from the ETP. The treatment configuration in the ETP will be ultrafiltration followed by reverse osmosis (close circuit or staged) to provide > 95% recovery of the wastewater (including chemical rejects during the membrane cleaning process). The non-chemical rejects from the ultrafiltration will flow to a clarifier and the settled solids dewatered and disposed offsite as a wet cake. The reverse osmosis rejects/concentrate will produce a liquid waste stream containing salts and a quantity of nutrients (4.7 kg/hr TN for Case 1A and 2.34 kg/hr TN for Case 1B). This will be transported off-site (and outside of the designated habitats site catchment) for further treatment. The treated wastewater from the ETP will be reused as make-up water in the Water Treatment Plant.

3.5.4 Case 2A and 2B represents an alternative to Minimalised Liquid Discharge. In this case, wastewater would be discharged via the NZT outfall to Tees Bay, with a maximum TN concentration of 15 mg/l annual average (1.569 kg/hr TN for Case 2A and 0.977 kg/hr TN for Case 2B).

3.5.5 Further details on the effluent quality are given in Chapter 9: Surface Water, Flood Risk and Water Resources (PEI Report, Volume I), but the design remains under development and will be considered further during the ongoing EIA process.

3.5.6 The continuous flows of effluent that would contain nitrogen are summarised in Plate 1a-d. In Case 1A and 1B there would be an overall continuous flow of liquid waste from the ETP for offsite disposal of 5.2 m^3/hr or 3.3 m^3/hr, respectively. For Case 2A and 2B there would be an overall continuous flow of process water effluent to be discharged to Tees Bay via the NZT outfall (or alternatively to Brans Sands WwTW) of 104.6 m^3/hr or 65.1 m^3/hr, respectively.

3.5.7 As outlined above, at this stage two options remain for disposal of treated process water and liquid waste depending on which of the four ‘cases’ is taken forward. The first option is transport of liquid waste (concentrate sludge/waste) off-site for further treatment based on Minimalised Liquid Discharge from the ETP. The second is discharge of treated process water to the Tees Bay outfall that will be constructed as part of the NZT project, where it will have to meet the standards required by the discharge permit (including an assessment of any cumulative impacts and ensuring compliance with WFD objectives including those for the designated sites). If there is discharge of process wastewater to the outfall at Tees Bay, then it is assumed that

the wastewater discharge will meet the requirements of the Best Available Techniques (BAT) Reference Document (BREF) for Common Wastewater and Waste Gas Treatment/Management Systems in the Chemical Sector 2016 (EC JRC, 2016). In both cases the permitting process will also consider the requirements of the HRA.

3.5.8 Amine contaminated water will be contained and where possible should be recovered and recycled for use within the process, or otherwise will be taken off-site by tanker to a specialist treatment plant, located outside of the habitats site catchment. Surface water runoff from uncovered external paved areas of the Proposed Development site containing amine equipment, which during normal operation is expected to result in chemical drips, leaks and minor spill and which could be contaminated, will be located within minimised local kerbed areas and be routed to the amine drain vessel for offsite disposal.

3.5.9 Water sampling facilities are to be provided for manual sampling of water prior any required discharge (dependent of which 'case' is progressed). The frequency of testing and parameters to be tested will be agreed with the permitting authority.

3.6 Foul Wastewater

3.6.1 Sanitary wastewater from welfare facilities will be at Northumbrian Water Marske-by-the-Sea WwTW. It is assumed given the relatively low volumes of foul effluent anticipated from the Proposed Development that NWL will treat this within their consent limits and in accordance with requirements to not cause deterioration or prevent improvement under the WFD. The flow diagrams in Plate 1 indicate an expected concentration of 49.24 mg/l TN in this foul effluent discharge (0.011 kg/hr) based on an indicative weekday shift of 52 personnel.

3.6.2 Given that the direction of prevailing current at Tees Bay from the Marske outfall is typically to the south, there is likely to be no pathway to the Teesmouth and Cleveland Coast SPA/Ramsar site (particularly Seal Sands) from Markse-by-the-Sea WwTW. This was agreed in discussions with Natural England and the Environment Agency on the water quality modelling undertaken for the NZT project.

3.7 Atmospheric Deposition of Nitrogen

3.7.1 There is potential for atmospheric deposition of nitrogen from emissions from the Proposed Development and modelling of this potential impact has been undertaken, and appropriate assessment through the Habitats Regulations Assessment will continue as part of the EIA process.

3.7.2 An estimation of TN load across Tees Bay has been made. Initial analysis suggests that this will have a negligible impact on ambient dissolved inorganic nitrogen (DIN) concentrations. Annual loads of between 0.001 and 0.32 kg N/ha/yr have been modelled, with the highest values found in the immediate vicinity of the Proposed Development. Values at Teesmouth are less than 0.05 kg N/ha/yr, with Seal Sands receiving <0.03 kg N/ha/yr.

3.7.3 Given the very small deposition rates in the Tees estuary, nitrogen contributions from this source are considered insignificant. It is also noteworthy that in other areas of

England where nutrient neutrality for effluent and surface runoff is a requirement, this has not been extended to include atmospheric sources of nitrogen.

4.0 SCREENING ASSESSMENT

4.1.1 The Proposed Development has the potential to release nitrogen via:

- surface water runoff;
- process water effluent discharge;
- foul water discharge; and
- atmospheric deposition.

4.1.2 Table 3 provides a screening table summarising the current understanding of the nutrient output from these various streams and whether (or not) the potential nitrogen source should be screened in for further assessment during the EIA.

Table 3: Nutrient Neutrality Screening

NITROGEN SOURCE	DEVELOPMENT DETAILS FOR NITROGEN SOURCE	SCREEN IN?
Surface Water Runoff	An Outline Surface Water Drainage Strategy will be prepared for the Proposed Development, with surface water runoff intended to be discharged to Tees Bay following attenuation. The Natural England nutrient budget calculator for Teesmouth suggests a nutrient loading of 5.78 kgTN/ha/yr for commercial and industrial land uses in the catchment (Darlington Borough Council, 2023). In the absence of specific nutrient loading data from schemes of this type, then this is the current best estimate of nutrient loading from surface water runoff in the absence of mitigation. Nonetheless, it is considered that there will be no significant change in land use between the current site and the Proposed Development Site that would be distinguishable in the budget calculator (i.e., still industrial / commercial under the Natural England land use classifications as there are no more appropriate land use categories) and thus no potential for the development to alter the nutrient load from existing site runoff. There may also potentially be betterment in terms of nutrient load reduction	No – the Proposed Development does not constitute a significant change in land use and thus there is no potential for the development to alter the nutrient load from existing site runoff.

NITROGEN SOURCE	DEVELOPMENT DETAILS FOR NITROGEN SOURCE	SCREEN IN?
	given proposed use of SuDS within the drainage philosophy.	
Process Water	There are two options for discharge of process water effluent: 1. Off-site transport of Minimalised Liquid Discharge waste from the ETP. This would contain 905 mg/l TN (Case 1A) and 710 mg/l TN (Case 1B). It has been confirmed that this would be taken for further treatment at a WwTW located outside of the catchment of the Teesmouth & Cleveland Coast Special Protection Area (SPA)/Ramsar site. 2. Discharge to Tees Bay via NZT outfall at 15 mg/l TN and at a discharge flow rate of 106.4m^3/hr (Case 2A) or 65.1 m^3/hr (Case 2B). This equates to a load of 1.596 kg/hr TN (Case 2A) and 0.977 kg/hr TN (Case 2B)[2]. Hydrodynamic modelling is required to determine the extent to which this would be dispersed into Tees Estuary and sensitive locations such as Seal Sands. The outcomes of this modelling will be reported in the ES.	Case 1A and Case 1B – No - liquid waste taken outside of the habitats site catchment for disposal. Case 2A and Case 2B - Yes – wastewater discharge from the NZT outfall would be to the SPA/Ramsar site, with modelling required to determine extent of impact should the NZT outfall be used.
Foul Wastewater	Foul wastewater will be discharged to Marske-by-the-Sea WwTW – whereby hydrodynamic modelling undertaken by NZTS indicates that the prevailing current would ensure movement of nutrients to the south and away from the designated site (Net Zero Teeside, 2022). Furthermore, the nutrient neutrality assessment method from Natural England is intended to estimate the nutrient budget from all types of development that would result in a net increase in population served by a wastewater system. This is indicated by development that would include overnight accommodation. It states that "*other types of business or commercial development, not involving overnight accommodation, will generally not need to be*	No – Natural England guidance assumes that staff will also live in the catchment and thus foul water generated is already part of the baseline. Furthermore, as Marske-by-the-Sea WwTW is to be used the prevailing currents would be away from the SPA / Ramsar.

[2] For context, the NZT project reported a base case of effluent flow through the outfall to Tees Bay of 36-640 m^3/hr effluent with 0.015 kgN/hr additional nitrogen discharged, and for their Option A had an effluent flow of 1,340 m^3/hr with 24.7 kgN/hr additional nitrogen discharged (Net Zero Teeside Project, Document Reference 9.36 Nutrient Nitrogen Briefing Paper).

NITROGEN SOURCE	DEVELOPMENT DETAILS FOR NITROGEN SOURCE	SCREEN IN?
	included in the assessment unless they have other (non-sewerage) water quality implications."	
Atmospheric Deposition	Air quality modelling indicates that TN loads would be very small from this source and given its distribution and dilution across a wide area of Tees Bay would likely be insignificant.	No – given small TN load, particularly in Tees estuary, and degree of dilution this source is not significant.

4.1.3 Natural England confirmed via consultation undertaken on 12th June 2023 that their concern with regard to nutrients (and their impact to the integrity of the site) for the Teesmouth and Cleveland Coast SPA/Ramsar site is primarily within the terrestrial and inter-tidal sections of the site, particularly the Seal Sands area. Where any discharge from the Proposed Development might occur to the sea and dispersion modelling can indicate no pathway to the terrestrial and inter-tidal sections of the site then there would likely be no issue with regard to nutrient neutrality and no further assessment or mitigation is likely to be required, all subject to agreement with Natural England. As such, the provisional screening outcome presented here will be reviewed during the EIA when further information is available to confirm whether certain potential nitrogen sources or pathways can be screened out of the detailed nutrient neutrality assessment in that context.

5.0 NEXT STEPS: NUTRIENT NEUTRALITY ASSESSMENT

5.1 Nutrient Neutrality Assessment

5.1.1 Nutrient neutrality is an approach which enables decision makers to assess and quantify mitigation requirements as a result of the effects of nutrient loading from new developments on habitats sites. Natural England considers nutrient neutrality as an acceptable means of counterbalancing nutrient impacts from development to demonstrate no adverse effects on the integrity of habitats sites.

5.1.2 A generic nutrient neutrality calculation methodology and a catchment specific nutrient budget calculator have been developed by Natural England and these were issued alongside the guidance to the LPAs in March 2022 (Planning House, 2023). Although primarily directed at residential developments, the guidance states that "other types of business or commercial development, not involving overnight accommodation, will generally not need to be included in the assessment unless they have other (non-sewerage) water quality implications". Given the potential of the Proposed Development to impact on water quality in the Tees Estuary and/or Tees Bay a bespoke assessment is therefore required within the relevant areas of the designated site.

5.1.3 The main function of the nutrient budget calculators is to estimate the annual nutrient load from foul water and from changes in land use via surface water runoff.

However, for the Proposed Development there are no overnight stays and so foul wastewater is not considered relevant, and for the purposes of this assessment the land use will effectively remain the same. It is the potential addition of nitrogen to process water effluent that is considered to trigger the need for a nutrient assessment (but which is not part of Natural England's existing calculator tool). Nonetheless, the principles of Natural England's method decision tree presented in the March 2022 letter (see Annex C) hold true and will be applied, and a similar approach for the determination of a nutrient budget for the Proposed Development will be undertaken (i.e., to estimate the annual nitrogen load from each new source to provide a total development nitrogen budget per year plus a buffer of 20%). Assumptions may be required for how the nitrogen load from various sources is estimated and this will be detailed in the final assessment. Once the annual nitrogen load plus buffer has been estimated, options for mitigation may be considered. Table 4 provides a summary of the main assessment stages and steps of the Natural England Nutrient Neutrality Generic Guidance with the final column setting out the bespoke approach for determining the budget for the Proposed Development.

Table 4: Comparison of Natural England Nutrient Neutrality Generic Methodology Stages and Steps and Bespoke Approach from NZT

<table>
<tr><th colspan="2">NATURAL ENGLAND NUTRIENT NEUTRALITY GENERIC METHODOLOGY STAGES AND STEPS</th><th>PROPOSED METHOD FOR H2TEESIDE</th></tr>
<tr><td rowspan="3">Stage 1 The increase in nutrient loading to a Habitats Site that results from the increase in wastewater from a new development</td><td>Step 1 Calculate increase in population due to development</td><td rowspan="3">Estimate annual load of nitrogen from process water discharges to the Tees Estuary in kg N/ yr.</td></tr>
<tr><td>Step 2 Calculate the increase in wastewater production (from population increase) due to development</td></tr>
<tr><td>Step 3 Determine the concentration of nutrients in wastewater and calculate additional wastewater nutrient load</td></tr>
<tr><td rowspan="2">Stage 2 The nutrient loading from the past/present land use of the development site</td><td>Step 1 Obtain nutrient export values from current land use</td><td rowspan="3">N/A as land use is not changing. This will be reviewed and if there is a change of land use, the catchment specific nutrient neutrality calculator will be used to measure each land use and to estimate nutrient loading from past/existing and future land uses.</td></tr>
<tr><td>Step 2 Calculate the annual nutrient export from current land use(s)</td></tr>
<tr><td>Stage 3 The nutrient loading from the future mix of land use on the development site</td><td>Step 1 Calculate the annual nutrient export from future land use(s)</td></tr>
</table>

NATURAL ENGLAND NUTRIENT NEUTRALITY GENERIC METHODOLOGY STAGES AND STEPS		PROPOSED METHOD FOR H2TEESIDE
Stage 4 Calculate the net change in nutrient loading to a Habitats Site with the addition of a buffer (the net change in the nutrient loading + the buffer is the nutrient budget)	Step 1 Calculate the nutrient budget	If it is confirmed that there is no change in land use, then the annual nitrogen load from process water discharges to the Tees Estuary equates to the nutrient budget.
	Step 2 Add the buffer to the nutrient budget	A precautionary buffer of 20% will be added to the Proposed Development Nutrient Budget as recommended by Natural England's methodology to account for uncertainty in the process and to provide reasonable certainty that there will no adverse effect on the integrity of the site.

5.2 Dispersion Modelling of Effluent

5.2.1 Modelling of process water effluent discharges to Tees Bay will support an assessment of potential impacts on the qualifying features of the Teesmouth and Cleveland Coast SPA/Ramsar and the potential for effluent to disperse into the Tees Estuary (e.g., by tidal incursion). It is important to determine whether any such pathway exists to determine whether any nutrient mitigation is required. If no pathway from the NZT outfall to Tees estuary / Seals Sands exists, then there would be no need for nutrient neutrality mitigation.

5.2.2 A modelling scope is to be agreed with the Environment Agency and Natural England for the relevant 'cases' and will include for cumulative assessment in combination with nitrogen outputs from the NZT development and where relevant other cumulative development sites (for determining potential for impacts against WFD requirements). The modelling and associated nutrient assessment will be presented in the Environmental Statement.

5.2.3 A separate water quality modelling report will be produced for inclusion in the DCO application and used to inform the nutrient neutrality assessment. This report will confirm whether (or not) process water effluent will enter the estuary and contribute to the loading on the designated sites, particularly Seal Sands.

5.3 Determine Mitigation Requirements

5.3.1 Once a nutrient budget has been determined for the Proposed Development following the above process (see Table 4), appropriate mitigation can be determined. If the Proposed Development does contribute to the load of nutrients released to the estuary via Bran Sands WwTW and Dabholm Gut, or if hydrodynamic modelling indicates a pathway from the Tees Bay outfall, then further mitigation to offset this nutrient load is likely to be required.

5.3.2 If nutrient neutrality cannot be proven beyond reasonable scientific doubt using mitigation measures for the Teesmouth and Cleveland Coast SPA/Ramsar, then the Proposed Development could not be consented without demonstrating 'imperative reasons of overriding public interest', that there are no alternatives and by delivering compensation. Similar considerations will also be required to ensure compliance with the Water Environment (Water Framework Directive) (England & Wales) Regulations 2017, as the conservation status of designated sites is a material consideration for WFD status of the Tees (transitional) and Tees Coastal WFD water bodies. In doing so various tests will need to be considered, such as consideration of all alternatives and identification of all possible mitigation.

5.3.3 Natural England guidance published to date suggests several potential ways of providing mitigation. These include direct measures, such as interceptor wetlands to prevent nutrients entering the habitats site, or indirect methods (i.e., off-setting) such as taking land out of nitrogen intensive uses (e.g. cropping of intensive livestock farming). However, where the new loads are large the need for, and space required for mitigation can also be significant, which can present challenges for deliver and thus early consideration of these issues is essential.

5.3.4 In areas where nutrient neutrality issues have become established, strategic solutions have begun to be developed. At Teesside, Natural England has launched a Nutrient Mitigation Scheme for housing developers. It is now possible to apply for credits to offset the small impact of development and create new wildlife habitats, such as wetlands. Natural England has already invested in land which will provide the first credits in the Tees catchment to unlock up to 1,600 homes this year (DEFRA, 2023). This is not expected to be applicable to larger scale industrial / commercial development, but this will be confirmed with Natural England.

5.3.5 On-site treatment options (denitrification) for the Proposed Development may be explored depending on the scale of mitigation required. Furthermore, there may be opportunities through ongoing consultation with Natural England and the Environment Agency to develop strategic solutions.

6.0 SUMMARY

6.1.1 On 16th March 2022, Natural England informed the Inspectorate, RCBC, STBC and HBC that as a Competent Authority under the Habitats Regulations, the LPAs (and the SoS for DCO applications) must carefully consider the nutrients impacts of any new plans and projects on the Teesmouth & Cleveland Coast SPA/Ramsar site and whether

those impacts may have an adverse effect on the site that requires mitigation, including through nutrient neutrality.

6.1.2 The Proposed Development has the potential to release nutrients via i) process water effluent discharge (where it introduces a new nitrogen load rather than just concentrating nitrogen already present in raw water and being returned to the habitats site); ii) surface water runoff; iii) foul water discharge; and iv) atmospheric deposition of nitrogen.

6.1.3 Following a screening exercise, it is proposed that process water effluent discharge is screened in only for those cases where it may enter the habitats site catchment (i.e., Cases 2A, 2B). Surface water runoff is considered to be 'no change' from the existing situation given it is currently an industrial site and so it is proposed that this can be screened out. The potential impact from foul effluent is also proposed to be screened out on the basis that operational workers are assumed to already live in the habitats site catchment and no 'new' overnight stays are created. Furthermore, if as Marske-by-the-Sea WwTW is to be used the prevailing currents would typically be away from the SPA / Ramsar sites. Impact from atmospheric deposition has also been screened out given the minimal deposition that has been modelled over Tees estuary which will be insignificant given the dilution and dispersal potential of the waterbody. Natural England will be consulted on the outcomes of this screening report to confirm their agreement.

6.1.4 For discharges to Tees Bay via the NZT project outfall (Case 2A and Case 2B), and considering the scope of assessment for the recent NZT project, hydrodynamic dispersion modelling is proposed to determine whether there is potential for nutrients to enter the Tees Estuary, particularly Seal Sands as the area of most concern in terms of eutrophication (as confirmed by Natural England). Natural England will expect mitigation approaches to be adopted to achieve nutrient neutrality if any discharges from the Proposed Development may contribute new nitrogen loads to the Teesmouth and Cleveland Coast SPA/Ramsar site. Similarly, these assessments would also need to consider WFD compliance including how the new discharge may impact achievement of conservation objectives for the designated sites. WFD compliance would also need to consider cumulative nitrogen loads (e.g., in combination with the NZT outfall).

6.1.5 If required, mitigation measures will be determined during the EIA once the nutrient budget has been determined with options likely to include on-site denitrification or working with Northumbrian Water to upgrade treatment works. Other approaches, which may be more appropriate to smaller developments, include use of the local nutrient credit scheme, conversion of agricultural land for community / wildlife benefit in the catchment of the Teesmouth and Cleveland Coast SPA/Ramsar site, woodland planting in the catchment of the habitats site, and use of wetlands (on site to treat runoff or offsite at a WwTW or elsewhere in the catchment).

6.1.6 As mentioned previously, under the WFD the Proposed Development must not cause deterioration or prevent improvement to good ecological potential of Tees transitional water body, taking into account the conservation objectives for the SPA/Ramsar sites. This includes long term aspirations to lower the nutrient load in

the estuary to reduce the extent of algal matts that are believed to hinder access to benthic fauna for bird species that are qualifying features. It remains unclear whether achieving nutrient neutrality alone is consistent with the target to reduce nutrient levels. Nonetheless, based on consultation undertaken to date, a requirement to go beyond achieving nutrient neutrality for the Proposed Development has not been stated to be required. However, this will be confirmed through further engagement with Natural England and the Environment Agency.

6.1.7 If it is not possible to deliver sufficient mitigation to demonstrate nutrient neutrality, then the competent authority (i.e. the SoS for this DCO application) cannot legally grant consent unless the Proposed Development can justify the impact by meeting the requirements of the Imperative Reasons of Overriding Public Interest (IROPI) tests (i.e. it must proceed despite the harm it will cause and that there are no feasible alternative solutions to meeting the objectives of the Proposed Development).

6.1.8 Importantly, even if the IROPI tests are passed it would be necessary to agree this position with Natural England, and if appropriate, deliver compensation for the harm caused to the SPA/Ramsar site.

6.1.9 Such compensation or mitigation could be in the form of habitat creation that would ensure the coherence of the National Site Network of internationally important wildlife sites was not compromised, and the Environment Agency have previously identified various local schemes with the NZT project already committed to exploring opportunities. However, in this case, delivering an area of compensation that served the needs of the SPA birds while not also being subject to nutrient neutrality issues would be extremely difficult, if not impossible, given that such issues affect the entire SPA/Ramsar site.

6.1.10 To conclude, on the basis of this screening exercise, it is proposed that a full nutrient neutrality assessment is undertaken during the EIA for inclusion in the DCO application focusing on Case 2A and 2B should they be retained as options for the Proposed Development. This will require a bespoke approach to assessment given that the existing nutrient calculator is not applicable this type of development. The bespoke methodology would be agreed with the Environment Agency and Natural England. For Case 1A and 1B, process water discharge, surface water runoff, foul drainage and atmospheric deposition are proposed to be screened out of further assessment on the basis of being unchanged from existing or not draining to the catchment of the designated.

7.0 REFERENCES

- Darlington Borough Council (2023) Nutrient Neutrality advice. [Online] Available at: Department for Environment, Food, and Rural Affairs (2023) Natural England's nutrient mitigation scheme for developers. Available at: https://www.gov.uk/government/publications/natural-englands-nutrient-mitigation-scheme-for-developers
- Department for Environment, Food, and Rural Affairs (2023) Natural England's nutrient mitigation scheme for developers. Available at: https://www.gov.uk/government/publications/natural-englands-nutrient-mitigation-scheme-for-developers
- Joint Nature Conservation Committee (1995) Standard data form for sites within the 'UK national site network of European sites' [Online] Available at: UK9006061.pdf (jncc.gov.uk)
- Natural England (2022a) Nutrient Neutrality Advice [Online]. Available at: https://publications.naturalengland.org.uk/publication/4792131352002560
- Natural England (2022b) Nutrient Neutrality Generic Methodology [Online]. Available at: https://publications.naturalengland.org.uk/publication/5143927928913920
- Natural England (2024) Site Improvement plan: Teesmouth & Cleveland Coast [Online]. Available at: https://publications.naturalengland.org.uk/publication/5803888850501632
- Net Zero Teeside (2022) Nutrient Nitrogen Briefing Paper [Online]. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010103/EN010103-002322-NZT%20DCO%209.36%20-%20Nutrient%20Nitrogen%20Briefing%20Paper%20Clean%20Oct%202022%20(D9).pd
- Partnership for South Hampshire (2023) Solent Nutrient Market Pilot [Online] Available at: https://www.push.gov.uk/defra-trading-platform/https://publications.naturalengland.org.uk/publication/4792131352002560
- Planning House (2023) Nitrates and Nutrient Neutrality [Online] Available at: https://planninghouse.co.uk/nitrates-nutrient-neutrality/
- Planning inspectorate (2022) Advice Note Ten [Online]. Available at: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-ten/
- Ramsar Sites Information Service (2020) Teesmouth & Cleveland Coast Ramsar [Online]. Available at: https://rsis.ramsar.org/ris/741

ANNEX A TEESMOUTH AND CLEVELAND COAST SPA/RAMSAR CATCHMENT AS DEFINED BY NATURAL ENGLAND

European protected sites requiring nutrient neutrality strategic solutions

Scale: 1:420,000

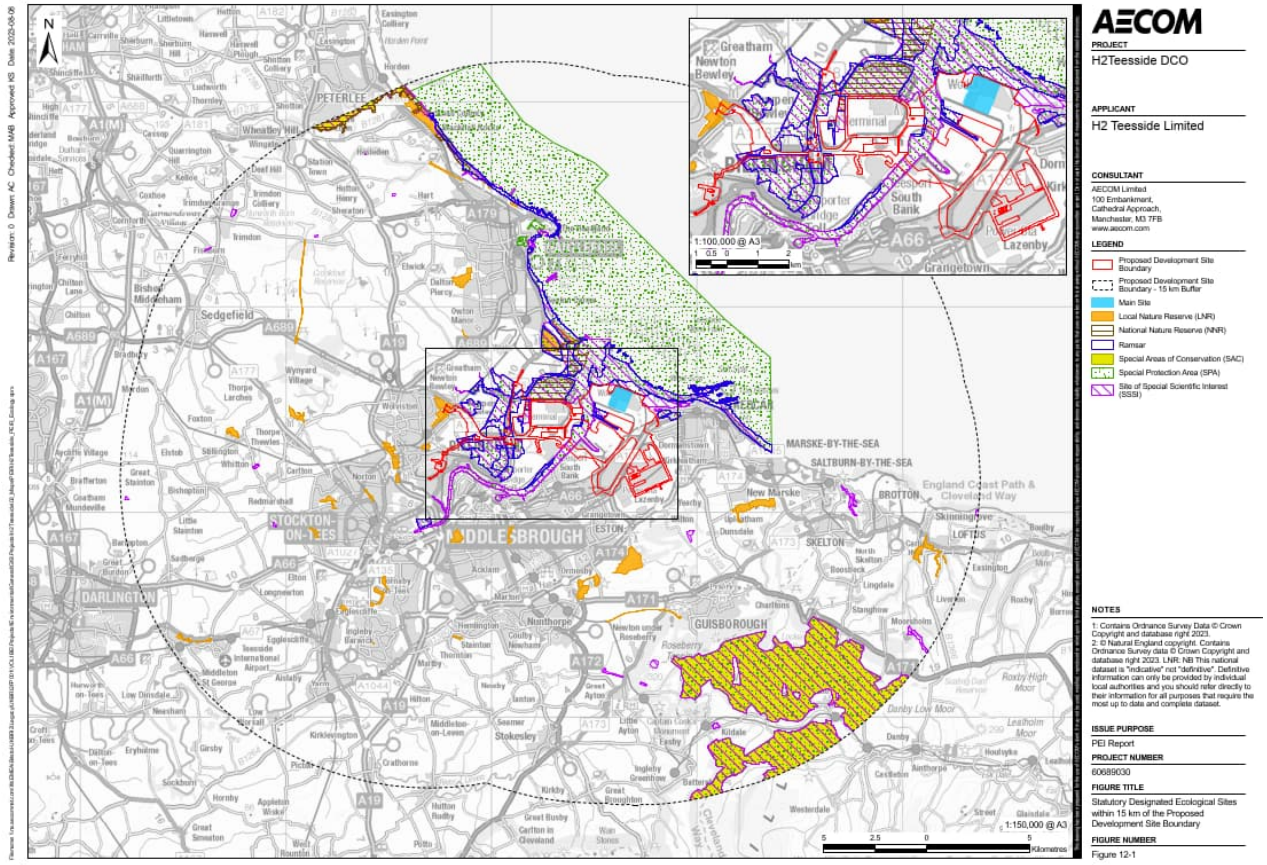
Component SSSIs of
Teesmouth and Cleveland Coast SPA/Ramsar

- Local Authorities
- SSSI subject to nutrient neutrality strategy
- Nutrient neutrality SSSI catchment
- National Parks

Produced by Defra Spatial Data Science

NATURAL ENGLAND

ANNEX B ECOLOGICAL DESIGNATIONS SURROUNDING THE PROPOSED DEVELOPMENT



AECOM

PROJECT
H2Teesside DCO

APPLICANT
H2 Teesside Limited

CONSULTANT
AECOM Limited
100 Embankment,
Cathedral Approach,
Manchester, M3 7FB
www.aecom.com

LEGEND
- Proposed Development Site Boundary
- Proposed Development Site Boundary - 15 km Buffer
- Main Site
- Local Nature Reserve (LNR)
- National Nature Reserve (NNR)
- Ramsar
- Special Areas of Conservation (SAC)
- Special Protection Area (SPA)
- Site of Special Scientific Interest (SSSI)

NOTES
1: Contains Ordnance Survey Data © Crown Copyright and database right 2023.
2: © Natural England copyright. Contains Ordnance Survey data © Crown Copyright and database right 2023. LNR, NB This national dataset is "indicative" not "definitive". Definitive information can only be provided by individual local authorities and you should refer directly to their information for all purposes that require the most up to date and complete dataset.

ISSUE PURPOSE
PEI Report

PROJECT NUMBER
60689030

FIGURE TITLE
Statutory Designated Ecological Sites within 15 km of the Proposed Development Site Boundary

FIGURE NUMBER
Figure 12-1

ANNEX C NATURAL ENGLAND NUTRIENT NEUTRALITY ASSESSMENT DECISION TREE (MARCH 2022)