H2Teesside Project

Planning Inspectorate Reference: EN070009/APP/5.14

Land within the boroughs of Redcar and Cleveland and Stockton-on-Tees, Teesside and within the borough of Hartlepool, County Durham

Document Reference: 5.14: Water Framework Directive Assessment

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 - Regulation 5(2)(e)

Applicant: H2 Teesside Ltd

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1.0 INTRODUCTION

1.1 Background

1.1.1 This Water Framework Directive (WFD) Assessment Report has been prepared as part of the Environmental Statement (ES). This should be read in conjunction with Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2).

1.1.2 New developments that have the potential to impact the current or targeted WFD status of a designated water body or tributaries in its catchment are required to assess their compliance against the WFD objectives of the potentially affected water bodies. The Planning Inspectorate's ('the Inspectorate') Advice Note Eighteen (The Inspectorate, 2017) and the Environment Agency guidance for competing WFD assessments for coastal and transitional waters (Environment Agency, 2016, 2023), suggest that a three-stage approach should be adopted as follows:

- Stage 1: WFD Screening;
- Stage 2: WFD Scoping; and
- Stage 3: WFD Impact Assessment.

1.1.3 This report presents the findings of Stage 1, Stage 2, and Stage 3, which have been undertaken in relation to the Proposed Development as described below.

1.2 The Proposed Development

1.2.1 The Proposed Development comprises the construction, operation (including maintenance where relevant) and decommissioning of an up to 1.2-Gigawatt Thermal (GWth) Lower Heating Value (LHV) Carbon Capture and Storage (CCS) enabled Hydrogen Production Facility located in Teesside, along with the pipeline infrastructure required to supply hydrogen (H_2) to offtakers (customers) and the necessary utility connections. Carbon captured by the Proposed Development will be transported by pipeline to the separately consented Northern Endurance Partnership (NEP) infrastructure on the adjacent Net Zero Teesside (NZT) site for high-pressure compression and offshore transport and underground storage.

1.2.2 A detailed description of the required works for the Proposed Development is provided in Chapter 4: Proposed Development (ES Volume I, EN070009/APP/6.2).

1.2.3 The main elements of the Proposed Development include the following:

- Hydrogen Production Facility
- CO_2 Export Corridor
- Natural Gas Supply Connection
- Hydrogen Pipeline Corridor
- Electrical Connection Corridor
- Water Connections

- Other Gases Connections
- Hydrogen Storage
- Material Storage

1.2.4 The components of the Proposed Development, including the Main Site and the Connection Corridors is provided detail in Chapter 4: Proposed Development (ES Volume I, EN070009/APP/6.2) and shown in Figures 4-1 to 4-8 (ES Volume II, EN070009/APP/6.3).

1.3 Structure of the Report

1.3.1 The structure of the remainder of this report is set out as follows:

- Section 2 provides a summary of the WFD requirements and screening process;
- Section 3 describes the assessment methodology;
- Section 4 describes the baseline conditions;
- Section 5 provides the screening assessment;
- Section 6 provides the scoping assessment;
- Section 7 describes the results of the assessment and provides details of possible mitigation and monitoring options to alleviate adverse effects; and
- Section 8 presents the conclusions and recommendations.

1.3.2 The report is supported by the following figures within ES Volume II (EN070009/APP/6.3) and the annexes within this document:

- Figure 9-1: Surface Water Features and their Attributes;
- Figure 9-2: Groundwater Features and their Attributes;
- Annex A: WFD Water Body Assessments Cycle 3;
- Annex B: Surface Water Quality Data;
- Annex C: Pond 14 Water Quality Monitoring Technical Note; and
- Annex D: Water Resources Tables.

2.0 OVERVIEW OF THE WATER FRAMEWORK DIRECTIVE

2.1 Legislative Context

2.1.1 The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (HM Government, 2017) implement the Water Framework Directive (WFD) , which aims to protect and enhance the water environment.

2.1.2 The WFD takes a holistic approach to sustainable management of the water environment by considering interactions between surface water, groundwater and water-dependent ecosystems. Ecosystem conditions are evaluated according to interactions between classes of biological, chemical, physico-chemical and hydromorphological elements known as 'Quality Elements'.

2.1.3 Under the WFD, ‘water bodies’ are the basic management units, defined as all or part of a river system or aquifer. Water bodies form part of a larger ‘river basin district’ (RBD), for which ‘River Basin Management Plans’ (RBMPs) are used to summarise baseline conditions and set broad improvement objectives. RBMPs are produced every six years, in accordance with the river basin management planning cycle. The current RBMPs are Cycle 3 that were published in 2022.

2.1.4 In England, the Environment Agency (EA) is the competent authority for implementing the WFD, although objectives are delivered in partnership with other public bodies and private organisations, for example Local Planning Authorities, water companies, rivers trusts, and private landowners and developers.

2.1.5 The EA is also responsible for managing flood risk and other activities on Main Rivers. Local Planning Authorities or drainage boards are typically responsible for consenting activities on Ordinary Watercourses. Local Planning Authorities are also typically responsible for highways drains, and landowners are typically responsible for ditches and watercourses within their property, including piped watercourses and culverts. The EA is ultimately responsible for enforcing the WFD on any water body, local authorities are required to plan and consent WFD related activities on Ordinary Watercourses.

2.1.6 In relation to planning and DCO applications, public bodies such as the Secretary of State must consider whether proposals for new developments have the potential to:

- cause a deterioration of any quality element of a water body from its current status or potential; and / or
- prevent future attainment of good status or potential where not already achieved.

2.1.7 Regulation 33 of the

2.1.8 Regulations 2017 (HM Government, 2017) (i.e. the WFD) states that public bodies “must, in exercising their functions so far as affecting a river basin district, have regard to - (a) the river basin management plan for that district as approved under regulation 31, and (b) any supplementary plan prepared under regulation 32.” The application must therefore consider the potential of the Proposed Development to

impact upon water body improvement priorities as outlined in the Northumbria RBMP.

2.1.9 In determining whether a development is compliant or non-compliant with the WFD objectives for a water body, the Secretary of State must also consider the conservation objectives of any Protected Areas (e.g. Natura 2000 sites or water dependent Sites of Special Scientific Interest) and adjacent WFD water bodies, where relevant (i.e. the next water body downstream).

3.0 ASSESSMENT METHODOLOGY

3.1 Introduction

3.1.1 There are no fixed methods for WFD assessment. The nature of the water environment and the breadth of the legislation mean that assessments are tailored to proposals on a case-by-case basis.

3.1.2 The following general guidance is available which has been applied for this assessment:

- Environment Agency (2023) Environment Agency guidance for competing WFD assessments for coastal and transitional waters ('Clearing the Waters for All');
- Environment Agency (2016a). Water Framework Directive risk assessment. How to assess the risk of your activity;
- Environment Agency (2016b). Protecting and improving the water environment. Water Framework Directive compliance of physical works in rivers; and
- The Inspectorate (2017). Advice Note eighteen: The Water Framework Directive.

3.1.3 A stepwise approach consisting of screening, scoping and impact assessment phases is generally followed in order to:

- (a) rationalise the levels of WFD assessment and impact mitigation that are required; and
- (b) verify that proposals meet the requirements of the WFD.

3.2 Assessment Stages

3.2.1 A three-stage approach was adopted:

- Stage 1: WFD Screening - Screening identifies the zone of influence of a Proposed Development, and if proposed activities (construction, operation or decommissioning) pose a risk to the water environment. It is used to identify if there are activities that do not require further consideration for WFD objectives, for example activities which have been ongoing since before the current RBMP plan cycle and which have thus formed part of the baseline. This is covered in Section 5.
- Stage 2: WFD Scoping – A scoping assessment is required to determine which receptors may be impacted by the Proposed Development, and therefore need to be assessed in the WFD impact assessment. For coastal and transitional water bodies the relevant receptors are defined in accordance with the Environment Agency Clearing the Waters Guidance (Environment Agency, 2016) and are based on the water body's quality elements; the receptors include (see Section 6):
  - hydromorphology;

- water quality;
- biology – habitats;
- biology – fish; and
- protected areas.

The scoping assessment also considers potential for spread of Invasive Non-Native Species (INNS) within WFD waterbodies as is required by the Clearing the Waters Guidance (Environment Agency, 2016).

Freshwater bodies are all taken forward for Stage 3 assessment.

- Stage 3: WFD Impact Assessment – This involves rationalised assessment of water bodies and quality elements that could be affected by proposed activities, in order to identify any areas of WFD non-compliance. Proposed activities are reviewed in terms of both positive and negative impacts, and the baseline mitigation measures, enhancements, and contributions to the WFD objectives described in the RBMP. Any proposed activities with potentially deleterious impacts are reviewed simultaneously with their corresponding mitigation proposals, to determine a net effect on WFD objectives. This is covered in Section 7.

3.2.2 This report covers Stages 1-3 of the above assessment process.

3.3 Mitigation Commitments

3.3.1 Proposed mitigation activities relied upon to demonstrate compliance at any of the stages referred to above are defined in this assessment. Mitigation is secured through the DCO either as a Requirement or a commitment within an approved document.

3.4 Further Assessments if Water Framework Directive Derogation is to be Considered by the Applicant

3.4.1 WFD Regulation 17 and Regulation 19 set out 'last resort' planning and legal processes for WFD derogation to set less stringent environmental objectives in the circumstance that WFD compliance cannot be achieved. WFD Regulation 17 covers part of the procedures for WFD derogation, including but not limited to that "the environmental and socio-economic needs served by such human activity cannot be achieved by other means which are a significantly better environmental option not entailing disproportionate costs".

3.4.2 Where the potential for deterioration of water bodies is identified, and the "body of water is so affected by human activity or its natural condition is such that the achievement of the environmental objectives set would be infeasible or disproportionately expensive", it is possible for an applicant to present further assessments in the context of WFD Regulation 19.

3.4.3 If derogation was to be considered, it would require detailed further analysis of each of the tests set out in Article 4.7/Regulations 19, to then be considered by the Secretary of State. .

3.4.4 Given the results of the impact assessment, derogation has not needed to be considered in this report.

3.5 Environment Agency Clearing the Waters for All Guidance

3.5.1 The Environment Agency's Clearing the Waters for All (Environment Agency, 2016) provides guidance on how to assess the impact of activities in estuarine and coastal waters on the objectives of the WFD. The assessment adopts a staged approach, including screening, scoping and impact assessment.

3.5.2 The Environment Agency's guidance on WFD assessment (Environment Agency, 2016) lists the following activities which can be screened out of any assessment due to being of low risk:

- a self-service marine licence activity or an accelerated marine licence activity that meets specific conditions;
- maintaining pumps at pumping stations – if the activities occur regularly, avoid low dissolved oxygen levels during maintenance and minimise silt movement when restarting the pumps;
- removing blockages or obstacles like litter or debris within 10 m of an existing structure to maintain flow;
- replacing or removing existing pipes, cables or services crossing over a water body – but not including any new structure or supports, or new bed or bank reinforcement; and
- 'over water' replacement or repairs to, for example bridge, pier and jetty surfaces – if the bank or bed disturbance is minimised.

3.5.3 Screening against these potential exemptions is undertaken in Section 5 of this assessment.

3.6 Flood Risk Activity Permit Exemptions

3.6.1 Certain activities on or near water bodies are exempt from the requirement for Environmental Permits for Flood Risk Activities (and the replacement regime through the Protective Provisions in the DCO), and hence would also be considered low risk activities that would be unlikely to require WFD assessments, as summarised in Table 3-1.

Table 3-1: Flood Risk Activity Exemptions

ACTIVITY	TYPE OF MODIFICATION
Low impact maintenance activities (encourage removal of obstructions to fish/eel passage)	Re-pointing (block work structures)
	Void filling ('solid' structures)
	Re-positioning (rock or rubble or block work structures)
	Replacing elements (not whole structure)
	Re-facing
	Skimming/ covering/ grit blasting
	Cleaning and/or painting of a structure
Temporary works	Temporary scaffolding to enable bridge re-pointing
	Temporary clear span bridge with abutments set-back from bank top
	Temporary cofferdam(s) (if eel/ fish passage not impeded)
	Temporary flow diversion (if fish/ eel passage not impeded) such as flumes and porta-dams
	Repair works to bridge or culvert which do not extend the structure, reduce the cross-section of the river or affect the banks or bed of the river, or reduce conveyance
	Excavation of trial pits of boreholes in byelaw margin
	Structural investigation works of a bridge/ culvert/ flood defence such as intrusive tests, non-intrusive surveys
Bridges	Permanent clear span bridge, with abutments set-back from bank top
	Bridge deck/ parapet replacement/ repair works
	Replacing road surface on a bridge
Service crossing	Service crossing below the river bed, installed by trenchless technologies if more than 1.5 m below the natural bed line of the river
	Service crossing over a river. This includes those attached to the parapets of a bridge or encapsulated within the bridge's footpath or road
	Replacement, installation or dismantling of service crossing/ high voltage cable over a river

ACTIVITY	TYPE OF MODIFICATION
Other structures	Fishing platforms
	Fish/ eel pass on existing structure (where <2% water body length is impacted)
	Cattle drinks
	Mink rafts
	Fencing (if open panel/ chicken wire) in byelaw margin
	Outfall to a river ≤300 mm diameter

3.6.2 If the project or components of the project meet the above criteria, they may be screened out of any further assessment, although agreement should also be sought from the Environment Agency. Screening is undertaken in Section 5 of this assessment.

3.7 General Approach

Consultation

3.7.1 The Environment Agency were contacted for pre-application planning advice, including WFD methodology, and a response was received on 17 March 2023. A summary of the planning advice relevant to this assessment were outlined in Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2), along with a summary of how the various points have been addressed. Comments related directly to the WFD assessment process are included in Table 3-2 below.

3.7.2 An EIA Scoping Opinion was requested from the Inspectorate in April 2023. A response was received in May 2023. The opinions received from the Environment Agency with regard to the WFD process are summarised in Table 3-2. Further consultation responses regarding the Preliminary Environmental Information (PEI) Report were received in November 2023 and are also included in the table below, where they relate specifically to the WFD assessment.

3.7.3 A joint workshop with the Environment Agency and Natural England was held on 12 June 2023 within which details of the Proposed Development and the water environment baseline were described, mitigation as defined at the PEI Report stage was presented, and the approach to the WFD assessment outlined. Further consultation meetings have been undertaken on the topic of Water Environment with Natural England on 13 November 2023, and with the Environment Agency on 24 November 2023.

Table 3-2: Summary of Environment Agency Pre-application Advice, Scoping Opinion and Statutory Consultation Response (and how addresssed)

CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
ENVIRONMENT AGENCY PRE-APPLICATION ADVICE (MARCH 2023)	
Water Framework Directive (WFD) Assessment Your development proposal should have regard to the objectives of 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 water body Tees estuary (GB510302509900) and ensure that there is no deterioration resulting from their activities. Information about the status of the water body is available at TEES | 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.	A WFD Assessment has been produced (this document). The approach and mitigation incorporated into the WFD assessment was outlined to the Environment Agency at a consultation meeting on 24 November 2023. All WFD water bodies in the study area have been considered, including Tees transitional water body and Tees Coastal water body. The WFD assessment considers impacts to water quality, fisheries, ecology, and the marine environment, both from the proposed activity once operational and during the construction phase.
ENVIRONMENT AGENCY SCOPING OPINION (MAY 2023)	
The Water Environment (Water Framework Directive) (WFD) Regulations. The applicant should provide an assessment of the impact of the proposal on water quality in respect to the following water bodies: • Tees (GB510302509900) • Tees Coastal (GB650301500005) • Tees Estuary (South Bank) GB103025072320) The WFD assessment will need to have regard to the Water Environment Regulations (WER) / WFD, and the Northumbria River Basin Management Plan (NRBMP).	A WFD Assessment has been produced (this document). This includes assessment of the Tees, Tees Coastal and Tees Estuary (South Bank) water bodies, as well as consideration of potential for impacts relating to pipeline corridors. Watercourse crossings for pipelines have been minimised where possible in the design. Where they are required, appropriate mitigation has been

CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
The applicant should ensure that: • The pipeline corridors do not add to the physical modification of the water environment unless equivalent appropriate mitigation measures are put in place; and • Pipeline corridor routes and excavations should as far as practicably minimise or avoid the crossing of watercourses, and not run proximate and parallel to watercourses. In particular, pipeline corridors should not be situated so as to jeopardise the potential for restoration of intertidal and riverine habitats that support the recovery of the Teesmouth and Cleveland Coast SPA. Preferably pipeline corridors should follow existing physical modifications such as road infrastructure or existing pipeline corridors.	included in the Proposed Development design. Mitigation is outlined in further detail in Section 7 of this assessment.
Baseline conditions The Scoping Report identifies in section 2.2 that large areas of the proposed development site was historically intertidal habitat within the Tees estuary. The progressive infilling of the estuary, port development and subsequent flood protection modifications have contributed to the Tees estuary water body being designated as a Heavily Modified Water body (HMWB) under WFD. In order to achieve the overarching WFD objective of Good Ecological Potential (GEP) in HMWBs, mitigation measures must be taken to address the ongoing ecological impacts of such modifications and prevent deterioration on this baseline. A Mitigation Measures Assessment has been undertaken and various information on appropriate mitigation measures is available. However, the limitations of the Catchment Data Explorer portal are such that this information cannot currently be provided through that platform.	A freedom of information request has been sent to the Environment Agency to obtain additional information regarding WFD mitigation measures. A response was received in May 2023. Details have been incorporated into the baseline where WFD waterbody status and objectives are considered. Refer to Section 4.0 Baseline Information.
EA and Partner Projects The EA and partners are bringing forward a programme of projects designed to mitigate the ongoing ecological impact of historical physical modifications on the Tees estuary and tributaries. The current Programme is scheduled to be completed by the commissioning date of the proposed development. The DCO should not jeopardise attainment of these WFD mitigation	Noted. These projects are incorporated into the baseline/future baseline presented in Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2) and summarised herein, and any

CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
measures. Therefore, the developer may wish to support these projects so as to demonstrate appropriate mitigation of any impacts, or to secure betterment of the local environment: • The Tees Tidelands Programme is led by the EA and Stockton-on-Tees Borough Council, and consists of a number of projects that aim to restore intertidal habitats and ecologically reconnect the Tees estuary to tributaries. • The EA Seal Sands Site of Special Scientific Interest (SSSI) restoration project is initially focusing on building a Tees estuary baseline hydraulic model, but in the future also seeks to identify the prioritised physical interventions to manage excess growth of macroalgae. • The Tees Rivers Trust (TRT) are undertaking a Tees Estuary Edges project to install a suite of bio-engineered designs that enhance ecology in the highly modified Tees navigation channel. • TRT are also undertaking species (oyster, seagrass, mussel) reintroduction projects at locations within Tees Bay and the estuary. • The Canal and River Trust (CRT) are developing designs to secure enhanced fish passage across the Tees Barrage and so throughout the Tees catchment.	potential impacts on these considered where necessary in the assessment.
ENVIRONMENT AGENCY STATUTORY CONSULTATION RESPONSE (November 2023)	
Water Framework Directive We welcome that our previous comments regarding WFD have been acknowledged within this PEIR and that a WFD assessment will be presented in the ES. From a marine ecology and fisheries perspective, the forthcoming WFD Assessment should: • Consider the impact of the proposal on the WFD status of the Tees Transitional water body (GB510302509900), Tees Coastal water body (GB650301500005) and any linked water bodies • Identify all potential risks to the following receptors: hydromorphology, biology – habitats, biology – fish, water quality, WFD protected areas and invasive non-native species (INNS)	This WFD Assessment has considered impacts to the Tees transitional water body and Tees Coastal water body, including all potential risks to the receptors listed. This follows the Environment Agency Clearing the Waters for All Guidance (Environment Agency, 2017) and PINS Advice Note 18 (PINS, 2017). The WFD Assessment provides information on how adverse impacts will be avoided and/or mitigated, to achieve no

CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
• Ensure that there is no deterioration resulting from the proposed activities • Demonstrate how the development/activity will avoid adverse impacts • Describe how any identified impacts will be mitigated for or suggest compensation for loss. • Guidance on how to assess the impact to WFD is available at: https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-andcoastal-waters	deterioration to the two water bodies and receptors. River and groundwater WFD water bodies have also been considered.
Dissolved Inorganic Nitrogen The applicant should note that although the dissolved inorganic nitrogen (DIN) element for the estuary is reported as at Moderate status, monitoring has identified with 100% certainty that the DIN element falls into the Bad classification status. It is a rule of the WFD classification system that only biological elements can drive overall status below moderate. The WFD objective to prevent deterioration in the status of each body of water applies. Where an element is already at its lowest class, any further deterioration should be prevented, if necessary, through mitigation of all those effects and not limited to significant effects.	Noted. The Proposed Development ensures, in keeping with Natural England's nutrient neutrality requirements, that there would be no net addition of nitrogen to the Tees Estuary and no deterioration to the WFD waterbody. Full details are provided in the Nutrient Neutrality Assessment (EN070009/APP/5.13). Impacts on WFD classification elements including DIN are assessed herein.
Geomorphology The WFD assessment should follow industry guidance, consider all relevant information sources, and present option appraisals for watercourse crossings to help demonstrate favourable outcomes.	Noted. Full details with regard to watercourse crossings have been included within this assessment and Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2), Chapter 4: Proposed Development (ES Volume I, EN070009/APP/6.2) and Chapter 5: Construction and Programme Management (ES Volume I, EN070009/APP/6.2). This WFD assessment follows the Inspectorate Advice Note 18 (WFD Assessment) and Environment Agency guidance with regard to undertaking WFD

CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
	assessment. Mitigation for watercourse crossings is outlined within this WFD assessment and Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2).

General Approach

3.7.4 The following provides a description of the assessment methodology. This assessment is mainly qualitative and based on readily available data and information, including a site survey, but also considers quantitative modelling as presented in Appendix 9B Water Quality Modelling Report (ES Volume III, EN070009/APP/6.4). It appraises the potential for non-compliance with the core WFD objectives of no deterioration or failure to improve, taking into account Protected Areas and adjacent water bodies.

Study Area

3.7.5 For the purposes of the WFD assessment, a Study Area of approximately 1 km around the Proposed Development has been considered in order to identify surface water bodies that could reasonably be affected. However, since watercourses flow and water quality impacts may propagate downstream, where relevant, the assessment also considers a wider study area based on professional judgement. The Tees Coastal WFD water body is considered the furthest downstream water body that could conceivably be impacted. Additional, indirect effects may also occur to other water environment receptors distant from the Study Area through increased demand on potable water supplies and foul water treatment.

Desk Study

3.7.6 The assessment is based on a desk study and a site walkover survey (and modelling (as above)). These are summarised below and are described in more detail in Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2).

3.7.7 A desk study has been undertaken to:

- Review online aerial imagery and current and historic and Ordnance Survey maps to review historical land uses, channel planform, notable morphological features and any changes to the channel;
- Review WFD classifications, Environment Agency investigation reports, and any mitigation measures proposed to meet Good Ecological Potential (as provided in response to a Freedom of Information request to the Environment Agency, received May 2022); and

- Review background water and sediment quality and biological data from online sources and provided directly by the Environment Agency, as well as water quality data collected to inform the baseline for the Proposed Development.

3.7.8 The desk study and site survey has been used as the basis for a qualitative review of the Proposed Development and to determine the components that require assessment of WFD compliance, or where mitigation or further investigation and assessment will be required.

Site Walkover

3.7.9 A site walkover was undertaken on 15 February 2023 and 2 October 2023 to assess the potentially affected WFD water bodies and other water receptors in the study area.

3.7.10 The aim was to identify the character and morphology of the water receptors in the study area, as well as their connectivity to the Proposed Development in terms of the surrounding topography and adjacent receptors (e.g. nearby sites of ecological importance). More details regarding the outcomes are given below in Section 4.

Source-Pathway-Receptor Approach

3.7.11 A source-pathway-receptor model is adopted at all three stages of the WFD assessment on the water environment. It consists of three components - the source, pathway, and receptor. An impact on the water environment is anticipated when all three components exist. To identify if the components exist, the following steps must be undertaken:

- Step 1: identify the causes or 'sources' of potential impact from a development through a review of the details of the development, including the size and nature of the development, potential construction methodologies and timescale. The impact source includes, but is not limited to, the release of polluting chemicals, particulate matter, or biological materials that cause harm or discomfort to humans or other living organisms, or the loss or damage to all or part of a water body;
- Step 2: undertake desk study and site surveys to identify all potential receptors, that is, the water environment receptors including water bodies and the services they support, that are sensitive to that impact;
- Step 3: determine if there is a viable exposure pathway or a 'mechanism' linking the source to the receptor. Local conditions relative to the water receptors within the Study Area, such as topography, geology, climatic conditions and the nature of the impact (e.g. the mobility of a liquid pollutant or the proximity to works that may physically impact a water body) need to be considered in the assessment.

3.7.12 The assessment of the likely significant effects is qualitative and requires professional judgment. It considers both construction and operation phases, as well as cumulative effects with other developments where appropriate. This assessment has considered the risk of pollution to surface water bodies directly and indirectly from construction activities. The risk of pollution from road runoff has also been

considered such that appropriate measures (such as Sustainable Drainage Systems (SuDS) or proprietary treatment devices) could be incorporated into the design of the Proposed Development.

3.8 Rochdale Envelope

3.8.1 To ensure a robust assessment of the likely significance of the environmental effects of the Proposed Development, the Water Framework Directive is being undertaken adopting the principles of the 'Rochdale Envelope' approach where appropriate in line with The Inspectorate's Advice Note Nine (The Inspectorate, 2018). This involves assessing the maximum (or where relevant, minimum)/worst case parameters for the elements where flexibility needs to be retained (building dimensions or operational modes for example).

3.8.2 The following are the reasonable worst case scenario assumptions (maximum parameters) for the purposes of the WFD assessment:

- The Proposed Development will be constructed in two phases as outlined in Chapter 4: Proposed Development (ES Volume I, EN070009/APP/6.2). Phase 1 will consist of a single hydrogen production unit, on-site hydrogen storage and supporting utilities. Phase 2 will consist of a further hydrogen production unit, on-site hydrogen storage and supporting utilities constructed thereafter. The majority of the Hydrogen Pipeline Corridors to facilitate the transportation of hydrogen to offtakers will be constructed and completed in Phase 1 except for specified short additional spurs within the Hydrogen Pipeline Corridors, to be completed in Phase 2.
- Permitted preliminary works for Phase 1 are expected to start in the third quarter (Q3) of 2025 (subject to the granting of the DCO), with the main civil works to start in Q4 of 2025. Construction of Phase 1 is anticipated to last approximately 32 to 36 months and is expected to be complete in Q2 2028.
- The early enabling works for Phase 2 may overlap with commissioning for Phase 1 in Q2 2028. It is expected that the main civils works for Phase 2 will begin in Q3 of 2028 (after Phase 1 is commissioned) and be completed by the end of 2030. It is proposed that there will be no overlap between the main construction phases of Phases 1 and 2.
- The assessment presented herein, considers construction, operational and decommissioning phases separately for the whole development. This is provided that the outlined mitigation measures (see Section 9.5 of Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2)) are implemented as appropriate for each phase (including where they may overlap) there would be no anticipated additional impacts or effects should there be overlap between the operation of Phase 1 and construction of Phase 2.
- It is assumed that during construction of the Proposed Development the Engineering, Procurement and Construction (EPC) Contractor(s) will, as a minimum, conform to all permit/consent/licence requirements and relevant

good practice measures to avoid, reduce and minimise the risk of water pollution or unacceptable physical impacts (without mitigation) on water bodies. Full Details of this mitigation and good practice standards are described in Section 9.5 of Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2) and summarised within this assessment (Section 7).

- Water for use in the internal processes of the plant is to be supplied to the Proposed Development via the existing Northumbrian Water Limited's (NWL) raw water pipeline feed from the River Tees to the South Tees Development Corporation (STDC) site, or alternatively a new connection to the existing NWL supply either via tie in to NZT infrastructure or the installation of a new connection. With either approach the source water would be from the River Tees. The abstraction flow rate would be 227 m^3/hr for Case 1B or 297 m^3/hr for Case 2B[1]. Treatment would be required to the supplied water to produce the desired water quality for utility water/cooling water make-up, firewater and for producing demineralised water.
- It is assumed for the purposes of the assessment, that there is no need for the Applicant to obtain a license for abstraction. It is understood based on discussions with NWL that there is sufficient supply of water to accommodate the Proposed Development project water demands.
- Case 1B (as detailed in Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2)) for the Proposed Development is based on Minimalised Liquid Discharge (MLD) from the Effluent Treatment Plant. In this scenario treated wastewater from the Effluent Treatment Plant will be reused as makeup water in the Water Treatment Plant. A liquid waste stream (concentrate sludge / waste) containing salts and nutrients would be taken offsite for further treatment at a rate of 4.0 m^3/hr. This will be be transported off-site by tanker to an approved and licensed facility and treated in a manner consistent with nutrient neutrality requirements by either a) denitrification and discharge of resultant effluent within the habitats site catchment or b) discharging outside of the habitats site catchment. Adoption of these options will avoid any implications in terms of nutrient neutrality (see Section 7).
- Case 2B would require discharge of treated process water effluent to Tees Bay via the neighbouring NZT project outfall. The process water discharge rate would be 75.0 m^3/hr for Case 2B. At the time of writing (March 2024) it has not been decided which option will be taken forward. However, a combined discharge under Case 2B to Tees Bay via the NZT outfall is the preferred option as the Applicant is seeking to optimise the water management through a synergised approach across the bp led Teesside projects.

[1] There are two cases for the operation of the Proposed Development which differ in terms of their water demand and process wastewater disposal route. The two cases are described further in Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2) and in Section 7 of this assessment.

- Should the option to discharge wastewater to the NZT outfall at Tees Bay be taken forward, 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 (European Commission Joint Research Centre, 2016). The discharge would also be required to meet the standards outlined within the discharge permit. Hydrodynamic modelling of the potential discharge has been undertaken and is presented with Appendix 9B (ES Volume III, EN070009/APP/6.4) and summarised within this assessment.
- This assessment assumes that should the Tees Bay outfall associated with the NZT project be utilised by the Proposed Development, then the impacts will be as per the assessment of morphological impact set out in the NZT project assessment, as it does not form part of the Proposed Development. No assessment has been included herein regarding installation of the outfall. They are not considered to be cumulative morphological effects from the outfall, as there are no additional morphological works in the Tees Coastal waterbody as part of the Proposed Development.
- Areas where amines are used, transferred or stored will be appropriately bunded and accidental spills will be cleaned and go to a separate closed drainage system. From here, it would be recovered and recycled for use within the process, or otherwise taken off-site by tanker to a specialist treatment plant in accordance with the prevailing waste management requirements.
- Clean surface water drainage will be discharged either to NZT outfall discharging to Tees Bay or alternatively to a new outfall via STDC drainage system discharging to Tees Estuary. Both options are considered by the assessment.
- All liquid chemicals stored within the operational Proposed Development Site will be kept in bunded areas with a volume of 110% of storage capacity.
- If discharging to the Tees Estuary, the local SuDS design guide indicates that the peak flow and volume control standards would not apply in this case.
- Foul water would connect to the STDC sewage network for appropriate disposal. This is likely to be Bran Sands STW but could be 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 Tees crossing and the crossing of Greatham Creek for the Hydrogen Pipeline Corridor will be constructed using trenchless technologies, and at a sufficient depth below the estuary bed and creek to ensure that there is no risk of exposure. For the purposes of assessment this is assumed to be 25m below the bed as a worst case. For the Tees Crossing this is expected to be more in the range of 40-50 m depth, but will be determined following the ground investigation at the detailed design phase, and;

- If open-cut methods are required for the Hydrogen Connection Corridor on Holme Fleet (NZ 49241 23828) and three unnamed watercourses (NZ 51091 23758, NZ 51110 24822, NZ 49091 24350), it is assumed that flow will be temporarily over-pumped, diverted around or flumed through the working area and the watercourse fully reinstated as before.

3.9 General Limitations and Assumptions

3.9.1 The assessment has been undertaken using Proposed Development design details at the time of writing (as presented in Chapter 4: Proposed Development (ES Volume I, EN070009/APP/6.2)). Where there is any remaining degree of optionality or uncertainty, the worst-case scenario has been considered.

3.9.2 No water quality monitoring has been undertaken. Background water quality has been determined from the nearest Environment Agency monitoring stations. This has been considered robust enough for the characterisation of water body importance and the determination of impacts on the surface water environment.

3.9.3 A reasonable assumption has been made that all works will take place using good practice, as set out and secured in a Framework Construction Environmental Management Plan (CEMP) (EN070009/APP/5.12) to be submitted with the ES (and which includes an Outline Water Management Plan).

3.9.4 The understanding of drainage arrangements assessed herein is based on provisional information. The drainage strategy will be subject to further development in consultation with the Environment Agency and Lead Local Flood Authorities (LLFA, i.e. Redcar and Cleveland Borough Council and Stockton-on-Tees Borough Council).

4.0 BASELINE INFORMATION

4.1 Introduction

4.1.1 The relevant baseline physical characteristics of the Study Area and the WFD water features present are described in this section. Please refer to Figure 9-1: Surface Water Features and their Attributes (ES Volume II, EN070009/APP/6.3) throughout.

4.2 Study Area Characteristics

4.2.1 The Production Facility is located on part of the former Redcar Steelworks site to the east of Redcar Bulk Terminal (referred to as 'the Foundry'). The site is coastal, being located immediately south-west of Teesmouth, at approximately 6 to 8 m above ordnance datum (AOD). Coatham Sands is immediately to the north and Bran Sands is located to the west (Figure 9-1: Surface Water Features and their Attributes (ES Volume II, EN070009/APP/6.3)). The Proposed Development Site is currently industrial, comprising former steelworks structures. Dormanstown is located south-east of the Proposed Development Site.

4.2.2 The Site boundary extends south-west of the Main Site into Tees Bay and west across the Tees Estuary (see Figure 9-1: Surface Water Features and their Attributes (ES Volume II, EN070009/APP/6.3). These areas of the Site are included in order to incorporate existing water supply and discharge infrastructure that are to be retained for use by the Proposed Development and also for the Hydrogen Pipeline Corridors (see Figure 9-1: Surface Water Features and their Attributes (ES Volume II, EN070009/APP/6.3)).

4.2.3 The Proposed Development Site extends west across the Tees Estuary at the southern extent of Bran Sands and continues west towards Billingham (Figure 9-1: Surface Water Features and their Attributes, ES Volume II, EN070009/APP/6.3). The crossing of the Tees Estuary is included to incorporate the Hydrogen Pipeline Corridor infrastructure required by the Proposed Development. To the north and west of the Tees Estuary the Hydrogen Pipeline Corridor partly 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 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 are included within local SSSI and Special Protection Area (SPA) designations).

4.2.4 South and east of the Tees Estuary, the Proposed Development Site extends south to Grangetown to accommodate the Electrical Connection Corridor, Water Connection Corridor, Natural Gas Connection Corridor, Other Gases Connection Corridor, and the Hydrogen Pipeline Corridor. This whole area is below 20 m AOD, rising gradually to the east. It is predominantly industrial but with some residential land use at the margins of the study area at Dormanstown and Grangetown.

4.2.5 The nearest weather station on the Met Office website (Met Office, n.d.) with historical data is located at Stockton-on-Tees, approximately 5.0 km south-west of the eastern extent of the Proposed Development Site, at NGR NZ 43846 19831. Based on the average climate data (for the period 1981 to 2010 (as the most recent data available)) for this weather station, it is estimated that the Study Area experiences an average of 574 mm of rainfall per year, with it raining more than 1 mm on around 112 days per year. This is a relatively low level of rainfall for England.

4.2.6 Plate 4-1 illustrates this data to show how the average rainfall varies throughout the year, with the wettest period being in the late summer to autumn, and driest in late winter to early spring. Average monthly rainfall is generally less than 60 mm throughout the year, except in August and November when it is between 60 and 65 mm. March is the driest month with an average of approximately 34 mm between 1991 and 2020.

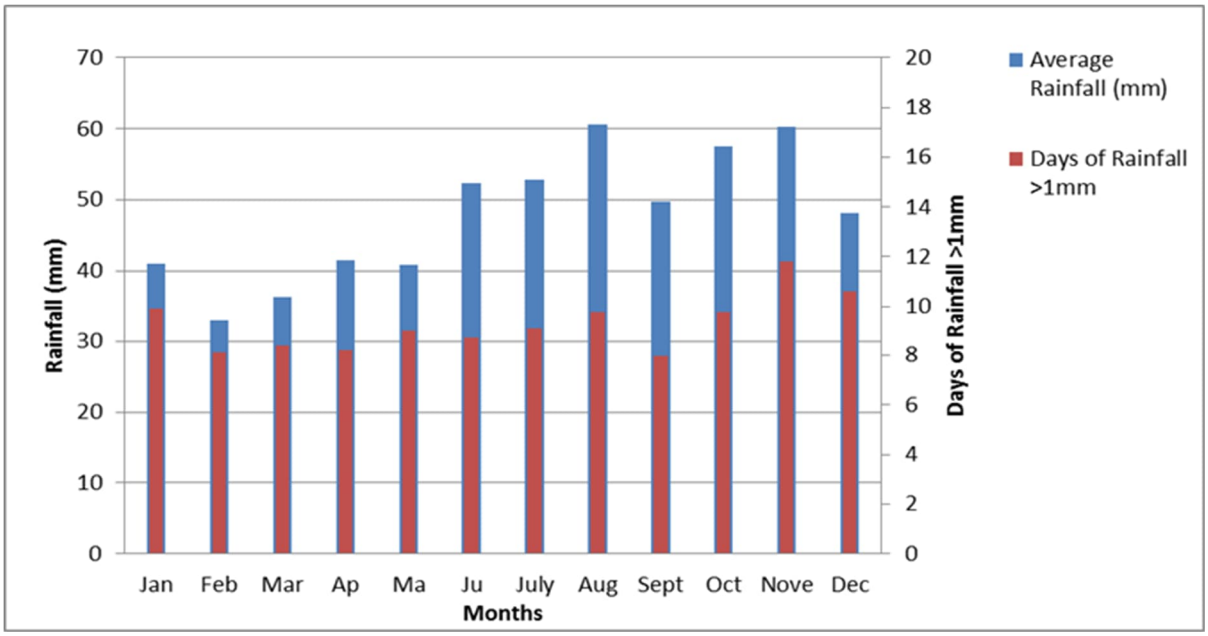

Plate 4-1: Stockton-on-Tees Weather Station – Average Rainfall per Month (1981-2010) and Average Days per Month with >1 mm of Rainfall (1981-2010)

4.3 Geology and Soils

4.3.1 Full details of geology and groundwater are provided in Chapter 10: Geology, Hydrogeology and Contaminated Land (ES Volume I, EN070009/APP/6.2). In summary, the BGS Geoindex viewer (BGS, n.d.) indicates that the solid geology beneath the Proposed Development Site consists of strata of Triassic and Jurassic age.

4.3.2 Immediately around the River Tees and to the south of Teesmouth the bedrock is Triassic Mercia Mudstone including the northern section of the Proposed Development Site which is also underlain by the Triassic Penarth Group. The southern half of the Proposed Development Site is underlain by Jurassic Redcar Mudstone, which also stretches south to beyond the Wilton International Site and

underlies the majority of the town of Redcar. (See Figure 10-3: Bedrock Geology (ES Volume II, EN070009/APP/6.3)

4.3.3 To the north of the Tees Estuary, Mercia Mudstone underlies the Seal Sands Industrial Estate, which overlies the Triassic Sherwood Sandstone Group, which is present beneath Seal Sands, Cowpen Marsh, Saltholme and the town of Billingham. (See Figure 10-3: Bedrock Geology (ES Volume II, EN070009/APP/6.3)

4.3.4 Bedrock is overlain by superficial deposits consisting 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 and the southern extent of the Wilton International Site are underlain by Devensian Till (diamicton). The north-west of the Study Area towards Cowpen Bewley is underlain by glaciolacustrine deposits. Finally, there are marine beach deposits on the coastline north of Teesmouth. (See Figure 10-2: Superficial Geology (ES Volume II, EN070009/APP/6.3)

4.3.5 Defra's Multi-agency geographical information for the countryside (MAGIC) website (Defra, n.d.) indicates that the Sherwood Sandstone to the north of the Tees is classified a Principal Aquifer. These 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.

4.3.6 The Mercia Mudstone bedrock deposits surrounding the Tees are classified as a Secondary B aquifer. These are lower permeability strata which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. The Redcar Mudstone to the south of this is Secondary (undifferentiated) aquifer. (See Figure 10-13: Bedrock Aquifier (ES Volume II, EN070009/APP/6.3) This 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.

4.3.7 The superficial deposits beneath the Main Site are classified as Secondary A aquifer and Secondary (undifferentiated) aquifer (see Figure 10-12: Superficial Aquifers (ES Volume II, EN070009/APP/6.3)). Secondary A aquifers comprise permeable layers that can support local water supplies and may form an important source of base flow to rivers.

4.3.8 The Study Area to the east and south of the Tees estuary is within the Tees Mercia Mudstone & Redcar Mudstone WFD groundwater body (GB40302G701300) (Environment Agency, 2023a) see Figure 9-2 (ES Volume II, EN070009/APP/6.3). The water body is at Poor Overall Status, with Good Quantitative Status but Poor Chemical Status. The latter is a consequence of Poor Chemical Dependent Surface Water Body Status, due to point source pollution from mining and quarrying sources. The water body has an area of 494.57 km^2.

4.3.9 The Study Area to the west and north of the Tees Estuary is mainly within the Tees Sherwood Sandstone WFD groundwater body (GB40301G702000), except an isolated point around Port Clarence, which remains in the Tees Mercia Mudstone & Redcar Mudstone WFD groundwater body see Figure 9-2 (ES Volume II, EN070009/APP/6.3). The Tees Sherwood Sandstone groundwater body is at Good Overall Status, with Good Quantitative and Chemical Elements. The water body has an area of 293.01 km^2.

4.3.10 There are no Groundwater Dependent Terrestrial Ecosystems (GWDTE) which are likely to be affected by activities related to the Proposed Development.

4.3.11 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 southern section of 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.

4.4 Water Features

4.4.1 A Site Walkover was undertaken on 15 February 2023 in cold, dry but overcast conditions. A further site visit was undertaken on 2 October 2023 in mild, mostly dry overcast conditions, with some occasional light rain. Table 4-1 summarises the surface water bodies and, where relevant to the assessment, groundwater water bodies identified during the site visits, with reference to data from OS mapping and the Environment Agency Catchment Data Explorer website. Watercourses are also presented in Figure 9-1: Surface Water Features and their Attributes and 9-2: Groundwater Features and their Attributes (ES Volume II, EN070009/APP/6.3). Table also provides an indication of whether the water body could be impacted or not by the Proposed Development, and which WFD designated water body catchment it is included within. Upstream water bodies have all been scoped out of the assessment as there is no pathway to impact.

Table 4-1: Surface and Groundwater Water Bodies Identified Within the Study Area

WATER BODY	TYPE OF WATER BODY	WFD DESIGNATION OR ASSOCIATED WFD WATER BODY (WHERE APPLICABLE)	SCOPED IN / SCOPED OUT
Tees Bay	Coastal	Tees Coastal Water (GB650301500005)	Scoped In – Receives discharge directly from the Proposed Development.

WATER BODY	TYPE OF WATER BODY	WFD DESIGNATION OR ASSOCIATED WFD WATER BODY (WHERE APPLICABLE)	SCOPED IN / SCOPED OUT
Tees Estuary	Watercourse (Main River)	Tees Transitional Water body (GB510302509900)	Scoped In – Crossed by the Hydrogen Pipeline Corridor and water may be abstracted from the water body for operation under an Environmental Permit
Tees Estuary (S Bank)	Watercourse (Main River)	WFD designated water body (GB103025072320)	Scoped In – Located within the Site boundary and so has potential to be impacted by construction or operation of the Proposed Development
The Fleet	Watercourse (Ordinary)	Tees Estuary (S Bank) (GB1030250723320)	Scoped In – Located within the Site boundary and so has potential to be impacted by construction or operation of the Proposed Development
Ash Gill	Watercourse (Ordinary)	Tributary of Tees Estuary (S Bank) (GB1030250723320)	Scoped In – Located within the Site boundary and so has potential to be impacted by construction or operation of the Proposed Development
Main's Dike	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Water body	Scoped In – Located within the Site boundary and so has potential to be impacted by construction or operation of the Proposed Development
Dabholm Gut	Watercourse (Ordinary)	Designated under the TEES Transitional Water body (GB510302509900)	Scoped In – Located within the Site boundary and so has potential to be impacted by construction or operation of the Proposed Development (considered within the TEES Transitional WFD water body)
Dabholm Beck	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Water body	Scoped In – Located within the Site boundary and so has potential to be impacted by

WATER BODY	TYPE OF WATER BODY	WFD DESIGNATION OR ASSOCIATED WFD WATER BODY (WHERE APPLICABLE)	SCOPED IN / SCOPED OUT
			construction or operation of the Proposed Development (considered within the TEES Transitional WFD water body)
Kettle Beck	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Water body	Scoped Out – This watercourse is upstream of any works relating to the Proposed Development and so is scoped out of further assessment.
Kinkerdale Beck/Mill Race	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Water body	Scoped In – Located within the Site boundary and so has potential to be impacted by construction or operation of the Proposed Development (considered within the TEES Transitional WFD water body)
Knitting Wife Beck	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Water body	Scoped In – Located within the Site boundary and so has potential to be impacted by construction or operation of the Proposed Development (considered within the TEES Transitional WFD water body)
Holme Fleet	Watercourse (Main River)	Tributary of the Tees Transitional WFD Water body	Scoped In – The Proposed Development requires pipeline construction adjacent to upstream tributaries of this water body, and so there is potential for pollutants from construction or operation to be conveyed downstream (considered within the TEES

WATER BODY	TYPE OF WATER BODY	WFD DESIGNATION OR ASSOCIATED WFD WATER BODY (WHERE APPLICABLE)	SCOPED IN / SCOPED OUT
			Transitional WFD water body)
Belasis Beck	Watercourse (Ordinary)	Tributary of Holme Fleet and therefore associated with the Tees Transitional WFD Water body	Scoped In – Crosses the Site boundary and so has potential to be impacted by construction or operation of the Proposed Development (considered within the TEES Transitional WFD water body)
Cross Beck	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Water body	Scoped In – This watercourse crosses the Electrical Connection Corridor of the Proposed Development Site and has the potential to be impacted during construction and operation of the Proposed Development.
Greatham Creek	Watercourse (Main River)	Tributary of the Tees Transitional WFD Water body	Scoped In – This watercourse is inside the 1 km Study Area and hydrologically connected by Mucky Fleet and Swallow Fleet and so has potential to be impacted during construction and operation of the Proposed Development (considered within the Tees Transitional WFD water body)
Greatham Beck	Watercourse (Main River)	Greatham Beck Catchment (trib of Tidal Tees) WFD Water body GB103025076030	Scoped Out – This watercourse is upstream of any works relating to the Proposed Development and so is scoped out of further assessment.
Mucky Fleet	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Water body	Scoped In – This watercourse is outside the 1 km Study Area but has potential to

WATER BODY	TYPE OF WATER BODY	WFD DESIGNATION OR ASSOCIATED WFD WATER BODY (WHERE APPLICABLE)	SCOPED IN / SCOPED OUT
			receive pollutants and sediments during construction and operation of the Proposed Development via upstream watercourses (considered within the Tees Transitional WFD water body)
Swallow Fleet	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Water body	Scoped In – This watercourse is not within the Site boundary but has potential to receive pollutants and sediments during construction and operation of the Proposed Development via upstream watercourses (considered within the Tees Transitional WFD water body)
Cowbridge Beck	Watercourse (Main River)	Cowbridge Beck from Source to North Burn WFD Water body GB103025072380	Scoped In – This watercourse is upstream of any works relating to the Proposed Development however there are some surface water ponds just south of the confluence with Greatham Creek that may have connectivity with Cowbridge Beck. These ponds pass through the Proposed Development.
North Burn	Watercourse (Main River)	North Burn from Source to Claxton Beck WFD Water body GB103025072540	Scoped Out – This watercourse is upstream of any works relating to the Proposed Development and so is scoped out of further assessment.

WATER BODY	TYPE OF WATER BODY	WFD DESIGNATION OR ASSOCIATED WFD WATER BODY (WHERE APPLICABLE)	SCOPED IN / SCOPED OUT
Billingham Beck	Watercourse (Main River)	Designated under the TEES Transitional Water body (GB510302509900)	Scoped Out – This watercourse is upstream of any works relating to the Proposed Development and so is scoped out of further assessment.
Castle Gill	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Water body	Scoped In – Crosses the Site boundary and so has potential to be impacted by construction or operation of the Proposed Development (considered within the TEES Transitional WFD water body)
Salthome Nature Reservoir Ponds, Brine Reservoirs, Brine Field and refinery ponds	Stillwater	Catchment of Tees Transitional WFD Water body	Scoped In – These water bodies have hydrological connectivity to the Site boundary through upstream tributaries in Saltholme Marsh and so have the potential to be impacted during construction or operation of the Proposed Development (considered within the Tees Transitional WFD water body).
Lake at Charlton's Pond Nature Reserve	Stillwater	Catchment of Tees Transitional WFD Water body	Scoped Out – This pond is upslope of the Proposed Development and so will not be impacted.
Ponds at Billingham Technology Park	Stillwater	Catchment of Tees Transitional WFD Water body	Scoped In – In close proximity to the Site boundary and so have potential to be impacted (considered within the Tees Transitional WFD water body).

WATER BODY	TYPE OF WATER BODY	WFD DESIGNATION OR ASSOCIATED WFD WATER BODY (WHERE APPLICABLE)	SCOPED IN / SCOPED OUT
Ponds within Coatham Dunes and Bran Sands	Stillwater	Catchment of Tees Coastal WFD water body	Scoped In – The Site boundary extends to the edge of the dunes and the study area includes an open water pond (Pond 14), which is scoped in. The remaining water bodies within the dunes complex are fully vegetated wetlands and so are not included in the assessment.
Ponds at Coatham Marsh	Stillwater	Catchment of Tees Estuary (S Bank)	Scoped In – In close proximity to the Site boundary and so have potential to be impacted (considered within the Tees Transitional WFD water body).
Numerous industrial ponds and artificial water bodies across the area including Lazenby Reservoirs and Salthouse Brine Reservoirs	Stillwater	Catchment of Tees Transitional WFD Water body	Scoped In – Numerous ponds are within the Site boundary and could be impacted by construction and operation of the Proposed Development.
Tees Sherwood Sandstone	Groundwater	WFD designation (GB40301G702000)	Scoped In – the Proposed Development is partly underlain by this groundwater body and so it is scoped in.
Tees Mercia Mudstone & Redcar Mudstone	Groundwater	WFD designation (GB40302G701300)	Scoped In – the Proposed Development is partly underlain by this groundwater body and so it is scoped in.

4.5 Surface Water Bodies

4.5.1 The Environment Agency's Catchment Data Explorer website (Environment Agency, n.d.a) confirms that the estuarine and coastal water bodies in the Study Area are contained within the Northumbria River Basin District, the Northumbria Transitional and Coastal (TraC) Management Catchment, and the Tees Lower and Estuary TraC Operational Catchment.

4.5.2 The fluvial water bodies are contained within the Northumbria River Basin District, Tees Management Catchment and Tees Lower and Estuary Operational Catchment.

4.5.3 There are four WFD designated surface water bodies within the Study Area that have been scoped in above – these are described in Table 4-2 (see also Figure 9-1: Surface Water Features and their Attributes, (ES Volume II, EN070009/APP/6.3)). Although these are the WFD reporting reaches, WFD principles and objectives apply to all tributaries of these watercourses. The WFD water bodies include one coastal water body (Tees Coastal Water), one estuarine water body (Tees transitional water body) and two rivers (The Fleet - designated as Tees Estuary (S Bank) and Cowbridge Beck.

4.5.4 There are also the two aforementioned WFD groundwater bodies and these have been included in Table 4-2 for completeness.

4.5.5 The full no deterioration baseline for each water body is the status that is reported in Annex A of this report (Tables A-1 to A-4 and A-6 to A-7).

Table 4-2: WFD Surface Water Bodies in the Study Area

WATER BODY	ECOLOGICAL STATUS / POTENTIAL	CHEMICAL STATUS	OVERALL TARGET OBJECTIVE	HYDROMORPHOLOGICAL DESIGNATION	REPORTABLE REACH
Tees Coastal Water body (GB650301500005)	Moderate Ecological Potential	Fail	Good (2027)	Heavily Modified	The Tees Coastal water body stretches from approximately 20 km south-east of Redcar at Boulby, to approximately 13 km north-west of Redcar at Crimdon. It includes a total area of 88.4 km^2.
Site observations: The Tees Coastal water body was observed from Coatham Sands between Redcar and Teesmouth. The water body 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 historical 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. The Teesside Offshore Wind Farm was observed approximately 1.5 km off the coast from Redcar. Mitigation Measures: Details of mitigation measures for this water body were requested from the Environment Agency but none were provided. Protected Areas: Teesmouth and Cleveland Coast SPA and Ramsar. 18 designated Bathing Waters including Redcar Coatham, Redcar Granville, Marske Sands, Seaton Carew North Gare, Seaton Carew Centre, Seaton Carew North, Redcar Stray and Redcar Lifeboat Centre. Notable Issues: There have been incidents of mass mortality reported in crabs and lobsters along the coastline between Hartlepool and Whitby in recent years, notably between October and December 2021, and continuing periodically through 2022. Some crustaceans were observed displaying unusual twitching behaviour. The exact cause of death has been highly disputed. However, several explanations have been proposed, including disease, harmful algal blooms, chemical toxicity resulting from historical industrial activity in Teesside, and dredging in the Tees area, including Tees Estuary. The most likely cause of death is a novel pathogen. However, the mortality event is still largely unexplained (Defra, 2023).					

WATER BODY	ECOLOGICAL STATUS / POTENTIAL	CHEMICAL STATUS	OVERALL TARGET OBJECTIVE	HYDROMORPHOLOGICAL DESIGNATION	REPORTABLE REACH
Tees Transitional Water body (GB510302509900)	Moderate Ecological Potential	Fail	Moderate (2015)	Heavily Modified	The Tees Transitional Water body extends from the Tees Barrage to the east of Stockton-on-Tees, to Teesmouth. This is a distance of approximately 16 km. It includes a total area of 11.41 km^2. The designation includes the mud and sand flats at Seal Sands, Tees Dock, Greatham Creek, Dabholm Gut and the lower reaches of Billingham Beck. 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) and into the Seaton on Tees Channel. Dabholm Gut is a kilometre-long tidal channel on the east bank of the Tees, left when the land on both sides was reclaimed from the Tees estuary.

WATER BODY	ECOLOGICAL STATUS / POTENTIAL	CHEMICAL STATUS	OVERALL TARGET OBJECTIVE	HYDROMORPHOLOGICAL DESIGNATION	REPORTABLE REACH
Site observations: The Tees water body 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 water body is flat, having been largely reclaimed in this area and is currently occupied by various heavy industries. Further details regarding hydrodynamics, tides and sediments are provided later in the baseline. The Dabholm Gut is an artificial channel of around 1 km length left following historical 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 northwest of the Wilton International Site (upstream of the tidal limit). Dabholm Beck has a single stem channel is around 3 – 4 m wide, incised and straight, and lacking bedform features of interest, being indicative of extensive past modification. Reeds surround the channel on both banks and there are several 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, with some visible foaming suggesting potential presence of agitated chemicals. There are numerous consented discharges here from the adjacent industry, and consents are shown in Figure 9-1: Surface Water Features and their Attributes (ES Volume, II EN070009/APP/6.3). The channel width remains constant up to the confluence with the Tees. At low tide, fine sediments are exposed in the channel and are dark in colour suggesting potential presence of pollutants. During especially high tides anecdotal evidence suggests the channel has been known to overtop onto the adjacent access road. The site is popular with birdlife and is included in the Teesmouth and Cleveland Coast SSSI. This WFD water body also includes Greatham Creek up to the National Tidal Limit (NTL). 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 of the road crossing. Mitigation Measures: Details of mitigation measures for this water body were requested from the Environment Agency but none were provided. Protected Areas: Teesmouth and Cleveland Coast SPA and Ramsar. Seal Sands (Tees Estuary) Urban Waste Water Treatment Directive (UKENCA98). Restoration Projects: There are some notable enhancement schemes relating to the Tees Estuary. Firstly, Tees Estuary Edges Enhancement Study (2018) (University of Hull) – this study aimed to identify a framework of habitat enhancement opportunities to improve biodiversity provision and habitat connectivity within the Tees. There is considered potential for functional provision to be improved for species associated with the existing and proposed					

WATER BODY	ECOLOGICAL STATUS / POTENTIAL	CHEMICAL STATUS	OVERALL TARGET OBJECTIVE	HYDROMORPHOLOGICAL DESIGNATION	REPORTABLE REACH
SPA designation (e.g. increased foraging potential for waders using intertidal mudflat habitat and breeding birds such as tern species through improvements to essential fish habitats and associated populations). The study focused on areas along the Tees estuary (from barrage to mouth) where estuary edges improvement techniques could be applied. Identified techniques included re-profiling foreshore levels, vegetated floating pontoons, fish habitat creation and extending intertidal areas. The Tees Tideland project Is currently assessing the potential for implementing measures to restore habitats in the Holme Fleet/Belasis Beck catchment that would formerly naturally have formed part of the Tees Estuary intertidal area, and to restore ecological connectivity with the Tees Estuary. Notable Issues: Natural England has identified the Teesmouth and Cleveland Coast SPA as a site that is impacted by excess nutrients. In particular, the Seal Sands area within this WFD water body is known to be adversely impacted; excessive growth of algal mats is impacting feeding opportunities for the bird populations that the SPA is designated for. Any development in the catchment of the SPA that may lead to an increase in the nitrogen emissions into the designated site must be supported by a robust nutrient neutrality assessment.					
Tees Estuary (South Bank) (GB1030250723320)	Moderate Ecological Potential	Fail	Good (2027)	Heavily Modified	This watercourse is known on local mapping as The Fleet and is designated from adjacent to Longbeck Lane in Saltburn (NGR NZ 60988 20908). It continues north to the west of Redcar, and then flows west through the industrial works to discharge into Dabholm Gut at NGR NZ 56131 24038.
Site observations: The watercourse was observed in Coatham Marsh Nature Reserve, where the channel has been artificially widened to flow through a pond/wetland area that reduces the rate of flow and likely alters the character of water quality. The channel is culverted beneath a bridge within the nature reserve through an overly constrained arch of around 2 m width, which leads to backing up of flow upstream. The channel is also choked by submerged and emergent macrophytes, the extent of which suggests some enrichment by nutrients. Upstream of the bridge the channel is approximately					

WATER BODY	ECOLOGICAL STATUS / POTENTIAL	CHEMICAL STATUS	OVERALL TARGET OBJECTIVE	HYDROMORPHOLOGICAL DESIGNATION	REPORTABLE REACH
8–- 9 m wide but increases to approximately 25–- 30 m wide immediately downstream where the channel looks like it may have been artificially constructed for access. There is good connectivity with the floodplain upstream of the culvert but less so downstream. Flows upstream of the culvert may on occasion spill onto the surrounding marsh. Various service crossing was noted over the watercourse near this location. Flow is sluggish as a result of the widespread macrophytes, culverted crossing and overwide nature of the channel. The watercourse flows into Dabholm Gut approximately 2 km downstream of this observation point in the Nature Reserve, although there are expected to be controlling structures before the confluence with Dabholm Gut. A tributary of The Fleet was also observed as it crosses Limerick Road in Dormanstown. This was an artificial, perfectly straight channel of around 5 m width. The bed was smothered in fine sediment and pollution pressures were notable with an oil sheen on the water. There were very few macrophytes and the channel has incised banks, rising steeply 1–- 2 m abruptly from the channel bed. Mitigation Measures: The Environment Agency have outlined mitigation measures to improve this water body. These include re-opening of culverts, restoring in channel morphological diversity, water level management, implementing appropriate vegetation control, removing obsolete structures, installing fish passes and enhancing structures to improve ecology. None of the mitigation measures are currently in place, except for water level management. Protected Areas: Teesmouth and Cleveland Coast SPA and Ramsar.					
Cowbridge Beck from Source to North Burn (GB103025072380)	Moderate Ecological Status	Fail	Good (2027)	Not designated artificial or heavily modified	The watercourse is designated from the junction of Thames Road and Wolviston Road in Wolviston (NGR NZ 45225 24805) and flows in an easterly direction to its confluence with North Burn at Cowpen Bewley Woodland Park where it is then designated as the Tees transitional water body (NGR NZ 48477 25835). It is 4.64 km

WATER BODY	ECOLOGICAL STATUS / POTENTIAL	CHEMICAL STATUS	OVERALL TARGET OBJECTIVE	HYDROMORPHOLOGICAL DESIGNATION	REPORTABLE REACH
					in length and has a catchment of 13.4 km^2.
Site observations: This watercourse was not observed during the initial site visit as it is upstream of any direct works required for the Proposed Development. Mitigation Measures: Not required as upstream of the development and so can be scoped out of assessment. Protected Areas: None associated with water body.					
Tees Mercia Mudstone and Redcar Mudstone (GB40302G701300)	Poor Overall Status (Good Quantitative Status)	Poor	Poor (2015)	N/A	The Study Area to the east and south of the Tees estuary is within the Tees Mercia Mudstone and Redcar Mudstone WFD groundwater body. The overall water body is 494.6 km^2 in area.
Protected Areas: Teesmouth and Cleveland Coast SPA and Ramsar, North York Moors SAC and SPA, Tees Mercia Mudstone and Redcar Mudstone Drinking Water Protected Area (UKGB40302G701300), River Wiske from Trenholme Stell to River Swale Nitrate Vulnerable Zone (NVZ), Lustrum Beck Catchment (trib of Tees) NVZ and Billingham Beck from Brierley beck to River Tees NVZ.					
Tees Sherwood Sandstone (GB40301G702000)	Good Overall Status	Good	Good	N/A	The Study Area to the west and north of the Tees Estuary is mainly within the Tees Sherwood Sandstone WFD groundwater body. The overall water body is 494.6 km^2 in area.

WATER BODY	ECOLOGICAL STATUS / POTENTIAL	CHEMICAL STATUS	OVERALL TARGET OBJECTIVE	HYDROMORPHOLOGICAL DESIGNATION	REPORTABLE REACH
Protected Areas: Teesmouth and Cleveland Coast SPA and Ramsar, Tees Sherwood Sandstone Drinking Water Protected Area (UKGB40301G702000), River Wiske from Trenholme Stell to River Swale NVZ, Skerne NVZ, Lustrum Beck Catchment (trib of Tees) NVZ and Billingham Beck from Brierley beck to River Tees NVZ.					

4.5.6 Within the catchments of the WFD water bodies outlined in Table , there are also a number of named watercourses shown on OS mapping (Bing, n.d.), and these are described in Table 4-3 (please refer to Figure 9-1: Surface Water Features and their Attributes (ES Volume II, EN070009/APP/6.3) throughout).

Table 4-3: Other Named Watercourses in the Study Area that are not Defined WFD Water Bodies

NAME	TRIBUTARY OF	WATERCOURSE DESCRIPTION	SITE OBSERVATIONS
Belasis Beck	Holme Fleet (within Tees Transitional Water body 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 Salthome 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. This creates a depositional environment, encouraging the growth of submerged and emergent macrophytes. Although these will take up nutrients during their growth, if they are not removed these are released back into the water column resulting in permanent recycling of nutrients and enriched conditions that support further growth of invasive macrophytes. Sediments are fine with little evidence of any transportation. They are also likely to be contaminated due to the past and current industry in this location. 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. A brown surface scum was observed

NAME	TRIBUTARY OF	WATERCOURSE DESCRIPTION	SITE OBSERVATIONS
			and was thought to be indicative of organics.
Dabholm Beck	Tees Transitional Water body Catchment	Dabholm Beck is a drainage channel marked on mapping as flowing northeast above ground for 700 m between NZ 56161 23102 and NZ 56710 23730. It then flows northwest into the tidal Dabholm Cut.	Refer to the Dabholm Gut description under the Tees Transitional Water body description above.
Kettle Beck	Tees Transitional Water body Catchment	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. Submerged macrophytes were abundant and some sections of the channel were shaded by overhanging vegetation and thick riparian vegetation. Flow was impeded by a road culvert at the observation site, which consisted of six small diameter (~0.5 m) pipes. The banks rose steeply from the channel bed and were incised meaning the channel is likely to be disconnected from the floodplain.
Holme Fleet	Tees Transitional Water body Catchment	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	Not visited during the site visit as it is outside of the Site Boundary but still considered where relevant within the Study Area of the assessment.

NAME	TRIBUTARY OF	WATERCOURSE DESCRIPTION	SITE OBSERVATIONS
		marshland channels join the Fleet, which also flows through several marshland open water bodies and reedbeds.	
Kinkerdale Beck	Tees Transitional Water body Catchment	This watercourse is mapped as a surface water body 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. Submerged macrophytes were abundant and some sections of the channel were shaded by overhanging vegetation. Water in this section of the channel was largely ponded. Further downstream the watercourse is largely culverted beneath the Wilton International Site.
Knitting Wife Beck	Tees Transitional Water body Catchment	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 but is known to outfall at the Lackenby Channel.	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; and this section of the channel largely shaded by overhanging deciduous vegetation. Pollution was evident with red staining on all of the vegetation immediately downstream of the culvert.

NAME	TRIBUTARY OF	WATERCOURSE DESCRIPTION	SITE OBSERVATIONS
Lackenby Channel	Tees Transitional Water body Catchment	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 15 m in width. It is likely to be very similar to Dabholm Gut with limited hydromorphological interest.
Main's Dike	Tees Estuary (S Bank) WFD Water body	Main's Dike watercourse rises from a spring in Wilton Wood to the southeast of the 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. The watercourse was heavily shaded, and no macrophytes were observed in the channel at this location although marginal vegetation was dense. The bed was dominated by fine sediment, with some isolated fine gravel patches (e.g. 2-3 cm diameter). 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	Tees Estuary (S Bank) WFD Water body	The course of the Mill Race is unclear as it is largely culverted but appears to emanate from coalescence of	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

NAME	TRIBUTARY OF	WATERCOURSE DESCRIPTION	SITE OBSERVATIONS
		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.	a circular culvert of around 2 m diameter, with artificial concrete banks in places. Banks were step 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	Tees Transitional Water body Catchment	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 Transitional Water body.	Not visited during the site visit because they are outside of the Site Boundary but still considered where relevant within the Study Area of the assessment
Castle Gill	Tees Estuary (S Bank) WFD Water body	This small drainage channel rises around NZ 57697 20558. It flows through the site boundary briefly at NZ 57287 20371 the exact course is unknown, however it is assumed to flow into Kettle Beck at NZ 56209 20268 and then into The Mill Run.	This watercourse was not observed during the initial site visit as it would not be expected to be directly impacted by the Proposed Development. On the basis of aerial photography it is partly in culvert, is straightened and heavily modified with a width of approximately 2 - 3 m.
Ash Gill	The Fleet - Tees Estuary (S Bank WFD Water body)	Ash Gill flows parallel to Main's Dike to the north of the Proposed Development Site. It rises in Kirkleatham and	This watercourse was not observed during the initial site visit as it is upstream of any direct works required for the Proposed Development. However, aerial

NAME	TRIBUTARY OF	WATERCOURSE DESCRIPTION	SITE OBSERVATIONS
		flows northwest through arable agricultural land and the outskirts of Dormanstown before meeting the Fleet at NGR NZ 57587 24388	imagery indicates that the watercourse is straightened with a modified character and is approximately 2 - 3m wide. It is culverted beneath Dormanstown and road crossings of the A108 and railway line.

4.5.7 Further baseline detail regarding the Tees and Tees Coastal waterbodies is provided in Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2)

4.5.8 In addition to the watercourses described in Table 4-2 and Table 4-3, 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. These ditches do not have nature conservation designations, and due to largely being in culvert, they are expected to have minimal biodiversity value. In places, the drainage channels are visible above ground and are typically of the order of 0.5-1 m in width, ephemeral (i.e. flowing for only part of the year or only after storms), have artificial engineered and sometimes concrete channels, and thus generally do not support functional flows (i.e. flows with the ability to erode, transport and deposit sediment resulting in the formation of geomorphic bedforms).

4.5.9 There is also a network of small watercourse channels throughout the saltmarsh and wetland area to the south and southwest 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 water bodies that are closely connected to their floodplains.

4.5.10 Other water bodies shown in Figure 9-1: Surface Water Features and their Attributes (ES Volume II, EN070009/APP/6.3) outside of the 1 km Study Area are not included in this assessment where they are upstream of any proposed works and so would not have any pathways through which to be impacted. This includes Skelton Beck, Cross Beck, Spencer Beck, Middle Beck, Marton West Beck, Lustrum Beck and Claxton Beck.

4.5.11 There are numerous standing waterbodies within the study area (see Chapter 12: Ecology and Nature Conservation (ES Volume I, EN070009/APP/6.2), and most of them are small ponds or artificial standing water bodies. The majority of these on the southeast bank of the Tees are small artificial water bodies and ponds related to the surrounding industrial land use. To the northeast of the Tees there are further artificial and industrial water bodies, such as the large brine reservoirs immediately north of the Site boundary at Saltholme. The surrounding wetlands here also includes several large, interconnecting water bodies which attract a great deal of

biodiversity interest, especially birdlife. The ponds within the Site boundary itself are predominantly very small and generally artificial, with the exception being several water bodies within the South Gare and Coatham Dunes.

4.5.12 The Coatham Dunes ponds have been surveyed and appear to have formed in depressions in the relatively impermeable historic slag deposits that lie between the Site and the more natural sand dunes that have evolved adjacent to the Tees Bay shoreline. Based on site visits between October 2020 and January 2021, they appear to be predominantly rainwater fed with little influence from tidal variation and groundwater (see Annex C). With the exception of Pond 14 (as numbered in Chapter 12: Ecology and Nature Conservation (ES Volume I, EN070009/APP/6.2) all ponds across the dunes have succeeded to become fully vegetated wetlands covered by *Phragmites australis*. Therefore, only Pond 14 will be considered by this assessment due to potential for its water quality and aquatic ecology to be impacted.

4.6 Surface Water Quality

4.6.1 The Tees Coastal WFD water body is currently at 'does not require assessment' for chemical status under Cycle 3 (2022) data. However, under the 2019 data the chemical status was Fail, due to failures for polybrominated diphenyl ethers (PBDE) and mercury and its compounds. The status of all other priority substances, priority hazardous substances, specific pollutants and other pollutants was either Good, High, or had not been assessed.

4.6.2 The Tees Transitional WFD water body is currently at 'does not require assessment' for chemical status under Cycle 3 (2022) data. However, under the 2019 data the chemical status was Fail, due to failed status for PBDEs, benzo(g-h-i)perylene, tributyltin compounds, and cypermethrin (Priority substances). The failure for tributyltin compounds were attributed to diffuse pollution from contaminated water body bed sediments.

4.6.3 The Tees Estuary (South Bank) water body is currently at 'does not require assessment' for chemical status under Cycle 3 (2022) data. However, under the 2019 data the chemical status was Fail, due to failures for PBDEs and mercury as well as its compounds (Environment Agency, 2023d). Priority substances were all at Good Status and Other Pollutants did not require assessment.

4.6.4 Despite being in the Study Area, North Burn and Cowbridge Beck are both upstream of the Proposed Development Site and so they are not considered further in this section.

4.6.5 Water quality data has been obtained from the Environment Agency's Water Quality Archive (Environment Agency, n.d.c) for the Tees Estuary. Annual average values for the period 2009 - 2022 are summarised for a sampling point close to the mouth of the Tees at the Gares, and at Smiths Dock, Redcar Jetty, Teesport and the confluence with Dabholm Gut moving upstream (these monitoring locations are shown on Figure 9-1: Surface Water Features and their Attributes (ES Volume II, EN070009/APP/6.3)). The parameter values are presented in Annex B (Surface

Water Quality Data) of this report are compared against WFD standards where they apply to transitional waters.

4.6.6 These data indicate only one failure against WFD Environmental Quality Standards (EQS) for transitional waters, which was for tributyltin in Dabholm Gut, although there is some evidence of slightly elevated metal concentrations across the monitoring sites, which is expected given the industrial and urban nature of the area surrounding the estuary mouth and the immediate upstream reaches of the river Tees. Raised tributyltin concentrations are consistent with the WFD 'Fail' classification for this water body.

4.6.7 The Water Quality Archive website (Environment Agency, 2023d) also provides water quality for other water bodies and sites in proximity to the Proposed Development Site, spanning the period 2019 - 2023 inclusive. This data is presented in Annex B.

4.6.8 The data summary presented in Annex B indicates that there remains substantial pollution pressure on the Tees Estuary from existing effluent and pollution discharges (e.g. several failures against EQS in the Wilton Complex effluent), although as noted above the Tees has a large capacity to absorb these pollutants with concentrations of most pollutants being below EQS in the monitored data from the Teesmouth area.

4.6.9 The freshwater streams in the Study Area draining to the River Tees are generally not routinely monitored by the Environment Agency. There is data for Billingham Beck, for both the downstream reach of the watercourse below the NTL (which is located at the south-western extent of the Study Area and is part of the Tees transitional WFD water body), and for a location upstream of the NTL at Billingham Bottoms. The freshwater reach of the watercourse is likely to exhibit similar water quality traits to those other freshwater rivers and streams in the Study Area given the similar surrounding urban land with heavy industry, low gradients and tide locking effect of the Tees Estuary. The data for this watercourse indicates that certain dissolved metals exceed WFD standards, while nitrates and phosphates are also slightly elevated.

Bathing Water

4.6.10 Further water quality data for the Study Area is available for Bathing Water areas as designated under the Bathing Water Regulations 2013 (as amended 2018). In the north-east of the Study Area, Coatham Sands is a designated bathing water (as 'Redcar Coatham'). Water quality at designated bathing water sites in England is assessed by the Environment Agency. From May to September each year, weekly assessments measure current water quality and at a number of sites daily pollution risk forecasts are issued. Annual ratings classify each site as excellent, good, sufficient or poor based on measurements of intestinal enterococci and Escherichia coli taken over a period of up to four years. Redcar Coatham had a 2023 classification of Good, which was reduced from Excellent in 2022 (Environment Agency, 2023d).

4.6.11 The Environment Agency's Bathing Water Quality website (Environment Agency, 2023c) notes that the Redcar Coatham bathing water is subject to short term pollution caused when heavy rainfall or high tides wash faecal material to the sea from livestock, sewage and urban drainage via rivers and streams, with water quality typically returning to normal after a few days.

4.6.12 The southern extent of the Seaton Carew North Gare Bathing Water is also within the 2 km of the Proposed Development Site and has a classification of Excellent for 2023 (Environment Agency, 2023d).

Open Water Pond

4.6.13 The only open water pond within the Coatham Dunes (Pond 14 within the Teesmouth and Cleveland Coast SSSI) has been monitored as part of the assessment to determine the potential for impacts from atmospheric deposition of pollutants from the Proposed Development. Pond 14 was monitored on three occasions between December 2022 and February 2023, to supplement previous monitoring undertaken as part of the NZT development between October 2020 and January 2021. In summary, the latest monitoring data indicated that the water is circum-neutral (mean pH 7.82), and well oxygenated with mean dissolved oxygen (DO) values of 97.2% saturated and 11.94 mg/l.

4.6.14 Mean electrical conductivity was 3,111 µS/cm suggesting brackish water. Average ammoniacal nitrogen was recorded at marginally above the laboratory limit of detection (LoD) at 0.05 mg/l. Furthermore, average nitrate values were low (0.4 mg/l) and nitrite was below the LoD. Total nitrogen had a mean average of 0.5 mg/l.

4.6.15 Certain metals including boron and molybdenum were elevated with recorded mean dissolved values of 750.67 µg/l and 200.00 µg/l respectively, and total values of 717.33 µg/l and 212.67 µg/l respectively. Total iron was also found to be elevated with an average value of 259 µg/l; however dissolved iron was far lower at 59.67 µg/l.

4.6.16 Previous sampling (2020 - 2021) of polycyclic aromatic hydrocarbons (PAHs) and total petroleum hydrocarbons (TPHs) all fell below LoDs. One sample of polychlorinated biphenyls (PCBs), semi-volatile organic compounds (SVOCs) and phenols was taken, all of which fell below the LoDs. Further results and analysis from the Pond 14 are included in Annex C.

4.7 Marine Ecology Overview

4.7.1 Full details regarding marine ecology within the Study Area is provided in Chapter 14: Marine Ecology (ES Volume I, EN070009/APP/6.2). A brief summary is provided below.

4.7.2 No protected phytoplankton species or invasive non-native species (INNS) were identified during the Environment Agency surveys in the Tees Estuary. However, there is evidence of some forms of taxa being present that cause harmful algal blooms in UK coastal waters. These included: *Alexandrium* spp., *Karenia mikimotoi*, *Dinophysis acuminata*, *Dinophysis acuta*, and *Pseudo-nitzschia* spp. which are all known to cause shellfish poisoning (Defra, 2008). In addition, several taxa known to

cause mortality in fish due to physical damage were also recorded; these included *Gymnodinium* spp., *Dictyocha speculum*, *Chaetoceros* spp. and *K. mikimotoi* (Defra, 2008).

4.7.3 No formal monitoring of harmful algal blooms is carried out within the lower Tees estuary or coastal water bodies, although the Tees WFD water body which covers the lower reaches of the estuary is classified as having 'Good' phytoplankton status, despite Seal Sands being recognised as a sensitive eutrophic area.

4.7.4 With regard to zooplankton, several INNS are known to have been introduced to the North Sea due to human activities and have responded to favourable conditions, but no protected species have been identified.

4.7.5 The most recent Phase I and Phase II intertidal benthic survey was undertaken in October 2019 as part of the NZT project surveys (NZT ES, Appendix 14A: Intertidal Benthic Ecology Survey Report). Overall, benthic communities were characterised by relatively low abundance, biomass, species richness and diversity. No protected species were identified during the intertidal survey. However, two biotopes (EUNIS A5.233 and A5.242 (European Environment Agency, n.d.)) were identified in the subtidal sampling which qualify as habitats of principal importance being listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 (HM Government, 2006) and belong to the UK Biodiversity Action Plan (BAP) priority habitat type, 'subtidal sands and gravels' (NERC Act, 2006). The only INNS recorded during the benthic surveys was the seaweed wakame (*Undaria pinnatifida*), found in the intertidal zone. In addition to the subtidal Tees Bay, the following habitats are present:

- Greatham Creek and Seaton Channel are characterised by estuarine muddy, soft sediment in the intertidal and subtidal areas, and some intertidal sandflats and saltmarsh also present;
- River Tees has estuarine mud and soft sediments; and
- Tees Bay is characterised by homogenous sand.

4.7.6 The Tees Transitional WFD water body is important for diadromous fish species which make seasonal migrations between the sea and riverine environment. Salmon (*Salmo salar*), sea trout (*Salmo trutta*), European eel (*Anguilla annguilla*), river lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*) are all known to be present within this water body and have been identified as Local Priority Species within the Tees Valley BAP. Salmon, river lamprey and sea lamprey are also protected species under Annex II of the Habitats Directive (EEA, n.d.). The River Tees is designated as one of the 64 main salmon rivers in England and Wales.

4.7.7 Estuarine and marine fish communities within the vicinity of the Proposed Development represent a mixed demersal and pelagic fish assemblage typical of the central North Sea (Teal, 2011; Callaway et al., 2002; EA, 2021). Data on the Environment Agency website indicates that the total number of the monthly combined upstream counts for salmon and sea trout at the Environment Agency fish counter at the Tees Barrage on the Lower Tees have steadily declined in recent

years, with total fish counted being 204 (2019), 328 (2020), 305 (2021), 266 (2022), and 180 (2023) (Environment Agency, 2023).

4.7.8 Common shellfish species within inshore waters include edible crab (*Cancer pagurus*), European lobster (*Homarus 52nguilla*) and velvet swimming crab (*Necora puber*). There are no designated shellfish waters within the vicinity of the Site.

4.7.9 The Tees Estuary is also important for harbour seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*) due to the presence of breeding colonies and haul-out sites located at Seal Sands and along Greatham Creek (INCA, 2022). Seal Sands is designated for harbour seals as part of the Teesmouth and Cleveland Coast SSSI and Teesmouth NNR. The North Sea and coastal waters around the Site are also known to be important for harbour porpoise (*Phocoena phocoena*), which is an Annex II species under the Habitats Directive (EEA, n.d.).

4.7.10 There have been incidents of mass mortality reported in crabs and lobsters along the coastline between Hartlepool and Whitby in recent years, notably between October and December 2021, and continuing periodically through 2022. Some crustaceans were observed displaying unusual twitching behaviour. The exact cause of death has been highly disputed. However, several explanations have been proposed, including disease, harmful algal blooms, chemical toxicity resulting from historical industrial activity in Teesside, and dredging in the Tees area, including River Tees. The most likely cause of death is a novel pathogen. However, the mortality event is still largely unexplained (Defra, 2023c).

4.8 Freshwater Ecology Overview

4.8.1 Full details regarding freshwater ecology within the Study Area are provided in Chapter 12: Ecology and Nature Conservation (ES Volume I, EN070009/APP/6.2). A brief summary is provided below.

4.8.2 The Tees Estuary South Bank (Water Body ID: GB103025072320) is the only riverine WFD water body within the boundary of the Proposed Development Site that is considered to be potentially impacted. Routine WFD monitoring is limited and there was limited aquatic data available from the Environmental Records and Information Centre (ERIC). As such, aquatic baseline surveys have been undertaken to gather more robust data to inform the assessment.

4.8.3 Several notable fish species were recorded within 2 km of the Proposed Development Site using Environment Agency data, NBN Atlas data, survey results for other developments in the area. These include Annex II species bullhead Cottus gobio, species of principal importance brown/sea trout Salmo trutta, in addition to the European eel Anguilla anguilla, which is classified as ‘Critically Endangered’ in the International Union for Conservation of Nature (IUCN) and afforded further protection under the Eel Regulations 2009 (HM Government, 2009) (see Chapter 12: Ecology and Nature Conservation, (ES Volume I, EN070009/APP/6.2)).

4.8.4 There were no specific records of protected macroinvertebrate species identified in the aquatic ecology desk study data. However, some notable taxa were identified, including the beetle (*Helochares obscurus*) (Vulnerable), the beetle (*Ilybius*

subaeneus) (nationally scarce), the beetle (*Noterus crassicornis*) (nationally scarce) and the caddisfly *Oxyethira simplex* (nationally scarce). These were found in and around the Swallow and Mucky Fleet area, which is outside the Proposed Development Site boundary, but within the Study Area.

4.8.5 Previous surveys and those undertaken for the Proposed Development within the Study Area only identified locally notable species. None of the species identified are listed under statutory or non-statutory designations.

4.8.6 There were no records of the white-clawed crayfish (*Austropotamobius pallipes*) within 2 km of the Proposed Development Site boundary within the last ten years, nor within 10 km of the Study Area, and there is no mention of presence within the Tees Valley BAP. However, there are recent records of American signal crayfish (*Pacifastacus leniusculus*) in the Study Area, which being an invasive species, reduces the likelihood of native white-clawed being present. White-clawed crayfish is therefore considered absent from the Study Area.

4.8.7 The WFD macroinvertebrate monitoring data provided by the Environment Agency from 2016 for Dabholm Gut (part of the 'Tees Estuary South Bank' WFD water body) at NZ 56570 23772 indicates that the water body has very poor quality (Whalley Hawkes Paisley Trigg score of 17.6 to 19.5, Average Score Per Taxa of 3.3 to 3.5, very low diversity) and no species of conservation interest were recorded (Environment Agency, N.D.).

4.8.8 On the basis of available data, there are no notable or protected macrophyte species recorded within the Study Area. However, Pond 14 had five uncommon species recorded including sea club-rush (*Bolboschoenus maritimus*), spiked water milfoil (*Myriophyllum spicatum*) and horned pondweed (*Zannichellia palustris*).

4.8.9 Several INNS species were identified in the desk study, from Environment Agency data and data from previous NZT surveys. Species identified on the Wildlife and Countryside Act 1981 (Schedule 9) (HM Government, 1981) include Floating Pennywort (*Hydrocotyle ranunculoides*), Giant Hogweed (*Heracleum mantegazzianum*), New Zealand pigmyweed (*Crassula helmsii*), Parrot feather (*Myriophyllum aquaticum*), Japanese knotweed (*Reynoutria japonica*) and Himalayan balsam (*Impatiens glandulifera*) (Wildlife and Countryside Act Schedule 9, 1981). Most of these species are outside the Study Area of the Proposed Development but floating pennywort has been found in The Fleet. During the summer macrophyte field surveys, Himalayan balsam was recorded along the margins of Kinkerdale Beck, and giant hogweed was observed along the banks of Dabholm Gut.

4.8.10 There are statutory constraints to limit their potential spread, and therefore mitigation will be required during Proposed Development construction to prevent their spread and where possible locally eradicate these species within the construction boundary.

4.9 Sites of Ecological Importance – Surface Water

4.9.1 Designations within and in close proximity to the Study Area are shown on Figure 10-10: Ecological Designations (ES Volume II, EN070009/APP/6.3). The Hydrogen Pipeline Corridor (where it crosses the Tees Estuary) crosses the Teesmouth and Cleveland Coast SSSI. The Teesmouth and Cleveland Coast SSSI is notified under Section 28C of the Wildlife and Countryside Act 1981 (HM Government, 1981) and is of special interest for many nationally important features that occur within and are supported by the wider mosaic of coastal and freshwater habitats. Habitats in the SSSI include sand dunes, saltmarshes, mudflats, rocky and sandy shores, saline lagoons, grazing marshes, reedbeds and freshwater wetlands. The site stretches from Crimdon Dene Mouth in the north, to Marske-by-the Sea in the south, and inland to Billingham including the entire Tees Estuary upstream to the Tees Barrage.

4.9.2 The coast either side of Teesmouth is also designated as being of international importance as the Teesmouth and Cleveland Coast SPA which is designated under the Conservation of Habitats and Species Regulations (2017) (UK Government, 2017b), and the Teesmouth and Cleveland Coast Ramsar site, which is a wetland designated as being of international importance under the Ramsar Convention. The designation is for its important bird populations, and the SPA is a complex of discrete coastal and wetland habitats. These include sandflats, mudflats, rocky foreshore, saltmarsh, sand dunes, wet grassland and freshwater lagoons. The SPA is classified for its breeding Little Tern, passage Sandwich Tern and Redshank, wintering Red Knot and an assemblage of over 20,000 wintering birds. The SPA and Ramsar site both fall cross the Proposed Development Site at its northern extent for the water discharge corridor.

4.9.3 Seaton Dunes and Common Local Nature Reserve (LNR) (part of the Teesmouth and Cleveland Coast SSSI) is located approximately 1.8 km from the Proposed Development. The area is of importance for its invertebrate fauna, flora and bird life. The range of habitats include sandy, muddy, and rocky foreshore, dunes, dune slacks and dune grassland, as well as relict saltmarsh, grazed freshwater marsh with dykes, pools and swells (Natural England, n.d.).

4.9.4 Charlton's Pond LNR is located approximately 0.5 km west of the Proposed Development Site. This is an 8 ha site, consisting of wetlands, amenity grassland and woodland. The site is upslope and upstream of the Proposed Development Site and so is scoped out of further assessment.

4.9.5 There are no other statutory, local non-statutory or other non-statutory designated sites whose reason for designation is due to aquatic habitats, species, or their assemblage up to 1 km from the Proposed Development Site.

4.10 Water Resources

4.10.1 The Study Area is not within a Nitrate Vulnerable Zone, Drinking Water Protected Area (Surface Water), Drinking Water Safeguard Zone or near any Source Protected Zones (SPZs).

4.10.2 This section contains information on water activity permits (e.g. discharges), water abstractions, and past water pollution incidents based on information provided by the Environment Agency or publicly available online data. Full data tables for water activity permits and abstraction licenses are provided in Annex D with brief summaries provided below.

Water Activity Permits

4.10.3 There are 70 water activity permits (i.e., discharge consents) within the Study Area (Defra, 2023d). Locations are shown in Figure 9-1: Surface Water Features and their Attributes (ES Volume II, EN070009/APP/6.3).

4.10.4 The majority of the consented discharges come from treated/untreated sewage effluent from storm tanks, pumping stations and combined sewer overflows (both private and public water company). There are also a substantial number of discharges coming from trade effluent, process/chemical, and cooling water in the Study Area, reflecting the presence of industrial land use. Furthermore, there are two active discharges for raised mine/groundwater where past activity continues to impact present-day water quality.

Abstractions

4.10.5 Data provided by the Environment Agency for the Proposed Development indicates that there are 27 licensed water abstractions within 1 km of the Site. Locations of these abstractions are shown in Figure 9-1: Surface Water Features and their Attributes (ES Volume II, EN070009/APP/6.3) and are listed in Annex D.

4.10.6 Of these, 24 abstractions are for groundwater from the underlying Triassic Sherwood Sandstone to the north and west of the Tees Estuary. They are predominantly for industrial, commercial, and public service use. There are also groundwater abstractions for water supply.

4.10.7 Details on private water supplies (PWS) have been requested from the local authorities. Redcar and Cleveland Borough Council have confirmed that there is one PWS located at NZ 56914 20433. This is for an abstraction of 2 m^3 per day for Barnaby Side Farm to the south of the Proposed Development Site. Stockton-on-Tees Borough Council have confirmed that there are no private water supplies in the Study Area in their respective administrative areas.

Water Pollution Incidents

4.10.8 Twelve water pollution incidents of Category 3 (minor) were identified within 1 km of the Proposed Development within the last 5 years. No Category 2 or Category 1 incidents were recorded. Details are given in Table 4-4 and locations are shown in Figure 9-1: Surface Water Features and their Attributes (ES Volume II, EN070009/APP/6.3).

Table 4-4: Pollution Incidents to Controlled Waters within 1 km of the Proposed Development Site within the last 5 years

ID	INCIDENT NUMBER	NOTIFICATION DATE/TIME	CATEGORY	POLLUTANT TYPE	WATER BODY	X	Y
P1	1604608	10/04/18 16:36	Category 3 (Minor)	Oils and Fuel	Tees Estuary	454040	523170
P2	1627835	01/07/18 14:43	Category 3 (Minor)	Contaminated Water	Billingham Beck	446344	521681
P3	1654441	28/09/18 17:20	Category 3 (Minor)	Sewage Materials	Belasis Beck	447394	523244
P4	1659617	23/10/18 10:24	Category 3 (Minor)	General Biodegradable Materials and Wastes	Tees Estuary	453900	523870
P5	1663756	13/11/18 15:20	Category 3 (Minor)	General Biodegradable Materials and Wastes	Tees Estuary	453900	523870
P6	1667924	06/12/18 17:34	Category 3 (Minor)	Oils and Fuel	Tees Estuary	454000	524070
P7	1707375	04/06/19 11:06	Category 3 (Minor)	Pollutant Not Identified	Greatham Creek	451003	522254
P8	1814296	04/06/20 14:06	Category 3 (Minor)	Sewage Materials	Tees Bay	447923	525756
P9	1927695	24/04/21 08:07	Category 3 (Minor)	Pollutant Not Identified	Cowbridge Beck	447994	525687
P10	2087233	09/08/22 12:15	Category 3 (Minor)	Pollutant Not Identified	Tees Estuary	454387	525101
P11	2098122	08/09/22 11:36	Category 3 (Minor)	Oils and Fuel	Marton Beck	452866	522166
P12	2147632	02/05/23 13:02	Category 3 (Minor)	Oils and Fuel	Lackenby channel	454110	523316

4.10.9 The recorded pollution incidents have impacted the Tees Estuary (including Greatham Creek), Billingham Beck, Belasis Beck, Cowbridge Beck, Marton Beck and Lackenby Channel. They have been related to pollution from oils, crude sewage and contaminated water associated with firefighting runoff.

4.11 Future Baseline

Construction (2025-2029); Operation 2030

4.11.1 As outlined in Chapter 5: Construction Programme and Management (ES Volume I, EN070009/APP/6.2) the construction of the Proposed Development is expected to commence with permitted preliminary works for Phase 1 in 2025, and so this year has been adopted as the future baseline for construction as a worst-case scenario. Full operation (for both Phase 1 and 2) is scheduled to commence in 2030.

4.11.2 The future baseline has been determined qualitatively by considering the possibility of changes in the attributes that are considered when deciding the importance of water bodies in the Study Area.

Surface Water

4.11.3 All WFD surface water bodies identified (and scoped in) within the Study Area (Tees Coastal, Tees Estuary (South Bank) and Cowbridge Beck) have a target of Good by 2027, with the exception of Tees Transitional which has a target of maintaining the existing Moderate Potential (i.e. no deterioration from the present condition). While this is the published position, the Environment Agency have confirmed that they wish to see significantly reduced dissolved inorganic nitrogen (DIN) in the estuary.

4.11.4 The Tees Estuary is considered to be undergoing a period of ecological recovery after several decades of industrial and sewage pollution. Numerous restoration schemes such as the Tees Tidelands programme are in place. As such, there is likely to be an improvement over current conditions due to interventions that are being implemented or have already been implemented. This includes the introduction of nutrient neutrality requirements that aim to ensure no further deterioration, and ultimately improvement, with regard to nutrient status.

4.11.5 It is likely that through the action of new legislative requirements and ever more stringent planning policy and regulation, that the health of the water environment will continue to improve post-2027. The Environment Act 2021 (HM Government 2021), the Levelling-Up and Regeneration Act 2023 (HM, Government 2023) and regulatory requirements (Water Company Price Review) include measures to tackle storm sewage discharges and set new requirements on nutrient removal from sewage treatment works (Environment Act, 2021; Levelling-Up and Regeneration Act, 2023). There are, however, significant challenges such as adapting to a changing climate and pressures of population growth that could have a retarding impact. It is also difficult to forecast these changes with any certainty. As such, the future baseline assumes that the objectives of the WFD waterbodies are achieved and that the Proposed Development would need to demonstrate that it would not prevent these future objectives from being met.

Groundwater

4.11.6 The Tees Mercia Mudstone & Redcar Mudstone WFD groundwater body is still at its objective of Poor Status (2015), while the Tees Sherwood Sandstone WFD

groundwater body WFD water body achieved and has maintained its objective of Good Status by 2015 (EA, n.d.).

4.11.7 No significant changes to current baseline conditions are predicted for the future baseline for the same reasons as outlined above for surface water. The impact assessment within this assessment is therefore undertaken against existing baseline conditions.

Decommissioning

4.11.8 It is considered that continued environmental improvements, tighter regulation at both national, regional and local scales, and environmental enhancements will lead to a gradual improvement over current baseline conditions in terms of water quality.

4.11.9 Climate change has the potential to significantly impact on drainage, for example through increased storm intensity and changes in future rainfall patterns. However, the design of the Proposed Development will incorporate the climate change projections required by the Environment Agency to ensure that potentially increased surface water flows are accounted for and managed across the lifetime of the Proposed Development.

4.11.10 It is assumed that by the time of decommissioning WFD water body objectives will be met, and that there will be no significant material and adverse changes to current baseline conditions within the next 31 years (assumed Proposed Development decommissioning date). Therefore, the impact assessment for the decommissioning phase of the Proposed Development is undertaken against a baseline of all relevant parameters being at the target status.

5.0 SCREENING ASSESSMENT

5.1 Introduction

5.1.1 The water bodies screened into the assessment have been selected based on the following criteria:

- all surface water and groundwater bodies that may potentially be directly or indirectly impacted by the proposed works within 1 km of the Proposed Development; and
- the relevant water bodies have been determined using a Zone of Influence (ZoI) approach, which firstly requires the identification of all potential pathways that may have an effect on all quality elements, and secondly determination of the extent of the effect (i.e. the ZoI).

5.1.2 Potential pathways that may have an effect within the ZoI have been identified from understanding of the proposed design (as presented in Section 1.1). Potential for effects on protected areas associated with the WFD water bodies has also been considered within the screening assessment.

5.2 Relevant Water Framework Directive Water Bodies

5.2.1 As outlined in Section 4, there are four WFD designated surface water bodies within the Study Area that were initially scoped in. Their WFD classification alongside observations recorded during the site walkover are described in Table . Although these are the WFD reporting reaches, WFD principles and objectives apply to all tributaries of these watercourses. The WFD water bodies include one coastal water body (Tees Coastal Water), one estuarine water body (Tees transitional water body) and three river water bodies (The Fleet – designated as Tees Estuary (S Bank) and Cowbridge Beck from Source to North Burn). These water bodies are shown in Figure 9-1: Surface Water Features and their Attributes (ES Volume II, EN070009/APP/6.3).

5.2.2 Furthermore, there are two relevant WFD groundwater bodies, these being the Tees Sherwood Sandstone Operational Catchment and the Tees Mercia Mudstone and Redcar Mudstone water body.

5.2.3 The full WFD classifications for these water bodies are summarised in Annex A.

5.3 Zone of Influence

5.3.1 WFD water bodies have been screened into this assessment using a Zone of Influence (ZOI) approach and on the basis of whether they are a designated WFD water body within the ZOI and so could be directly or indirectly impacted.

5.3.2 Table sets out the pathways to an effect, the extent of the ZOI and the water bodies that are directly within the ZOI.

Table 5-1: ZOIs and Relevant WFD Water Bodies

POTENTIAL PATHWAY	ZOI AND BASIS FOR DETERMINATION	RELEVANT WATER BODIES TO SCREEN IN	ADJACENT WATER BODIES
CONSTRUCTION			
Water Quality: Runoff of fine sediment Construction works adjacent to, on the banks of, and within watercourses can be a direct source of fine sediment mobilisation, and this sediment could contain contaminants given the past industrial activities at the Proposed Development Site. This would include works within, beneath or adjacent to watercourses for pipeline installation, or any excavations or construction with potential to runoff to watercourses. There will be open-cut crossings of watercourses for pipelines which could have direct impacts in terms of sediment mobilisation. For the Hydrogen Pipeline Corridor, open-cut works are expected to impact Holme Fleet at approximately NGR NZ 49241 23828 and unnamed watercourses north of the Tees estuary at NZ 51091 23758, NZ 51110 24822, and NZ 49091 24350. None of these are WFD designated themselves but form part of the wider WFD catchment and so remain relevant. Furthermore, indirect impacts could occur to WFD water bodies if sediments are mobilised downstream. The nature of watercourse crossing methodology for the Electrical Connection Corridor, Water Connection Corridor and Other Gases Corridor is not yet finalised and may be either	All watercourses within and immediately adjacent to the Proposed Development Site or boundary could be impacted by runoff containing fine sediment during construction, or sediments mobilised by direct works to watercourses. These include the Tees Estuary (S Bank), Tees Transitional and Tees Coastal WFD water bodies and their numerous tributaries. Given dilution and dispersal potential in the tidal Tees Transitional and Tees Coastal water bodies, a zone of influence up to 1 km downstream of the Proposed Development in Tees Coastal WFD water body is appropriate.	Tees Estuary (S Bank) WFD water body Tees Coastal WFD water body Tees Transitional WFD water body (including Greatham Creek, Dabholm Gut, Billingham Beck) A number of tributaries and unnamed drainage ditches throughout the study area that drain to the above water bodies.	All watercourses in the Study Area drain to Tees Coastal WFD water body, and so there are no additional downstream receptors.

POTENTIAL PATHWAY	ZOI AND BASIS FOR DETERMINATION	RELEVANT WATER BODIES TO SCREEN IN	ADJACENT WATER BODIES
above or below ground or a combination of the two. However, no watercourse crossings are known to be required to facilitate the installation of these connections. Trenchless crossings (using Horizontal Directional Drilling or similar) of watercourses including the Tees Estuary and Greatham Creek have potential to cause sediment mobilisation from works to install send and receive pits and use of plant in the vicinity of watercourses. Similarly, installation of pipe bridges requires works in close proximity to watercourses and so could cause runoff of sediments if not controlled appropriately.			
Water Quality: Spillages During construction, fuel, hydraulic fluids, solvents, grouts, paints and detergents and other potentially polluting substances will be stored and / or used on Site. Leaks and spillages of these substances could pollute the nearby surface watercourses or groundwater if their use or removal is not carefully controlled and spillages enter existing flow pathways or water bodies directly. As with sediment mobilisation, the risk is greatest where there are direct works to water bodies, or works in close proximity to water bodies, as described above.	All surface watercourses or groundwater within or immediately adjacent to the Proposed Development Site or boundary could be impacted by accidental spillages during construction. These include the Tees Estuary (S Bank), Tees Transitional and Tees Coastal WFD surface water bodies and their tributaries, and the Tees Mercia Mudstone and Redcar Mudstone and Tees Sherwood Sandstone groundwater bodies. Given	Tees Estuary (S Bank) WFD water body (including the Mill Race) Tees Coastal WFD water body Tees Transitional WFD water body (including Dabholm Gut and Belasis Beck) Tees Mercia Mudstone and Redcar Mudstone WFD groundwater body	All watercourses in the Study Area drain to Tees Coastal WFD water body, and so there are no additional downstream surface water receptors. Tees Mercia Mudstone and Redcar Mudstone WFD groundwater body

POTENTIAL PATHWAY	ZOI AND BASIS FOR DETERMINATION	RELEVANT WATER BODIES TO SCREEN IN	ADJACENT WATER BODIES
	dilution and dispersal potential in the tidal Tees Transitional and Tees Coastal water bodies, a zone of influence up to 1 km downstream of the Proposed Development in Tees Coastal WFD water body is appropriate.	Tees Sherwood Sandstone WFD groundwater body A number of unnamed drainage ditches	Tees Sherwood Sandstone WFD groundwater body
Groundwater: Pollution Excavations (e.g. HDD pits) or installation of foundations (e.g. piling) required during construction of the Proposed Development have the potential to intercept groundwater and may create a pathway for pollutants to be transferred to groundwater if not mitigated. A Ground Investigation will be undertaken to inform the design development and to guide appropriate construction methods to minimise impacts on groundwater flow, which may in turn impact baseflow in rivers or groundwater abstractions.	Groundwater bodies directly beneath the Proposed Development Site.	Tees Mercia Mudstone and Redcar Mudstone WFD groundwater body Tees Sherwood Sandstone WFD groundwater body	Tees Mercia Mudstone and Redcar Mudstone WFD groundwater body Tees Sherwood Sandstone WFD groundwater body
Groundwater: Disturbance of flow There may be potential for disturbance of groundwater flow pathways related to excavations, installation of pipelines and use of receive/launch pits/shafts for trenchless crossings, as well as for the boring tunnel. This could impact on the quantitative element of WFD groundwater bodies if not mitigated.	Groundwater bodies directly beneath the Proposed Development Site.	Tees Mercia Mudstone and Redcar Mudstone WFD groundwater body Tees Sherwood Sandstone WFD groundwater body	Tees Mercia Mudstone and Redcar Mudstone WFD groundwater body Tees Sherwood Sandstone WFD groundwater body

POTENTIAL PATHWAY	ZOI AND BASIS FOR DETERMINATION	RELEVANT WATER BODIES TO SCREEN IN	ADJACENT WATER BODIES
Construction works to install the Hydrogen Pipeline Connection beneath the Tees Estuary and Greatham Creek using drilling or boring techniques may involve a temporary pit either side of the watercourse (>10 m measured from the water's/channel edge under normal flows) as well as regularly spaced jointing pits where longer sections of boring are required (pits typically 10 m long x 5 m wide x 3 m deep). Open-cut works are expected to impact Holme Fleet at approximately NGR NZ 49397 23941 and unnamed watercourses north of the Tees estuary at NZ 51091 23758, NZ 51110 24822, and NZ 49091 24350. None of these are WFD designated themselves but form part of the wider WFD catchment and so remain relevant. Furthermore, indirect impacts could occur to WFD water bodies if sediments are mobilised downstream. There is potential for shallow groundwater levels associated with the various connection corridors, and so there is potential for groundwater ingress to the pits. This will be managed following standard construction techniques potentially including pumping, damming, or shoring up the pits with sheet piling.			
Hydromorphology: Physical modification Physical modification of water bodies which may have adverse morphological impacts (including scour, deposition and habitat loss). For the Hydrogen Pipeline Corridor, open-cut works are expected to impact Holme Fleet at approximately NGR NZ	The immediate footprint and environs of water bodies that will be directly physically altered (within which any scour affects would be expected to occur).	Tees Estuary (S Bank) WFD water body (including the Mill Race) Tees estuary (Tees WFD water body).	Not applicable, this pathway relates to morphology of the bed of the water body that is directly impacted

POTENTIAL PATHWAY	ZOI AND BASIS FOR DETERMINATION	RELEVANT WATER BODIES TO SCREEN IN	ADJACENT WATER BODIES
49397 23941 and unnamed watercourses north of the Tees estuary at NZ 51091 23758, NZ 51110 24822, and NZ 49091 24350. None of these are WFD designated themselves but form part of the wider WFD catchment and so remain relevant. Furthermore, indirect impacts could occur to WFD water bodies if sediments are mobilised downstream.			
OPERATION			
Water Quality: Runoff of diffuse pollutants Surface water runoff from the Site during operation could contain various diffuse urban pollutants given the industrial nature of the site. These could be discharged to Tees Bay or Tees estuary.	All surface water runoff is anticipated to be discharged to Tees Bay (Tees Coastal WFD water body) or Tees estuary (Tees WFD water body), via attenuation for flows and water quality. Given dilution and dispersal potential in the tidal Tees Transitional and Tees Coastal water bodies, a zone of influence up to 1 km downstream of the Proposed Development in Tees Coastal WFD water body is appropriate.	Tees Coastal WFD water body Tees estuary (Tees WFD water body)	No adjacent receptors given scale of Tees Coastal and Tees estuary water bodies
Water Quality: Process water discharge Process water from the Proposed Development will be treated by a dedicated on-site Water Treatment Plant. This would include:	For Case 2B, all treated process water runoff is to be discharged to Tees Bay. The ZoI for the estuary is not expected to be greater than 1	Tees Coastal WFD water body	No adjacent receptors given scale of Tees Coastal water body

POTENTIAL PATHWAY	ZOI AND BASIS FOR DETERMINATION	RELEVANT WATER BODIES TO SCREEN IN	ADJACENT WATER BODIES
1. boiler blowdown; 2. process condensate; and 3. hazardous liquid wastes – to be taken off-site (e.g. amine). There is potential for chemical pollution should any contaminants not be suitably treated. Process condensate will be treated by a dedicated on-site Water Treatment Plant. The treated process condensate will be reused as makeup water in the Water Treatment Plant and so will not be discharged. Other wastewater streams (cooling tower blowdown and demineralisation plant rejects) will be treated in an Effluent Treatment Plant (ETP). Case 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. This will be transported off-site for further treatment. The treated wastewater from the ETP will be reused as make-up water in the Water Treatment Plant.	km downstream of the proposed outfall location as a worst case, given the dynamic nature of this coastal water.		

POTENTIAL PATHWAY	ZOI AND BASIS FOR DETERMINATION	RELEVANT WATER BODIES TO SCREEN IN	ADJACENT WATER BODIES
Case 2B represents an alternative to Minimalised Liquid Discharge. In this case, wastewater would be discharged via the NZT outfall to Tees Bay. In this event, then it is assumed that the wastewater discharge will meet the requirements of the BREF for Common Wastewater and Waste Gas Treatment/Management Systems in the Chemical Sector 2016 (EC JRC, 2016). 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.			
Water Quality: Foul water discharge Foul water will connect to the STDC sewage network for appropriate treatment and discharge. This is likely to be via Bran Sands WwTW but may also be via 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. Sanitary wastewater from welfare facilities will be at NWL's 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	Given that any treated effluent from a wastewater treatment works would be subject to an Environmental Permit, the ZoI should be small. A reasonable worst-case scenario would be 1 km downstream from the outfall in the receiving water body.	Tees Coastal WFD water body	No adjacent receptors given scale of Tees Coastal water body

POTENTIAL PATHWAY	ZOI AND BASIS FOR DETERMINATION	RELEVANT WATER BODIES TO SCREEN IN	ADJACENT WATER BODIES
and in accordance with requirements to not cause deterioration or prevent improvement under the WFD.			
Water Quality and Quantity: abstraction Abstraction of water will be required from the River Tees (Tees WFD water body) for process operations. The Proposed Development requires a flow rate of 227 m^3/hr (5.45MI/day) for Case 1B and 297 m^3/hr (7.13 MI/day) for Case 2B. Northumbrian Water's Water Resources Management Plan 2019 (Northumbrian Water, 2019) indicates that there should be sufficient resources within the network to accommodate this, if required. The plan undertook a supply and demand forecast for each Water Resource Zone (WRZ) in their jurisdiction (with the Industrial WRZ being relevant for the Proposed Development) for a scenario of a worst historical drought and a 1 in 200 year return period drought. Based on licensed quantities from the River Tees there is 170 MI/d of water available for the Industrial WRZ under normal operation. In the 1 in 200 design drought year there is only 130 MI/d of water available for the Industrial WRZ. This means that based on a current demand of 82 M l/d the WRZ has a headroom of 48 MI/d in the design drought year. Furthermore, given advancements in water efficiency in industry, future demand is expected to decline. The Plan confirms that a water supply surplus will be maintained up to 2060. Furthermore, the volume	As abstraction relates to water volume, the Zone of Influence is the water body scale. However, the current assumption is that water would be abstracted under existing licence(s).	Tees transitional WFD water body	Tees transitional WFD water body is adjacent to the Tees Coastal WFD water body, which would not be impacted given its scale.

POTENTIAL PATHWAY	ZOI AND BASIS FOR DETERMINATION	RELEVANT WATER BODIES TO SCREEN IN	ADJACENT WATER BODIES
of water forecast to be abstracted over the planning period will not lead to deterioration in the status of the water bodies from which NWL abstract. It should be noted that NWL are producing a new Water Resources Management Plan (WRMP) for publication in 2024 (Northumbrian Water, 2024). Within the draft document, the Industrial WRZ has been integrated into the Kielder WRZ. This is because NWL demonstrate that the Industrial Supply Zone can be supported by Kielder reservoir and the Tyne–Tees Transfer system and is therefore subject to the same risk to supply as the rest of the Kielder WRZ. The final plan supply demand balance in the draft WRMP for 2024 indicates a supply surplus for the Kielder WRZ across the planning period from 2025 to 2084.			

5.4 Screening against Clearing the Waters for All Exemptions

5.4.1 In accordance with Environment Agency Clearing the Waters for All guidance (Environment Agency, 2016), a screening assessment is not required if the proposed activity meets any one of several criteria that indicate the activity is low risk. The screening criteria are listed in Table , alongside assessment of whether the Proposed Development meets the criteria.

Table 5-2: Screening Criteria from the Environment Agency Clearing the Waters Guidance

SCREENING CRITERIA		SCREENING ASSESSMENT
A self-service marine licence activity or an accelerated marine licence activity that meets specific conditions		The Proposed Development is not applicable for a self-service or accelerated marine licence activity
Maintaining pumps at pumping stations – if you do it regularly, avoid low dissolved oxygen levels during maintenance and minimise silt movement when restarting the pumps		Not applicable to the Proposed Development
Removing blockages or obstacles like litter or debris within 10 m of an existing structure to maintain flow		Not applicable to the Proposed Development
Replacing or removing existing pipes, cables or services crossing over a water body – but not including any new structure or supports, or new bed or bank reinforcement		The Proposed Development will require new crossings over (or under) water bodies rather than replacement or removal, and so is not exempt from further assessment.
'Over water' replacement or repairs to, for example bridge, pier and jetty surfaces – if you minimise bank or bed disturbance		The Proposed Development will require new crossings over (or under) water bodies rather than replacement or removal, and so is not exempt from further assessment.
The activity was carried out during 2009 to 2014 and a WFD assessment was undertaken. The WFD assessment does not need repeating unless:	Changes made to how that activity is carried out, including method, size or scale, volume, depth, location or timings	Not applicable to the Proposed Development
	There has been a pollution incident since the activity was last carried out	

5.4.2 The Proposed Development does not meet any of the Clearing the Waters exemptions assessed in Table (or they are not applicable to the Proposed Development), therefore continued assessment is required.

5.5 Flood Risk Activity Exemptions

5.5.1 The Proposed Development can also be screened against the list of Flood Risk Activity exemptions detailed in Table 3-1.

5.5.2 The following exemptions may be relevant:

- Service crossing below the river bed, installed by trenchless technologies if more than 1.5 m below the natural bed line of the river – this is relevant to the crossing of the Tees Estuary and other watercourses for the various pipeline networks; and
- Service crossing over a river. This includes those attached to the parapets of a bridge or encapsulated within the bridge's footpath or road – the Proposed Development includes numerous pipeline crossings, for example for the Hydrogen Pipeline Network and electrical connection corridors. These are comparable to a 'service crossing over a river' and where this does not involve any direct works to the river channel, and so it is considered appropriate that this exemption is applied where relevant. Watercourse crossings are described later in the assessment (see Section 7).

5.6 Stage 1 Screening Summary

5.6.1 The WFD screening process has followed guidance in the PINS Advice Note 18 (PINS, 2017) and Clearing the Waters for All guidance (Environment Agency, 2016). Proposed work activities that could influence water bodies (i.e. WFD designated or otherwise as non-designated reaches but forming part of a WFD catchment) have been outlined and the WFD water bodies that could potentially be affected have been identified through consideration of the Zone of Influence.

5.6.2 The following water bodies have been identified within the study area and screened in for further consideration at the subsequent assessment stages:

- Tees Coastal Water body (GB650301500005);
- Tees Transitional Water body (GB510302509900);
- Tees Estuary (South Bank) (GB1030250723320);
- Tees Mercia Mudstone and Redcar Mudstone (GB40302G701300); and
- Tees Sherwood Sandstone (GB40301G702000).

6.0 SCOPING ASSESSMENT

6.1 Overview

6.1.1 A scoping assessment (Stage 2) is required to determine which coastal and estuarine receptors may be impacted by the Proposed Development, and therefore need to be assessed in the WFD impact assessment. These receptors are defined in accordance with the Environment Agency Clearing the Waters Guidance (Environment Agency, 2016) and are based on the water body's quality elements; the receptors include:

- Hydromorphology;
- Water quality;
- Biology – habitats;
- Biology – fish; and
- Protected areas

6.1.2 The scoping assessment also considers INNS.

6.1.3 As the scoping assessment outlined in the Clearing the Waters Guidance is designed for coastal and estuarine water bodies it is applied here to the Tees Coastal and Tees Transitional water bodies only. The fluvial (Tees Estuary (S Bank)) and groundwater bodies (Tees Mercia Mudstone & Redcar Mudstone and Tees Sherwood Sandstone) are taken forward for further assessment on the basis of the screening assessment presented in Section 5.

6.1.4 There are some components of the Proposed Development that impact watercourses that do not lie within WFD water bodies. Nevertheless, impacts to these watercourses should still be considered and are addressed under 'Impacts to Unmapped Water Bodies'.

6.2 Tees Coastal Water Body

6.2.1 The footprint of the Proposed Development falls partially within the catchment of the Tees Coastal WFD water body and includes a potential discharge location within the water body.

6.2.2 The Tees Coastal water body is a HMWB that is currently at Moderate Ecological Potential. There are currently no mitigation measures identified in the Northumbria RBMP for this water body. It has an objective of Good Ecological Potential by 2027 (see Annex A).

Hydromorphology

6.2.3 Hydromorphology refers to the physical characteristics of water bodies. Hydromorphological quality elements include the size, shape and structure of the water body, and the flow and quantity of water and sediment. Impacts on hydromorphology include changes to morphological conditions (for example variation in the structure of the seabed and intertidal zone) and tidal patterns (for

example dominant currents, freshwater flow and wave exposure). Hydromorphology is only a WFD quality element for high status water bodies, but significantly influences other elements, particularly biological ones, and thus is an important part of the assessment.

6.2.4 The proposed works will utilise an outfall and water discharge pipeline proposed as part of the NZT project that has already been considered by the WFD Assessment for that project. This Proposed Development does not seek to consent those works and they therefore do not need to form part of this assessment. The potential effects to hydromorphological quality in the Tees Coastal water body due to construction of the new outfall and water discharge pipeline have been assessed within the NZT WFD assessment. Therefore, there are no anticipated impacts to hydromorphology elements within the Tees Coastal water body.

6.2.5 The scoping assessment of the potential effects to hydromorphology is provided in Table . The risk criteria in the table are taken from the Environment Agency guidance on WFD assessment for estuarine and coastal waters (Environment Agency, 2017).

Table 6-1: Scoping Assessment of Risks to Hydromorphology for the Tees Coastal Water Body

RISK	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	HYDROMORPHOLOGY RISK ISSUE(S)
Could impact on the hydromorphology (e.g. morphology or tidal patterns) of a water body at high status	n/a - water body not at high status	n/a - water body not at high status	n/a - water body not at high status
Could significantly impact the hydromorphology (i.e. bed morphology and substrate) of any water body		✓	Proposed activities will not impact the morphology of the seabed and local sediment dynamics as there are no direct works within the water body.
Activity is in a water body that is heavily modified for the same use as your activity		✓	Proposed activities will not impact the morphology of the seabed and local sediment dynamics as there are no direct works within the water body.

Water Quality – Physico-Chemical Quality Elements

6.2.6 Impacts to ecological water quality relates to effects on any of the following: Water clarity, temperature, salinity, oxygen levels, nutrients, microbial patterns for longer than a spring neap tidal cycle (approximately 14 days). In addition to the above, if

the water body has a history of harmful algae or a phytoplankton status of Moderate, Poor or Bad, this will need to be considered.

6.2.7 During construction and operation, if not mitigated there could be impacts on Tees Coastal chemical status from diffuse urban pollutants in surface water runoff, or as a result of accidental chemical spillages, which will potentially be discharged via the potential outfall to Tees Bay. Similarly, changes in water quality within Tees Bay could occur from operational discharges of treated process wastewater (although these would only be allowed under an Environmental Permit).

6.2.8 Phytoplankton status has not been classified for the Tees Coastal water body. There is no monitoring of harmful algae, which it is assumed to indicate that this is not a particular risk for this water body. As such, further consideration of phytoplankton and harmful algae has been scoped out from further consideration in the WFD impact assessment, summarised in Table .

Table 6-2: Scoping Assessment of Risks to Physico-chemical Quality Elements in the Tees Coastal Water Body

RISK	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	WATER QUALITY RISK ISSUE(S)
Could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)	✓		Impacts on Tees Coastal water body from mobilisation of sediments, diffuse urban pollutants in surface water runoff or process water effluent, or as a result of accidental spillages, which may be discharged via the potential outfall to Tees Bay.
Is in a water body with a phytoplankton status of moderate, poor or bad		✓	There is no monitoring of harmful algae, and is therefore assumed that this is not a particular risk for this water body. As such, further consideration of phytoplankton and harmful algae has been scoped out from further consideration in the WFD impact assessment
Is in a water body with a history of harmful algae		✓	N/A as per above comment.

Water Quality – Chemical Status

6.2.9 During construction and operation, if not mitigated there could be impacts on Tees Coastal chemical status from diffuse urban pollutants in surface water runoff, or as a result of accidental chemical spillages, which are discharged via the potential outfall to Tees Bay. Similarly, changes in water quality within Tees Bay could occur from operational discharges of treated process wastewater (although these would only be allowed under an Environmental Permit).

6.2.10 The scoping assessment for chemical status is summarised in Table 6-3.

Table 6-3: Scoping Assessment of Risks to Chemical Status in the Tees Coastal Water Body

RISK	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	WATER QUALITY RISK ISSUE(S)
The chemicals are on the Environmental Quality Standards Directive (EQSD) list	✓		Potential for a range of chemicals to be discharged to Tees Coastal water body from diffuse urban pollutants in surface water runoff or process water effluent, or as a result of accidental spillages, which could be discharged via the potential outfall to Tees Bay, if not mitigated.
It disturbs sediment with contaminants above CEFAS Action Level 1		✓	There would be no direct works to the seabed and so sediment disturbance would not occur.

Biology - Habitats

6.2.11 A number of habitats have been highlighted in the Environment Agency Clearing the Waters guidance (Environment Agency, 2016) as being of higher and lower sensitivity based on their resistance to, and recovery rate, from human pressures. Table outlines the higher and lower sensitivity habitats associated with the Tees Coastal water body (based on the Environment Agency WFD water body summary table), which have the potential to be impacted during operation by discharges from the potential outfall causing thermal plumes or chemical changes in water quality and deposition of air pollutants.

Table 6-4: Higher and Lower Sensitivity Habitats found in the Tees Coastal water body

HIGHER SENSITIVITY HABITATS	AREA (HA)	LOWER SENSITIVITY HABITATS	AREA (HA)
Mussel beds (including blue and horse mussel)	121.98	Cobbles, gravel and shingle	3.36
Subtidal kelp beds	175.17	Intertidal soft sediment	845.53
		Rocky shore	184.33
		Subtidal rocky reef	7170.03
		Subtidal soft sediments	1219.64

6.2.12 Habitats should be included as part of the WFD impact assessment if the footprint of the activity is any of the following (Environment Agency, 2016), noting that this also includes the footprint of thermal or sediment plumes:

- 0.5 km^2 or larger in area within the estuarine or coastal water body;
- 1% or more of the water body's area; and
- Within 500 m of any higher sensitivity habitat or covering 1% or more of any lower sensitivity habitat area.

6.2.13 Magic Map (DEFRA, n.d.a) has been used to confirm the proximity of the noted sensitive habitats to the proposed works. The nearest Higher Sensitivity Habitat (Mussel beds at South Gare) are over 1 km away.

6.2.14 In accordance with this EA guidance, the habitats outlined in Table have been scoped into the WFD impact assessment on account of the potential plumes of thermally enhanced water or pollutants to be produced by the Proposed Development.

Table 6-5: Scoping Assessment of Risks to Biological Habitat in the Tees Coastal Water Body

FOOTPRINT IS:	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	BIOLOGICAL HABITAT RISK ISSUE(S)
0.5 km^2 or larger	✓		Potential for thermal and pollutant plumes to exceed 0.5 km^2.
1% or more of the water body's area		✓	There will be no constructed footprint within the coastal water body (c.100 m^2 maximum area).

FOOTPRINT IS:	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	BIOLOGICAL HABITAT RISK ISSUE(S)
Within 500 m of any higher sensitivity habitat		✓	Over 1 km to nearest higher sensitivity habitat
1% or more of any lower sensitivity habitat		✓	There will be no constructed footprint within the Coastal water body (c.100 m^2 maximum area).

Fish

6.2.15 The Tees Coastal water body is known to support several nationally and internationally protected migratory fish species, including salmon, sea trout, European eel, river lamprey and sea lamprey. This water body also supports a range of estuarine and marine demersal and pelagic fish taxa which are of national and international importance, such as cod (*Gadus morhua*), herring (*Clupea herengus*), and whiting (*Merlangius merlangus*).

6.2.16 There could be operational impacts of discharging treated process waters to the Tees Coastal water body such as the release of a thermal plume from process water which could affect fish movement or contaminants in surface water runoff or process water discharge that may affect fish population health in the short term (risk of chemical spillages or failures in long term treatment systems) or longer term (spillages and routine discharges from the development). The scoping assessment of risk to fish is provided in Table .

Table 6-6: Scoping Assessment of Risks to Biological Fish in the Tees Coastal Water Body

RISK	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	BIOLOGICAL FISH RISK ISSUE(S)
Could impact on normal fish behaviour like movement, migration, or spawning (e.g. creating a physical barrier, noise, chemical change or change in depth or flow)	✓		Proposed outfall at Tees Bay could cause the release of a thermal discharge plume or pollutants in surface water runoff or discharge of process water effluent to the water body.
Could cause entrainment or impingement of fish		✓	No abstractions are proposed within the Tees Coastal water body therefore entrainment or

RISK	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	BIOLOGICAL FISH RISK ISSUE(S)
			impingement of fish is unlikely to occur.

Water Framework Directive Protected Areas

6.2.17 The location of the Proposed Development in relation to the following WFD Protected Areas has been considered (see Table 4-2 for baseline details of relevant Protected Area):

- Special Areas of Conservation (SACs);
- Special Protection Areas (SPAs);
- Shellfish waters;
- Bathing waters; and
- Nutrient sensitive areas.

6.2.18 The outcome of the scoping assessment for WFD protected areas is shown in Table 6-7 below.

Table 6-7: Scoping Assessment of WFD Protected Areas in the Tees Coastal Water Body

RISK	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	BIOLOGICAL FISH RISK ISSUE(S)
Activity is within 2 km of any WFD protected area	✓		Activity is within 2 km of WFD protected areas – i.e. it overlaps Teesmouth and Cleveland Coast Special Protection Area SPA and Redcar and Coatham Bathing Waters.

Invasive Non-Native Species

6.2.19 There are no anticipated effects regarding INNS due to the H2 project. The scoping assessment of risks from INNS is summarised in Table .

Table 6-8: Scoping Assessment of Risks from INNS in the Tees Coastal Water Body

RISK	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	BIOLOGICAL FISH RISK ISSUE(S)
Activity may introduce or spread INNS to a water body	✓		Due to the use of vessels as part of the Proposed Development, there is the potential for the introduction, transportation and spread of INNS, either from biofouling or from the discharge of ballast water and bilge water.

Summary

6.2.20 A summary of the receptors and relevant WFD quality elements that have been scoped into the WFD impact assessment for the Tees Coastal is shown in Table .

Table 6-9: Scoping Outcome for the Tees Coastal Water Body

RECEPTOR	RELEVANT WFD QUALITY ELEMENT(S)	POTENTIAL RISK TO RECEPTOR
Hydromorphology	Hydromorphological elements	Proposed activities will not impact the hydromorphological elements of the Tees Coastal water body.
Water Quality	Physico-chemical and chemical water quality elements	Impacts arising from diffuse urban pollutants in surface water runoff or process water effluent, or as a result of accidental spillages, which may be discharged via the potential outfall to Tees Bay.
Biology: Habitats	Habitats and benthic invertebrates	Potential thermal and water quality plumes during operation could affect marine ecology within Tees Bay.
Biology: Fish	Fish	Fish behaviour could be affected by chemical or thermal change in the water body, as well as changes in visual stimuli (such as artificial light), and underwater noise.
Protected areas	N/A	Activity is within 2 km of WFD protected areas (i.e. it overlaps Teesmouth and Cleveland Coast SPA and Redcar and Coatham Bathing Waters).

RECEPTOR	RELEVANT WFD QUALITY ELEMENT(S)	POTENTIAL RISK TO RECEPTOR
INNS	Biological quality elements	Potential for the introduction, transportation and spread of INNS, with resultant impact on marine and aquatic ecology (species and habitats)

6.3 Tees Transitional Water Body

6.3.1 The footprint of the Proposed Development falls partially within the catchment of the Tees Transitional WFD water body (i.e. the Tees Estuary).

6.3.2 There will be crossing of the Tees Transitional water body for the Hydrogen Pipeline Corridor. This crossing will not be implemented using open-cut techniques, and so will be trenchless, likely being done using either Horizontal Directional Drilling (HDD) or using a Micro Bored Tunnel (MBT).

6.3.3 The Tees Transitional water body is a HMWB that is currently at Moderate Ecological Potential. There are currently no mitigation measures identified in the Northumbria RBMP for this water body. It has an objective of Good Ecological Potential by 2015 (Environment Agency, n.d.a.).

Hydromorphology

6.3.4 The Proposed Development does not require direct works to the Tees Transitional water body for neither the Hydrogen Pipeline Network nor any other utility pipelines.

6.3.5 The scoping assessment of the potential effects to hydromorphology is provided in Table .

Table 6-10: Scoping Assessment of Risks to Hydromorphology in the Tees Transitional Water Body

RISK	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	HYDROMORPHOLOGY RISK ISSUE(S)
Could impact on the hydromorphology (e.g. morphology or tidal patterns) of a water body at high status		✓	n/a - water body not at high status
Could significantly impact the hydromorphology (i.e. bed morphology and substrate) of any water body		✓	Open cut techniques will not be used to cross beneath the Tees Estuary.

RISK	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	HYDROMORPHOLOGY RISK ISSUE(S)
Activity is in a water body that is heavily modified for the same use as your activity		✓	Open cut techniques will not be used to cross beneath the Tees Estuary.

Water Quality – Physico-Chemical Quality Elements

6.3.6 Across the wider Site there will be works in close proximity to Dabholm Gut, The Fleet (Tees Estuary (S Bank)), The Mill Race, Lackenby Channel, Knitting Wife Beck, Kinkerdale Beck, Belasis Beck, Ash Gill and minor tributaries of these watercourses for the Hydrogen Pipeline Corridor, Natural Gas Connection Corridor, Electrical Connection Corridor, CO_2 Export Network and other utility corridors. There would be the potential for conveyance of fine sediment and chemical spillages to any of these water bodies during construction through uncontrolled site runoff or through any existing drains that discharge to these watercourses, if not mitigated. All of these water bodies discharge to Tees Estuary, where there is potential for a cumulative impact in terms of fine sediment impacts or chemical spillages on water quality. Surface water runoff during operation may also be discharged to Tees Estuary and could affect physico-chemical elements if not mitigated.

6.3.7 Phytoplankton Status is Good for the Tees Transitional water body. There is no monitoring of harmful algae, which it is assumed to indicate that this is not a particular risk for this water body. As such, further consideration of phytoplankton and harmful algae has been scoped out from further consideration in the WFD impact assessment, summarised in Table .

Table 6-11: Scoping Assessment of Risks to Physico-chemical Quality Elements in the Tees Transitional Water Body

RISK	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	WATER QUALITY RISK ISSUE(S)
Could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)	✓		Impacts from mobilisation of sediments, surface water runoff containing contaminants (including to tributaries of the water body) or as a result of accidental spillages. Discharge of operational surface water runoff could also affect chemical status.

RISK	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	WATER QUALITY RISK ISSUE(S)
Is in a water body with a phytoplankton status of moderate, poor or bad		✓	Phytoplankton is at Good Status
Is in a water body with a history of harmful algae		✓	There is no monitoring of harmful algae, so it is assumed that this is not a particular risk for this water body. As such, further consideration of phytoplankton and harmful algae has been scoped out from further consideration in the WFD impact assessment.

Water Quality – Chemical Status

6.3.8 As for physico-chemical status, there is potential for chemical spillages and runoff containing contaminants from upstream tributaries, which discharge to the water body and also intersect the Site. Operational surface water runoff discharge could also affect chemical status if not appropriately treated.

6.3.9 There is potential for open trench pipeline crossing methodologies to disturb contaminated sediments in the catchment and affect the chemical status of the Tees Estuary.

6.3.10 The scoping assessment for chemical status is summarised in Table .

Table 6-12: Scoping Assessment of Risks to Chemical Status in the Tees Transitional Water Body

RISK	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	WATER QUALITY RISK ISSUE(S)
The chemicals are on the Environmental Quality Standards Directive (EQSD) list	✓		Potential for a range of chemicals to be discharged to Tees Transitional water body from diffuse urban pollutants in surface water runoff, or as a result of accidental spillages. Discharge of operational surface water runoff could also affect chemical status.

RISK	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	WATER QUALITY RISK ISSUE(S)
It disturbs sediment with contaminants above CEFAS Action Level 1	✓		Potential for construction of pipeline crossings tributaries of the Tees Estuary to disturb sediments and thus affect chemical status of the WFD water body. Discharge of operational surface water runoff could also affect chemical status.

Biology -Habitats

6.3.11 Table outlines the higher and lower sensitivity habitats associated with the Tees Transitional water body (based on the Environment Agency WFD water body summary table).

Table 6-13: Higher and Lower Sensitivity Habitats Found in the Tees Transitional Water Body

HIGHER SENSITIVITY HABITATS	AREA (HA)	LOWER SENSITIVITY HABITATS	AREA (HA)
Saltmarsh	46.24	Cobbles, gravel and shingle	0.77
Subtidal kelp beds	4.13	Intertidal soft sediment	400.13
		Rocky shore	26.93
		Subtidal rocky reef	4.13
		Subtidal soft sediments	610.31

6.3.12 Magic Map (DEFRA) has been used to confirm the proximity of the noted sensitive habitats to the proposed works.

6.3.13 Habitats should be included as part of the WFD impact assessment if the footprint of the activity is any of the following (Environment Agency, 2016), noting that this also includes the footprint of thermal or sediment plumes:

- 0.5 km^2 or larger;
- 1% or more of the water body's area; and
- within 500 m of any higher sensitivity habitat or 1% or more of any lower sensitivity habitat.

6.3.14 In accordance with this guidance the habitats outlined in Table have been scoped out of the WFD impact assessment as they do not meet the above criteria.

Table 6-14: Scoping Assessment of Risks to Biological Habitat in the Tees Transitional Water Body

FOOTPRINT IS:	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	BIOLOGICAL HABITAT RISK ISSUE(S)
0.5 km^2 or larger		✓	There are no proposed open cut crossings for pipeline crossings of the Tees Estuary.
1% or more of the water body's area		✓	There are no proposed open cut crossings for pipeline crossings of the Tees Estuary.
Within 500 m of any higher sensitivity habitat		✓	Over 800 m to nearest higher sensitivity habitat.
1% or more of any lower sensitivity habitat		✓	There are no proposed open cut crossings for pipeline crossings of the Tees Estuary.

Fish

6.3.15 The Tees Transitional water body is known to support several nationally and internationally protected migratory fish species (e.g. salmon, sea trout, European eel, river lamprey and sea lamprey), whilst also supporting a range of national and international important estuarine and marine demersal and pelagic fish taxa.

6.3.16 Release of a pollutants from runoff or spillages during construction could affect fish population health. The scoping assessment of risk to fish is provided in Table .

Table 6-15: Scoping Assessment of Risks to Biological Fish in the Tees Transitional Water Body

RISK	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	BIOLOGICAL FISH RISK ISSUE(S)
Is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary	✓		Proposed construction works and operational discharge of surface water runoff could cause a chemical change in the water body which could adversely impact fish health if not mitigated

RISK	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	BIOLOGICAL FISH RISK ISSUE(S)
Could impact on normal fish behaviour like movement, migration, or spawning (e.g. creating a physical barrier, noise, chemical change or change in depth or flow)	✓		Use of artificial lighting in both construction and operational phases may impact on fish behaviour if sufficient mitigation is not applied.
Could cause entrainment or impingement of fish		✓	No abstractions, which could cause entrainment of fish, are proposed within the marine environment.

Water Framework Directive Protected Areas

6.3.17 The location of the proposed works in relation to the following WFD protected areas has been considered:

- Special areas of conservation (SAC);
- Special protection areas (SPA);
- Shellfish waters;
- Bathing waters; and
- Nutrient sensitive areas.

6.3.18 The outcome of the scoping assessment for WFD protected areas is shown in Table .

Table 6-16: Scoping Assessment of Risks to WFD Protected Areas in the Tees Transitional Water Body

RISK	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	BIOLOGICAL FISH RISK ISSUE(S)
Activity is within 2 km of any WFD protected area	✓		Activity is within 2 km of WFD protected areas –Teesmouth and Cleveland Coast Special Protection Area SPA and a Eutrophic Coastal Sensitive Area (designated under the Urban Wastewater Treatment Directive).

Invasive Non-Native Species

6.3.19 The scoping assessment of risks from INNS is summarised in Table .

Table 6-17: Scoping Assessment of Risks from INNS in the Tees Transitional Water Body

RISK	REQUIRES IMPACT ASSESSMENT	IMPACT ASSESSMENT NOT REQUIRED	INNS SUMMARY
Activity may introduce or spread INNS to a water body	✓		Works within the channel of the Tees Estuary and its upstream tributaries could result in INNS impact to this water body. In addition, given the use of vessels as part of the Proposed Development, there is the potential for the introduction, transportation and spread of INNS, either from biofouling or from the discharge of ballast water and bilge water.

Summary

6.3.20 A summary of the receptors and relevant WFD quality elements that have been scoped into the WFD impact assessment for the Tees transitional waterbody is shown in Table .

Table 6-18: Scoping Outcome for the Tees Transitional Water Body

RECEPTOR	RELEVANT WFD QUALITY ELEMENT(S)	POTENTIAL RISK TO RECEPTOR
Hydromorphology	Hydromorphological elements	Proposed activities will not impact the hydromorphological elements of the Tees Transitional water body.
Water Quality	Physico-chemical and chemical water quality elements	Potential for conveyance of fine sediment and chemical spillages to Tees Estuary or its upstream tributaries or through any existing drains that discharge to these watercourses, if not mitigated during construction. Potential for diffuse urban pollution through operational site runoff.
Biology: Habitats	Habitats and benthic invertebrates	Fine sediment disturbance and chemical spillages leading to surface water runoff could impact habitats if not mitigated during construction. Potential for diffuse urban

RECEPTOR	RELEVANT WFD QUALITY ELEMENT(S)	POTENTIAL RISK TO RECEPTOR
		pollution through operational site runoff which could impact habitats.
Biology: Fish	Fish	Fine sediment runoff and chemical spillages could impact fish species if not mitigated during construction. Potential for diffuse urban pollution through operational site runoff which could impact fish and habitats.
Protected areas	N/A	Activity is within 2 km of WFD protected areas (i.e. it overlaps Teesmouth and Cleveland Coast SPA and Redcar and Coatham Bathing Waters).
INNS	Biological quality elements	Potential for the introduction, transportation and spread of INNS, with resultant impact on marine and aquatic ecology (species and habitats)

6.4 Impacts to Undesignated Water Bodies

6.4.1 Under the WFD, water bodes are the basic management unit and cover the majority of land in England. However, there are small areas, generally in coastal and tidal regions, where water body coverage is not complete, as is the case within the Proposed Development's Study Area. As such, there are watercourses within the Study Area that may be impacted upon that are not part of a WFD water body, and so not included in the sections above that cover the Tees Coastal and Tees Transitional water bodies (see Figure 9-1: Surface Water Features and their Attributes (ES Volume II, EN070009/APP/6.3)).

6.4.2 Impacts to these watercourses are summarised in Table 6-19Table .

Table 6-19: Scoping Outcome for Impacts to Unmapped Water Bodies

RECEPTOR	RELEVANT WFD QUALITY ELEMENT(S)	POTENTIAL RISK TO RECEPTOR
Hydromorphology	Hydromorphological elements	Potential for impacts to hydromorphology of the water body due to use of open cut techniques for the Hydrogen Connection Corridor's crossing of Holme Fleet and three unnamed watercourses.
Water Quality	Physico-chemical and chemical water quality elements	Open cut crossing techniques could mobilise large amounts of fine sediment, if not adequately mitigated against, which

RECEPTOR	RELEVANT WFD QUALITY ELEMENT(S)	POTENTIAL RISK TO RECEPTOR
		could impact physico-chemical quality elements.
Biology: Habitats	Habitats and benthic invertebrates	Open cut crossing techniques could mobilise fine sediment, if not adequately mitigated against, which could reduce in-stream habitat quality and conditions.
Biology: Fish	Fish	Fine sediment and chemical spillages leading to surface water runoff could impact fish species if not mitigated.
Protected areas	N/A	Fine sediment and chemical spillages could impact fish species if not mitigated.

6.5 Stage 2 Scoping Summary

6.5.1 The scoping exercise has identified potential impacts to all of the estuarine / coastal waterbodies identified as potentially impacted during the screening assessment, namely the Tees, Tees Coastal and unmapped waterbodies. As such, these are all taken forward to further assessment at Stage 3 alongside the potentially affected freshwater and groundwater WFD water bodies.

7.0 WATER FRAMEWORK DIRECTIVE ASSESSMENT

7.1 No Deterioration Assessment

7.1.1 The first stage of the full (Stage 3) assessment is to consider the likely impact of the Proposed Development on WFD parameters and whether it is likely to cause deterioration of any WFD quality elements or prevent Environment Agency mitigation measures from being implemented.

7.1.2 The appraisal of these two WFD objectives is considered under the following sub-sections.

7.2 Potential Construction Phase Impacts

7.2.1 Construction phase impacts that could occur, prior to the implementation of mitigation, are related to the following activities:

General Construction Works

7.2.2 Where construction and decommissioning works are undertaken within or in proximity to water features, close to existing land drains providing a pathway to surface watercourses, groundwater or ponds, or on steeper terrain angled towards a water feature, there is the potential for adverse impacts on water quality due to deposition or spillage of soils, sediments, oils, fuels, or other construction chemicals spilt on site. There may also be indirect water quality impacts to downstream receptors, as spills or contaminated water can propagate along the initial receiving watercourse. In this case the downstream receptors are the Tees transitional and Tees Coastal WFD water bodies as all watercourses within the Study Area are tributaries of these.

7.2.3 The construction works in general, but particularly earthworks, dewatering of excavations, the construction of watercourse crossing structures, and drainage installations have the potential to cause a reduction in water quality through contaminated construction runoff, and the risk of chemical spillages from plant, equipment and materials.

7.2.4 Construction of open cut intrusive pipeline crossings will require works close to and within the receiving watercourses. There will be potential for conveyance of spills and fine sediment during any works to these pipelines, resulting in potential direct impacts on the receiving watercourses.

Open-Cut Intrusive Pipeline Crossings

7.2.5 Open-cut works are expected to facilitate the Hydrogen Connection Corridor at Holme Fleet at approximately NGR NZ 49241 23828, and unnamed watercourses west of the Tees estuary at NZ 51091 23758, NZ 51110 24822 and NZ 49091 24350 (see Figure 9-1: Surface Water Features and their Attributes (ES Volume II, EN070009/APP/6.3)). No open-cut crossings are required for the Water Connection Corridor, Other Gas Connections, or Electrical Connection Corridor.

7.2.6 If not mitigated the open-cut watercourse crossings could result in short-term adverse impacts to physico-chemical and chemical quality elements (and hence

biological elements) from potential increase in fine sediment load and organic matter delivered to water body, and chemical spillage risk. There would also be impacts to hydromorphological quality elements due to a reduction in the morphological diversity and a change in the structure of the riverbed. Impacts to physico-chemical quality elements would also be expected due to a potential increase in fine sediment load and organic matter delivered to water body from the newly reinstated, bare earth banks.

Trenchless Crossings

7.2.7 There will be works close to the River Tees and Greatham Creek for the trenchless installation of the Hydrogen Pipeline Crossings. The minimum depth of the pipeline beneath these water bodies will be 10 m. Furthermore, launch and reception pits will be a minimum of 10 m from the channel in each case to reduce the potential for runoff and spillages to the watercourse. There is also a chance of 'frac-out' events (i.e., hydraulic fluid break out) from drilling to the watercourse if not appropriately mitigated for site specific conditions.

7.2.8 There is the potential for impacts to physico-chemical quality elements from an increase in fine sediment load and organic matter delivered to watercourses and impacts to biological and physico-chemical quality elements from any spillages of drill fluids or pollutants. There could also be impacts to groundwater flow or quality as part of the excavation activities.

Above Ground Pipelines Using Existing Pipe Bridges and Culverts

7.2.9 There are four above ground crossings for the Hydrogen Connection Corridor. These are existing culverts over The Fleet (Tees Estuary (S Bank) WFD water body) (approximate NGR NZ 56750 23738) and the Mill Race (approximate NGR NZ 57329 23682), and existing pipe bridges of unnamed watercourses at approximate NGRs NZ 51075 23583 and NZ 47676 22853. One watercourse crossing of the Fleet (Tees Estuary (S Bank) WFD water body) is also required at NZ 57977 24723 for the Water Connection Corridor using an existing pipe bridge.

7.2.10 Due to the proximity of the works to watercourses, there could be impacts to physico-chemical and chemical quality elements (and hence biological elements) from a potential increase in fine sediment load in site runoff or chemical spillages delivered to watercourses due to the close proximity of the works.

7.3 Construction Phase Mitigation and Avoidance Measures

7.3.1 A Framework CEMP (EN070009/APP/5.12) is included within the DCO Application and sets out the key measures to be employed during the Proposed Development construction phase in order to control and minimise the impacts on the environment – including the minimisation of water environment effects. Final CEMP(s) will be prepared by the EPC Contractor(s) in accordance with the Framework CEMP prior to construction. The submission, approval, and implementation of the Final CEMP(s) will be secured by a Requirement of the draft DCO.

7.3.2 The Final CEMP(s) 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 in this section are the minimum standards that the EPC Contractor(s) will implement. However, it is acknowledged that for some issues, there are multiple ways in which they may be addressed. In addition, the methods of dealing with pollutant risk will need to be continually reviewed on Site and adapted as construction works progress in response to different types of work, weather conditions and locations of work.

7.3.3 The Final CEMP(s) will be standard procedure for the Proposed Development and will describe the principles for the protection of the water environment during construction. The Final CEMP(s) will be supported by a Water Management Plan (WMP). The Final WMP will provide greater detail regarding the mitigation to be implemented to protect the water environment from adverse impacts during construction, in substantial accordance with the Outline WMP which is included within the Framework CEMP (EN070009/APP/5.12).

7.3.4 The potential for adverse impacts will be avoided, minimised and reduced by the adoption of the general mitigation measures which are outlined in the following sections and described in the Outline WMP and Framework CEMP (EN070009/APP/5.12).

Good Practice Guidance

7.3.5 The following relevant Good Practice Guidance (GPP) have been released to date on the NetRegs website (NetRegs, n.d.) and are listed below. While these are not regulatory guidance in England where the UK government website outlines regulatory requirements, it remains a useful resource for good practice:

- GPP1: Understanding your environmental responsibilities – good environmental practices;
- GPP 2: Above ground oil storage;
- GPP3: 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 6: Working on construction and demolition sites;
- 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;
- GPP 22: Dealing with spills; and

- GPP 26: Safe storage – drums and intermediate bulk containers.

7.3.6 Where new GPPs are yet to be published, previous Pollution Prevention Guidance (PPG) 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:

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

7.3.7 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);
- C811 (2023) Environmental good practice on site guide (fifth edition) (CIRIA, 2023);
- C648 (2006) Control of water pollution from linear construction projects, technical guidance (CIRIA, 2006);
- 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).

Management of Construction Site Runoff

7.3.8 The measures outlined below, which will be included in the Final CEMP(s) and WMP, may be required for the management of fine sediment in surface water runoff as a result of the construction activities:

7.3.9 Reasonably practicable measures will be taken to prevent the deposition of fine sediment or other material in, and the pollution by sediment of, any existing water body, arising from construction activities. The measures will accord with the principles set out in industry guidelines including the CIRIA report 'C532: Control of water pollution from construction sites' (CIRIA, 2001). Measures may include use and maintenance of temporary lagoons, tanks, seeding / covering of earth stockpiles, earth bunds, straw bales and sandbag walls, proprietary measures (e.g. lamella clarifiers or contained chemical treatment) and fabric silt fences or silt screens as well as consideration of the type of plant used.

7.3.10 A temporary drainage system will be developed to prevent runoff contaminated with fine particulates from entering surface water drains without treatment. This will include identifying all land drains and water bodies on the Site and ensuring that they are adequately protected using drain covers, sandbags, earth bunds, geotextile silt fences, straw bales, or proprietary treatment (e.g. lamella clarifiers). Discharge to such water bodies (directly or indirectly) will only be made with the permission of the Environment Agency (or Northumbrian Water if to the public foul sewer) and with the necessary treatment measures implemented.

7.3.11 Where practicable, earthworks will be undertaken during the drier months of the year and will avoid periods of wet weather, if possible, to minimise the risk of generating runoff contaminated with fine particulates. However, it is likely that some working during wet weather periods will be unavoidable, in which case mitigation measures will be implemented to control fine sediment laden runoff.

7.3.12 To protect water bodies from fine sediment runoff, topsoil/subsoil will be stored a minimum of 20 m from any water body on flat lying land (and further if the ground is sloping, subject to a site risk assessment and observational monitoring) and not within the fluvial floodplain. Where this is not possible, and it is to be stockpiled for longer than a two-week period, the material will either be covered with geotextile mats or seeded to promote vegetation growth. In all situations, runoff from the stockpile will be prevented from draining to a watercourse without prior treatment. If located where there is a risk of tidal flooding or within fluvial Flood Zone 2, additional measures will be provided to reduce the risk of erosion (e.g. by protecting the base using spaced out concrete blocks, pegged in geotextile sheets, etc.).

7.3.13 Mud deposits will be controlled at entry and exit points to the Site using wheel washing facilities and / or road sweepers operating during earthworks activities or other times as considered necessary.

7.3.14 Equipment and plant are to be washed out and cleaned in designated areas within the Site compound where runoff can be isolated for treatment before discharge to surface water drainage under appropriate consent and / or agreement with Environment Agency and / or Northumbrian Water, or otherwise removed from the Site for appropriate disposal at a licensed waste facility.

7.3.15 Debris and other material will be prevented from entering surface water drainage, through maintenance of a clean and tidy site, provision of clearly labelled waste receptacles, grid covers and the presence of site security fencing.

7.3.16 The Final WMP will include details of pre, during and post-construction water quality monitoring based on the framework set out in the Outline WMP. This will be based on a combination of visual observations, frequent in situ testing using water quality probes, and periodic sampling for laboratory analysis.

Management of Spillage Risk

7.3.17 The measures outlined below may be implemented to manage the risk of accidental spillages on site and potential conveyance to nearby water bodies via surface runoff or land drains. The measures relating to the control of spillages and leaks will be

included in the Final WMP and Final CEMP(s) and adopted during the construction works, to be in substantial accordance with what is set out in the Framework CEMP and Outline WMP.

7.3.18 Fuel will be stored and used in accordance with the Control of Substances Hazardous to Health Regulations 2002, and the Control of Pollution (Oil Storage) (England) Regulations 2001 (Defra, 2001) (COSH, 2002; Control of Pollution (Oil Storage) (England) Regulations, 2001). Particular care will be taken with the delivery and use of concrete and cement as it is highly corrosive and alkaline.

7.3.19 Fuel and other potentially polluting chemicals will either be in self-bunded leak proof containers or stored in a secure impermeable and bunded area (minimum capacity of 110% of the largest container).

7.3.20 Any plant, machinery or vehicles will be regularly inspected and maintained to ensure they are in good working order and clean for use in a sensitive environment. This maintenance is to take place off site if possible or only at designated areas within the Site compound. Only construction equipment and vehicles free of all oil/fuel leaks will be permitted on site. Drip trays will be placed below static mechanical plant.

7.3.21 All washing down of vehicles and equipment will take place in designated areas and wash water will be prevented from passing untreated into watercourses.

7.3.22 All refuelling, oiling and greasing will take place above drip trays or on an impermeable surface which provides protection to underground strata and watercourses, and away from drains as far as reasonably practicable. Vehicles will not be left unattended during refuelling.

7.3.23 As far as reasonably practicable, only biodegradable hydraulic oils will be used in equipment working in or over watercourses. All fixed plant used on the Site will be self-bunded. Mobile plant is to be in good working order, kept clean and fitted with plant 'nappies' at all times.

7.3.24 A Pollution Prevention Plan will form part of the Emergency Response Plan alongsidethe Final CEMP(s). Spill kits and oil absorbent material will be carried by mobile plant and located at high risk locations across the Site and regularly topped up. All construction workers will receive spill response training and toolbox talks.

7.3.25 The Site will be secure to prevent any vandalism that could lead to a pollution incident.

7.3.26 Construction waste / debris are to be prevented from entering any surface water drainage or water body.

7.3.27 Surface water drains on roads or within the construction compound will be identified and, where there is a risk that fine particulates or spillages could enter them, the drains will be protected (e.g. using covers or sandbags).

7.3.28 Suitable facilities for concrete wash water (e.g. geotextile wrapped sealed skip, container or earth bunded area) will be adequately contained, prevented from

entering any drain, and removed from the Site for appropriate disposal at a suitably permitted waste facility.

7.3.29 Water quality monitoring of potentially impacted watercourses in the vicinity of the construction works will be undertaken to ensure that pollution events can be detected against baseline conditions and can be dealt with effectively. Refer to the Outline WMP for further details (EN070009/APP/5.12).

7.3.30 In addition, any site welfare facilities will be appropriately managed, and all foul waste disposed of by a licensed contractor to a suitably permitted facility.

Management of Risks to Groundwater

7.3.31 Construction phase mitigation measures in relation to the hydrogeological environment are summarised here, where different to the measures described above.

7.3.32 Prior to the design and construction of the project, a ground investigation (GI) will be undertaken to assess the degree to which the Site is contaminated and identify the potential impacts this may have to site users and the environment. The scope of which will be agreed with the relevant authorities prior to commencing works, as secured by DCO Requirement. The GI findings will feed into the detailed design process so that appropriate measures can be taken. Specific measures include building and foundation design. In addition, existing pipeline infrastructure will be used where possible, running along existing pipe racking and using existing culverts and overbridges, to minimise impacts upon the ground and groundwater.

7.3.33 Should the GI prove the need for piling or soil mixing to take place, the construction methodology will be assessed to reduce as far as reasonably practicable the risk of development of preferential pathways (e.g. groundwater flow) between the Made Ground present and the underlying Secondary 'A' or 'B' bedrock Aquifers.

7.3.34 If during the course of the development any contamination is found which has not been previously identified, an appropriate risk assessment will be prepared. Any actions resulting from the risk assessment will be agreed with the Environment Agency along with any remedial measures, pursuant to the DCO. Contamination assessment will be in accordance with the CIRIA C552 - Contamination Land Risk Assessment, A Guide to Good Practice and the Model Procedures for the Management of Contaminated Land, CLR11 (Environment Agency, 2004). These remedial measures will be adopted as part of the Proposed Development.

Management of Construction Dewatering

7.3.35 To minimise the impact of the dewatering on groundwater and surface water receptors where pipeline construction or deep excavations are required, a Construction Dewatering Strategy will be prepared by the EPC Contractor(s) (as secured by DCO Requirement) in accordance with a Groundwater Risk Assessment to be developed post consent. The purpose of the Construction Dewatering Strategy will be to:

- review ground investigation data and estimate volume of water that may need to be dewatered and the likely quality of that water;

- consider how phasing/sequencing of excavations will influence the amount of water that may need to be managed at any given time;
- undertake a feasibility assessment of options to remove water, including undertaking appropriate ecological and hydromorphological surveys, and hydraulic modelling (if necessary). Disposal options may include, but are not limited to:
  - re-use of water on-site (e.g. for dust suppression);
  - discharge to local watercourses; and
  - spraying to nearby fields.

7.3.36 At this stage the preferred option is to discharge any groundwater abstracted from dewatering activities to a watercourse (where it may compensate for any reduction that might occur from localised lowering of the groundwater table temporarily).

7.3.37 When discharging water to a nearby watercourse the rate of discharge will need to be agreed with the Environment Agency to ensure that there is no unacceptable increase in flood risk or risk of scour. Where the required rate of discharge to keep the excavations dry exceeds what may be allowed to a single watercourse, additional locations for discharging the water will need to be provided or storage provided. Any discharge will need to be undertaken with the agreement of the relevant statutory regulator and will need to comply with the pollution prevention requirements set out in the Final CEMP(s).

7.3.38 If groundwater contains high concentrations of suspended fine sediment, this will be filtered by using storage basins and in combination with other proprietary measures (for example lamella clarifiers).

Construction of Hydrogen Pipeline Corridor – Trenchless Crossings

7.3.39 The Hydrogen Pipeline is expected to be 6 to 24 inches in diameter and while being primarily above ground, it would cross the Tees Estuary and Greatham Creek (and adjacent water features at Seal Sands) using trenchless technologies (Horizontal Direction Drilling (HDD) or Micro Bored Tunnelling (MBT)). The Hydrogen Pipeline Corridor is shown in Figure 4-4: Hydrogen Pipeline Corridor (ES Volume II, EN070009/APP/6.3).

7.3.40 The use of trenchless technologies avoids any direct impact to the estuary bed, associated sediment mobilisation and scour. For the purposes of assessment, the worst-case depth below the bed is assumed to be 10 m. For the Tees Crossing this is expected to be in the range of 40 to 50 m depth but will be determined following the ground investigation at the detailed design phase (maximum depth would be 60 m).

7.3.41 In addition to the control and management measures for site runoff and spillage risk noted above, the methodology of the drilling, or other trenchless techniques, will include measures to minimise the risk to the environment, as set out in the Framework CEMP (EN070009/APP/5.12). For HDD methods, there are risks associated with the use of drilling muds and plant close to the channel. For example,

although rare, without due care there is a risk that drilling muds can 'break out' into watercourses leading to pollution (known as 'hydraulic fracture' or 'frac-out' event) or that the HDD bore may collapse.

7.3.42 Risk of hydraulic fracture will be minimised by:

- performing appropriate geotechnical investigations along the HDD alignment;
- designing the HDD profile to pass at an appropriate depth below the watercourse (>10 m for Greatham Creek and >25 m for the Tees River). The depth should be sufficient to minimise the risk of failure or collapse based on the expected ground conditions;
- designing the HDD profile to pass through competent soil layers identified in geotechnical investigations;
- detailed design of the launch and exit points of the HDD, taking account of geological layers and the intended drill path;
- performing drilling fluid hydrofracture analyses for each drilling operation and maintaining downhole pressures within recommended limits;
- using appropriate downhole annular pressure monitoring equipment (set by fracture calculations) in real time to warn of over pressurising by drilling fluid;
- designing a drilling fluid appropriate for the anticipated ground conditions;
- appropriate monitoring of drilling fluid parameters during drilling; and
- performing regular monitoring of the ground above the HDD alignment for drilling fluid leaks to the surface.

7.3.43 In addition, for HDD casing pipe to contain drilling fluid may be installed through less competent shallow ground layers at entry or exit points when considered necessary. Similarly, MBT shafts will be lined with concrete rings for stability.

7.3.44 For HDD, a site-specific Hydraulic Fracture Risk Assessment will be developed prior to construction following further investigation of specific ground conditions at the crossing locations, and appropriate mitigation developed in line with best construction practice. This may include ground stabilisation prior to drilling. The drilling fluid that returns to the drilling rig is recycled within that drilling rig. Any wastewater/drilling products that are not recycled will be stored and removed by a suitable waste management contractor and disposed of at a licensed wastewater facility. Lost circulation materials on site can also be used to seal any breakout.

7.3.45 The sections of the Hydrogen Pipeline that will be installed via trenchless techniques will require launch and reception pits for HDD and shafts for MBT to be installed. It is assumed for the purposes of the assessment that excavations for drilling/boring will be located at least 10 m from the watercourse, as measured from the top of bank, under which they will be directional drilled.

7.3.46 The exact dimensions of the launch and receive pits for HDD will be determined by site and ground conditions but will be kept to a safe minimum in terms of length, width and depth. Such pits are typically 10 m long x 5 m wide x 3 m deep. A shoring

system appropriate to the ground conditions will be used as appropriate to minimise water ingress into the pits. This may be timbers, sheet piling, or a modular system and will be chosen based on suitability for the site conditions. The ingress of any groundwater will be carefully managed through design of the launch or reception pit, shoring method, and a pumping and treatment system. Excessive ingress of water will make the pit unsafe and thus it is important that ingress is minimised and that a suitable system of managing that water is implemented.

7.3.47 Furthermore, to reduce the works required adjacent to the Teesmouth and Cleveland Coast SPA, a pipe stringing area would be established a minimum of 30 m away from the SPA. The pipe stringing area would be used to fabricate manageable lengths of pipe string. The sections of pipe string would subsequently be carried into position along the spread and dummy spread to allow the remaining joints to be fabricated and complete the pipeline.

7.3.48 Once the Hydrogen Pipeline is installed beneath the watercourse, the HDD pits, MBT shafts and any trenches will be backfilled to the original ground level and seeded to reduce the risk of runoff and fine sediments entering watercourses. The drill fluids used within the HDD drilling machine will be water based, such as naturally occurring bentonite clay. The fluid component of the drilling mud will be mains water, obtained from a nearby supply and tankered to site when required. There will be some recycling of drilling muds by the drilling plant used. However, refer to Chapter 21 Materials and Waste Management (ES Volume I, EN070009/APP/6.2) for detail regarding disposal of used drilling fluids and any waste arisings from the works.

7.3.49 The bentonite within the drilling fluid is a naturally occurring mineral and enables the fluid to have sufficient viscosity to carry the cutting chips back to the surface machine whilst lubricating and keeping cool the drilling bit. Directional drilling, or other trenchless techniques, will be undertaken by a specialist contractor and the water column above the drill path will be continuously monitored during drilling. It is noted that drill fluid leakage into a watercourse is not a common problem, particularly given the proposed depths. However, where there is an increased perceived risk (i.e. lack of drilling mud returns), the drilling/boring operation will be suspended, remediation action implemented, and subsequently the methodology for that crossing re-evaluated.

7.3.50 These mitigation measures are secured within the Framework CEMP (EN070009/APP/5.12).

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

7.3.51 Four cases where the requirement for open-cut installation of pipelines has been identified at this stage (as outlined above) and the number of open-cut crossings will be confirmed in detailed design. During construction, the following mitigation will be implemented whenever there is open-cut crossing.

7.3.52 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 the pipeline 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.

7.3.53 At this stage it is assumed that where open-cut crossings are required that water flow will be maintained by damming and over pumping or fluming. Works will be carried out in the drier months where possible as this will reduce the risk of pollution propagating downstream, particularly in the case of ephemeral watercourses. Once the watercourses are reinstated, silt fences, geotextile matting or straw bales will be used initially to capture mobilised sediments until the watercourse has returned to a settled state. It will be a requirement that the watercourses are reinstated as found and water quality monitoring will be undertaken prior to, during, and following on from the construction activity. 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 Final WMP.

7.3.54 Based on this mitigation, and the artificial and modified nature of the watercourses to be crossed, this is not considered to result in a deterioration of WFD status.

Construction of Water Connection Corridor

7.3.55 Raw water will be supplied via the existing NWL raw water supply to the STDC site or a new connection to the existing NWL raw water supply either via tie in to NZT infrastructure or the installation of a new connection. There would also be a connection to NZT for use of the discharge outfall (for Case 2B). At this stage in the design development, the water connections may be entirely above or below ground or a combination of the two.

7.3.56 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, as shown by Figure 4-7: Water Connections Corridor (ES Volume II, EN070009/APP/6.3) to account for all options. One watercourse crossing of the Fleet (Tees Estuary (S Bank) WFD water body) is required at NZ 57977 24723, but would utilise an existing pipe bridge, with no works to the watercourse being required.

Construction of Gas Connections

7.3.57 Gas connection pipelines may be required for the transportation of compressed O_2 and N_2 for use at the Production Facility (this is referred to as the 'Other Gases Connection Corridor', shown by Figure 4-8: Other Gases Connection Corridor (O_2 and N_2) (ES Volume II, EN070009/APP/6.3). The connections for other gases may be entirely above or below ground or a combination of the two. There are no required watercourse crossings associated with this corridor.

7.3.58 As outlined in Chapter 4: Proposed Development (ES Volume I, EN070009/APP/6.2), CO_2 captured and compressed after metering will be exported from the Proposed Development to the NEP CO_2 gathering network on the adjacent NZT site via a CO_2

export connection pipeline. No watercourse crossings are required to facilitate installation of this connection.

7.3.59 Similarly, natural gas will need to be imported to the Hydrogen Production Facility for use in the reforming process. The exact pipeline routeing of this connection within the Natural Gas Connection Corridor is subject to ongoing design. A natural gas pipeline up to 24" diameter will connect the Hydrogen Production Facility at the Main Site to an existing gas pipeline with AGIs at each end. Again, no watercourse crossings are required to facilitate the installation of this.

Construction of Electrical Connection Corridor

7.3.60 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.

7.3.61 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. In any option, no watercourse crossings are known to be required to facilitate installation of this connection.

7.3.62 Where there is a need for transformers and switchgear, these will be bunded given that they may contain hydraulic oils.

Water Quality Monitoring

7.3.63 During construction it is proposed to undertake a water quality monitoring programme to ensure that mitigation measures are operating as planned and preventing pollution. This is standard practice for this type of construction works. The monitoring programme will also be to ensure that should pollution occur it is identified as quickly as possible and appropriate action is taken in line with a Pollution Prevention Plan.

7.3.64 The water quality monitoring programme is set out in the Outline WMP with the Final WMP setting out the finalised approach, to be produced post-consent. The programme will be expected to include a combination of regular observations and monitoring using a calibrated, handheld water quality probe through the upstream and downstream reaches of water features hydrologically connected to the Proposed Development Site. It is expected that water quality sampling will be undertaken on a periodic as well as ad-hoc basis, dependent upon circumstances/activities on site. Monitoring and sampling will be undertaken prior to the commencement of construction to allow for sufficient baseline data.

Management of Construction Vessels

7.3.65 Vessels including barges and geared vessels will be required for transportation and delivery of construction materials. It is required that all vessels associated with the Proposed Development will adhere to the following:

- Harbour Authority approvals;
- International Convention for the Control and Management of Ships' Ballast Water and Sediments with the aim of preventing the spread of marine INNS (IMO, 2017);
- International Maritime Organisation (IMO) Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species (Biofouling Guidelines) (IMO, 2011);
- International Regulations for Preventing Collisions at Sea (IMO, 1972) and regulations relating to International Convention for the Prevention of Pollution from Ships (the MARPOL Convention 73/78) (IMO, 2021) with the aim of preventing and minimising pollution from ships; and
- The Shipboard Oil Pollution Emergency Plan (SOPEP) (IMO, 2019); all vessels shall have a contingency plan for marine oil pollution.

7.4 Construction Phase Assessment

Tees Coastal Water Body (Tees Bay)

Surface Water Quality – Suspended Fine Sediment

7.4.1 Construction works on the Hydrogen Production Facility and surrounding Connection Corridors, including installation of new drainage infrastructure has the potential to mobilise sediments e.g. soils exposed during excavations or levelling, which could be directed to Tees Bay through existing drainage infrastructure. However, implementation of good practice construction approaches, as outlined above, including measures outlined in the Final CEMP(s) would mitigate for this.

7.4.2 Overall, given that the construction phase mitigation measures described above would be in place, it is considered that there would be a very minor localised and temporary minor impact to the Tees Coastal water. This would not be significant at the water body scale and any sediment plume would be very quickly dispersed by the prevailing hydrodynamic conditions. As such, no reduction in any WFD element would occur due to suspended fine sediments, nor any non-compliance with WFD objectives for the water body.

Surface Water Quality – Chemical Spillages

7.4.3 If appropriate mitigation measures are implemented as described in 'Construction Phase Mitigation and Avoidance Measures' above, including water quality monitoring and a frac out plan and risk assessment, then the risk of chemical spillages to the Tees Coastal water body would be minor, particularly as there would be no works in the immediate vicinity of the water body.

7.4.4 There is also an indirect risk of spillages entering the water body from works undertaken at the main Hydrogen Production Facility, whereby any spillages that enter the existing drainage infrastructure could discharge to Tees Bay through the existing drainage infrastructure. Overall, this impact is considered minor given the mitigation outlined above, including good practice measures in the Final CEMP(s),

and the fact that Tees Coastal water body has a large capacity to dilute and disperse pollutants. No reduction in any WFD element would therefore be anticipated from chemical spillages, or any prevention of future improvement.

Marine Ecology

7.4.5 Likely impacts and significant effects during the construction phase, as detailed in Chapter 14: Marine Ecology (ES Volume I, EN070009/APP/6.2), include changes in the marine environment as a result of surface water runoff and accidental spills of fuels and oils, collision risk between vessels and marine mammals, changes in the airborne soundscape, changes in visual stimuli (namely artificial lighting), and the introduction of INNS.

7.4.6 Overall, as a result of good practice and the mitigation measures outlined above, it is not considered that there would be any deterioration in any WFD quality elements, nor any prevention of future objectives being met within the Tees Coastal Water Body.

7.4.7 A summary of construction phase impacts is described below. For further details, refer to Chapter 14: Marine Ecology (ES Volume I, EN070009/APP/6.2).

7.4.8 During land-based construction activities for the Proposed Development, there is the potential for impacts on marine water quality in Tees Bay from chemical and fine sediment discharges into the marine environment, which may propagate downstream to the Tees Coastal WFD water body. However, the implementation of good guidance and the mitigation measures outlined above will sufficiently reduce the risk of pollutants entering the marine environment and so no significant impacts are expected.

7.4.9 The use of vessels for the delivery and transport of construction materials is expected and construction support presents a potential risk of accidental release of fuels and oils, which would negatively affect water quality. Leaked fuels and oils can directly impact benthic habitats and species, fish and shellfish and marine mammals through smothering which can cause toxicity or inhibition of normal behaviours (e.g., feeding and egg laying) and ultimately lead to mortality. However, all vessels utilised during the Proposed Development will be required to comply with the International Regulations for Preventing Collisions at Sea (1972) (International Maritime Organisation (IMO), 1972) and regulations relating to International Convention for the Prevention of Pollution from Ships (MARPOL Convention 73/78) (IMO, 1978) specifically including compliance with Annex IV of the MARPOL Convention on pollution by sewage and prevention of air pollution by ships; and Annex V of the MARPOL Convention on pollution by garbage from ships. Therefore, given the good practice design and regulatory measures in place, and the high baseline presence of vessels in the Tees Coastal water body, any significant effect to marine ecology receptors is considered unlikely and would not be significant at the scale of the WFD water body.

7.4.10 Vessels deployed as part of the construction of the Proposed Development could also pose a threat to marine mammals through increased collision risk during foraging or social interaction. Direct strikes from a sharp object such as a rotating

propellor blade could result in lethal injury. The vessels used for the Proposed Development are likely to be large and therefore will be traveling at slow speeds (estimated to be less than 10 knots), particularly through the estuary. At such speeds, vessels are unlikely to pose a significant risk of collision to marine mammals. Marine mammals are highly mobile species and are expected to move away from oncoming vessels. In addition, any marine mammals present in the estuary and North Sea are also expected to have habituated to the high baseline level of vessel presence.

Introduction and Spread of Invasive Non-Native Species

7.4.11 Due to the use of vessels as part of the Proposed Development, there is the potential for the introduction, transportation and spread of INNS, either from biofouling or from the discharge of ballast water and bilge water. INNS can out-compete native species which could result in habitat loss, increased competition for space and food, ecosystem modifications, and the introduction of disease and pathogens. During intertidal and subtidal benthic surveys conducted in the Study Area in 2019 (AECOM, 2021a), only one species of INNS was identified, wakame (*Undaria pinnatifida*) in the intertidal zone of South Gare Breakwater. Therefore, the presence of INNS within the site is limited. All vessels will be required to comply with the International Convention for the Control and Management of Ships' Ballast Water and Sediments with the aim of preventing the spread of marine INNS (IMO, 2017), and shall also adhere to the International Maritime Organisation (IMO) Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species (Biofouling Guidelines) (IMO, 2011). Therefore, given the limited use of vessels and the implementation of good practice and regulatory mitigation measures, the risk of existing or new INNS becoming established or proliferating to an extent that would cause ecological harm is considered to be very low.

7.4.12 Given that no physical works are proposed within the Tees Coastal water body plus the good practice measures in relation to vessels as described above, the introduction and spread of INNS within the coastal environment is unlikely. As such, there will be no detriment or prevention of future improvement to the WFD water body.

Morphological Impacts

7.4.13 Given that no works are proposed within the Tees Coastal water body any morphological impacts would be due to increased sediment loads received by the watercourse as a result of on land construction adjacent to the Tees Coastal Water body. Given that construction impacts will be controlled by the Final CEMP(s) any impacts to the morphological status of the Tees Coastal water body can be assumed to be negligible.

7.4.14 As such there is no morphological impact to watercourses, and no deterioration or prevention of improvement in morphology for the wider WFD water body.

Tees Transitional Water Body (Tees Estuary)

Surface Water Quality – Suspended Fine Sediment

7.4.15 Across the wider Site there will be works in close proximity to Mill Race, Dabholm Gut, Ash Gill, Belasis Beck, Holme Fleet, Swallow Fleet, Mucky Fleet and Greatham Creek and other tributaries of these watercourses for the various Connection Corridors. Furthermore, the trenchless crossing of the Tees Estuary and Greatham Creek through either HDD or MBT will require launch, reception, and jointing pits that involve works in close proximity to the watercourse. For example, although rare, without due care there is a risk that drilling muds can 'break out' into watercourses leading to pollution (known as 'hydraulic fracture' or 'frac-out' event). There would be the potential for conveyance of fine sediment to any nearby water bodies through uncontrolled site runoff or through any existing drains that discharge to these watercourses, if not mitigated. There may also be a requirement for dewatering from excavations to watercourses. All of these water bodies discharge to Tees Estuary, where there is potential for a cumulative impact in terms of fine sediment impacts on water quality.

7.4.16 Measures to manage formation of excessive sediment in runoff and to provide treatment prior to discharge will be implemented as described in the Framework CEMP and Outline WMP. This would include implementation of a temporary site drainage system and a frac-out risk assessment to reduce and minimise the risk of hydraulic fracture when installing the trenchless crossing of the Tees Estuary. Dewatering would be managed via a Construction Dewatering Strategy. Given this mitigation, as outlined in greater detail above, any residual impact would be temporary and minor within the water bodies directly affected and are not significant to the Tees Estuary at the WFD water body scale, particularly given the dispersal and diluting potential of the estuary.

7.4.17 Overall, no reduction in any WFD element in the Tees Estuary is anticipated due to suspended fine sediments, nor any non-compliance with WFD objectives. As such, there would be no subsequent impact on other WFD elements including status of fish and protected areas.

Surface Water Quality – Chemical Spillages

7.4.18 There is also an indirect risk of spillages entering the water body from works undertaken across the wider Site, whereby uncontrolled site runoff enters watercourses (or on-line ponds) and pollutants propagate downstream to the Tees Estuary. However, this risk is considered minor given the mitigation outlined above, including good practice measures in the Final CEMP(s), and the fact that the Tees Transitional water body has a large capacity to dilute and disperse pollutants. No reduction in any WFD element would therefore be anticipated from chemical spillages, nor any prevention of future improvement. If appropriate mitigation measures are implemented as described in 'Construction Phase Mitigation' above, including water quality monitoring, then the risk of chemical spillages to the Tees Transitional water body and its upstream tributaries would be low. As such, there

would be no subsequent impact on other WFD elements including status of fish and protected areas.

Marine Ecology

7.4.19 During land-based construction activities for the Proposed Development, there is the potential for impacts on marine water quality in Greatham Creek and Tees Estuary from chemical and fine sediment discharges into the marine environment. However, the implementation of good guidance and mitigation measures will sufficiently reduce the risk of pollutants entering the marine environment and so no significant impacts are expected.

7.4.20 With regard to vessels, and as outlined above, all vessels utilised during the Proposed Development will be required to comply with the International Regulations for Preventing Collisions at Sea (1972) (International Maritime Organisation (IMO), 1972) and regulations relating to International Convention for the Prevention of Pollution from Ships (MARPOL Convention 73/78) (IMO, 1978) specifically including compliance with Annex IV of the MARPOL Convention on pollution by sewage and prevention of air pollution by ships; and Annex V of the MARPOL Convention on pollution by garbage from ships. Given the good practice and regulatory measures in place, and the high baseline presence of vessels in the Tees Coastal water body, any significant effect to marine ecology receptors from vessels is considered unlikely and would not be significant at the scale of the water body.

7.4.21 The vessels used for the Proposed Development are likely to be large and therefore will be traveling at slow speeds (estimated to be less than 10 knots), particularly through the estuary. At such speeds, vessels are unlikely to pose a significant risk of collision to marine mammals. Marine mammals are highly mobile species and are expected to move away from oncoming vessels. In addition, any marine mammals present in the estuary and North Sea are also expected to have habituated to the high baseline level of vessel presence.

7.4.22 Marine and land-based construction activities associated with the Proposed Development will create airborne sound which has the potential to disturb seals that are hauled-out nearby on Seal Sands or in Greatham Creek or have surfaced whilst in the water. For HDD activities located close to Seal Sands, there is expected to be an increase in the unweighted SEL (Sound Exposure Level) of 3 decibels (Db) above ambient, which may result in some perceptible change for seals. However, the HDD is only predicted to occur for a maximum duration of two to three weeks and will operate continuously over that period (rather than stopping and starting which would be more disturbing). It was recommended that mitigation measures are implemented to reduce the current predicted 3 Db increase in unweighted SEL above ambient. It is proposed that noise abatement barriers are placed around the area of HDD at the Greatham Site to reduce the amount of perceptible change in airborne sound. This has been introduced as part of the Framework CEMP.

7.4.23 In terms of visual stimuli, changes may occur from land and marine-based construction activities (such as artificial lighting) which could lead to behavioural

responses in fish and shellfish taxa who are photoreceptive. However, any changes would be highly localised to the construction works or Site and therefore the spatial extent of any disturbance would be small. The majority of lighting, plant and personnel would also be mobile and so any effect would be temporary, short-term and intermittent. Furthermore, an Indicative Lighting Strategy (Construction) (EN070009/APP/5.8) has been developed as part of design measures to reduce glare and light spill into the marine environment.

7.4.24 Seals which have surfaced or hauled out at Seal Sands could be affected by changes to visual stimuli (e.g. from moving vessels and artificial lighting used as part of the construction phase) causing individuals to stop resting, breeding, feeding, travelling and / or socialising, with possible long-term effects of repeated disturbance resulting in permanent displacement and / or a decline in fitness and productivity. However, the Tees Estuary is characterised by a high volume of industrial and vessel activity, and therefore, seals are likely to be habituated in part to changes in visual stimuli, such as from moving vessels and artificial light. Furthermore, an Indicative Lighting Strategy (Construction) has been appended to the Framework CEMP (EN070009/APP/5.12) has been developed as part of design measures to reduce glare and light spill into the marine environment. Vessel movements will also be limited to the main Tees Estuary, rather than close to Seal Sands. Thus, effects to marine mammals are predicted to be negligible.

7.4.25 Overall, as a result of good practice and mitigation measures, it is not considered that there would be any deterioration in any WFD quality elements, nor any prevention of future objectives being met within the Tees Transitional Water Body.

Introduction and Spread of Invasive Non-Native Species

7.4.26 As previously outlined, given the limited use of vessels and the implementation of good practice mitigation measures, the risk of existing or new INNS becoming established or proliferating through vessel use to an extent that would cause ecological harm is considered to be very low.

7.4.27 Given that no physical works are proposed within the Tees Coastal water body plus the good practice measures in relation to vessels as described above, the introduction and spread of INNS within the coastal environment is unlikely. As such, there will be no detriment or prevention of future improvement to the WFD water body.

Morphological Impacts

7.4.28 Opencut crossings for the Hydrogen Pipeline Corridor are proposed on Holme Fleet and three unnamed watercourses. This would cause unavoidable disturbance of watercourse channel banks and the bed as well as disturbances of sediment which could be conveyed downstream to the Tees Transitional water body. As such there is potential for morphological impact to the Tees Estuary, and potential prevention of improvement in morphology for the wider WFD water body.

7.4.29 Where this open cut installation is required, flow will be maintained by damming and over pumping to create a dry working area and minimise the risk of polluting the watercourse. Works should therefore be carried out in the drier months of the

year where possible as this will reduce the volume of water to manage and the risk of pollution propagating downstream. Once the watercourse is reinstated, silt fences, geotextile matting, straw bales or other similar measure etc. will be used initially to capture mobilised sediments until the watercourse has returned to a settled state and thereby reduce risks of downstream water quality impacts. The watercourse would be reinstated as found having undertaken a pre-works hydromorphological survey. Water quality monitoring will also be undertaken prior to, during, and following on from the construction activity to ensure any spillages or other pollution is identified. These mitigation requirements will be outlined in the Final WMP.

7.4.30 Given the proposed mitigation there would be no permanent morphological impact to these watercourses, with full recovery anticipated within 5 years. At the WFD water body scale there would be no deterioration or prevention of future improvement in the morphology status element.

Tees Estuary (S Bank) Water Body (The Fleet)

Surface Water Quality – Suspended Fine Sediment

7.4.31 There will be works undertaken in close proximity to the Tees Estuary (S Bank) WFD water body and its tributary The Mill Race and several unnamed ditches for the Hydrogen Pipeline Corridor and Electrical Connection Corridor. This would include installation an above ground crossing of Tees Estuary (S Bank) at approximate NGR NZ 57977 24723, but would utilise an existing pipe bridge, with no works to the watercourse being required.

7.4.32 During works in close proximity to the above watercourses, there would be the potential for conveyance of fine sediment to any of these water bodies through uncontrolled site runoff or through any existing drains that discharge to these watercourses, if not mitigated.

7.4.33 Measures to manage formation of excessive sediment in runoff and to provide treatment prior to discharge will be implemented as described above and included in a Final CEMP(s) and WMP. This would include implementation of a temporary site drainage system. Given this mitigation, any residual impact would be negligible within the water bodies directly affected and are not significant to the Tees Estuary (S Bank) at the WFD water body scale, particularly given the dispersal and diluting potential of this river.

7.4.34 Overall, no reduction in any WFD element in the Tees Estuary (S Bank) is anticipated due to suspended fine sediments, nor any non-compliance with WFD objectives.

Surface Water Quality – Chemical Spillages

7.4.35 Given that appropriate mitigation measures are to be implemented to prevent and deal with chemical spillages as described in ‘Construction Phase Mitigation’ above, including water quality monitoring, then the risk of chemical spillages to the Tees Estuary (S Bank) water body would be minor. The main risk would result from working immediately adjacent to the river (and its tributaries such as The Mill Race), and for work over the river or within the channel to install the new pipe crossings

(e.g. for the Water Connection Corridor crossings of the Mill Race and Tees Estuary (S Bank)). During this work there is potential for spillages of fuels, oils and other chemicals.

7.4.36 There is also an indirect risk of spillages entering the water body from works undertaken across the wider Site, whereby uncontrolled site runoff enters watercourses, and pollutants propagate downstream to the Tees Estuary (S Bank) water body. However, this risk is considered negligible given the mitigation outlined above, including good practice measures in the Final CEMP(s). No reduction in any WFD element would therefore be anticipated from chemical spillages, or any prevention of future improvement.

Aquatic Ecology

7.4.37 Works associated with construction of the Connection Corridors could result in runoff laden with fine sediment or containing pollutants into the water body as described above. This could potentially lead to temporary adverse effects on aquatic ecology in the Tees Estuary (S Bank) and its tributaries, if not mitigated. However, given the implementation of the best practise mitigation described in 'Construction Phase Mitigation' above, including the Final CEMP(s), temporary site drainage systems and spillage controls and response protocols, then the risk is temporary and minor to aquatic ecology. No adverse effect to any of the ecological WFD parameter would be anticipated or prevention of future improvement.

Morphology Impacts

7.4.38 No open cut watercourse crossings are required of the Tees Estuary (S Bank) WFD water body or any of its tributaries. As such there is limited potential for morphological impact to watercourses. However, there will be works to the existing pipe bridges over the WFD water body itself and its tributary the Mill Race, to install a pipeline for the Water Connection Corridor. There may be potential for sediment mobilisation from the banks or immediate surroundings of the watercourse where works are required. However, provided that this is managed appropriately using the good practice construction measures outlined above and to be set out in the Final CEMP(s), then there would be not deterioration of the morphological condition of the Tees Estuary (S Bank) WFD water body and no prevention of future improvement.

<u>Tees Mercia Mudstone & Redcar Mudstone Water Framework Directive Groundwater Body and Tees Sherwood Sandstone WFD Groundwater Body</u>

7.4.39 Excavations and foundations have the potential to disrupt shallow groundwater. It is anticipated that the foundations within the Main Site will include bored piles (approximately 20 m deep) for heavily loaded structures that are sensitive to settlement. A Piling Risk Assessment and associated Piling Methodology will be undertaken in accordance with Environment Agency's Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention (Environment Agency, 2001). The results of this assessment will be used in the piling design and this is secured pursuant to the DCO.

7.4.40 A review of published geological and hydrogeological information and historical borehole records indicates that shallow groundwater levels are approximately 3 m below the development platform which is planned at approximately 7.1 m above Ordnance Datum (AOD). With the exception of piled foundations, excavation below the existing groundwater level is not anticipated to be necessary as part of the proposed foundation works at the Main Site.

7.4.41 A Ground Investigation will be undertaken to inform the design development and to guide appropriate construction methods to minimise impacts on groundwater flow, which may in turn impact baseflow in rivers or groundwater abstractions.

7.4.42 Depths required for construction of the Hydrogen Pipeline, Electrical Connection, Other Gases Connections and Water Connection Corridors are anticipated to be below the water table over part of their routes, and particularly where crossings beneath watercourses are required. The profile of the pipelines is considered to be small compared to the spatial and vertical extent of the secondary superficial aquifers, and therefore the pipelines are considered to have a Negligible impact on groundwater flow.

7.4.43 Construction works to install the Hydrogen Pipeline Corridor beneath the Tees Estuary and Greatham Creek using drilling or boring techniques would involve a temporary pit either side of the watercourse (>10 m measured from the water's/channel edge under normal flows) as well as regularly spaced jointing pits where longer sections of boring are required. Maximum parameters for the pit are assumed to be 5 m width x 10 m length x 3 m depth for the purposes of the assessment.

7.4.44 There is potential for shallow groundwater associated with the various connection corridors, and so there is potential for groundwater ingress to the pits. This will be managed following standard construction techniques potentially including pumping, damming, or shoring up the pits with sheet piling.

7.4.45 A temporary abstraction licence may be required from the Environment Agency when abstracting more than 20 m^3 of water per day. Any discharge of groundwater to a watercourse may also require a discharge consent from the Environment Agency if it is considered to be 'unclean' and the conditions of the Environment Agency's Regulatory Position Statement 'Temporary dewatering from excavations to surface water' (April 2021) cannot be met. This document states that uncontaminated, clean water, is water that is wholly or mainly clear rainwater or infiltrated groundwater that has collected in the bottom of temporary excavations on an uncontaminated site.

7.4.46 The pits will be backfilled with the original excavated material upon completion and will not affect groundwater base flow in the longer term. While groundwater may be encountered, taking into account that it will be appropriately managed in line with any required permit conditions and industry practice outlined in the Framework CEMP (EN070009/APP/5.12) and a Construction Dewatering Strategy, there is considered to be a negligible impact on groundwater levels and flow from dewatering.

7.4.47 If during the course of the construction of the Proposed Development any contamination is found which has not been previously identified, an appropriate risk assessment will be prepared. Any actions resulting from the risk assessment will be agreed with the Environment Agency along with any remedial measures, pursuant to the DCO. These remedial measures will be adopted as part of the Proposed Development.

7.4.48 Overall, with the implementation of the mitigation measures described above and set out in the Framework CEMP, Outline WMP and Chapter 9: Surface Water, Flood Risk and Water Resources and Chapter 10: Geology and Hydrogeology (ES Volume I EN070009/APP/6.2), any residual impacts to the WFD groundwater bodies would be temporary and minor and would not be significant at the water body scale. The Proposed Development is therefore compliant with the WFD objectives for these two water bodies during construction.

Cumulative Impacts on WFD Water Bodies during Construction

7.4.49 There is the potential for cumulative impacts on WFD waterbodies, where impacts associated with the Proposed Development may act in conjunction with those associated with other planned projects and local plan allocations in the vicinity (hereafter referred to as 'other developments'). This is considered in detail in EIA terms in Appendix 23D: Stage 4 - Assessment of Cumulative and Combined Effects (ES Volume III, EN070009/APP/6.4).

7.4.50 The 'Other Developments' identified with the greatest potential to lead to cumulative effects are the neighbouring NZT project (ID3) and HyGreen project (ID222). These are both immediately adjacent to the Proposed Development (see Figure 23-3: Short List of Other Developments (ES Volume II, EN070009/APP/6.3). NZT includes for potential construction of a new outfall to Tees Coastal WFD waterbody for discharge of process water and surface water (which would also potentially be used by the Proposed Development for process and surface water discharge). Watercourse crossings are required for pipelines associated with NZT (including a trenchless crossing of Tees Estuary) and HyGreen but none are known to require an open-cut, intrusive approach at the time of writing (March 2024). There would be construction works in the proximity of many of the watercourses associated with the Proposed Development for both of these neighbouring developments, and thus potential for effects from construction site runoff and accidental spillages. However, no significant effects were identified with regard to the water environment (including flood risk) within the EIA for NZT (bp, 2021a) while the ES for HyGreen is yet to be submitted (as of the time of writing).

7.4.51 Overall, there is the potential for short term, temporary construction related pollutants generated from both the Proposed Development and the other developments identified in Appendix 23D: Stage 4 - Assessment of Cumulative and Combined Effects (ES Volume III, EN070009/APP/6.4) to impact on WFD water bodies in the study area. However, provided that standard and good practice mitigation is implemented on the above construction sites through their respective CEMPs and as per the conditions of the relevant planning permission, environmental permits and licences, as is being proposed for this development, the

cumulative risk can be effectively managed and there would not be a significant increase in the risks to any waterbodies. As such, there would not be any additional cumulative impacts during construction that would lead to deterioration or prevention of future improvement of the WFD water bodies considered herein.

7.5 Potential Operation Phase Impacts

7.5.1 During the operation phase the following potential water environment impacts may occur, if appropriate mitigation is not applied:

- impacts on receiving water features from diffuse urban pollutants and sediments in surface water runoff, or as a result of accidental spillages;
- changes in water quality from operational discharges including the discharge of treated process wastewater (this includes increases in nutrients to receiving water features);
- potential nutrient enrichment of ponds located adjacent to the Main Site from atmospheric deposition of nitrogen emitted from the Proposed Development; and
- water quality impacts on receiving water features (including the sea) from an increase in foul drainage from the Proposed Development.

7.5.2 For full details of Operational Phase Impacts, see Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2).

7.6 Operation Phase Mitigation and Avoidance Measures

7.6.1 The Production Facility will require an Environmental Permit and will comply with this under the Environmental Permitting (England and Wales) Regulations 2016 (HM Government, 2016). In addition, the Proposed Development will be operated in line with appropriate standards, whilst the operator will implement and maintain an Environment Management System (EMS) which will be attested to International Standards Organisation (ISO) 14001. The EMS will outline requirements and procedures required to ensure that the Proposed Development Site is operating to the appropriate standard. The Applicant has also begun engagement with the Environment Agency under the enhanced pre-application scheme and is finalising an application for an Environmental Permit anticipated to be submitted in 2024.

7.6.2 The source of water to supply the Proposed Development will be the existing NWL raw water pipeline feed from the River Tees to the STDC site, or alternatively a new connection to the existing NWL supply either via tie in to NZT infrastructure or the installation of a new connection.

7.6.3 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), surface water runoff and foul effluent.

7.6.4 The two ‘cases’ for the Proposed Development are summarised in Table 7-1. Note that this does not include management of surface water runoff which is discussed further below.

Table 7-1: Summary of the Two Cases Being Considered for the Proposed Development

	CASE 1B	CASE 2B
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 further treatment at a rate of 4.0 m^3/hr. This will be be transported off-site by tanker to an approved and licensed facility and treated in a manner consistent with nutrient neutrality requirements by either a) denitrification and discharge of resultant effluent within the habitats site catchment or b) discharging outside of the habitats site catchment.	Treated process water effluent to discharge to Tees Bay via NZT outfall

7.6.5 The difference between the cases is that Case 1B uses 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. Case 2B is an alternative to MLD and requires discharge of process effluent to the NZT project outfall at Tees Bay.

7.6.6 Surface water drainage will discharge either: 1) to the Tees Estuary via an existing STDC outfall; or 2) to Tees Bay via the NZT outfall (with any new pipework and outfall to be consented under a subsequent planning application). This is described further below.

7.6.7 Further details regarding water demand, surface water drainage, process wastewater and foul wastewater are described below. A number of mitigation features will be incorporated into the Proposed Development design in order to avoid, minimise and reduce potential adverse impacts on water features – these are also described in the following sections where relevant.

Water Demand

7.6.8 There is a significant clean water requirement for the Proposed Development comprising the elements listed in Table 7-2.

Table 7-2: Clean Water Requirement for the Proposed Development

WATER REQUIREMENT	CASE 1B & 2B (M^3/HR) (PHASE 1&2)
Cooling water make-up	167
Utility water	10
Firewater make up	Nominal Flow
Demineralised water for boiler feed water make-up, chemicals, CO_2 absorber and HCl scrubber	104

7.6.9 Water is to be supplied via the existing NWL's raw water pipeline feed from the River Tees. Treatment is required to the supplied water to produce the desired water quality for utility water.

Surface Water Drainage

7.6.10 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, culverts or otherwise installed underground.

7.6.11 Surface water drainage will discharge to one of three options: 1) to the Tees Estuary via an existing STDC outfall; or 2) to Tees Bay via the proposed NZT outfall.

7.6.12 Due to the nature of the Proposed Development, it is likely that a range of different diffuse pollutant types may be present in surface water runoff, with minor concentrations varying depending on many factors..

7.6.13 A detailed Surface Water Drainage Strategy will be developed for approval pursuant to a Requirement of the DCO. The main functional requirements of the drainage system are:

- to collect, contain or remove major spills to limit the effects of any fire and/ or its duration;
- to minimise exposure of personnel to harmful substances;
- To recycle or reuse effluents to reduce costs and avoid waste;
- to prevent contamination to ground and surface water systems outside the limits of the process plant;

- to collect and treat firewater and contaminated rainwater; and
- to provide a treatment system that will meet local and national code and legislative requirements.

7.6.14 SuDS will be used 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 surface water runoff to ensure potential adverse effects on water quality in receiving watercourses are avoided. At this stage the following potential SuDS have been proposed:

- Incorporation of rainwater harvesting across suitable site buildings, with the potential for collected water to be used on-site to meet process needs. Rainwater harvesting will reduce the volume of runoff generated and will contribute to reduced attenuation storage;
- Pervious paving is recommended across car park areas, enabling rainwater to infiltrate into the sub-base and discharge in a controlled manner to the site drainage system. Pervious paving will reduce peak runoff through the provision of attenuation storage and offer filtration, adsorption, biodegradation and sedimentation within the sub-surface;
- Where achievable the use of gravel cover is recommended. Pore spaces within the gravel matrix provide attenuation storage, reducing peak runoff rates. In additional the gravel provides a degree of pre-treatment;
- Swales are recommended for conveyance of road run-off; and
- An attenuation pond will be present to provide storage but also will provide a degree of water quality treatment.

7.6.15 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 from accidental discharges of oil, chemicals or run-off from firefighting effluent. Clean, uncontaminated storm water will be segregated from potentially contaminated water.

7.6.16 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. An oily water drain will provide for collecting water from plant areas where oil may be present. Rotating equipment with lube oil systems which are located outdoors shall be provided with paving and be kerbed/bunded with controlled discharge to ensure that uncontrolled surface run-off is avoided and that spillage and leakages from equipment are contained. Lube oil spillages in the kerbed/bunded area will be manually cleaned up and disposed of offsite. Transformers and substations shall be located within kerbed areas. Lube-oil and transformer oil change-out shall be drained to portable drums with spillages contained by oil mats and good-practice clean-up. Used oils will be disposed of off-site. Drainage is routed by gravity via the oily water sewer to a below ground Oily

Water Separator contained within the Oily Water Treatment Package. The liquids that are transferred to the Oily Water Treatment Package will be settled and filtered to remove hydrocarbons. Treated water discharged from the treatment package flows to the surface water attenuation pond. Oil removed in the treatment package is collected as waste and is disposed off-site by vacuum tankers.

7.6.17 Areas for chemical injection packages and chemical storage tanks (excluding amine solvent) shall be kerbed/bunded to ensure that spillages and leaks from chemical dosing packages and associated intermediate storage tanks are contained. Chemical spills within bunds / kerbed areas should be routed to sumps within the bund area and from which the contents are routed to a neutralisation pit to prevent unwanted reactions. Provision will be provided to allow routing of clean neutralised fluid or storm water from chemical drainage areas to the oily water drain upon testing by the operator to confirm that the water is non contaminated. Contaminated water can be collected via vacuum truck for offsite disposal. To minimise rainwater collection where practicable and safe to do so, these chemical injection packages and intermediate storage tanks shall be located indoors or be provided with a rain shelter if outdoors. The rain shelters shall have open sides for ventilation.

7.6.18 The amine contaminated surface water drain is an independent hazardous segregated drain system. For Inside Battery Limit areas with equipment that contain amine, there is the potential for rainwater or fire water falling in this area to be contaminated with amine. To ensure that it is not released to the environment, kerbed or bunded areas shall be provided to collect this fluid which is gravity fed to an Interceptor Pit. Here a sample will be taken to confirm if the contents of the sump meet the site criteria prior to pumping the sump contents to the main non-hazardous open drain. Contaminated fluid is disposed off-site by vacuum tankers.

7.6.19 In addition to the above sources of surface water, under exceptional circumstances firewater may be generated. Firefighting 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 the first flush of potentially contaminated firefighting water and divert it away from the existing surface water SuDS system. The contaminated firefighting water would then be stored and tested. Should contamination be present, this water will be directed to an oil separator (or pumped out for appropriate off-site disposal at a licensed waste facility depending on the extent of the contamination), or if considered clean, it will go to the stormwater attenuation pond. The storage requirements and the method by which firefighting water is diverted (i.e. an automatic or manual operated system) will be further determined as part of the development of the detailed Surface Water Drainage Strategy. At this stage, it is suggested that the capacity of the firewater catchment will be sufficient to prevent overspill to adjacent catchment areas or systems. Storage across the drainage networks will be sufficient for the 4 hours of firewater plus leak scenario.

7.6.20 The Detailed Surface Water Drainage Strategy to be developed post-consent under a Requirement in the draft DCO will outline the consequences for the drainage system should the Proposed Development close or be decommissioned. This will

also outline the final details of firewater management and drainage. It is also envisaged that a Surface Water Maintenance and Management Plan will 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. Furthermore, the development of the final, Detailed Surface Water Drainage Strategy will include an appropriate water quality risk assessment.

Process Wastewater

7.6.21 Process waste waters will be generated on the Main Site as follows:

- boiler blowdown – 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 – this has 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).

7.6.22 Process condensate will be treated by a dedicated on-site Water Treatment Plant. The treated process condensate will be reused as makeup water in the Water Treatment Plant and will not be discharged.

7.6.23 Other wastewater streams (cooling tower blowdown and demineralisation plant rejects) will be treated in an Effluent Treatment Plant (ETP). Case 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. This will be transported off-site for further treatment. The treated wastewater from the ETP will be reused as make-up water in the Water Treatment Plant.

7.6.24 Case 2B represents an alternative to Minimalised Liquid Discharge. In this case, wastewater would be discharged via the NZT outfall to Tees Bay at a rate of 75 m^3/hr. The discharge would have to meet the standards required by the Environmental Permit (in combination with cumulative impacts from NZT discharges). 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 (European Commission, 2016).

7.6.25 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. Surface water runoff from uncovered external paved areas of the Main 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.

7.6.26 Should treated wastewater be discharged to Tees Bay under Case 2B, the indicative effluent quality is given in Table 9-22 of Chapter 9 Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2).

7.6.27 Water sampling facilities are to be provided for manual sampling of water prior to 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.

Foul Wastewater

7.6.28 Foul water will connect to the STDC sewage network for appropriate treatment and discharge. This is likely to be via Bran Sands WwTW but may also be via 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.

Management of Hazardous Substances on Site

7.6.29 The use of the chemical products at the Main Site will follow the product-specific environmental guidelines, as well as the legislative requirements set out in the Control of Substances Hazardous to Health Regulations (COSHH (HSE, 2002) and Control of Major Accident Hazards (COMAH) Regulations (HSE, 2015).

7.6.30 A site Emergency Response Plan (prepared for Regulation 9 of the COMAH Regulations) will be in place for dealing with emergency situations involving loss of containment of hazardous substances. This will detail how to contain and control incidents to minimise the effects and limit danger to persons, the environment and property. The Emergency Response Plan will set out the emergency spill control procedure that will include the actions adapted from the Health and Safety Executive's Emergency Response/Spill Control Technical Measures Document (Health and Safety Executive, n.d.).

7.6.31 Further guidance to be consulted in development of the site Emergency Response Plan include:

- HS(G)191 Emergency planning for major accidents. Control of Major Accident Hazards Regulations 1999 (Health and Safety Executive, 1999);
- HS(G)71 Chemical warehousing: the storage of packaged dangerous substances (Health and Safety Executive, 1992); and

7.6.32 BS 5908: Fire and explosion precautions at premises handling flammable gases, liquids and dusts. Code of practice for precautions against fire and explosion in chemical plants, chemical storage and similar premises (British Standards Institute, 1990).

Maintenance

7.6.33 The objective of plant maintenance is to ensure the Hydrogen Production Facility and the connections operate safely and reliably. Routine maintenance will be planned and scheduled via the maintenance management system with major overhauls occurring approximately once every four years on each unit.

7.6.34 Inspection and maintenance activities are key criteria for determining the footprint and layout of the Hydrogen Production Facility. The maintenance strategy to be adopted will use established methods such as Risk Based Inspection (RBI) and Reliability Centred Maintenance (RCM). Therefore, to support the maintenance strategy for the Hydrogen Production Facility, each major element would have appropriate access and laydown areas, whilst the internal road layout for the Main Site would enable free movement for cranes and heavy lifting equipment.

7.6.35 Pipelines will be subject to an Integrity Management Plan that will include, but not limited to, Inline Inspection, Cathodic Protection surveys, visual inspections, and maintenance of associated equipment at frequencies informed by RBIs.

7.6.36 It is anticipated that an integrated Operations and Maintenance (O&M) team would have the responsibility for daily operations, including troubleshooting and effecting minor repairs on the plant. Major O&M interventions are likely to be outsourced, whilst major equipment items are likely to be serviced by original equipment manufacturers.

7.6.37 All major maintenance activities requiring significant equipment outages will be coordinated to occur during the planned routine turnaround (TAR). Equipment requiring routine maintenance outside of this timeframe will be spared and fitted with sufficient isolation to facilitate the activity whilst plant production continues.

Tees Coastal Water Body

Surface Water Routine Runoff and Accidental Spillages

7.6.38 The Proposed Development is an industrial site with constant use of a range of fuels, oils and other chemicals. There is potential for these to be mobilised by surface water runoff and to discharge into the Tees Coastal water body should this discharge option be taken forward (rather than discharge to Tees Estuary). Surface water runoff may therefore contain a range of pollutants that could lead to chronic adverse impacts on the receiving watercourses in terms of their physico-chemical and ecological status, although it should be noted that there is a large capacity for dilution and dispersal in this water body. There is also a risk that a significant chemical spillage or pollution incident occurs on the Main Site, thereby impacting the Tees Coastal water body.

7.6.39 The provisional drainage arrangements propose to attenuate surface water runoff and contain chemical spillages from the operational Proposed Development Site. As outlined above, a new surface water drainage network and management system will be provided for the Main Site that will provide 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.

7.6.40 Discharges to the Surface Water Drainage System will include stormwater from roadways and access area drainage, car park, roof drainage, landscape areas and walkways. At this stage, incorporation of rainwater harvesting is proposed across suitable site buildings, with the potential for collected water to be used on-site to meet process needs. Pervious paving is to be used across car park areas, enabling rainwater to infiltrate into the sub-base and discharge in a controlled manner to the site drainage system. For the remainder of the site drainage system, a gravel matrix is proposed for bioretention (the exact make up of which will be confirmed in the detailed drainage design post consent), swales will also be used and discharged to the attenuation pond prior to outfall to Tees Bay/Tees Estuary.

7.6.41 In Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2), the SuDS Manual's Simple Index Approach (CIRIA, 2016) has been applied to provisionally demonstrate the suitability of the SuDS treatment trains within the Pre-FEED drainage design (which will be further developed for inclusion in the detailed surface water strategy as a DCO requirement). The assessment indicated that the proposed SuDS mitigation provides sufficient treatment for pollutants, and so no adverse effects from surface water runoff would be expected to the water quality of Tees Coastal WFD water body as a result of the Proposed Development. Nonetheless, this is a provisional finding, and a repeat assessment would be undertaken as part of the detailed Drainage Strategy (a DCO requirement) once treatment trains have been finalised. Further treatment would be incorporated where necessary depending on the outcome of the further analysis.

7.6.42 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 be separated from the main 'clean' surface water drainage system using appropriate methods such as kerbs, bunds, sumps. An oily water sewer system will be in place which conveys the potentially contaminated water to a open drain sump, from where it will be monitored. 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.

7.6.43 Amine contaminated water will be contained and where possible would be recovered and recycled for use within the process, or otherwise taken off-site by tanker to a specialist treatment plant.

7.6.44 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 the first flush of potentially contaminated fire-fighting water and divert it away from the existing surface water SuDS system. The contaminated fire water would then be stored and tested. Should contamination be present, this water will be directed to an oil separator (or pumped out for appropriate off-site disposal at a licensed waste

facility depending on the extent of the contamination), or if considered clean, it will go to the stormwater attenuation pond. The storage requirements and the method by which fire-fighting water is diverted (i.e. an automatic or manual operated system) will be determined as part of the development of the detailed Surface Water Drainage Strategy.

7.6.45 An inventory of hazardous substances used on the Proposed Development Site will be developed throughout the design process. In each case the product will have a Material Safety Data Sheets providing guidance on the safe disposal of waste chemicals, that the operator of the facility will adhere to the guidance regarding the impact avoidance measures for disposal of product containers and chemical waste.

7.6.46 Water quality monitoring will be regularly undertaken by the site operator to confirm the quality of any water in bunded areas, sumps or tanks to ensure that it is suitable for discharge from the site to Tees Coastal WFD water body, or otherwise is taken by tanker for off-site disposal at a suitably permitted wastewater facility. A Pollution Prevention Plan and an Emergency Response Plan will also be prepared. Should any spillage occur that results in the pollution of controlled waters, the Environment Agency will be immediately informed, or NWL should it impact the foul water system.

7.6.47 A Surface Water Maintenance and Management Plan will be prepared during the detailed design phase to describe the requirements for access and frequency for maintaining drainage infrastructure on the Proposed Development Site. The maintenance regime must be fully implemented throughout the lifetime of the Proposed Development to avoid issues such as blockages which could lead to flooding, or failure of the spillage containment and pollution prevention systems.

7.6.48 Given that the Surface Water Drainage Strategy will have to meet standards required by the regulators and the local policy requirements, and that measures will be included for dealing with spillages and firewater (including water quality monitoring), then no deterioration in any WFD element or prevention of future improvement is predicted from surface water runoff or chemical spillages.

Impacts of Process Discharges

Cooling Water System – Impacts of Thermal Discharges

7.6.49 Cooling water from the Hydrogen Production Facility could be discharged to the Tees Coastal water body under an Environmental Permit. If water is not sufficiently cooled it could create a thermal barrier to fish passage, especially salmon and lamprey, and have other environmental consequences on the designated coastal sites in terms of ecosystem dynamics and assemblages.

7.6.50 Sea temperature changes are discussed in full detail within Chapter 14: Marine Ecology and Nature Conservation (ES Volume I, EN070009/APP/6.2); this includes potential changes to the marine environment surrounding the outfall and associated effects on receptors. Water quality modelling including consideration of thermal impacts is presented in Appendix 9B Water Quality Modelling Report (ES Volume III, EN070009/APP/6.4). This indicates that thermal effects are extremely small, with the temperature of the mixing plume falling below 3°C above ambient

conditions within a very short distance of the Tees Bay outfall. Surface temperatures are not increased by more than 3°C for any combination of effluent discharge option and tidal stage. When modelled in combination with NZT the thermal mixing zones remained extremely small. Refer to Appendix 9B for full details.

7.6.51 With regards to marine plankton, given the highly limited predicted extent of the thermal plume and the apparent degree of mixing, it is unlikely that the planktonic community would be exposed to a temperature increase that would affect their metabolic rate or productivity, even within the immediate vicinity of the treated water outfall. Any effect is therefore unlikely to impact the wider abundance and diversity of plankton communities and is considered to have a negligible impact.

7.6.52 Regarding intertidal habitats and communities, the intertidal area within the vicinity of the discharge outfall is known to support a low abundance and diversity of macrofauna with few species of macroalgae present. All intertidal habitats and associated communities within the footprint of the thermal plume are highly resistant and resilient to local temperature increases (see Chapter 14: Marine Ecology (ES Volume I, EN070009/APP/6.2)). There is predicted to be limited interaction between the small thermal plume and intertidal habitats and so the magnitude of impact is predicted to be minor and highly localised.

7.6.53 Subtidal organisms are naturally less adapted to wide fluctuations or increases in temperature than those in intertidal communities, and as a result are possibly more susceptible to the effects of thermal stress. However, the thermal plume has been shown to be very localised, and thermal effluent generated by the Proposed Development will be naturally buoyant (due to lower salinity and the lower density of warmer water) and therefore the footprint of the thermal plume on the seabed will likely be further reduced. Discharge of thermal effluents during operations of the Proposed Development is not predicted to have any discernible impact on the subtidal habitats and the abundance, distribution, and diversity of associated species beyond the immediate vicinity of the outfall (dominated by *Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand). The magnitude of impact is therefore predicted to be minor and highly localised.

7.6.54 The exposure of fish and shellfish (namely demersal life stages and species such as sandeels) to the thermal plume is unlikely to result in changes to communities in terms of abundance and diversity. The thermal plume is also not predicted to affect the reproductive success of fish species of conservation and / or commercial importance nor would it represent a barrier to migratory species, and so a negligible impact on fish is expected.

7.6.55 Direct effects to marine mammals from the discharge of thermal effluent, including harbour seal which is a feature of the Teesmouth and Cleveland Coast SSSI, is predicted to be not significant. Refer to Chapter 14: Marine Ecology (ES Volume I, EN070009/APP/6.2) for further details. As such, no impact on designated sites is predicted.

7.6.56 Finally, in terms of INNS, during baseline surveys, wakame (*Undaria pinnatifida*) was reported as the only INNS currently known to be present and growing within the Study Area. This intertidal macroalgae is a species of kelp which originates from Japan. Due to its rapid growth rate, it is known to outcompete native species within rocky reef habitats (GB NNSS, nd.).

7.6.57 The growth of wakame is stimulated by reduced rather than increased temperatures with persistent colder conditions below 15°C promoting recruitment and growth. Thus, cooling water system operations are not predicted to exacerbate growth of this species within the vicinity of the Proposed Development.

7.6.58 It is possible that some INNS which are present in the surrounding waters, that are adapted to warmer water, could become established in the vicinity of the treated water outfall during operation. The baseline for non-native species will continue to evolve during the construction phase and therefore it is not possible to accurately predict the species that could become established.

7.6.59 Overall, the risk that thermal discharge from the Proposed Development could facilitate introduction and spread of INNS during operation is considered to be low given the limited identified thermal change and the few INNS identified in the Study Area. The effect on native habitats and species from the establishment of non-natives linked to the thermal plume is therefore predicted to not be significant. As such, deterioration or prevention of improvement to the WFD water body is not expected from the thermal plume.

Chemical Impacts from Process Wastewater Discharge

7.6.60 Given the potential of the Proposed Development to discharge nitrogen via the Tees Bay outfall (Case 2B), hydrodynamic modelling has been undertaken to determine the degree of dispersion from the outfall for constituents of the wastewater. The outcomes are summarised briefly below with full details given in Appendix 9B: Water Quality Modelling Report (ES Volume III, EN070009/APP/6.4). The modelling has considered the impact of the Proposed Development in isolation and also the cumulative impact when operating simultaneously with NZT.

7.6.61 The discharged effluent from the Main Site will be comprised of treated process water which is sourced from the River Tees and will contain river water contaminants. These will be concentrated within the process effluent, however the effluent will be treated via a denitrification plant prior to discharge which will reduce dissolved inorganic nitrogen (DIN) concentrations to 15 mg/l. Discharges from the adjacent NZT site (discharging via the same outfall) will likewise comprise concentrated River Tees water with additional flows generated on-site and treated via reverse osmosis. There is also a possibility that surface water runoff will be discharged via the NZT outfall, depending which option is taken forward post consent. This has also been taken into account within the modelling scenarios (see Appendix 9B: Water Quality Modelling Report (ES Volume III, EN070009/APP/6.4).

7.6.62 Water quality data for the River Tees were provided by NWL and combined with information from Environment Agency and details of water treatment technology

planned for the Proposed Development to characterise final discharge effluent flows and loads for the modelling exercise.

7.6.63 Pollutant concentrations determined for the final effluent were compared with Environmental Quality Standards (EQS) for Tees Bay under the WFD. The available information shows that effluent concentrations of DIN (as well as benzo(b)-fluoranthene, benzo(g,h,i)-perylene, fluoranthene, PFOS, polyaromatic hydrocarbons (PAHs), chromium, copper, iron, lead, mercury, zinc and diazinon) may exceed EQS values. Effective volume flux calculations have been carried out and show that only DIN and PAHs will be discharged above the allowable volume flux value, although lead is also discharged above the allowable volume flux value when taking account of NZT discharges. Effective volume flux calculations cannot be carried out for benzo(g,h,i)-perylene or PFOS because ambient concentrations of these substances already exceed EQS values.

7.6.64 DIN, PAHs, lead, benzo(g,h,i)-perylene and PFOS were therefore taken forward for modelling. Mixing zones for DIN, polyaromatic hydrocarbons and lead have been defined based on EQS limits and mixing zones for benzo(g,h,i)-perylene and PFOS have been defined using an EQS proxy of 5% above ambient.

7.6.65 Near field modelling was carried out for summer and winter conditions at four stages across the tidal cycle – low tide, high tide, maximum current velocity and minimum current velocity. Water level and current data at each stage in the tidal cycle were extracted from a Delft3D hydrodynamic model of Tees Bay and the River Tees constructed and calibrated in 2019 (and included as an annex within Appendix 9B: Water Quality Modelling Report (ES Volume III, EN070009/APP/6.4)). The current proposal is to discharge the effluent via a new outfall (for which consent is being sought through the NZT DCO application) with a multiport diffuser located in an area with an average water depth of approximately 9 m. Far field modelling has been used to estimate the extent of the mixing zone under minimum current conditions.

7.6.66 The near field and far field modelling show that the impact of the Proposed Development process effluent discharge is small for all polluting substances at all stages of the tidal cycle. The chemical contaminants are diluted to below the EQS within a very short distance of the outfall and generally before the mixing plume reaches the water surface. The chemical contaminants are rapidly diluted to below the EQS within a very short distance of the outfall by diffusion and mixing with the large volume of ambient water surrounding the discharge point. The largest elevations in pollutant concentrations occur close to the outfall and within the deeper water layers, however the maximum increase in concentration in any model cell in any layer is 0.017 mg/l for DIN and 0.022 ng/l for polyaromatic hydrocarbons, neither of which is sufficient to breach EQS values. The maximum modelled increase in benzo(g,h,i)perylene concentration is 0.018 ng/l above ambient concentrations and the maximum increase in PFOS concentration is 0.003 ng/l above ambient concentrations. Both these values are less than 5% above the ambient background.

7.6.67 The far field and near field modelling therefore shows that process effluent discharges from the Main Site, in isolation, would not result in a reduction in water quality in Tees Bay at any point over a tidal cycle.

7.6.68 The cumulative impact of discharges from the Main Site and NZT sites is larger than that for the Proposed Development alone, with mixing zones more likely to reach the water surface. Concentrations of DIN are slightly elevated above background concentrations over a wider area but the overall increase in average and maximum pollutant concentrations do not approach EQS values, taking into account the complex tidal currents in this region which can result in pollutants accumulating in shallow water. The near field and far field modelling results show that the development proposals for both the Main Site and adjacent NZT site include sufficient treatment of process effluent (and surface water runoff) to ensure that there is no significant impact on water quality in Tees Bay due to the cumulative impact of discharges from both.

Foul Water Discharge

7.6.69 Sanitary wastewater from welfare facilities will be treated at a Northumbrian Water WwTW. This is assumed to be either the Marske-by-the-Sea or Brans Sands WwTW, but this is still to be confirmed at the time of writing (March 2024). Should the option to discharge to Marske-by-the-Sea WwTW be taken forward, then this would ultimately discharge to Tees Coastal WFD water body. 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. Given that the discharge from wastewater treatment works is tightly regulated, no deterioration or prevention of future improvement in any WFD element for the Tees Bay water body is predicted.

Atmospheric Deposition Impacts

7.6.70 Deposition of air pollutants released from point source emissions can be deposited into the marine environment either by wet or dry deposition processes. Deposition of air pollutants, particularly nitrogen and sulphur compounds can cause direct disturbance to marine habitats and species through acidification.

7.6.71 An assessment of atmospheric deposition has been undertaken in Chapter 8: Air Quality (ES Volume I, EN070009/APP/6.2). Emissions from the Proposed Development have been assessed using the Environment Agency's Risk Assessment (Defra and Environment Agency, 2016 as updated in 2023). Detailed dispersion modelling using the atmospheric dispersion model ADMS (currently ADMS 5.2.2) has been used to calculate the concentrations of pollutants at identified receptors. These concentrations have been compared with the defined Air Quality Assessment Levels (AQALs) for relevant pollutants.

7.6.72 An assessment of nutrient nitrogen enrichment has been undertaken by applying published deposition velocities to the predicted annual average nitrogen dioxide (NO_2) and NH_3 concentrations at the Teesmouth and Cleveland Coast SPA, determined through dispersion modelling, to calculate nitrogen deposition rates

(expressed as kilograms per ha per year, Kg/ha/yr). These deposition rates have then been compared to the Critical Loads for nitrogen published by UK Air Pollution Information System (APIS) (APIS, n.d.), taking into consideration the baseline deposition.

7.6.73 The modelling is presented in Chapter 8 (air quality) and the impacts on designated wildlife sites also presented in Chapter 12 Ecology and Nature Conservation (ES Volume I, EN070009/APP/6.2).

7.6.74 As set out in Section 3 (Assessment Methodology and Significance Criteria) of Chapter 8: Air Quality (ES Volume I, EN070009/APP/6.2), an assessment of combined impacts from both peak construction and operational emissions (Phases 1 and 2) has been carried out to confirm no significant effects would occur during any overlap in activities as a worst case scenario. The magnitude of impacts at sensitive receptors is predicted to be below 1% of the critical load for nitrogen deposition on all ecological receptors. NOx concentrations are predicted to be below 1% of the critical level at most ecological receptors, with the exception of two locations within the Teesmouth and Cleveland SSSI where concentrations are predicted to increase by up to 0.5 µg/m^3, or 1.5% (locations RE008 and RE003, see Chapter 8). At these two locations, the total increase in NOx, does not result in an exceedance of the critical level. The combined change was therefore not considered significant. The air quality assessment concludes that there will be no significant impacts to ecological receptors, see Chapter 8: Air Quality (ES Volume I, EN070009/APP/6.2).

7.6.75 An assessment of possible nutrient enrichment of Pond 14 was undertaken in Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2). This showed that water quality monitoring of Pond 14 between October 2020 and February 2023 indicates a maximum total nitrogen concentration value of 1.6 mg/l (6 January 2021). This is variable over relatively short time scales with total nitrogen having been below the laboratory limits of detection on five of 11 sampling visits (i.e. <0.5 mg/l). Based on the maximum recorded total nitrogen baseline value of 1.6 mg/l in Pond 14, a predicted deposition of 0.05 kg/N/ha/yr as a worst-case scenario would cause an increase in total nitrogen concentration to 1.61 mg/l after one year, for a hypothetical scenario with no other gains or losses of nitrogen. This is considered to be within the likely range of concentrations that would be observed in the pond over a year and would not be of detriment to the pond ecosystem.

7.6.76 The extent of impact of atmospheric nitrogen deposition at the Tees Coastal WFD water body scale has also been considered through a simple mass balance analysis, to determine whether there would be any potential for deterioration or prevention of future improvement. The analysis was based on the total nitrogen isopleth mapping from the air quality modelling outputs. This assumed a precautionary closed box system, with the maximum average total nitrogen deposition of 0.02 kg N/ha/yr applied across the entire water body (>88 km^2) with an assumed precautionary average water depth of 8m.

7.6.77 Based on these assumptions the analysis indicated that the impact on nitrogen concentrations within the WFD water body would be not significant with an increase of 0.128% total nitrogen per year within a closed box system. In reality, total nitrogen would be dispersed outside of the WFD water body and the highest nitrogen deposition rate would only apply to a very small area off Coatham Sands, and so the true value would be very much lower. As a simple analysis the results cannot be interpreted in absolute terms, but the predicted worst case increase is so small that there is confidence that atmospheric deposition of nitrogen is a not significant issue, and no further water quality modelling of this issue is considered necessary.

7.6.78 The Proposed Development will be designed such that process emissions to air comply with the ELV requirements as agreed in the environmental permit, as per the emerging techniques for hydrogen production with carbon capture guidance. This will be agreed as part of the Environmental Permit Application with the Environment Agency. The Environment Agency will then regulate the operation of the Proposed Development.

7.6.79 Overall, it is considered that there will be no deterioration or prevention of improvement to the wider WFD water body. For full details of the air quality monitoring, please refer to Chapter 8: Air Quality (ES Volume I, EN070009/APP/6.2).

Tees Transitional Water Body (Tees Estuary)

Surface Water Routine Runoff and Accidental Spillages

7.6.80 As outlined above with regard to Tees Coastal water body, there is an option to discharge surface water runoff to Tees Estuary via STDC infrastructure. The drainage arrangements would correspond to the assessment outlined above which includes the use of SuDS. The Simple Index Approach assessment undertaken in Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2) provisionally indicates that adequate provision is included to treat surface water prior to discharge. Drainage arrangements will be subject to further development into a Detailed Surface Water Drainage Strategy as secured via DCO requirement. Given that the Detailed Surface Water Drainage Strategy will have to meet standards required by the regulators and the local policy requirements, and that measures will be included for dealing with spillages and firewater (including water quality monitoring) and maintenance (as outlined above), then no deterioration in any WFD element or prevention of future improvement is predicted to Tees transitional water body from surface water runoff or chemical spillages.

Impacts of Process Discharges

7.6.81 No process water will be discharged to Tees Transitional water body, and the modelling undertaken in Appendix 9B: Water Quality Modelling Report (ES Volume III, EN070009/APP/6.4) indicates that the overall increase in average and maximum pollutant concentrations at Tees Bay (under Case 2B) do not approach EQS values for the Proposed Development or when considered cumulatively with NZT. The hydrodynamic modelling indicates that none of the discharged pollutants (including DIN) would enter the Tees Estuary.

7.6.82 The conservation and WFD objectives for the Tees Estuary and Teesmouth & Cleveland Coast SPA/Ramsar site also require nitrogen loading of the estuary to be reduced. In particular, it is the intertidal and terrestrial areas of the Tees estuary that are of most concern (notably Seal Sands). Given this context, it is notable that the raw water for the Proposed Development is abstracted from the River Tees upstream, therefore resulting in the overall load of nutrients in the Seal Sands area and intertidal sections of the Estuary being reduced, given that the process water discharge does not return any nitrogen to the estuary but instead is discharged to Tees Coastal WFD water body (under Case 2B).

7.6.83 Assessment of nutrient flows in Appendix 9B Nutrient Neutrality Assessment (ES Volume III, EN070009/APP/6.4) indicates that there would be 1.33 kg/hr of total nitrogen abstracted form the River Tees upstream through NWL's supply under Case 1B, or 1.74 kg/hr under Case 2B. Under Case 1B, a low-volume liquid waste stream containing salts and nutrients would be transported off-site by tanker to an approved and licensed facility and treated in a manner consistent with nutrient neutrality requirements by either a) denitrification and discharge of resultant effluent within the habitats site catchment or b) discharging outside of the habitats site catchment. Under Case 2B treated effluent would be discharged to Tees Bay. Given that modelling indicates that the discharge under Case 2B does not return into the Tees Estuary, then this represents a significant reduction in nutrient load in the sensitive areas of the water body.

7.6.84 Should Bran Sands WwTW be used for foul water disposal then there would be an estimated discharge of 0.011 kg/hr of total nitrogen to the water body. However, this would still represent an overall total nitrogen reduction of 1.319 kg/hr and 1.729 kg/hr to the estuary once the upstream abstraction is taken into account.

7.6.85 As such, it is not considered that there would be potential for non-compliance against the DIN objective for Tees Transitional WFD water body, or any non-compliance with any WFD element or objective.

Foul Wastewater

7.6.86 There is the potential for foul water to be discharged to Tees Transitional WFD water body via Bran Sands WwTW. It is assumed that NWL will treat foul water from the Proposed Development Site within their consent limits and in accordance with requirements to not cause deterioration or prevent improvement under the WFD.

7.6.87 No further operational impacts are predicted to this water body. There will be pipe bridges over tributaries of the water body, but these would not have any impact during operation. As such, the Proposed Development would be compliant with all WFD objectives for this water body.

Tees Estuary (S Bank) Water body (The Fleet)

7.6.88 No operational impacts are predicted to this water body given that it does not have any direct hydrological connection to the Proposed Development. There will be pipe bridges over the watercourse, but all operational surface water runoff and process water discharges are directed to the Tees Coastal or Tees transitional water bodies.

As such, the Proposed Development would be compliant with all WFD objectives for this water body.

Tees Mercia Mudstone & Redcar Mudstone Groundwater Body and Tees Sherwood Sandstone Water Framework Directive groundwater body

7.6.89 All surface water runoff and treated process water from areas of hardstanding on the Main Site will be discharged to surface water. There are no planned discharges to groundwater during operation. There is some potential for leaks, spillages and contamination from storage of chemicals and use of fuels that could affect groundwater. However, any such fuel and chemical storage areas would be bunded/separated as outlined in 'Operation Phase Mitigation' above to prevent spread of spillages and to allow rapid clean up and removal for off-site disposal. Given that the majority of spillages would be directed to the surface water drainage system (including treatment and isolation potential), and that storage areas would be adequately bunded/separated, negligible impacts on these WFD groundwater bodies are predicted during operation of the Proposed Development. The Proposed Development would therefore be compliant with all WFD objectives for these water bodies.

Cumulative Impacts on WFD Water Bodies during Operation

7.6.90 There is the potential for cumulative impacts on WFD waterbodies during operation. This is considered in detail in EIA terms in Appendix 23D: Stage 4 - Assessment of Cumulative and Combined Effects (ES Volume III, EN070009/APP/6.4).

7.6.91 The neighbouring NZT project (ID3) is of particular importance, as under Case 2B for the Proposed Development, process wastewater would be discharged to Tees Bay via a proposed new outfall to be built for the NZT development's wastewater and surface water runoff. Hydrodynamic dispersion modelling has been undertaken of the cumulative impact of the combined discharge from NZT and the Proposed Development, as described in Appendix 9B: Water Quality Modelling Report (ES Volume III, EN070009/APP/6.4).

7.6.92 Near and far field modelling indicated that the cumulative impact of discharges from the Proposed Development Site and NZT site is larger for all polluting substances and temperature at all stages of the tidal cycle than for the Proposed Development alone, as would be expected, with mixing zones more likely to reach the water surface. However, the thermal mixing zones remain extremely small and pollutants are diluted to below the EQS value within a very short distance of the discharge point. Concentrations of DIN are slightly elevated above background concentrations over a wider area than the Proposed Development alone, but the overall increase in average and maximum pollutant concentrations do not exceed EQS values, taking into account the complex tidal currents in this region which can result in pollutants accumulating in shallow water. The near field and far field modelling results show that the development proposals for both the Proposed Development Site and NZT site include sufficient treatment of process effluent to

ensure that there is no significant impact on water quality of Tees Bay Coastal WFD water body due to the cumulative impact of discharges from both sites.

7.6.93 Furthermore, it is assumed that drainage strategies for all of the other developments included in the cumulative assessment (Appendix 23D: Stage 4 - Assessment of Cumulative and Combined Effects (ES Volume III, EN070009/APP/6.4)) have been or will be produced with reference to relevant policies and guidance and will have to show that they are compliant with WFD requirements. The Proposed Development assessed in this Chapter will similarly be designed to ensure no long-term deterioration in water quality or impact to marine and aquatic habitats and species. Attenuation and treatment will be provided for runoff from the Proposed Development prior to discharge to waterbodies as has been outlined in this assessment. As such, provided that all the mitigation measures are implemented for all schemes, then the cumulative impacts from the Proposed Development and the above schemes will not cause a deterioration or prevention in future improvement to any of the identified WFD water bodies assessed herein.

7.7 Decommissioning

7.7.1 At the end of its operating life (25 years for Phase 1 and Phase 2), all above-ground equipment associated with the Proposed Development will be decommissioned and removed from the site. The same timescales apply for the hydrogen pipeline and other connections. It is assumed that all underground infrastructure would remain in-situ, however, all connection and access points would be sealed or grouted to ensure disconnection.

7.7.2 On this basis, decommissioning impacts are expected to be limited to water bodies in proximity to the Proposed Development Site (i.e., primarily Tees Estuary (including Dabholm Gut and Greatham Creek), Tees Bay and The Fleet (Tees Estuary (S Bank)) and will be similar to the impacts reported for the construction phase, but with fewer earthworks, excavations and tunnel arisings to manage.

7.7.3 A detailed Decommissioning Environmental Management Plan (DEMP) would be produced pursuant to a DCO Requirement. This would identify the required measures to prevent pollution during this phase of the development. The DEMP would be agreed with the Environment Agency.

7.7.4 Overall, no significant effects are anticipated during Proposed Development decommissioning provided that the appropriate mitigation measures are implemented, and therefore there is not anticipated to be any non-compliance with WFD objectives.

7.8 Mitigation Measures / Reasons for not Achieving Good Status Assessment

7.8.1 No mitigation measures have been provided by the Environment Agency for the Tees Transitional, Tees Coastal and Tees Mercia Mudstone and Redcar Mudstone groundwater body. As such, consideration has been given to the potential impact of the Proposed Development on the pressures and reasons for not achieving Good Status/Potential that can be viewed on the Environment Agency's Catchment Data Explorer Website (see Table 7-3Table to Table 7-6). As the Tees Sherwood

Sandstone WFD groundwater body is already at Good Ecological Potential, no pressures are listed for these water bodies.

7.8.2 With the available information about the pressures and reasons for not being at Good Ecological Status or Good Ecological Potential no potential non-compliance with the WFD objective 'failure to prevent improvement' is predicted.

7.8.3 The Environment Agency have provided mitigation measures for the Tees Estuary (S Bank). An assessment has been made in Table regarding whether the Proposed Development has the potential to prevent implementation of these mitigation measures. It is concluded that the Proposed Development will not prevent implementation of any of these mitigation measures.

Table 7-3: Tees Coastal Water Body – Assessment Against Reasons for not Achieving Good Status and Reasons for Deterioration

CLASSIFICATION ELEMENT AFFECTED	PRESSURE TYPE	ACTIVITY	APPRAISAL
Mitigation Measures Assessment	Physical Modification	Local and Central Government / Sector under Investigation	It is proposed to use the existing water discharge pipeline which is to be installed as part of the NZT project (i.e. subject to a separate consent). As such, no construction will take place within the water body for this project and it is not considered that the Proposed Development would prevent implementation of improvements in terms of physical modifications.

Table 7-4: Tees Estuary Water Body – Assessment Against Reasons for not Achieving Good Status and Reasons for Deterioration

CLASSIFICATION ELEMENT AFFECTED	PRESSURE TYPE	ACTIVITY	APPRAISAL
Tributyltin Compounds	Diffuse source	Contaminated water body bed sediments	There is no potential for mobilisation of bed sediments which may contain tributyltin compounds.
Angiosperms	Physical modification	Coastal Squeeze	No new structures proposed within the water body and so there should be no impact on the angiosperm WFD classification from physical

CLASSIFICATION ELEMENT AFFECTED	PRESSURE TYPE	ACTIVITY	APPRAISAL
			modification associated with the Proposed Development.
Polybrominated diphenyl ethers (PBDE)	Unknown	Unknown	PBDEs are flame retardants found in a wide array of products and can commonly pollute watercourses. Measures to protect watercourses from pollution during construction are outlined in the Final CEMP(s) and Outline WMP. As such, there is not anticipated to be any impact on PBDEs as a result of the Proposed Development in this water body.
Dissolved Inorganic Nitrogen	Diffuse Source	Agriculture – Poor nutrient management	Not applicable – relates to other parts of the catchment
	Point Source	Water Industry – Sewage discharge (continuous)	Sanitary wastewater from welfare facilities will be treated at a Northumbrian Water WwTW. This is assumed to be either the Marske-by-the-Sea or Brans Sands WwTW, but this is still to be confirmed. 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. Consultation will continue with NWL as the Proposed Development evolves to ensure there is sufficient capacity to take foul water from the Proposed Development.
	Point Source	Industry – Trade / Industry discharge	Should surface water runoff be discharged to Tees Estuary via the STDC drainage infrastructure then the Surface Water Drainage Strategy ensures sufficient treatment for runoff

CLASSIFICATION ELEMENT AFFECTED	PRESSURE TYPE	ACTIVITY	APPRAISAL
			in order to prevent adverse water quality impacts. No process discharge would discharge to Tees Estuary.
Macroalgae	Diffuse Source	Agriculture – Poor nutrient management	Not applicable – relates to other parts of the catchment
	Point Source	Navigation – Ports and harbours (structures) and recreation	There will be no construction impacts relating to navigation and so will not have any impact on the macroalgae classification.
	Physical modification	Coastal squeeze	No new permanent structures are proposed, and so there should be no impact on the macroalgae WFD classification from physical modification associated with the Proposed Development.
	Point Source	Industry – trade / industry discharge	Should surface water runoff be discharged to Tees Estuary via the STDC drainage infrastructure then the Detailed Surface Water Drainage Strategy will ensure sufficient treatment for runoff in order to prevent adverse water quality impacts. No process discharge would discharge to Tees Estuary.
	Point Source	Sewage discharge (continuous)	Foul water from the Proposed Development will be treated at Marske-by-the-Sea or Bran Sands WwTW and discharged to Tees Bay under the conditions of Northumbrian Water's environmental permit. Northumbrian Water is responsible for ensuring no deterioration or prevention of improvement in the receiving water body from their treatment works. Consultation will continue with NWL as the scheme develops to ensure there is sufficient

CLASSIFICATION ELEMENT AFFECTED	PRESSURE TYPE	ACTIVITY	APPRAISAL
			capacity to take foul water from the Proposed Development.
Invertebrates	Point Source	Sewage discharge (continuous)	Sanitary wastewater from welfare facilities will be treated at a Northumbrian Water WwTW. This is assumed to be either the Marske-by-the-Sea or Brans Sands WwTW, but this is still to be confirmed. 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. Consultation will continue with NWL as the scheme develops to ensure there is sufficient capacity to take foul water from the Proposed Development.
	Point Source	Industry – trade / industry discharge	Should surface water runoff be discharged to Tees Estuary via the STDC drainage infrastructure then the Detailed Surface Water Drainage Strategy will ensure sufficient treatment for runoff in order to prevent adverse water quality impacts. No process discharge would discharge to Tees Estuary.

Table 7-5: Tees Mercia Mudstone and Redcar Mudstone Groundwater Body – Assessment against Reasons for not Achieving Good Status and Reasons for Deterioration

CLASSIFICATION ELEMENT AFFECTED	PRESSURE TYPE	ACTIVITY	APPRAISAL
Chemical Dependent	Point Source	Mining and Quarrying –	Pollution impacts to groundwater during construction would be controlled through measures outlined in the Final CEMP(s),

CLASSIFICATION ELEMENT AFFECTED	PRESSURE TYPE	ACTIVITY	APPRAISAL
Surface Water Body Status		Abandoned Mine	Final WMP, and Remediation Strategy. Any piling operations required would be subject to foundation works risk assessment and any potential to cause pollution to the aquifer would be covered by measures to be detailed in piling method statements. There are no planned discharges to groundwater during operation. There is potential for leaks, spillages and contamination from storage of chemicals and use of fuels that may affect groundwater. However, any fuel and chemical storage areas would be bunded to prevent spread of spillages and to allow rapid clean up and removal for off-site disposal. Given the above, there is not considered to be any prevention of future improvement of the Chemical Dependent Surface Water Body Status for this groundwater body.

Table 7-6: Tees Estuary (S Bank) – Mitigation Measures Assessment

MITIGATION MEASURE OPTION	MITIGATION MEASURE SCREENING AND STATUS	APPRAISAL
Restore or increase floodplain (lateral) connectivity	Required but not yet implemented	No new structures (e.g. culverts) are proposed over the watercourse, but only the use of existing infrastructure (a pipe bridge). There would be no adverse impacts on future implementation of this mitigation measure
Install fish passes	Required but not yet implemented	Not applicable
Enhance existing structures to improve ecology	Required but not yet implemented	No works to existing structures are planned with the exception of potentially strengthening existing pipe bridges to accommodate new pipes. There would be

MITIGATION MEASURE OPTION	MITIGATION MEASURE SCREENING AND STATUS	APPRAISAL
		no adverse impacts on future implementation of this mitigation measure.
Remove obsolete structure(s)	Required but not yet implemented	No works to existing structures are planned with the exception of potentially strengthening existing pipe bridges to accommodate new pipes. There would be no adverse impacts on future implementation of this mitigation measure.
Implement changes to locks etc.	Required but not yet implemented	Not applicable
Implement appropriate vegetation control technique	Required but not yet implemented	The Proposed Development does not prevent this mitigation measure from being implemented in future, with no works to vegetation proposed.
Implement appropriate timing (vegetation control)	Required but not yet implemented	The Proposed Development does not prevent this mitigation measure from being implemented in future, with no works to vegetation proposed.
Implement invasive species techniques	Required but not yet implemented	The Final CEMP(s) will include measures to ensure that invasive species are not spread during construction. The Proposed Development does not prevent this mitigation measure from being implemented in future, with no works to vegetation proposed.
Retain habitats	Required but not yet implemented	The Proposed Development does not prevent this mitigation measure from being implemented in future, with no works to vegetation proposed. Any potential construction impacts that may affect habitats (e.g. runoff of sediment or chemical spillages) will be dealt with by good practice measures outlined in the Final CEMP(s).
Ensure maintenance minimises habitat impact	Required but not yet implemented	The Proposed Development does not prevent this mitigation measure from being implemented in future, with no works to the watercourse proposed following strengthening of pipe bridge structures.

MITIGATION MEASURE OPTION	MITIGATION MEASURE SCREENING AND STATUS	APPRAISAL
Remove or soften hard bank engineering	Required but not yet implemented	There are no works proposed to the banks of this watercourse. This will not prevent future softening of watercourse banks.
Ensure maintenance prevents sediment transfer	Required but not yet implemented	The Proposed Development does not prevent this mitigation measure from being implemented in future, and mitigation measures described in the Final CEMP(s) will be implemented to prevent further sediment entering the watercourse during construction.
Water level management	In place and functioning effectively	The Proposed Development does not prevent this mitigation measure from being implemented in future, with no works that might impact water levels proposed. All surface water runoff and process water will be discharged to Tees Coastal water body rather than this watercourse.
Preserve or restore habitats	Required but not yet implemented	The Proposed Development does not prevent this mitigation measure from being implemented in future, with no works that might impact habitats proposed to this watercourse. Any potential construction impacts that may affect habitats (e.g. runoff of sediment or chemical spillages) will be dealt with by good practice measures outlined in the Final CEMP(s).
Educate landowners	Required but not yet implemented	Not applicable – applies elsewhere in the catchment.
Restore or Increase In-channel morphological diversity	Required but not yet implemented	The Proposed Development does not prevent this mitigation measure from being implemented in future, with no direct works to the channel bed or banks proposed that might influence morphology.
Re-opening of culverts	Required but not yet implemented	No works to existing structures are planned with the exception of pipe bridges that will need strengthening to accommodate new pipes. There would be no adverse impacts on future implementation of this mitigation measure.
Alter culvert channel bed	Required but not yet implemented	No works to existing structures are planned with the exception of potentially strengthening existing pipe

MITIGATION MEASURE OPTION	MITIGATION MEASURE SCREENING AND STATUS	APPRAISAL
		bridges to accommodate new pipes. There would be no adverse impacts on future implementation of this mitigation measure.

7.9 Enhancements

7.9.1 The Environment Agency have highlighted notable enhancement projects at the Tees Estuary during consultation, in particular the following:

- Tees Estuary Edges Enhancement Study (2018) (University of Hull): this study aimed to identify a framework of habitat enhancement opportunities to improve biodiversity provision and habitat connectivity within the Tees. There is considered potential for functional provision to be improved for species associated with the existing and proposed SPA designation (e.g. increased foraging potential for waders using intertidal mudflat habitat and breeding birds such as tern species through improvements to essential fish habitats and associated populations). The study focused on areas along the Tees estuary (from barrage to mouth) where estuary edges improvement techniques could be applied. Identified techniques included re-profiling foreshore levels, vegetated floating pontoons, fish habitat creation and extending intertidal areas (Boyes, Cutts and Thomson, 2018);
- The Tees Tideland project is currently assessing the potential for implementing measures to restore habitats in the Holme Fleet / Belasis Beck catchment that would formerly naturally have formed part of the Tees Estuary intertidal area, and to restore ecological connectivity with the Tees Estuary; and
- The Canal and River Trust (CRT) are developing designs to secure enhanced fish passage across the Tees Barrage and so throughout the Tees catchment.

7.9.2 The Proposed Development does not introduce any additional constraints to these enhancements to the WFD catchments being able to brought forward. However, these potential opportunities have not been used as part of the WFD assessment process presented here, whereby no deterioration or prevention of future improvement has been identified for any water body.

8.0 CONCLUSION

8.1.1 The WFD assessment indicates that, based on the current understanding of the Proposed Development, no significant adverse impacts to WFD relevant water bodies will occur and therefore the Proposed Development is compliant with WFD objectives, provided that the outlined mitigation measures are implemented.

8.1.2 These mitigation measures include good practice to be adopted during construction to manage all pollution risks, and which will be implemented by the EPC Contractor(s) using a Final WMP and Final CEMP(s). During operation, mitigation measures will includes implementation of a detailed Surface Water Drainage Strategy, and appropriate measures to manage the risk of future spillages or pollution incidents occurring on the Site.

8.1.3 A number of permissions will be required from the Environment Agency (through permitting or protective provisions approval, depending on the activity) and these will provide an additional check on the proposed works (refer to Other Consents and Licenses Statement (EN070009/APP/5.7)).

8.1.4 Consultation with Northumbrian Water has been undertaken. It is understood that there is sufficient supply of water to accommodate the Proposed Development's water demands.

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ANNEX A WFD WATER BODY ASSESSMENTS CYCLE 3

Table A-1: Surface Water Body Classification Details – Tees Coastal

RMBP PARAMETER	NORTHUMBRIA MIDDLE CYCLE 3 2022 CLASSIFICATION
RBMP	Northumbria RMBP
Water body Name and ID	Tees Coastal - GB650301500005
Water Body Type	Coastal Water
Hydromorphological Designation	Heavily Modified
Length	-
Catchment area	8844.241 ha
Overall Ecological Potential	Moderate
Chemical Status	Does not require assessment
Downstream Water body	-
Supporting elements (Surface Water)	Moderate
Mitigation Measures Assessment	Moderate or less
Biological Quality Elements	High
Angiosperms	-
Fish	-
Invertebrates	High
Macroalgae	-
Phytoplankton	High
Physico-Chemical Parameters	High
Dissolved Inorganic Nitrogen	-
Dissolved oxygen	High
Hydromorphological Supporting Elements	-
Specific Pollutants	High
Arsenic	High
Copper	High
Iron	High
Zinc	High

RMBP PARAMETER	NORTHUMBRIA MIDDLE CYCLE 3 2022 CLASSIFICATION
Priority Substances	Does not require assessment
Fluoranthene	-
Lead and Its Compounds	-
Nickel and Its Compounds	-
Other Pollutants	Does not require assessment
Priority Hazardous Substances	Does not require assessment
Polybrominated diphenyl ethers (PBDEs)	-
Perfluoroctane sulphonate (PFOS)	-
Benzo(a)pyrene	-
Cadmium and Its Compounds	-
Dioxins and dioxin-like compounds	-
Heptachlor and cis-Heptachlor epoxide	-
Hexabromocyclododecane (HBCDD)	-
Hexachlorobenzene	-
Hexachlorobutadiene	-
Mercury and Its Compounds	-

Table A-2: Surface Water Body Classification Details - Tees

RMBP PARAMETER	CYCLE 3 2022 CLASSIFICATION
RBMP	Northumbria RMBP
Water body Name and ID	TEES - GB510302509900
Water Body Type	Transitional Water
Hydromorphological Designation	Heavily Modified
Length	-
Catchment area	1148.102 ha
Overall Ecological Potential	Moderate
Chemical Status	Does not require assessment
Downstream Water body	-
Supporting elements (Surface Water)	Moderate

RMBP PARAMETER	CYCLE 3 2022 CLASSIFICATION
Mitigation Measures Assessment	Moderate or Less
Biological Quality Elements	Moderate
Angiosperms	Moderate
Fish	Moderate
Invertebrates	Good
Macroalgae	Good
Phytoplankton	Good
Physico-Chemical Parameters	*Moderate*
Dissolved Inorganic Nitrogen	Moderate
Dissolved Oxygen	High
Hydromorphological Supporting Elements	*Supports Good*
Hydrological regime	Supports Good
Specific Pollutants	*High*
Chlorothalonil	High
Pendimenthalin	High
Chromium (IV)	High
Triclosan	High
2,4-dichlorophenol	High
2,4-dichlorophenoxyacetic acid	High
Arensic	High
Copper	High
Diazinon	High
Dimethoate	High
Iron	High
Linuron	High
Mecoprop	High
Phenol	High
Toluene	High
Un-ionised ammonia	High

RMBP PARAMETER	CYCLE 3 2022 CLASSIFICATION
Zinc	High
Priority Substances	Does not require assessment
1,2-dichloroethane	-
Atrazine	-
Benzene	-
Alachlor	-
Chlorpyrifos	-
Cypermethrin (Priority hazardous)	-
Octylphenol	-
Dichlorvos (Priority)	-
Aclonifen	-
Bifenox	-
Chlorfenvinphos	-
Cybutryne (Irgarol®)	-
Terbutryn	-
Dichloromethane	-
Diuron	-
Fluoranthene	-
Isoproturon	-
Lead and Its Compounds	-
Napthalene	-
Nickel and Its Compounds	-
Pentachlorophenol	-
Simazine	-
Trichlorobenzenes	-
Trichloromethane	-
Other Pollutants	Does not require assessment
Aldrin, Dieldrin. Endrin and Isodrin	-
Carbon Tetrachloride	-

RMBP PARAMETER	CYCLE 3 2022 CLASSIFICATION
DDT Total	-
para - para DDT	-
Tetrachloroethylene	-
Trichloroethylene	-
Priority Hazardous Substances	Does not require assessment
Anthracene	-
Polybrominated diphenyl ethers (PBDE)	-
Perfluorooctane sulphonate (PFOS)	-
Cadmium and Its Compounds	-
Dioxins and dioxin-like compounds	-
Benzo(b)fluoranthene	-
Benzo(g-h-i)perylene	-
Benzo(k)fluoranthene	-
Heptachlor and cis-Heptachlor epoxide	-
Hexabromocyclododecane (HBCDD)	-
Quinoxyfen	-
Di(2-ethylhexyl) phthalate (Priority hazardous)	-
Endosulfan	-
Hexachlorobenzene	-
Hexachlorobutadiene	-
Mercury and Its Compounds	-
Nonylphenol	-
Pentachlorobenzene	-
Tributyltin Compounds	-
Trifluralin (Priority hazardous)	-

Table A-3: Surface Water Body Classification Details - Tees Estuary (S Bank)

RMBP PARAMETER	WFD CYCLE 3 2022 CLASSIFICATION
RBMP	Northumbria RMBP

RMBP PARAMETER	WFD CYCLE 3 2022 CLASSIFICATION
Water body Name and ID	Tees Estuary (S Bank) - GB103025072320
Water Body Type	River
Hydromorphological Designation	Heavily Modified
Length	8.721 km
Catchment area	3245.943 ha
Overall Ecological Potential	Moderate
Chemical Status	Does not require assessment
Downstream Water body	Tees (GB510302509900)
Supporting elements (Surface Water)	Moderate
Mitigation Measures Assessment	Moderate or Less
Biological Quality Elements	Bad
Invertebrates	Bad
Physico-Chemical Parameters	-
Hydromorphological SupportingElements	Supports Good
Hydrological regime	Supports Good
Specific Pollutants	-
Priority Substances	Does not require assessment
Cypermethrin (Priority hazardous)	-
Fluoranthene	-
Other Pollutants	Does not require assessment
Priority Hazardous Substances	Does not require assessment
Polybrominated diphenyl ethers (PBDE)	-
Perfluorooctane sulphonate (PFOS)	-
Dioxins and dioxin-like compounds	-
Heptachlor and cis-Heptachlor epoxide	-
Hexabromocyclododecane (HBCDD)	-
Hexachlorobenzene	-
Hexachlorobutadiene	-
Mercury and Its Compounds	-

Table A-4: Surface Water Body Classification Details - Cowbridge Beck from Source to North Burn Water Body

RMBP PARAMETER	WFD CYCLE 3 2022 CLASSIFICATION
RBMP	Northumbria RMBP
Water body Name and ID	Cowbridge Beck from Source to North Burn - GB103025072380
Water Body Type	River
Hydromorphological Designation	Not designated heavily modified or artificial
Length	4.64 km
Catchment area	1342.06 ha
Overall Ecological Potential	Moderate
Chemical Status	Does not require assessment
Downstream Water body	Tees (GB510302509900)
Biological Quality Elements	Moderate
Invertebrates	Moderate
Macrophytes and Phytobenthos Combined	Moderate
Physico-Chemical Parameters	Moderate
Ammonia	High
Dissolved oxygen	Good
Phosphate	Moderate
Temperature	High
pH	High
Hydromorphological Supporting Elements	Supports Good
Hydrological regime	Supports Good
Specific Pollutants	*High*
Triclosan	High
Priority Substances	Does not require assessment
Cypermethrin (Priority hazardous)	-
Fluoranthene	-
Other Pollutants	Does not require assessment

RMBP PARAMETER	WFD CYCLE 3 2022 CLASSIFICATION
Priority Hazardous Substances	Does not require assessment
Polybrominated diphenyl ethers (PBDE)	-
Perfluorooctane sulphonate (PFOS)	-
Dioxins and dioxin-like compounds	-
Heptachlor and cis-Heptachlor epoxide	-
Hexabromocyclododecane (HBCDD)	-
Hexachlorobenzene	-
Hexachlorobutadiene	-
Mercury and Its Compounds	-

Table A-5: Surface Water Body Classification Details - North Burn from Source to Claxton Beck Water Body

RMBP PARAMETER	WFD CYCLE 3 2022 CLASSIFICATION
RBMP	Northumbria RMBP
Water body Name and ID	North Burn from Source to Claxton Beck - GB103025072540
Water Body Type	River
Hydromorphological Designation	Not designated heavily modified or artificial
Length	25.742 km
Catchment area	30.098 ha
Overall Ecological Potential	Bad
Chemical Status	Does not require assessment
Downstream Water body	Tees (GB510302509900)
Biological Quality Elements	Bad
Fish	Bad
Invertebrates	Good
Macrophytes and Phytobenthos Combined	High
Physico-Chemical Parameters	Good
Ammonia	High

RMBP PARAMETER	WFD CYCLE 3 2022 CLASSIFICATION
Dissolved oxygen	High
Phosphate	Good
Temperature	Good
pH	High
Hydromorphological Supporting Elements	Supports Good
Hydrological regime	High
Priority Substances	Does not require assessment
Cypermethrin (Priority hazardous)	-
Fluoranthene	-
Other Pollutants	Does not require assessment
Priority Hazardous Substances	Does not require assessment
Polybrominated diphenyl ethers (PBDE)	-
Perfluorooctane sulphonate (PFOS)	-
Dioxins and dioxin-like compounds	-
Heptachlor and cis-Heptachlor epoxide	-
Hexabromocyclododecane (HBCDD)	-
Hexachlorobenzene	-
Hexachlorobutadiene	-
Mercury and Its Compounds	-

Table A-6: Tees Estuary (S Bank) - Mitigation Measures

MITIGATION MEASURE OPTION	MITIGATION MEASURE SCREENING AND STATUS
Restore or increase floodplain (lateral) connectivity	Required but not yet implemented
Install fish passes	Required but not yet implemented
Enhance existing structures to improve ecology	Required but not yet implemented
Enhance existing structures to improve ecology	Required but not yet implemented
Remove obsolete structure(s)	Required but not yet implemented

MITIGATION MEASURE OPTION	MITIGATION MEASURE SCREENING AND STATUS
Implement changes to locks etc.	Required but not yet implemented
Implement appropriate vegetation control technique	Required but not yet implemented
Implement appropriate timing (vegetation control)	Required but not yet implemented
Implement invasive species techniques	Required but not yet implemented
Retain habitats	Required but not yet implemented
Ensure maintenance minimises habitat impact	Required but not yet implemented
Remove or soften hard bank engineering	Required but not yet implemented
Ensure maintenance prevents sediment transfer	Required but not yet implemented
Water level management	In place and functioning effectively
Preserve or restore habitats	Required but not yet implemented
Educate landowners	Required but not yet implemented
Restore or Increase In-channel morphological diversity	Required but not yet implemented
Re-opening of culverts	Required but not yet implemented
Alter culvert channel bed	Required but not yet implemented

Table A-7: Ground Water Body Classification Details - Tees Sherwood Sandstone

RMBP PARAMETER	WFD CYCLE 3 2019 CLASSIFICATION
RBMP	Northumbria RMBP
Water body Name and ID	Tees Sherwood Sandstone – GB40301G702000
Water Body Type	Groundwater Body
Groundwater Area	29,301.122 ha
Surface Area	293.011 km^2
Overall Water Body Status	Good
Quantitative Status	Good
Quantitative Saline Intrusion	Good

RMBP PARAMETER	WFD CYCLE 3 2019 CLASSIFICATION
Quantitative Water Balance	Good
Quantitative GWDTEs Test	Good
Quantitative Dependent Surface Water Body Status	Good
Chemical Status	Good
Chemical Drinking Water Protected Area	Good
General Chemical Test	Good
Chemical GWDTEs Test	Good
Chemical Dependent Surface Water Body Status	Good
Chemical Saline Intrusion	Good
Supporting Elements	
Prevent and Limit Objective	Active
Trend Assessment	No Trend

Table A-8: Ground Water Body Classification Details - Tees Mercia Mudstone & Redcar Mudstone

RMBP PARAMETER	WFD CYCLE 3 2019 CLASSIFICATION
RBMP	Northumbria RMBP
Water body Name and ID	Tees Mercia Mudstone & Redcar Mudstone – GB40302G701300
Water Body Type	Groundwater Body
Groundwater Area	49,457.045 ha
Surface Area	494.57 km^2
Overall Water Body Status	Poor
Quantitative Status	Good
Quantitative Saline Intrusion	Good
Quantitative Water Balance	Good
Quantitative GWDTEs Test	Good

RMBP PARAMETER	WFD CYCLE 3 2019 CLASSIFICATION
Quantitative Dependent Surface Water Body Status	Good
Chemical Status	Poor
Chemical Drinking Water Protected Area	Poor
General Chemical Test	Poor
Chemical GWDTEs Test	Good
Chemical Dependent Surface Water Body Status	Good
Chemical Saline Intrusion	Good
Supporting Elements	
Prevent and Limit Objective	Active
Trend Assessment	Upward Trend

ANNEX B SURFACE WATER QUALITY DATA

Table B-4: Summary of Water Quality Data for Wilton Complex Main Effluent Composite Based on Monitoring Data from January 2019 – March 2023

DETERMINAND	UNIT	MEAN	10th PERCENTILE	90th PERCENTILE	NO. OF SAMPLES
BOD	mg/l	28	10	45.0	174
Chromium	µg/l	10	3.53	15.9	174
Chloroform	µg/l	20	7.95	37.7	174
Copper	µg/l	11	7	15	174
Zinc	µg/l	59	38	79.7	174

Table B-5: Summary of Water Quality Data for Bran Sands (Outfall) Based on Monitoring Between 2009-2019

DETERMINAND	UNIT	MEAN	10th PERCENTILE	90th PERCENTILE	NO. OF SAMPLES
pH	pH	8.1	8.01	8.23	6
Temperature of Water	°C	10.77	6.81	16.04	6
Ammoniacal Nitrogen as N	mg/l	0.48	0.15	0.75	5
Nitrogen, Total Oxidised as N	mg/l	0.75	0.20	1.27	5
Nitrate as N	mg/l	0.70	0.18	1.20	5
Nitrite as N	mg/l	0.05	0.01	0.09	5
Orthophosphate, reactive as P	mg/l	0.07	0.03	0.10	5
Oxygen, Dissolved, % Saturation	%	114.20	114.20	114.20	1

Table B-6: Summary of Water Quality Data for River Tees at Dabholm Gut Confluence (Surface) Based on Monitoring Between January 2019 – March 2023

DETERMINAND	UNIT	MEAN	10th PERCENTILE	90th PERCENTILE	NO. OF SAMPLES
Copper, Dissolved	µg/l	1.24	0.64	1.85	10
Zinc, Dissolved	µg/l	5.9	3.04	8.34	10

Table B-7: Summary of Water Quality Data for Greatham Creek-100m from out – Surface Based on Monitoring Between 2009 – 2019

DETERMINAND	UNIT	MEAN	10th PERCENTILE	90th PERCENTILE	NO. OF SAMPLES
pH	pH	8.00	7.98	8.13	17
Temperature of Water	°C	11.32	6.05	14.95	17
Ammoniacal Nitrogen as N	mg/l	0.21	0.16	0.29	5
Arsenic, Dissolved	µg/l	1.19	1	1.41	11
Copper, Dissolved	µg/l	0.69	0.36	0.94	9
Zinc, Dissolved	µg/l	3.14	2.21	5.09	12
Cadmium, Dissolved	µg/l	<0.04	<0.04	<0.04	<0.04
Nickel, Dissolved	µg/l	0.83	0.47	1.26	12
Nitrogen, Total Oxidised as N	mg/l	0.39	0.2	0.69	5
Nitrate as N	mg/l	0.37	0.18	0.67	5
Nitrite as N	mg/l	0.02	0.01	0.02	5
Orthophosphate, reactive as P	mg/l	0.05	0.04	0.07	5
Oxygen, Dissolved as O_2	mg/l	8.4	7.55	9.47	12
Oxygen, Dissolved, % Saturation	%	92.47	86.74	97.17	12

Table B-8: Summary of Water Quality Data for Billingham Beck 50m U/S of River Tees Confluence Based on Monitoring Between 2019 – 2021

DETERMINAND	UNIT	MEAN	10th PERCENTILE	90th PERCENTILE	NO. OF SAMPLES
pH	pH units	7.5	7.0	7.9	15
Temperature of Water	°C	13.9	6.8	20.4	15
Ammoniacal Nitrogen as N	mg/l	16.7	7.6	33.1	15

DETERMINAND	UNIT	MEAN	10th PERCENTILE	90th PERCENTILE	NO. OF SAMPLES
Carbon, Organic, Dissolved as C- {DOC}	mg/l	12.2	11.0	13.8	3
Copper, Dissolved	µg/l	3.0	2.4	3.7	3
Zinc, Dissolved	µg/l	6.3	5.3	7.4	3
Nitrogen, Total Oxidised as N	mg/l	19.4	6.2	38.2	15
Nitrate as N	mg/l	19.3	6.1	38.1	15
Nitrite as N	mg/l	0.1	0.1	0.2	15
Orthophosphate, reactive as P	mg/l	1.8	0.3	3.3	15
Oxygen, Dissolved as O_2	mg/l	8.9	7.0	11.2	15
Oxygen, Dissolved, % Saturation	%	85.2	76.1	97.4	15

Table B-9: Summary of Water Quality Data for Billingham Beck at Billingham Bottoms Based on Monitoring Between January 2019 – March 2023

DETERMINAND	UNIT	MEAN	10th PERCENTILE	90th PERCENTILE	NO. OF SAMPLES
pH	pH Units	8.0	7.8	8.3	24
Temperature of Water	°C	9.5	4.2	15.1	24
Ammoniacal Nitrogen as N	mg/l	0.1	0.0	0.2	24
Nitrogen, Total Oxidised as N	mg/l	5.2	2.9	8.4	24
Nitrate as N	mg/l	5.2	2.9	8.3	24
Nitrite as N	mg/l	0.03	0.01	0.06	24
Orthophosphate, reactive as P	mg/l	0.3	0.1	0.394	24
Oxygen, Dissolved as O2	mg/l	9.9	6.9	12.4	24

DETERMINAND	UNIT	MEAN	10th PERCENTILE	90th PERCENTILE	NO. OF SAMPLES
Oxygen, Dissolved, % Saturation	%	85.0	67.9	95.1	24

ANNEX C POND 14 WATER QUALITY MONITORING TECHNICAL NOTE

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PLATES

C.0 ANNEX C – WATER QUALITY MONITORING TECHNICAL NOTE – POND 14

C.1 Introduction

Background

C.1.1 The Coatham Sand Dunes are part of the South Gare and Coatham Sands Site of Special Scientific Interest (SSSI). They were formed through natural processes following the construction of the South Gare Breakwater. However, to the south of these dunes there is an extensive tract of made ground between the dunes and the former Redcar Steelworks, formed of historic slag deposits. Within the dunes and area of made ground there is a complex of ponds and wetlands.

C.1.2 According to the Natural England citation (Natural England, 1988) for the site, "*The site known as South Gare and Coatham Sands is of considerable interest for its flora, invertebrate fauna and birdlife. The range of habitats present includes extensive tracts of intertidal mud and sand, sand dunes, saltmarsh and freshwater marsh which have all developed since the construction of the South Gare breakwater with tipped slag during the 1860's. Also exposed at low tide are areas of rocky foreshore along the breakwater, three slag banks known as the German Charlies, and Coatham Rocks*."

C.1.3 In the UK, there is a general trend for dune slack ponds to be drying out and becoming more nutrient enriched. Using historical satellite imagery, it is evident that these ponds (albeit not natural 'dune slacks') have been succeeding as the spatial area of the standing water bodies has significantly decreased over the last 20 years.

C.1.4 As part of the Environmental Impact Assessment (EIA) for the Net Zero Teesside (NZT) project, a combination of site walkovers, water quality and water level monitoring were undertaken between September 2020 and January 2021 at Coatham Sand Dunes in order to better understand the current baseline conditions and help characterise the water chemistry of the single remaining open water pond (hereafter referred to as 'Pond 14') (bp, 2021). Further water quality monitoring was undertaken between December 2022 and February 2023 in support of the Proposed Development to determine whether conditions had changed in Pond 14.

C.1.5 This baseline data provides an indication of trophic status and the pond's sensitivity to atmospheric nitrogen / ammonia deposition. Furthermore, the various site visits have provided an opportunity to better understand the hydrology of these ponds and temporal fluctuations or trends (including the possibility of any tidal influence).

C.1.6 The data presented herein informs the assessment within Chapter 9, Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2) and the Water Framework Directive Assessment (EN070009/APP/5.14).

C.2 Water Quality and Hydrology of Dune Slack Ponds

C.2.1 Dune slack ponds are thought to be more sensitive to nutrient enrichment than other small still water bodies as they do not tend to have catchments from where nutrients may be sourced. If a water body is already nutrient rich, then it will be less sensitive to increases in atmospheric nutrient deposits than other still waters.

C.2.2 Large water bodies and those that have short residence times will also tend to be less sensitive as they offer greater dilution or flushing of excess nutrients. However, a small waterbody that is naturally oligotrophic (i.e. relatively poor in nutrients) and with a long residence time (i.e. low overturn or flushing of the water column) will tend to be more sensitive to excess deposition of nutrients, potentially including the loads from atmospheric deposition.

C.2.3 Where flushing rates are limited, small waterbodies will tend to accumulate nitrogen / ammonia, and this will result in changes in water chemistry and lead to poorer conditions for aquatic organisms.

C.2.4 Furthermore, any reduction in water levels and the overall size of a water body may reduce dilution and limit dissolved oxygen (DO) levels, which may already be reduced due to the effects of eutrophication. However, biological activity may remove nutrients from the water column during the growing season, although seasonal die back of vegetation can re-release nutrients back into the water column.

C.2.5 Small waterbodies with long residence times may also be susceptible to changes in pH, although the presence of bases may allow the water body to buffer the risk from acidification.

C.2.6 Overall, water chemistry, conversion and removal processes, hydrology and biological activity are all important considerations.

C.2.7 The sensitivity of a pond and the risk of acidification, nutrient enrichment or other chemical changes due to the deposition of nitrogen and ammonia will depend on changes in atmospheric deposition / amount of atmospheric deposition, pond hydrology, and water chemistry, conversion and removal processes.

C.2.8 A plan of the dune slack ponds at Coatham Sand Dunes is shown in Plate C-1.

Plate C-1: Dune Slack Ponds at Coatham Dunes

C.3 Groundwater

Groundwater Levels

C.3.1 Groundwater level, as measured in an observation borehole, reflects the amount of water in storage in the monitored aquifer. In general, when recharge exceeds natural discharge plus abstraction, groundwater levels rise. When recharge is less than natural discharge plus abstraction, groundwater levels fall. In addition to this, groundwater levels at the shoreline may also be influenced by the rise and fall of the tide.

Current Groundwater Levels

C.3.2 British Geological Survey (BGS) Geological maps (BGS, n.d.) show substantial covering of beach and tidal flat deposits (sand), blown sand and Tidal Flat Deposits (sand, silt and clay) across the sand dune complex. These superficial deposits are classed as a Secondary A Aquifer. Beneath this, the local bedrock is Mercia Mudstone, which is classified as a Secondary B Aquifer.

C.3.3 Historic BGS logs (BGS, n.d.) located within the former Redcar steelworks site and less than 200 m from the Coatham Dunes indicate that superficial deposits are over 15 m thick above the Mercia Mudstone (e.g. BGS Borehole ID 718374, NGR NZ

56627 25778), which would indicate a sizeable superficial aquifer extending inland. This would also imply that there is the possibility of groundwater supporting the hydrology of these dune slack ponds. However, there is clear evidence especially on the more landward side of the sand dunes, that the natural superficial deposits have been interfered with by past industrial activity with extensive Made Ground, including surrounding Pond 14 (see Plate C-2 for the location of this pond). As a result, the hydrology of these ponds may differ considerably from the natural processes controlling the formation and character of dune slacks.

C.3.4 Dune slacks are normally formed by blow outs and erosion of the sand down to the Groundwater Level (GWL) and thus their hydrology is usually controlled by groundwater rather than surface water contributions (there is no surface drainage network to provide an inflow). This Annex considers the relative position of previously monitored groundwater depth beneath the SSSI and the location and likely depth of these ponds, drawing a theoretical (and linear) GWL between the monitoring point and either Mean High Water (MHW) and Mean Low Water (MLW) (as inferred from the further position of the sea on Ordnance Survey maps). This is shown in Plate C-1, below, with the monitoring location on the left of each image, and the MHW and MLW to the right, and a theoretical line between the two.

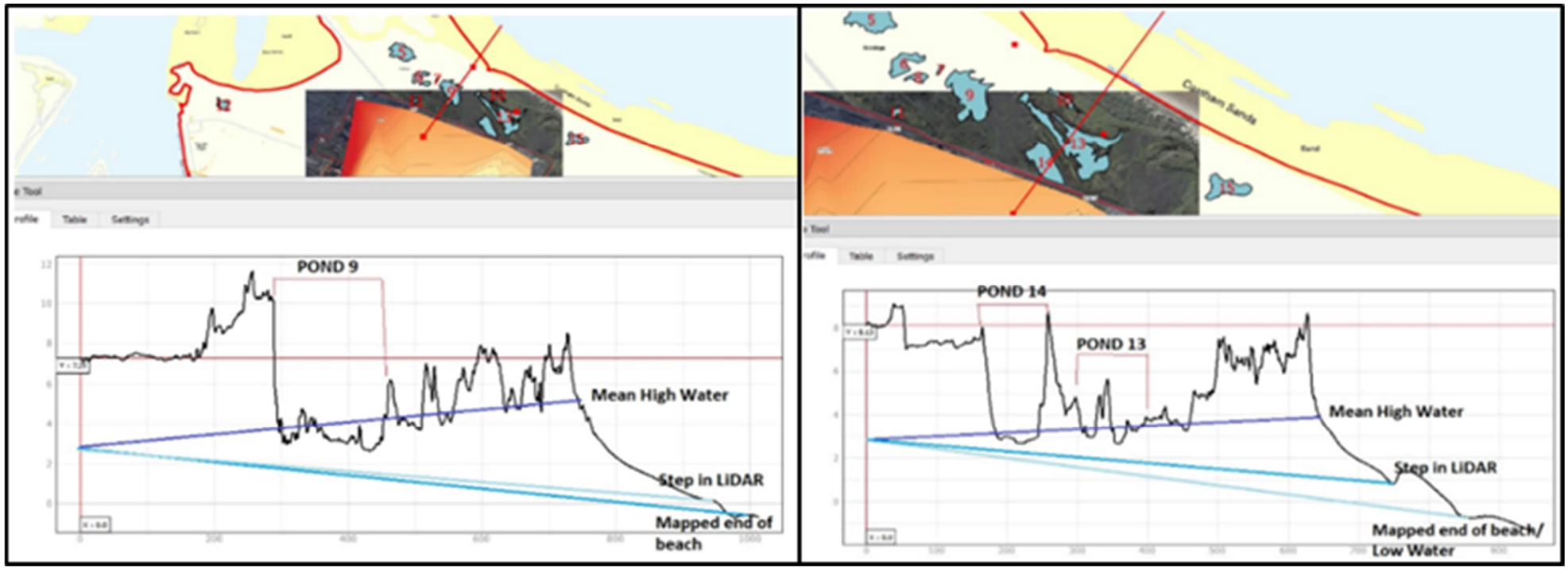

Plate C-2: Graphs Showing Theoretical GWL Between SSSI Site and MHW/MLW (bp, 2021)

C.3.5 If one assumes that the Light Detection and Ranging (Lidar) is sensitive to water level (some penetration is expected, and this may explain why the Lidar data is not level for each pond) then one must also consider a pond depth below the level shown. Site evidence indicates that water depths are generally <1 m. Although a linear and static GWL would not be expected, this illustrates that GWL may well intersect with the base of some of these ponds and thus cannot be ruled out.

C.3.6 Theoretically, there could also be ingress from the sea to the ponds at MHW, but the influence from the sea will be dependent on the duration of time the head is higher than GWL and how easily the signal is transmitted to groundwater through the ground and ultimately to the ponds (which depends on the permeability of the ground). Salinity readings taken during ecology surveys for NZT (bp, 2021) suggested only marginal salinity, and this would indicate a more limited connectivity with the sea (for example, only slightly brackish conditions may potentially be caused by salt spray).

C.3.7 Overall, the potential role of groundwater in the superficial deposits in driving water levels in the dune slacks cannot be determined without more detailed investigations (including seasonal trends in GWL over time (GWL may fluctuate seasonally to intercept the base of slacks).

C.3.8 Groundwater Dependent Terrestrial Ecosystems (GWDTEs) do not need to hold open water but can be sensitive to groundwater close to the surface, i.e. groundwater interactions exist even if groundwater is not above the surface. However, the limited groundwater data that is available suggests flow towards the shore. Refer to Chapter 10: Geology, Hydrogeology and Contaminated Land (ES Volume I, EN070009/APP/6.2) for more details regarding ground conditions.

C.4 Site Walkover

C.4.1 A site walkover was undertaken on 17 September 2020 as part of the NZT Project (bp, 2021), in dry, fair-weather conditions. All waterbodies marked on Plate C-1 were viewed on site.

C.4.2 The site walkover involved making visual observations of all ponds identified on Ordnance Survey maps and aerial imagery. Where open water ponds were located DO and temperature data was collected using a self-calibrating handheld YSI Pro20 probe.

C.4.3 The site walkover confirmed that all ponds are unnatural features developed in the historic slag deposits, and their hydrological functioning is unlikely to be consistent to typical sand dune slacks (that are found more to seaward).

C.4.4 Notably, only one of these ponds (Pond 14), contained open water and could be considered a ‘pond’ and surface waterbody. The remaining waterbodies are fully overgrown with emergent macrophytes to the extent that no open water could be observed, and so they should be considered as wetlands. This remained the case throughout the water quality monitoring period, which included periods of heavy rainfall in December 2020 and January 2021.

C.4.5 Typical photos of the waterbodies are shown in Plate C-3 and Plate C-4Error! Reference source not found., and the open water of Pond 14 in Plate C-5, Plate C-6 and Plate C-7.

Plate C-3: Panoramic Photo of ‘Waterbody’ 5

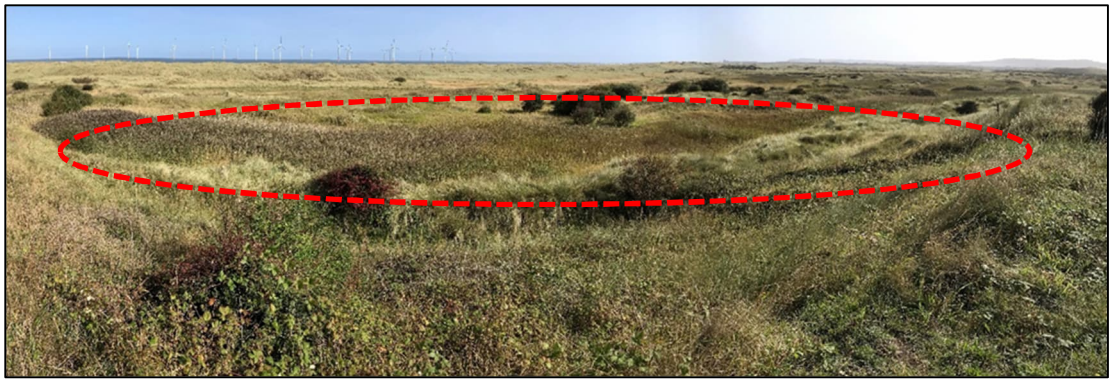

Plate C-4: Panoramic Photo of ‘Waterbody’ 13

Plate C-5: Panoramic Photo of Pond 14, taken on 17 September 2020

Plate C-6: Panoramic Photo of Pond 14, taken on 8th October 2020

Plate C-7: Panoramic Photos of Pond 14, taken on 21st January 2021

C.5 Designated Conservation Sites

C.5.1 The ponds between the Coatham Sands and former Redcar steelworks fall under the Teesmouth and Cleveland Coast SSSI designation. This is a large SSSI consisting of 33 units.

C.5.2 Unit 28 is 'South Gare and Coatham Sands'. This unit itself is 143 ha in area, while the whole SSSI is 2,964 ha in size. The citation details for this SSSI (Natural England, 2018) state the following with regard to freshwater waterbodies:

The Teesmouth and Cleveland Coast SSSI is an extensive mosaic of coastal and freshwater habitats centred on the Tees Estuary. These include sand dunes, saltmarshes, mudflats, rocky and sandy shores, saline lagoons, grazing marshes, reedbeds and freshwater wetlands.

The site supports an extensive complex of dunes flanking both side of the Tees estuary. It is the largest dune complex between Druridge Bay and Spurn Point. The dunes support a large area of semi-natural vegetation, including the typical succession from strandline through foredunes and mobile dunes to fixed dune grassland, as well as transitions to wetter habitats.

There are two main dune systems: Seaton Dunes to the north of the Tees, and Coatham Dunes to the south. The structure and geomorphology of both systems has

been heavily influenced by a long history of human intervention, including sand extraction. Most significant has been the construction of two large breakwaters (North Gare and South Gare), which guard the entrance to the estuary. They have a strong influence on sediment dynamics and result in both dune systems showing a combination of the features of bay and spit dune systems.

There are a number of damp depressions ('slacks') in both dune systems, which support a range of wetter vegetation types, usually with a sward dominated by mixtures of red fescue, Yorkshire fog (Holcus lanatus) and creeping bent (Agrostis stolonifera). Creeping willow (Salix repens) is extremely scarce in the Tees Estuary and so does not form a regular component of the dune slacks in contrast to many dunes systems. A particularly prominent feature of some of the slacks are large and colourful stands of marsh orchids (Dactylorhiza) species and their hybrids. Some of the slacks show affinities with saltmarsh vegetation, with a selection of salt tolerant species such as saltmarsh rush (Juncus gerardii), sea plantain (Plantago maritima) and sea-milkwort (Glaux maritima), and are likely to have been derived from the isolation of saltmarsh vegetation by developing dunes. More consistently wet slacks support swamp communities. Fertile feather moss (Drepanocladus polygamous) and flat-sedge (Blysmus compressus) occur in some of the slacks.

C.5.3 Pond 14 is not a true sand dune slack and does not appear to support the above interest features. The pond is an artificial feature and appears to have limited biodiversity with few ecological features of note aside from a stand of common reed (*Phragmites australis*) at its northern margin, which is not thought to contribute to the designation of the SSSI Unit. However, the pond provides open water habitat which is limited in the sand dune complex and habitat at times for certain bird populations, particularly redshank (*Tringa totanus*), who move inland to open water at high tide.

C.5.4 It should be noted that the ponds at Coatham Sands are also within the Teesmouth and Cleveland Coast Special Protection Area (SPA). The SPA was first classified in 1995 for its numbers of European importance of breeding little tern, passage sandwich tern, wintering Red knot (*Calidris canutus islandica*) and passage Common redshank (*Tringa totanus tetanus*) as well as an assemblage of over 20,000 waterbirds. At this time only Pond 5 (as shown in Plate C-1) was in the designation The SPA was updated in 2000 to include additional areas of coastal and wetland habitats important for waterbirds. Coatham Sands is an important feeding and roosting areas for waders, notably red knot and sanderling.

C.5.5 The ponds are also within the Teesmouth and Cleveland Coast Ramsar site (Ramsar Sites Information Service, n.d.). The Ramsar site was first classified in 1995 for encompassing a range of habitats which support internationally important numbers of waterbirds, such as Common redshank (*Tringa totanus*) and wintering Red knot (*Calidris canutus islandica*).

C.5.6 Following formal consultation in 2018 led by Natural England, the Teesmouth and Cleveland Coast SPA and Ramsar sites were extended on the 16 January 2020, and now encompass the ponds shown in Plate C-1 having only included Pond 5 prior to this date.

C.6 Monitoring Approach

Water Quality Monitoring

C.6.1 Water quality monitoring at Pond 14 at Coatham Sands SSSI was initially undertaken between October 2020 and January 2021 in support of the NZT Project (bp, 2021). During this period eight water samples were collected for laboratory analysis, as well as in situ measurements of temperature and DO. Surveyors returned to the site between December 2022 and February 2023 and collected 3 further samples in support of the Proposed Development. The main aim of the latter sampling was to determine whether there had been any appreciable change from baseline conditions.

C.6.2 Monitoring was undertaken across a variety of climatic conditions where feasible, to understand the effects of these external factors on Pond 14 water quality and hydrology.

C.6.3 Water quality samples were analysed for a comprehensive suite, as summarised below in Table C-1.

Table C-1: Water Quality Analysis Suite

DETERMINANDS	UNITS	DETERMINANDS	UNITS
Biochemical Oxygen Demand (BOD)	mg/l	Metals (total and dissolved)	µg/l
Ammoniacal Nitrogen	mg/l	Colour	pcu
Unionised Ammonia	mg/l	Salinity	%
Nitrate	mg/l	Chlorophyll A	µg/l
Nitrite	mg/l	Total Organic Carbon	mg/l
Total Oxidised Nitrogen	mg/l	Dissolved Organic Carbon	mg/l
Total Inorganic Nitrogen	mg/l	Total Phosphorous	µg/l
Chloride	mg/l	Soluble Reactive Phosphorus (Orthophosphate as PO_4)	mg/l
Total Suspended Solids (TSS)	mg/l	Polycyclic Aromatic Hydrocarbons (PAHs)	µg/l
Turbidity	NTU	Total Petroleum Hydrocarbons (TPHs)	µg/l
pH	pH units	Temperature (in situ)	°C
Alkalinity	mg/l	Dissolved Oxygen (in situ)	mg/l
Electrical Conductivity	µS/cm	Semi-Volatile Compounds (SVOCs)	µg/l
Polychlorinated biphenyls (PCBs)	µg/l	Phenols	µg/l

DETERMINANDS	UNITS	DETERMINANDS	UNITS
Earth Metals (dissolved)	mg/l	Iron II and III (dissolved)	mg/l

C.6.4 DO and water temperature were measured in situ using a fully calibrated handheld probe (YSI Pro20).

C.6.5 Reported results of Polyaromatic Hydrocarbons (PAHs), Total Petroleum Hydrocarbons (TPHs), Polychlorinated biphenyls (PCBs), Semi-Volatile Organic Compounds (SVOCs) and Phenols all fell below the laboratory limit of detection (LoD). The LoDs are generally higher than the WFD annual average Environmental Quality Standards (EQS) but lower than some of the maximum allowable concentration EQS. However, not all of the organic compounds have standards. Overall, samples were not analysed for PCBs, SVOCs and Phenols after the initial visit, and PAHs and TPHs after the second sampling visit of the initial sampling run. Samples were analysed for these determinands during the later sample runs; however, results were again below LoD.

C.6.6 The raw results for 2022/2023 and summary data (averages, maximum, minimum and percentile data) can be found in Attachment 1. For the previous 2020/2021 data refer to the Net Zero Teesside WFD Assessment (bp, 2021).

C.7 Results

Water Quality Monitoring

C.7.1 Table C-2 summarises the water quality results for physico-chemical, major ions, nutrients and sanitary pollutants in Pond 14. See Attacment 1 for raw laboratory results and further statistical summary data.

C.7.2 Due to the water in Pond 14 being slightly ‘brackish’ with a mean specific electrical conductivity in the 2022/2023 samples of 3,111 µS/cm (‘clean’ freshwater would typically not have an electrical conductivity above 2,000 µS/cm), it is considered appropriate to compare the results against WFD saltwater standards for specific pollutants (where relevant). Furthermore, DO results are compared against the standards for transitional and coastal waters with salinities <35[1], and ammonia against the standards for lakes (HM Government, 2015).

C.7.3 Some compounds are compared against the WFD Annual Average (AA-EQS) and Maximum Allowable Concentration EQS (MAC-EQS) for Priority Substances and Other Pollutants for inland surface waters (HM Government, 2015).

[1] Salinity is a measure of the concentration of dissolved salts in seawater - it has no units but is nearly equal to the weight in grams of dissolved salts per kilogram of seawater.

Table C-2: Summary of Water Quality Result Averages for Physico-chemical, Major Ions, Nutrients and Sanitary Pollutants

PARAMETER	UNITS	LIMIT OF DETECTION	2020/2021 AVERAGE	2022/2023 AVERAGE	AVERAGE % CHANGE
Temperature	ºC	N/A	7.37	6.30	-14.48%
Dissolved Oxygen (%)	% Sat.	N/A	106.0	97.2	-8.32%
Dissolved Oxygen (mg/l)	mg/l	N/A	12.72	11.94	-6.12%
Apparent Colour	mg/l PtCo	<15	34.8	29.5	-15.23%
pH	pH units	<0.01	7.67	7.82	1.91%
Total Alkalinity as $CaCO_3$	mg/l	<1	61.25	76.00	24.08%
Electrical Conductivity @25C	uS/cm	<2	2250	3111	38.28%
Salinity	%	<0.1	0.11	0.20	75.00%
Chloride	mg/l	<0.3	243.46	307.23	26.19%
BOD (Settled)	mg/l	<1	1.5	Below LoD	
Total Suspended Solids	mg/l	<10	18.4	Below LoD	
Turbidity	NTU	<0.1	6.43	4.10	-36.19%
Dissolved Organic Carbon	mg/l	<2	3.86	3.67	-4.94%
Total Organic Carbon	mg/l	<2	5.25	4	-23.81%
Free Ammonia as N	mg/l	<0.006	Below LoD		
Ammoniacal Nitrogen as N	mg/l	<0.03	0.05	0.05	-7.41%
Total Oxidised Nitrogen as N	mg/l	<0.2	Below LoD		
Inorganic Nitrogen	mg/l	<0.05	0.05	Below LoD	
Total Nitrogen	mg/l	<0.5	1.10	0.50	-54.55%
Nitrate as NO_3	mg/l	<0.2	0.2	0.4	100.00%
Nitrite as NO_2	mg/l	<0.02	Below LoD		
Ortho Phosphate as PO_4	mg/l	<0.06	Below LoD		
Chlorophyll A	µg/l	<1	21.25	Below LoD	

C.7.4 Average DO values were 106% and 12.72 mg/l in the 2020/2021 results indicating supersaturation (i.e. over 100%) which is often associated with photosynthesis activity during daylight hours, and / or significant aeration. The large water-air interface and exposed nature of Pond 14 is considered to have the greatest

influence on aeration compared to photosynthesis, especially due to lack of macrophytes and the timing of the monitoring over the late autumn and winter period. For the 2022/2023 results, the average DO values did see a reduction of 8.3% down to 97.2% and by 6.1% to 11.94 mg/l.

C.7.5 Average DO values of 12.72 mg/l and 11.94 mg/l are both classified as 'High' under the WFD DO standards for transitional and coastal water with salinities <35, suggesting that the pond is well oxygenated.

C.7.6 The highest DO values were recorded during the 6th and 7th visits in 2020/2021 at 114.8% and 119.8% respectively, which coincided with the lowest recorded pond temperatures of 2.2ºC and 1.6ºC respectively, consistent with the solubility of oxygen increasing with decreasing temperature. Furthermore, the 6th and 7th visits also coincided with rainfall which may have added to increased DO levels at the time of monitoring. It is possible that DO levels will fall in the summer as water level decreases and the water warms. However, there appears to be a lack of faunal organisms to consume oxygen, and a lack of plants that might decompose later in the year and further deplete DO levels.

C.7.7 The average pH value is circum-neutral at 7.82 in the 2022/2023 readings. Minimum and maximum values across all the samples of 7.18 and 8.01, respectively, indicate Pond 14 is within generally acceptable pH levels for aquatic organisms.

C.7.8 Average electrical conductivity was 2,250 µS/cm in 2020/2021 and 3,111 µS/cm in 2022/2023. However, during the 6th visit the electrical conductivity was recorded at 1,386 µs/m which lies within the upper end of what is generally considered freshwater. This value coincided with rain during the site visit and snowmelt the previous day, suggesting precipitation has a strong influence on conductivity in Pond 14. The water temperature was also a lot lower which would reduce electrical conductivity readings. The wide variation of individual readings between 1,386 µS/cm and 3,232 µS/cm further shows that conductivity varies widely over the course of the year depending on temperature and precipitation.

C.7.9 Average Ammoniacal Nitrogen was 0.05 mg/l during both sampling periods, marginally above the laboratory LoD, indicating a negligible presence of sanitary pollutants in the pond. This falls within the WFD 'Good' category for a Type 3 lake, defined as having an alkalinity between 50 and 100 mg/l. This is reinforced by low Biochemical Oxygen Demand (BOD) values. Furthermore, average Nitrate in 2022/2023 is 0.4 mg/l, whilst average Nitrite is below LoD.

C.7.10 Average Total Nitrogen concentration in 2020/2021 was 1.1 mg/l with a maximum of 1.6 mg/l. In 2022/2023 a fall of 54.55% to an average of 0.5 mg/l was recorded. Average Total Phosphorus concentration also fell from 0.047 mg/l (2020/2021) to 0.011 mg/l (2022/2023). Based on these average concentrations in 2022/2023, the total nitrogen (TN) to total phosphorus (TP) ratio is 45.5, indicating that phosphorus is by far the limiting nutrient, with total nitrogen inputs expected to predominantly be related to atmospheric deposition. Further details on the potential impact of nitrogen deposition from the Proposed Development can be found in Chapter 9 Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2).

C.7.11 In the 2020/2021 data Chlorophyll a has a mean concentration of 21.25 µg/l, with a maximum concentration of 70 µg/l, indicating that the pond would typically be considered eutrophic (i.e. nutrient enriched) but can become hyper-eutrophic. The 2022/2023 data was under the LoD. More data would be needed to fully determine the trophic status of the pond. Macrophytes are not abundant, but it is likely that there are other controls that are preventing colonisation of the pond by macrophytes. The variable water levels or perhaps a hard, impenetrable bed from Made Ground just beneath a soft veneer of organic sediment that prevents rooting by plants are possible reasons.

C.7.12 Tables C-3 and C-4 below summarise the water quality results for a number of metals and metalloids including those often associated with the steel making process such as arsenic, chromium, cadmium, zinc, nickel and boron. These are compared against the WFD standards. See Attachment 1 for raw laboratory results.

Table C-3: Summary of Water Quality Result Averages for Metals

PARAMETER	UNIT	LOD	20/21 AVERAGE	22/23 AVERAGE	AVERAGE % CHANGE
Dissolved Heavy Metals					
Aluminium	µg/l	<20	22.33	Below LoD	
Antimony	µg/l	<2	4	Below LoD	
Arsenic	µg/l	<2.5	3.43	Below LoD	
Barium	µg/l	<3	20.38	22.67	11.25%
Beryllium	µg/l	<0.5	Below LoD		
Boron	µg/l	<12	503.25	750.67	49.16%
Cadmium	µg/l	<0.5	Below LoD		
Chromium	µg/l	<1.5	Below LoD		
Cobalt	µg/l	<2	Below LoD		
Copper	µg/l	<7	Below LoD		
Iron	µg/l	<20	30.17	59.67	97.79%
Lead	µg/l	<5	Below LoD		
Manganese	µg/l	<2	36.63	145.33	296.81%
Mercury	µg/l	<1	Below LoD		
Molybdenum	µg/l	<2	217.75	200.00	-8.15%
Nickel	µg/l	<2	2	Below LoD	
Phosphorus	µg/l	<5	8.2	6.33	-22.76%

PARAMETER	UNIT	LOD	20/21 AVERAGE	22/23 AVERAGE	AVERAGE % CHANGE
Selenium	µg/l	<3	4	Below LoD	
Thallium	µg/l	<3	Below LoD		
Vanadium	µg/l	<1.5	1.95	Below LoD	
Zinc	µg/l	<3	4.25	6	41.18%
Dissolved Earth Metals					
Calcium	mg/l	<0.2	274.53	564.57	105.65%
Magnesium	mg/l	<0.1	28.68	47.27	64.84%
Potassium	mg/l	<0.1	50.68	82.57	62.93%
Sodium	mg/l	<0.1	112.00	182.30	62.77%
Dissolved Iron II and III					
Iron II	mg/l	<0.02	0.04	0.03	-25.00%
Iron III	mg/l	<0.02	0.02	0.05	150.00%

C.7.13 Both average dissolved arsenic (3.43 µg/l in 2020/2021 and < LoD in 2022/2023) and average dissolved zinc (4.25 µg/l in 2020/2021 and 6 µg/l in 2022/2023) fall below the WFD long-term (mean) standard for specific pollutants of 25 µg/l and 10.9 µg/l (i.e. 6.8 µg/l plus 4.1 µg/l Tees catchment ambient background concentration), respectively.

C.7.14 Average dissolved nickel and its compounds falls below the AA-EQS and MAC-EQS of 4 µg/l and 8.6 µg/l respectively.

C.7.15 Average dissolved mercury and its compounds were not detected above its LoD of 1 µg/l. However, its MAC-EQS of 0.07 µg/l indicates that there is a 0.93 µg/l margin where the WFD standard could be exceeded without detection.

C.7.16 Similarly, average dissolved cadmium and its compounds were not detected above its LoD of 0.5 µg/l. Its AA-EQS of 0.09 µg/ indicates that there is a 0.41 µg/l margin where the WFD standard could be exceeded without detection. However, its MAC-EQS of 0.6 µg/l was not exceeded.

Table C-4: Summary of Water Quality Result Averages for Total Metals

PARAMETER	UNIT	LOD	2020/2021 AVERAGE	2022/2023 AVERAGE	AVERAGE % CHANGE
Total Metals					
Aluminium	µg/l	<20	160.33	44.33	-72.35%
Antimony	µg/l	<2	8	2	-75.00%
Arsenic	µg/l	<2.5	3.05	Below LoD	
Barium	µg/l	<3	21.13	20.00	-5.33%
Beryllium	µg/l	<0.5	Below LoD		
Boron	µg/l	<12	494.38	717.33	45.10%
Cadmium	µg/l	<0.5	Below LoD		
Chromium	µg/l	<1.5	Below LoD		
Cobalt	µg/l	<2	Below LoD		
Copper	µg/l	<7	Below LoD		
Iron	µg/l	<20	795	259	-67.42%
Lead	µg/l	<5	Below LoD		
Manganese	µg/l	<2	65.25	134.67	106.39%
Mercury	µg/l	<1	Below LoD		
Molybdenum	µg/l	<2	213.88	212.67	-0.56%
Nickel	µg/l	<2	2		
Phosphorus	µg/l	<5	47.00	11.33	-75.89%
Selenium	µg/l	<3	5.5	Below LoD	
Thallium	µg/l	<3	Below LoD		
Vanadium	µg/l	<1.5	3	Below LoD	
Zinc	µg/l	<3	7.63	7.33	-3.83%

C.7.17 The results show that beryllium, cadmium, chromium, cobalt, copper, lead, mercury and thallium are all below the LoD for both dissolved and total concentrations.

C.7.18 Elevated levels of boron and molybdenum were recorded with the 2022/2023 data giving average dissolved values of 750.67 µg/l and 200 µg/l respectively, and total values of 707.33 µg/l and 212.67 µg/l, respectively. Boron concentrations were recorded to increase from the end of the 2020/2021 data to the 2022/2023 data by 49% (dissolved) and 45% (total).

C.7.19 Both average dissolved and total boron and molybdenum concentrations are significantly elevated suggesting that not only are their concentrations high, but these metals are primarily present in their soluble forms. In the 2020/2021 data, both average total aluminium and iron concentrations are significantly higher than their dissolved concentrations: 160.3 µg/l and 795 µg/l compared to 22.33 µg/l and 30.77 µg/l respectively. As total metal concentration equals dissolved metal concentration plus the particulate (insoluble) metal concentration, this suggests there is a much higher proportion of insoluble aluminium and iron in Pond 14 compared to the soluble portion. In the 2022/2023 data dissolved aluminium levels fell below LoD. However, average Dissolved iron increased by 97.8% from 30.17 µg/l to 59.67µg/l in the 2022/2023 data. Total Iron decreased by 67.4%.

C.7.20 Average dissolved manganese increased by almost 300% between the two datasets from 36.63 µg/l to 145.33 µg/l. Total Manganese also increased by 106% from 65.25 µg/l to 134.67 µg/l. Similarly, concentrations of Dissolved Earth Metals were all recorded to increase by over 60%, with calcium concentrations increasing by 105.7% from 274.53 mg/l to 564.57 mg/l.

C.7.21 These metals, along with the majority of others analysed, may have been used as part of the steel manufacturing process at the former SSI works, with the pond being formed in slag deposits from the works. However, it is not possible to determine the reasons behind the variability in metal concentrations found in Pond 14 based on the water quality sampling results alone. It might be considered that the type of steel manufactured (and associated materials) influenced the concentration of metals in the waste product (i.e. slag deposits, which can change over time). For example, boron and molybdenum can be used in the steel manufacturing process to improve high-temperature strength and corrosion resistance.

Water Level Monitoring

C.7.22 Previous results of water level monitoring at Pond 14 (bp, 2021) indicated that the water level does not appear to correlate to changes in the tide and tide height. This would suggest water levels are primarily being recharged by precipitation from late autumn and likely until early spring, with minimal connection to groundwater.

C.7.23 Recorded increases in water levels towards mid-winter when the past monitoring ended did not correlate with changes in tidal state and is most likely related to the winter season being generally wetter with higher average rainfalls than summer and autumn months, and lower levels of evaporation.

Runoff and Overland Flow

C.7.24 No evidence of any surface water runoff or other overland flow pathways into Pond 14 were observed during the monitoring site visits, which included monitoring coincident with heavy rainfall.

C.8 Conclusions

C.8.1 The water quality monitoring results suggest that water quality is generally stable with physico-chemical parameters primarily affected by changes in seasonal climate

such as rainfall and temperature. The pond water is slightly brackish overall, well-oxygenated and appears to be eutrophic (nutrient enriched). Several metals are elevated and are likely related to the previous industrial use of the surroundings and the slag deposits within which they are formed. While other pollutants such as sanitary products, hydrocarbons and semi-volatile organic compounds were all low in concentration or below laboratory limits of detection, the pond is not believed to support a diverse aquatic fauna and flora.

C.8.2 Water levels in Pond 14 appear to be controlled by seasonal heavy rain over the late autumn and winter periods, when direct precipitation and overland flow and seepage from surrounding embankments exceed losses from infiltration and evaporation. No influence from groundwater or the tide was observed.

C.8.3 The lack of vegetation across the pond implies that there may be a hard, impenetrable bed that is preventing rooting by plants. This would also support the notion that Made Ground is not very permeable and does not support significant volumes of groundwater. Thus, long periods of heavy rain that occurred late December 2020 and early January 2021 during the initial monitoring period, with limited infiltration and evaporation, resulted in an acceleration of the ponds recharge.

C.8.4 With limited inflows and outflows, once water is contained within the pond losses will be controlled by infiltration (unknown rate but believed to be low) and evaporation. Therefore, it is expected that the retention time in the pond will be very long and thus any chemical pollutants or excess nutrients present (or from atmospheric deposition) would tend to concentrate during periods of low rainfall, where they are not deposited on the bed or taken up by plants around the pond's northern perimeter.

C.9 References

- Natural England (1988). South Gare & Coatham Sands SSSI Designation.
- Natural England (2018). Teesmouth and Cleveland Coast SSSI Hartlepool, Middlesbrough, Redcar and Cleveland, Stockton-on-Tees.
- British Geological Society (BGS) (n.d.) *Geoindex Website.*
- HM Government (2015). *The Water Framework Directive (Standards and Classification) Directions (England and Wales).*
- bp (2021). *Net Zero Teesside DCO Document 6.4.11 ES Volume III Appendix 9C: Water Framework Directive Assessment.*
- Ramsar Sites Information Service (n.d.). *Teesmouth & Cleveland Coast.*

ATTACHMENT 1: WATER QUALITY RESULTS SUMMARY

SITE INFORMATION			ROUND 1	ROUND 2	ROUND 3	AVERAGE	MAX	MIN	90TH%ILE	10TH%ILE
Site	Coatham Sand Dunes	Job Ref	22/20573	23/1300	23/2440	For results above LoD only				
Water Body	Pond 14	Date	13/12/2022	19/01/2023	16/02/2023					
Sample Location Grid Ref	NZ 56950 25950	Time	12:00	11:30	11:00					
		Weather Conditions	Dry, Overcast. Pond was mostly frozen	Dry, Sunny	Dry, Overcast					

PARAMETER	UNIT	LOD	ROUND 1	ROUND 2	ROUND 3	AVERAGE	MAX	MIN	90TH%ILE	10TH%ILE
Temperature	ºC	N/A	6.2	5.6	7.1	6.30	7.1	5.6	6.92	5.72
Dissolved Oxygen (%)	% Sat.	N/A	108.1	97.8	85.6	97.2	108.1	85.6	106.04	88.04
Dissolved Oxygen (mg/l)	mg/l	N/A	13.45	12.12	10.26	11.94	13.5	10.3	13.184	10.632
General Organics										
Apparent Colour	mg/l PtCo	<15	31	<15	28	29.5	31	28	30.7	28.3
pH	pH units	<0.01	7.7	7.85	7.9	7.82	7.9	7.7	7.89	7.73
Total Alkalinity as $CaCO_3$	mg/l	<1	72	78	78	76.00	78	72	78	73.2

PARAMETER	UNIT	LOD	ROUND 1	ROUND 2	ROUND 3	AVERAGE	MAX	MIN	90TH%ILE	10TH%ILE
Electrical Conductivity @25C	uS/cm	<2	3232	3131	2969	3111	3232	2969	3211.8	3001.4
Salinity	%	<0.1	0.2	0.2	0.2	0.20	0.2	0.2	0.2	0.2
Chloride	mg/l	<0.3	337.9	306.8	277	307.23	337.9	277	331.68	282.96
BOD (Settled)	mg/l	<1	<1	<1	<1	Below LoD				
Total Suspended Solids	mg/l	<10	<10	<10	<10	Below LoD				
Turbidity	NTU	<0.1	5.1	1.5	5.7	4.10	5.7	1.5	5.58	2.22
Dissolved Organic Carbon	mg/l	<2	4	3	4	3.67	4	3	4	3.2
Total Organic Carbon	mg/l	<2	4	4	4	4	4	4	4	4
Free Ammonia as N	mg/l	<0.006	<0.006	<0.006	<0.006	Below LoD				
Ammoniacal Nitrogen as N	mg/l	<0.03	<0.03	<0.03	0.05	0.05	0.05	0.05	0.05	0.05
Total Oxidised Nitrogen as N	mg/l	<0.2	<0.2	<0.2	<0.2	Below LoD				
Inorganic Nitrogen	mg/l	<0.05	<0.05	<0.05	<0.05	Below LoD				
Total Nitrogen	mg/l	<0.5	0.5	<0.5	<0.5	0.50	0.5	0.5	0.5	0.5
Nitrate as NO_3	mg/l	<0.2	<0.2	<0.2	0.4	0.4	0.4	0.4	0.4	0.4
Nitrite as NO_2	mg/l	<0.02	<0.02	<0.02	<0.02	Below LoD				
Ortho Phosphate as PO_4	mg/l	<0.06	<0.06	<0.06	<0.06	Below LoD				
Chlorophyll A	µg/l	<1	<7	<7	No sample	Below LoD				
Heavy Metals/Metalloids										
Dissolved										
Aluminium	µg/l	<20	<20	<20	<20	Below LoD				
Antimony	µg/l	<2	<2	<2	No sample	Below LoD				

PARAMETER	UNIT	LOD	ROUND 1	ROUND 2	ROUND 3	AVERAGE	MAX	MIN	90TH%ILE	10TH%ILE
Arsenic	µg/l	<2.5	<2.5	<2.5	<2.5	Below LoD				
Barium	µg/l	<3	23	23	22	22.67	23	22	23	22.2
Beryllium	µg/l	<0.5	<0.5	<0.5	<0.5	Below LoD				
Boron	µg/l	<12	774	755	723	750.67	774	723	770.2	729.4
Cadmium	µg/l	<0.5	<0.5	<0.5	<0.5	Below LoD				
Chromium	µg/l	<1.5	<1.5	<1.5	<1.5	Below LoD				
Cobalt	µg/l	<2	<2	<2	<2	Below LoD				
Copper	µg/l	<7	<7	<7	<7	Below LoD				
Iron	µg/l	<20	84	52	43	59.67	84	43	77.6	44.8
Lead	µg/l	<5	<5	<5	<5	Below LoD				
Manganese	µg/l	<2	122	126	188	145.33	188	122	175.6	122.8
Mercury	µg/l	<1	<1	<1	<1	Below LoD				
Molybdenum	µg/l	<2	163	204	233	200.00	233	163	227.2	171.2
Nickel	µg/l	<2	<2	<2	<2	Below LoD				
Phosphorus	µg/l	<5	6	6	7	6.33	7	6	6.8	6
Selenium	µg/l	<3	<3	<3	<3	Below LoD				
Thallium	µg/l	<3	<3	<3	<3	Below LoD				
Vanadium	µg/l	<1.5	<1.5	<1.5	<1.5	Below LoD				
Zinc	µg/l	<3	5	7	6	6	7	5	6.8	5.2
Dissolved Earth Metals										
Calcium	mg/l	<0.2	553.8	511.3	628.6	564.57	628.60	511.30	613.64	519.80

PARAMETER	UNIT	LOD	ROUND 1	ROUND 2	ROUND 3	AVERAGE	MAX	MIN	90TH%ILE	10TH%ILE
Magnesium	mg/l	<0.1	52	43.4	46.4	47.27	52.00	43.40	50.88	44.00
Potassium	mg/l	<0.1	89.1	79.9	78.7	82.57	89.10	78.70	87.26	78.94
Sodium	mg/l	<0.1	201.6	173.9	171.4	182.30	201.60	171.40	196.06	171.90
Dissolved Iron II and III										
Iron II	mg/l	<0.02	0.02	0.04	<0.02	0.03	0.04	0.02	0.038	0.022
Iron III	mg/l	<0.02	0.06	<0.02	0.04	0.05	0.06	0.04	0.058	0.042
Total										
Aluminium	µg/l	<20	42	22	69	44.33	69	22	63.6	26.0
Antimony	µg/l	<2	2	<2	<2	2	2	2	2	2
Arsenic	µg/l	<2.5	<2.5	<2.5	<2.5	Below LoD				
Barium	µg/l	<3	23	17	20	20.00	23	17	22.4	17.6
Beryllium	µg/l	<0.5	<0.5	<0.5	<0.5	Below LoD				
Boron	µg/l	<12	767	685	700	717.33	767	685	753.6	688
Cadmium	µg/l	<0.5	<0.5	<0.5	<0.5	Below LoD				
Chromium	µg/l	<1.5	<1.5	<1.5	<1.5	Below LoD				
Cobalt	µg/l	<2	<2	<2	<2	Below LoD				
Copper	µg/l	<7	<7	<7	<7	Below LoD				
Iron	µg/l	<20	350	95	332	259	350	95	346.4	142.4
Lead	µg/l	<5	<5	<5	<5	Below LoD				
Manganese	µg/l	<2	109	107	188	134.67	188	107	172.2	107.4
Mercury	µg/l	<1	<1	<1	<1	Below LoD				

PARAMETER	UNIT	LOD	ROUND 1	ROUND 2	ROUND 3	AVERAGE	MAX	MIN	90TH%ILE	10TH%ILE
Molybdenum	µg/l	<2	195	213	230	212.67	230	195	226.6	198.6
Nickel	µg/l	<2	<2	<2	<2	Below LoD				
Phosphorus	µg/l	<5	12	9	13	11.33	13	9	12.8	9.6
Selenium	µg/l	<3	<3	<3	<3	Below LoD				
Thallium	µg/l	<3	<3	<3	<3	Below LoD				
Vanadium	µg/l	<1.5	<1.5	<1.5	<1.5	Below LoD				
Zinc	µg/l	<3	7	7	8	7.33	8	7	7.8	7
PAH (MS)										
Naphthalene	µg/l	<0.1	<0.1	<0.1	<0.1	Below LoD				
Acenaphthylene	µg/l	<0.013	<0.005	<0.005	<0.005	Below LoD				
Acenaphthene	µg/l	<0.013	0.005	0.016	0.027	Below LoD				
Fluorene	µg/l	<0.014	<0.005	0.008	0.014	Below LoD				
Phenanthrene	µg/l	<0.011	0.008	0.007	<0.005	0.01	0.008	0.007	0.0079	0.0071
Anthracene	µg/l	<0.013	<0.005	<0.005	<0.005	Below LoD				
Fluoranthene	µg/l	<0.012	0.005	<0.005	<0.005	0.01	0.005	0.005	0.005	0.005
Pyrene	µg/l	<0.013	<0.005	<0.005	<0.005	Below LoD				
Benzo(a)anthracene	µg/l	<0.015	<0.005	<0.005	<0.005	Below LoD				
Chrysene	µg/l	<0.011	<0.005	<0.005	<0.005	Below LoD				
Benzo(bk)fluoranthene	µg/l	<0.018	<0.008	<0.008	<0.008	Below LoD				
Benzo(a)pyrene	µg/l	<0.016	<0.005	<0.005	<0.005	Below LoD				
Indeno(123cd)pyrene	µg/l	<0.011	<0.005	<0.005	<0.005	Below LoD				

PARAMETER	UNIT	LOD	ROUND 1	ROUND 2	ROUND 3	AVERAGE	MAX	MIN	90TH%ILE	10TH%ILE
Dibenzo(ah)anthracene	µg/l	<0.01	<0.005	<0.005	<0.005	Below LoD				
Benzo(ghi)perylene	µg/l	<0.011	<0.005	<0.005	<0.005	Below LoD				
PAH 16 Total	µg/l	<0.195	<0.173	<0.173	<0.173	Below LoD				
Benzo(b)fluoranthene	µg/l	<0.01	<0.008	<0.008	<0.008	Below LoD				
Benzo(k)fluoranthene	µg/l	<0.01	<0.008	<0.008	<0.008	Below LoD				
PAH Surrogate % Recovery	%	<0	75	80	90	81.67	90	75	88	76
MTBE	µg/l	<5	<5	<5	<5	Below LoD				
Benzene	µg/l	<5	<5	<5	<5	Below LoD				
Toluene	µg/l	<5	<5	<5	<5	Below LoD				
Ethylbenzene	µg/l	<5	<5	<5	<5	Below LoD				
m/p-Xylene	µg/l	<5	<5	<5	<5	Below LoD				
o-Xylene	µg/l	<5	<5	<5	<5	Below LoD				
TPH (CWG)										
Aliphatics										
>C5-C6	µg/l	<10	<10	<10	<10	Below LoD				
>C6-C8	µg/l	<10	<10	<10	<10	Below LoD				
>C8-C10	µg/l	<10	<10	<10	<10	Below LoD				
>C10-C12	µg/l	<5	<5	<5	<5	Below LoD				
>C12-C16	µg/l	<10	<10	<10	<10	Below LoD				
>C16-C21	µg/l	<10	<10	<10	<10	Below LoD				
>C21-C35	µg/l	<10	<10	<10	<10	Below LoD				

PARAMETER	UNIT	LOD	ROUND 1	ROUND 2	ROUND 3	AVERAGE	MAX	MIN	90TH%ILE	10TH%ILE
Total aliphatics C5-35	µg/l	<10	<10	<10	<10	Below LoD				
Aromatics										
>C5-EC7	µg/l	<10	<10	<10	<10	Below LoD				
>EC7-EC8	µg/l	<10	<10	<10	<10	Below LoD				
>EC8-EC10	µg/l	<10	<10	<10	<10	Below LoD				
>EC10-EC12	µg/l	<5	<5	<5	<5	Below LoD				
>EC12-EC16	µg/l	<10	<10	<10	<10	Below LoD				
>EC16-EC21	µg/l	<10	<10	<10	<10	Below LoD				
>EC21-EC35	µg/l	<10	<10	<10	<10	Below LoD				
Total aromatics C5-35	µg/l	<10	<10	<10	<10	Below LoD				
Total aliphatics and aromatics(C5-35)	µg/l	<10	<10	<10	<10	Below LoD				
PCBs										
PCB 28	µg/l	<0.1	<0.1	<0.1	<0.1	Below LoD				
PCB 52	µg/l	<0.1	<0.1	<0.1	<0.1	Below LoD				
PCB 101	µg/l	<0.1	<0.1	<0.1	<0.1	Below LoD				
PCB 118	µg/l	<0.1	<0.1	<0.1	<0.1	Below LoD				
PCB 138	µg/l	<0.1	<0.1	<0.1	<0.1	Below LoD				
PCB 153	µg/l	<0.1	<0.1	<0.1	<0.1	Below LoD				
PCB 180	µg/l	<0.1	<0.1	<0.1	<0.1	Below LoD				
Total 7 PCBs	µg/l	<0.7	<0.7	<0.7	<0.7	Below LoD				
Total Phenols HPLC	µg/l	<0.15	<0.15	<0.15	<0.15	Below LoD				

PARAMETER	UNIT	LOD	ROUND 1	ROUND 2	ROUND 3	AVERAGE	MAX	MIN	90TH%ILE	10TH%ILE
SVOC (MS)										
Phenols										
2-Chlorophenol	µg/l	<1	<1	<1	<1	Below LoD				
2-Methylphenol	µg/l	<0.5	<0.5	<0.5	<0.5	Below LoD				
2-Nitrophenol	µg/l	<0.5	<0.5	<0.5	<0.5	Below LoD				
2,4-Dichlorophenol	µg/l	<0.5	<0.5	<0.5	<0.5	Below LoD				
2,4-Dimethylphenol	µg/l	<1	<1	<1	<1	Below LoD				
2,4,5-Trichlorophenol	µg/l	<0.5	<0.5	<0.5	<0.5	Below LoD				
2,4,6-Trichlorophenol	µg/l	<1	<1	<1	<1	Below LoD				
4-Chloro-3-methylphenol	µg/l	<0.5	<0.5	<0.5	<0.5	Below LoD				
4-Methylphenol	µg/l	<1	<1	<1	<1	Below LoD				
4-Nitrophenol	µg/l	<10	<10	<10	<10	Below LoD				
Pentachlorophenol	µg/l	<1	<1	<1	<1	Below LoD				
Phenol	µg/l	<1	<1	<1	<1	Below LoD				
PAHs										
2-Chloronaphthalene	µg/l	<1	<1	<1	<1	Below LoD				
2-Methylnaphthalene	µg/l	<1	<1	<1	<1	Below LoD				
Phthalates										
Bis(2-ethylhexyl) phthalate	µg/l	<5	<5	<5	<5	Below LoD				
Butylbenzyl phthalate	µg/l	<1	<1	<1	<1	Below LoD				
Di-n-butyl phthalate	µg/l	<1.5	<1.5	<1.5	<1.5	Below LoD				

PARAMETER	UNIT	LOD	ROUND 1	ROUND 2	ROUND 3	AVERAGE	MAX	MIN	90TH%ILE	10TH%ILE
Di-n-Octyl phthalate	µg/l	<1	<1	<1	<1	Below LoD				
Diethyl phthalate	µg/l	<1	<1	<1	<1	Below LoD				
Dimethyl phthalate	µg/l	<1	<1	<1	<1	Below LoD				
Other SVOCs										
1,2-Dichlorobenzene	µg/l	<1	<1	<1	<1	Below LoD				
1,2,4-Trichlorobenzene	µg/l	<1	<1	<1	<1	Below LoD				
1,3-Dichlorobenzene	µg/l	<1	<1	<1	<1	Below LoD				
1,4-Dichlorobenzene	µg/l	<1	<1	<1	<1	Below LoD				
2-Nitroaniline	µg/l	<1	<1	<1	<1	Below LoD				
2,4-Dinitrotoluene	µg/l	<0.5	<0.5	<0.5	<0.5	Below LoD				
2,6-Dinitrotoluene	µg/l	<1	<1	<1	<1	Below LoD				
3-Nitroaniline	µg/l	<1	<1	<1	<1	Below LoD				
4-Bromophenylphenylether	µg/l	<1	<1	<1	<1	Below LoD				
4-Chloroaniline	µg/l	<1	<1	<1	<1	Below LoD				
4-Chlorophenylphenylether	µg/l	<1	<1	<1	<1	Below LoD				
4-Nitroaniline	µg/l	<0.5	<0.5	<0.5	<0.5	Below LoD				
Azobenzene	µg/l	<0.5	<0.5	<0.5	<0.5	Below LoD				
Bis(2-chloroethoxy)methane	µg/l	<0.5	<0.5	<0.5	<0.5	Below LoD				
Bis(2-chloroethyl)ether	µg/l	<1	<1	<1	<1	Below LoD				
Carbazole	µg/l	<0.5	<0.5	<0.5	<0.5	Below LoD				
Dibenzofuran	µg/l	<0.5	<0.5	<0.5	<0.5	Below LoD				

PARAMETER	UNIT	LOD	ROUND 1	ROUND 2	ROUND 3	AVERAGE	MAX	MIN	90TH%ILE	10TH%ILE
Hexachlorobenzene	µg/l	<1	<1	<1	<1	Below LoD				
Hexachlorobutadiene	µg/l	<1	<1	<1	<1	Below LoD				
Hexachlorocyclopentadiene	µg/l	<1	<1	<1	<1	Below LoD				
Hexachloroethane	µg/l	<1	<1	<1	<1	Below LoD				
Isophorone	µg/l	<0.5	<0.5	<0.5	<0.5	Below LoD				
N-nitrosodi-n-propylamine	µg/l	<0.5	<0.5	<0.5	<0.5	Below LoD				
Nitrobenzene	µg/l	<1	<1	<1	<1	Below LoD				
Surrogate Recovery 2-Fluorobiphenyl	%	<0	67	94	118	67	118	67	113.2	72.4
Surrogate Recovery p-Terphenyl-d14	%	<0	70	96	137	70	137	70	128.8	75.2

ANNEX D WATER RESOURCES TABLES

Table D-1: Water Activity Permits Within the Study Area (data provided by the Enviornment Agency, 2023)

ID (FIG 9-1)	ISSUED DATE	PERMIT NUMBER	DESCRIPTION	RECEIVING WATER BODY	WATER BODY TYPE	EFFLUENT TYPE	X	Y
D1	23-apr-02	25/04/1711	Storm tank/cso on sewerage network (water company)	Mill race	Freshwater river	Sewage discharges - sewer storm overflow - water company	446140	521420
D2	05-jul-23	254/0255	Pumping station on sewerage network (water company)	Billingham beck	Freshwater river	Sewage discharges - sewer storm overflow - water company	447069	520653
D3	05-jul-23	254/0255	Pumping station on sewerage network (water company)	Billingham beck	Freshwater river	Sewage discharges - pumping station - water company	447069	520653
D4	25-nov-19	25/04/1785	Pumping station on sewerage network (water company)	Trib of cowbridge beck	Freshwater river	Sewage discharges - pumping station - water company	447786	525271
D5	25-nov-19	25/04/1785	Pumping station on	Trib of cowbridge beck	Freshwater river	Sewage discharges -	447786	525271

ID (FIG 9-1)	ISSUED DATE	PERMIT NUMBER	DESCRIPTION	RECEIVING WATER BODY	WATER BODY TYPE	EFFLUENT TYPE	X	Y
			sewerage network (water company)			sewer storm overflow - water company		
D6	29-apr-05	254/1873	Waste collection/treatment/disposal/materials recovery	River tees saline estuary	Estuary/tidal river	Trade discharges - site drainage	447900	521100
D7	26-jul-12	254/1280	Sale of motor vehicles/maintenance + repair	Groundwater	Into land / infiltration system	Trade discharges - process effluent - not water company	447900	522200
D8	17-may-99	Qc.25/04/1581	Undefined or other	Unnamed trib of cowbridge beck	Freshwater river	Sewage discharges - final/treated effluent - not water company	447900	525400
D9	05-oct-92	254/1113	Wwtw (not water co) (not stp at a private premises)	Tees estuary	Estuary/tidal river	Sewage discharges - stw storm overflow/storm tank - not water company	447920	521150

ID (FIG 9-1)	ISSUED DATE	PERMIT NUMBER	DESCRIPTION	RECEIVING WATER BODY	WATER BODY TYPE	EFFLUENT TYPE	X	Y
D10	20-jan-09	254/1965	Wwtw/sewage treatment works (water company)	North sea	Freshwater river	Sewage discharges - stw storm overflow/storm tank - water company	448460	525840
D11	20-jan-09	254/1965	Wwtw/sewage treatment works (water company)	North sea	Sea	Sewage discharges - final/treated effluent - water company	447930	525730
D12	20-jan-09	254/1965	Wwtw/sewage treatment works (water company)	North sea	Freshwater river	Sewage discharges - stw storm overflow/storm tank - water company	448460	525840
D13	20-jan-09	254/1965	Wwtw/sewage treatment works (water company)	North sea	Freshwater river	Sewage discharges - stw storm overflow/storm tank - water company	448460	525840

ID (FIG 9-1)	ISSUED DATE	PERMIT NUMBER	DESCRIPTION	RECEIVING WATER BODY	WATER BODY TYPE	EFFLUENT TYPE	X	Y
D14	20-jan-09	254/1965	Wwtw/sewage treatment works (water company)	North sea	Freshwater river	Sewage discharges - stw storm overflow/storm tank - water company	448080	525610
D15	20-jan-09	254/1965	Wwtw/sewage treatment works (water company)	North sea	Freshwater river	Sewage discharges - stw storm overflow/storm tank - water company	448460	525840
D16	20-jan-09	254/1965	Wwtw/sewage treatment works (water company)	North sea	Freshwater river	Sewage discharges - stw storm overflow/storm tank - water company	447940	525730
D17	30-jan-06	254/1906	Wwtw (not water co) (not stp at a private premises)	River tees estuary	Estuary/tidal river	Sewage discharges - final/treated effluent - not water company	448050	521790

ID (FIG 9-1)	ISSUED DATE	PERMIT NUMBER	DESCRIPTION	RECEIVING WATER BODY	WATER BODY TYPE	EFFLUENT TYPE	X	Y
D18	02-aug-99	Qr.25/04/1588	Making of chemicals + chemical products	Tees	Estuary/tidal river	Trade discharges - process effluent - not water company	447950	521900
D19	02-aug-99	Qr.25/04/1588	Making of chemicals + chemical products	Tees	Estuary/tidal river	Trade discharges - process effluent - not water company	447530	522100
D20	10-nov-99	25/04/1611	Wwtw/sewage treatment works (water company)	River tees estuary	Estuary/tidal river	Sewage discharges - final/treated effluent - water company	448060	521250
D21	30-sep-87	254/x/0674	Wwtw (not water co) (not stp at a private premises)	Billingham beck	Freshwater river	Trade discharges - process effluent - not water company	448060	521900
D22	10-nov-99	25/04/1612	Wwtw/sewage treatment	River tees estuary	Estuary/tidal river	Sewage discharges - final/treated	448070	521250

ID (FIG 9-1)	ISSUED DATE	PERMIT NUMBER	DESCRIPTION	RECEIVING WATER BODY	WATER BODY TYPE	EFFLUENT TYPE	X	Y
			works (water company)			effluent - water company		
D23	26-jul-12	254/1897	Wwtw (not water co) (not stp at a private premises)	Land - tees estuary	Into land / infiltration system	Sewage discharges - final/treated effluent - not water company	448070	522610
D24	16-apr-13	Eprpb3938au	Offices admin + support	Groundwater via infil system	Into land / infiltration system	Sewage discharges - final/treated effluent - not water company	448046	522632
D25	31-oct-05	254/1891	Undefined or other	Tees estuary	Estuary/tidal river	Trade discharges - site drainage	448260	522060
D26	13-jul-93	254/1114	Wwtw (not water co) (not stp at a private premises)	Tees	Estuary/tidal river	Sewage discharges - unspecified - not water company	448280	522040
D27	01-mar-94	254/1359	Cultural/zoo/community centre/museu	Tees estuary	Estuary/tidal river	Trade discharges - process	448800	522400

ID (FIG 9-1)	ISSUED DATE	PERMIT NUMBER	DESCRIPTION	RECEIVING WATER BODY	WATER BODY TYPE	EFFLUENT TYPE	X	Y
			m/library/archive			effluent - not water company		
D28	01-mar-94	254/1359	Cultural/zoo/community centre/museum/library/archive	Tees estuary	Estuary/tidal river	Miscellaneous discharges - swimming pool water	448800	522400
D29	03-aug-04	25/04/1794	Sub-station/electricity/gas/air conditioning supply	Holme fleet tees trib	Freshwater river	Sewage discharges - final/treated effluent - not water company	449200	523700
D30	03-aug-04	25/04/1794	Sub-station/electricity/gas/air conditioning supply	Holme fleet tees trib	Freshwater river	Miscellaneous discharges - surface water	449200	523700
D31	11-nov-08	254/1923	Wwtw (not water co) (not stp at a private premises)	Trib of holme fleet	Freshwater river	Sewage discharges - final/treated effluent - not water company	450330	523272

ID (FIG 9-1)	ISSUED DATE	PERMIT NUMBER	DESCRIPTION	RECEIVING WATER BODY	WATER BODY TYPE	EFFLUENT TYPE	X	Y
D32	21-nov-79	254/a/0582	Wwtw (not water co) (not stp at a private premises)	Greatham creek, tributary of	Freshwater river	Sewage discharges - final/treated effluent - not water company	450800	523300
D33	04-jan-80	254/a/0583	Mineral/gravel extraction/quarrying	Tees, tributary of	Freshwater river	Sewage & trade combined - unspecified	450810	523310
D34	04-jan-80	254/a/0583	Mineral/gravel extraction/quarrying	Tees, tributary of	Freshwater river	Sewage discharges - final/treated effluent - not water company	450810	523310
D35	17-nov-17	Eprgb3996vr	Offices admin + support	Gw via an infiltration system	Into land / infiltration system	Sewage discharges - final/treated effluent - not water company	451025	521623
D36	28-sep-62	254/e/0381	Wwtw (not water co) (not stp at a private premises)	North sea	Freshwater river	Trade discharges - process effluent - not water company	451500	525400

ID (FIG 9-1)	ISSUED DATE	PERMIT NUMBER	DESCRIPTION	RECEIVING WATER BODY	WATER BODY TYPE	EFFLUENT TYPE	X	Y
D37	07-aug-23	25/04/1758	Wwtw/sewage treatment works (water company)	Greatham creek/seaton channel	Estuary/tidal river	Sewage discharges - stw storm overflow/storm tank - water company	451827	527106
D38	07-aug-23	25/04/1758	Wwtw/sewage treatment works (water company)	Greatham creek/seaton channel	Estuary/tidal river	Sewage discharges - final/treated effluent - water company	451834	527106
D39	28-mar-01	25/04/1674	Domestic property (multiple) (incl farm houses)	River tees	Freshwater river	Sewage discharges - final/treated effluent - not water company	452640	521740
D40	26-jul-12	25/04/1739	Undefined or other	Land	Into land / infiltration system	Sewage discharges - final/treated effluent - not water company	452670	524785
D41	10-nov-99	25/04/1599	Pumping station on sewerage	Tidal river tees	Estuary/tidal river	Sewage discharges - pumping	452790	521910

ID (FIG 9-1)	ISSUED DATE	PERMIT NUMBER	DESCRIPTION	RECEIVING WATER BODY	WATER BODY TYPE	EFFLUENT TYPE	X	Y
			network (water company)			station - water company		
D42	10-nov-99	25/04/1599	Pumping station on sewerage network (water company)	Tidal river tees	Estuary/tidal river	Sewage discharges - sewer storm overflow - water company	452790	521910
D43	15-jul-99	Qc.25/04/1590	Pumping station on sewerage network (water company)	The river tees	Estuary/tidal river	Sewage discharges - pumping station - water company	452900	522000
D44	15-jul-99	Qc.25/04/1590	Pumping station on sewerage network (water company)	The river tees	Estuary/tidal river	Sewage discharges - sewer storm overflow - water company	452900	522000
D45	10-mar-88	254/0592	Wwtw (not water co) (not stp at a private premises)	Tees	Freshwater river	Sewage discharges - final/treated effluent - not water company	452920	522040

ID (FIG 9-1)	ISSUED DATE	PERMIT NUMBER	DESCRIPTION	RECEIVING WATER BODY	WATER BODY TYPE	EFFLUENT TYPE	X	Y
D46	04-sep-92	254/1141	Making of chemicals + chemical products	Tees estuary	Estuary/tidal river	Trade discharges - site drainage	453960	524160
D47	02-sep-88	254/0653	Wwtw (not water co) (not stp at a private premises)	Tees	Freshwater river	Sewage discharges - final/treated effluent - not water company	454130	524190
D48	29-aug-07	254/1955	Real estate activities/buying/selling/renting	River tees	Estuary/tidal river	Trade discharges - site drainage (contam surface water, not waste sit	454450	525080
D49	26-jul-12	Qc.25/04/1579	Wwtw (not water co) (not stp at a private premises)	Land in the tees catchment	Into land / infiltration system	Sewage discharges - final/treated effluent - not water company	455070	524310
D50	28-apr-99	Qc.25/04/1578	Wwtw (not water co) (not	Land (river tees)	Into land / infiltration system	Sewage discharges - final/treated	455180	524210

ID (FIG 9-1)	ISSUED DATE	PERMIT NUMBER	DESCRIPTION	RECEIVING WATER BODY	WATER BODY TYPE	EFFLUENT TYPE	X	Y
			stp at a private premises)			effluent - not water company		
D51	15-feb-19	254/1935	Storm tank/cso on sewerage network (water company)	Kinkerdale beck	Freshwater river	Sewage discharges - sewer storm overflow - water company	455342	522124
D52	26-jul-12	254/1423	Making of chemicals + chemical products	Land	Into land / infiltration system	Trade discharges - cooling water	456000	523000
D53	31-jul-14	254/1528	Making of chemicals + chemical products	The dabholm gut	Freshwater river	Trade discharges - process effluent - not water company	457463	523512
D54	31-jul-14	254/1528	Making of chemicals + chemical products	The dabholm gut	Freshwater river	Trade discharges - process effluent - not water company	457463	523512
D55	31-jul-14	254/1528	Making of chemicals +	The dabholm gut	Freshwater river	Sewage discharges -	457463	523512

ID (FIG 9-1)	ISSUED DATE	PERMIT NUMBER	DESCRIPTION	RECEIVING WATER BODY	WATER BODY TYPE	EFFLUENT TYPE	X	Y
			chemical products			sewer storm overflow - not water company		
D56	25-nov-10	254/1920	Wwtw/sewage treatment works (water company)	Dabholm gut	Freshwater river	Sewage discharges - stw storm overflow/storm tank - water company	456140	524090
D57	25-nov-10	254/1920	Wwtw/sewage treatment works (water company)	Dabholm gut	Freshwater river	Sewage discharges - pumping station - water company	456140	524090
D58	25-nov-10	254/1920	Wwtw/sewage treatment works (water company)	Dabholm gut	Freshwater river	Sewage discharges - final/treated effluent - water company	456140	524090
D59	11-jan-21	Eprsb3698ak	Remediation activities/other waste management services	North sea	Sea	Trade discharges - cooling water	456466	525617

ID (FIG 9-1)	ISSUED DATE	PERMIT NUMBER	DESCRIPTION	RECEIVING WATER BODY	WATER BODY TYPE	EFFLUENT TYPE	X	Y
D60	01-nov-00	25/04/1646	Pumping station on sewerage network (water company)	Dabholm gut	Freshwater river	Sewage discharges - pumping station - water company	456550	523780
D61	21-feb-05	254/1813	Storm tank/cso on sewerage network (water company)	Dabholme beck,trib of	Freshwater river	Sewage discharges - sewer storm overflow - water company	457140	520140
D62	21-feb-05	254/1813	Storm tank/cso on sewerage network (water company)	Dabholme beck,trib of	Freshwater river	Sewage discharges - sewer storm overflow - water company	457150	520140
D63	23-mar-10	25/04/1776	Storm tank/cso on sewerage network (water company)	Unnamed trib of dabholme beck	Freshwater river	Sewage discharges - stw storm overflow/storm tank - water company	457177	520096

ID (FIG 9-1)	ISSUED DATE	PERMIT NUMBER	DESCRIPTION	RECEIVING WATER BODY	WATER BODY TYPE	EFFLUENT TYPE	X	Y
D64	18-feb-04	25/04/1777	Storm tank/cso on sewerage network (water company)	Unnamed trib of dabholme beck	Freshwater river	Sewage discharges - stw storm overflow/storm tank - water company	457170	520090
D65	31-mar-06	254/1914	Wwtw/sewage treatment works (water company)	Trib of the fleet	Freshwater river	Sewage discharges - stw storm overflow/storm tank - water company	457970	523810
D66	17-mar-93	256/0908	Wwtw/sewage treatment works (water company)	North sea	Sea	Sewage discharges - stw storm overflow/storm tank - water company	458360	525970
D67	31-mar-06	254/1916	Wwtw/sewage treatment works (water company)	Fleet beck trib	Freshwater river	Sewage discharges - sewer storm overflow - water company	458460	524670

ID (FIG 9-1)	ISSUED DATE	PERMIT NUMBER	DESCRIPTION	RECEIVING WATER BODY	WATER BODY TYPE	EFFLUENT TYPE	X	Y
D68	31-mar-06	254/1915	Wwtw/sewage treatment works (water company)	Fleet beck (trib)	Freshwater river	Sewage discharges - sewer storm overflow - water company	458670	524240
D69	31-mar-06	254/1912	Storm tank/cso on sewerage network (water company)	Unnamed watercouse - tees estu	Freshwater river	Sewage discharges - sewer storm overflow - water company	458730	524080
D70	24-jul-59	256/e/0227	Wwtw (not water co) (not stp at a private premises)	The fleet	Freshwater river	Sewage discharges - final/treated effluent - not water company	459300	521900

Table D-2: Abstractions in the Study Area (data provided by the Environment Agency, 2023)

ID (FIG. 9-1)	ABSTRACTION NUMBER	PURPOSE	SOURCE	X	Y
A1	1/25/04/134	Industrial, Commercial and Public Services	Groundwater	450700	522950
A2	1/25/04/134	Industrial, Commercial and Public Services	Groundwater	450830	523400
A3	1/25/04/134	Industrial, Commercial and Public Services	Groundwater	451030	523380
A4	1/25/04/134	Industrial, Commercial and Public Services	Groundwater	451180	524100
A5	1/25/04/134	Industrial, Commercial and Public Services	Groundwater	451200	524370
A6	1/25/04/134	Industrial, Commercial and Public Services	Groundwater	451230	524700
A7	1/25/04/134	Industrial, Commercial and Public Services	Groundwater	451280	525000
A8	1/25/04/134	Water Supply	Groundwater	450700	522950
A9	1/25/04/134	Water Supply	Groundwater	450830	523400
A10	1/25/04/134	Water Supply	Groundwater	451030	523380
A11	1/25/04/134	Water Supply	Groundwater	451180	524100
A12	1/25/04/134	Water Supply	Groundwater	451200	524370
A13	1/25/04/134	Water Supply	Groundwater	451230	524700
A14	1/25/04/134	Water Supply	Groundwater	451280	525000
A15	1/25/04/134	Environmental	Groundwater	450700	522950
A16	1/25/04/134	Environmental	Groundwater	450830	523400
A17	1/25/04/134	Environmental	Groundwater	451030	523380

ID (FIG. 9-1)	ABSTRACTION NUMBER	PURPOSE	SOURCE	X	Y
A18	1/25/04/134	Environmental	Groundwater	451180	524100
A19	1/25/04/134	Environmental	Groundwater	451200	524370
A20	1/25/04/134	Environmental	Groundwater	451230	524700
A21	1/25/04/134	Environmental	Groundwater	451280	525000
A22	1/25/04/142	Industrial, Commercial and Public Services	Groundwater	447500	524100
A23	1/25/04/161	Industrial, Commercial and Public Services	Tidal Waters (Tees Estuary)	448105	521942
A24	1/25/04/164	Environmental	Groundwater	452310	523190
A25	NE/025/0001/008	Environmental	Surface Waters (Holme Fleet)	449732	522992
A26	NE/025/0001/018	Industrial, Commercial and Public Services	Tidal Waters (Tees Estuary)	452188	526949
A27	NE/025/0001/024	Industrial, Commercial and Public Services	Groundwater	458132	522714