

LONG ACRES ENVIRONMENTAL STATEMENT

VOLUME 2: CHAPTER G
WATER MANAGEMENT AND FLOODING

Long Acres, South Tees

Volume 2: Environmental Statement (December 2020)

Chapter G: Water Management and Flooding

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G1.0 Introduction

- G1.1 This chapter of the Environmental Statement ('ES') has been prepared by JBA Consulting (JBA) on behalf of the applicant, South Tees Development Corporation ('STDC'). It assesses the proposed development described in Chapter B and it considers the effects of the proposed development on Water Management and Flooding surrounding the site.
- G1.2 The chapter describes the existing environment in relation to hydrology and hydrogeology and assesses the potential impacts of the construction and operation of the proposed development on hydrology (surface water quality, levels and flows) and hydrogeology (groundwater quality and levels).
- G1.3 The geological descriptions within this section provide context for the sensitivity of the hydrogeology assessment only. Existing potential contamination and its potential interrelationship with human health and groundwater quality is considered in Paragraph G 4.47 of this chapter.
- G1.4 The baseline situation is considered before the likely environmental effects of the proposed development are identified, both during construction and operational phases of the proposed development. Mitigation measures to reduce any negative environmental effects are identified as appropriate, before the residual environmental effects are assessed.
- G1.5 This chapter is supported by the following technical appendices: -
- 1 **Appendix G1:** Summary of Consultation with statutory consultees; and
 - 2 **Appendix G2:** Flood Risk Assessment (FRA).

About the Author

- G1.6 The Water Management and Flooding Environmental Statement Chapter has been prepared by JBA Consulting on behalf of STDC, following commission in November 2020. JBA Consulting is a member of the IEMA Environmental Impact Assessment (EIA) Quality Mark.

Table G 1: Core Staff Competencies

Team Member	Role and Qualifications
Samantha Cogan – 5 years' professional experience in hydrology, flood risk assessment and sustainable drainage. MSc, BSc	Lead Flood Risk Author
Alice Gent - 7 years' professional experience in environmental management including geomorphology and river restoration, flood risk assessment, EIA and SEA. BSc CEnv MCIWEM C.WEM	Lead Flood Risk Author
René Dobson - over 25 years' experience in the engineering sector and over 20 years of specialist experience in water and environmental engineering in the UK and Ireland BEng CEng MICE	Lead Flood Risk Reviewer
Eleanor Williams - 15 years' professional experience in hydrogeology and EIA. CGeol, FGS, BSc, PhD	Lead Hydrogeology Author
Mike McDonald – 30 years' professional experience in hydrogeology and brownfield land reclamation, including iron and steel manufacturing facilities BSc, MSc, PhD, CGeol, FGS.	Lead Hydrogeology Reviewer

Team Member	Role and Qualifications
<p>Dorian Latham - over 30 years' experience in delivering multi discipline projects for both the public and private sector, including numerous statutory Environmental Statements and non-statutory Environmental Report for public and private clients in the role of report editor and technical reviewer, but provides specialist knowledge to the Ecology, Water Quality / Water Framework Directive and Cumulative Impacts sections. Dorian is the National EIA and Environmental Lead for JBA Consulting.</p> <p>BA PhD CEnv FCIEEM</p>	<p>Lead EIA Reviewer</p>

G2.0 Policy Context

Overview

- G2.1 This section provides an overview of the issues from the relevant planning policies and policy guidance which have been considered in assessing potentially significant effects related to the water environment.
- G2.2 A summary of policies and legislation is set out in the below tables. Further details are then provided, including on their relevance to this ES chapter.

Table G2.1 Policy Issues considered in preparing the water environment assessment

Policy Reference	Policy Issues
National Planning Policy Framework (NPPF) (revised, 2019) (Ref 37)	
Paragraph 17	Achieving Sustainable Development principles (para 8c) include contributing to protecting and enhancing the natural environment and minimising pollution.
Section 14, Paragraph 150a	New development should be planned to avoid increased vulnerability to the range of impacts arising from climate change including flood risk and water supply. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure.
Section 14, Paragraphs 155-165	Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere. Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate.
Section 15, Paragraph 170e	New and existing development should not contribute to or be put at unacceptable risk from, or be adversely affected by, unacceptable levels of water pollution.
National Planning Practice Guidance (Ref 38)	Multiple benefits for people and the environment can be achievable through good design and mitigation. For example, flood risk can be reduced and biodiversity and amenity improved by designing development that includes permeable surfaces and other sustainable drainage systems, removing artificial physical modifications (for example, weirs and concrete channels) and recreating natural features. Water quality can be improved by protecting and enhancing green infrastructure and further information on this can be found in the planning practice guidance on the Natural Environment. Good design and mitigation measures can be secured through site specific policies for allocated sites and through non-site-specific policies on water infrastructure and protecting the water environment. For example, they can be used to ensure that new development and mains water and wastewater infrastructure provision is aligned and to ensure new development is phased and not occupied until the necessary works relating to water and wastewater have been carried out. Local planning authorities can use planning conditions and / or obligations to secure mitigation and compensatory measures where the relevant tests are met. Planning obligations can be used to set out requirements relating to monitoring water quality, habitat creation and maintenance and the transfer of assets where this

Policy Reference	Policy Issues
	mitigates an impact on water quality. The guidance supports the NPPF.
Redcar and Cleveland Borough Council (RCBC) Local Plan (May 2018) (Ref 51)	
Policy SD1: Sustainable development	Protect the quality and availability of water resources and maximise the efficient use of water.
Policy SD7: Flood and water management	Flood risk will be taken into account at all stages in the planning process to avoid inappropriate development in areas at current or future risk.

G2.3 The legislation relevant to the assessment of effects of the proposed development on the water environment is summarised below.

Table G2.2 Legislation relevant to the assessment of the water environment

Legislation	Description
Water Environment (Water Framework Directive (WFD)) (England and Wales) Regulations 2017 (Ref 35)	The WFD came into force in 2000 and is the most substantial piece of EU water legislation to date. All new activities in the water environment will need to take the Directive into account. The Directive imposes legal requirements to protect and improve the water environment. The EU WFD was transposed into law in England and Wales by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. The 2003 regulations were consolidated and replaced with the Water Environment (WFD) (England and Wales) Regulations 2017. The Directive requires that Environmental Objectives be set for all surface and ground waters in England and Wales to enable them to achieve Good Status (or Good Ecological Potential for Heavily Modified and Artificial Water Bodies)
Water Act 2003 (Ref 27)	This Act was a revision of the Water Resources Act (1991) which stated that it is an offence to cause or knowingly permit polluting, noxious, poisonous or any solid waste matter to enter controlled waters. The Act sets out regulatory controls for water abstraction, discharge to water bodies, water impoundment and protection of water resources. Elements of the Water Resources Act 1991 have now also been superseded by the Environmental Permitting (England and Wales) Regulations 2010 (Ref 29).
Environmental Permitting (England and Wales) Regulations 2010 (Ref 29)	This provides a consolidated system for environmental permits and exemptions for activities which include discharges to surface waters. It also sets out the powers, functions and duties of the regulators.
Groundwater Regulations 1998 (Ref 25)	These require the prevention of List I substances (such as mercury, cadmium, polycyclic aromatic hydrocarbons) entering groundwater and the control of List II substances (such as heavy metals, nutrients, phenols) to avoid pollution of groundwater. Within the context of the WFD, the groundwater daughter directive was brought into force in January 2009, which will seek to prevent deterioration in groundwater quality.
The Land Drainage Act 1991 & 1994 (Ref 23 & 24)	This places responsibility for maintaining flows in watercourses on landowners and gives Local Authorities powers to serve a notice on landowners to ensure works are carried out to maintain flow of

Legislation	Description
	watercourses.
Floods and Water Management Act 2010 (Ref 30)	This sets out the Government’s proposals to improve flood risk management, water quality and ensure water supplies are more secure. In December 2009, the Flood Risk Regulations were published, which transpose the EU Floods Directive into UK law and these cover the flood issues from the Floods and Water Management Bill.

G2.4 Other policy, regulatory and best practice guidance of relevance to this assessment includes the following:

- EA Principles and Practice for the Protection of Groundwater (GP3) (Ref 31);
- EA Pollution Prevention Guidance (PPG) Notes¹ (Ref 31):
 - PPG 3 Use and design of oil separators in surface water drainage systems
 - PPG 6 Working at construction and demolition sites;
 - PPG 7 The safe operation of refuelling facilities;
- GOV.UK Guidance for pollution prevention for businesses (superseding relevant PPGs) (Ref 58):
 - Polluting substances;
 - Activities that produce contaminated water;
 - Correct use of drains;
 - Storing materials, products and waste;
 - Unloading and moving potential pollutants;
 - Construction, inspection and maintenance.
- Construction Industry Research and Information Association (CIRIA) Report C532: Control of Water Pollution from Construction Sites (Ref 44);
- CIRIA Report C502: Environmental Good Practice on Site (Ref 6);
- CIRIA Report 515: Groundwater Control – design and practice (Ref 7);
- CIRIA Report C753: The SuDS manual (Ref 8 & 9);
- BS6031: 2009 Code of Practice for Earth Works (Ref 3);
- Good Practice Guide for Handling Soils (MAFF, 2000) (Ref 42);
- Local and Regional Land Drainage Bylaws;
- Redcar and Cleveland Strategic Flood Risk Assessment (RCBC, 2016) (Ref 49 & 50); and
- River Tees Catchment Flood Management Plan (EA, 2009) (Ref 12).

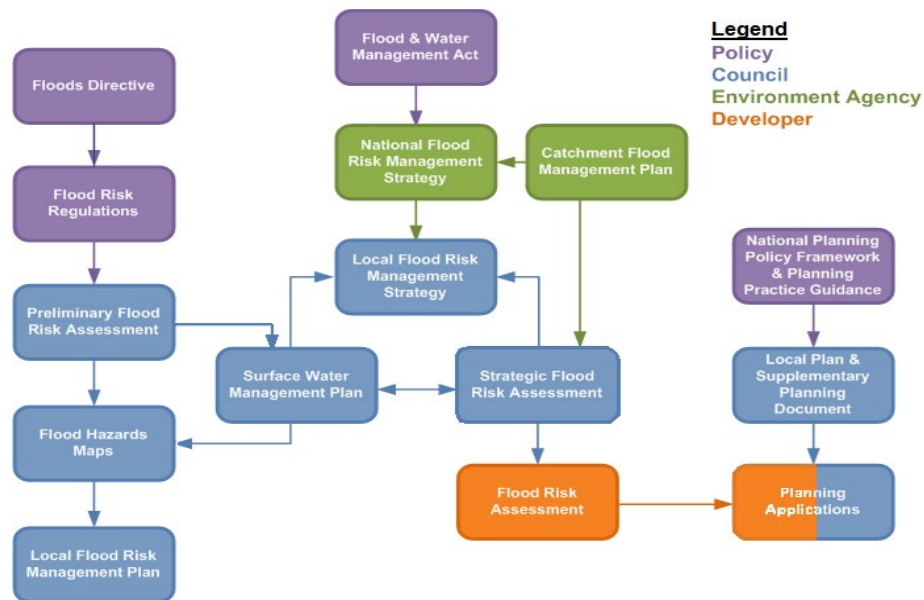
Requirements of Flood Risk Legislation, Policy and Guidance

G2.5 There are a number of pieces of legislation relating to flooding as shown in the flow diagram below. The EU Floods Directive 2007 was interpreted into the England and Wales legislation Flood Risk Regulations 2009 (Regulations) (Ref 28) and the Flood and Water Management Act 2010 (Act) (Ref 30).

¹ It is noted that the PPG notes are now withdrawn but are nonetheless applied in the absence of direct replacement guidance notes.

- G2.6 The Regulations identify and take action in areas with the most significant flood risks and require the following to be produced:
- 1 A preliminary Flood Risk Assessment Report providing a high-level overview of flood risk from local flood risk sources and identifying the Flood Risk Areas;
 - 2 Flood hazard maps and flood risk maps for Flood Risk Areas; and
 - 3 Flood risk management plans for Flood Risk Areas.
- G2.7 The purpose of the Act is to:
- 1 Introduce the concept of flood risk management and the framework for the delivery of flood and coastal erosion risk management through national and local strategies; and
 - 2 Provide definitions, for example "flood", "surface runoff", "Risk Management Authorities", "Lead Local Flood Authority" (LLFA).

Figure G2-1 Key documents and strategic planning links with flood risk



National Planning Policy

- G2.8 The new NPPF (Ref 37) was published in July 2018 and updated was in June 2019. The NPPF sets tests to protect people and property from flooding which all local planning authorities are expected to follow. It must be taken into account in the preparation of local plans and is a material consideration in planning decisions. Where these tests are not met, national policy is clear that new development should not be allowed. The main steps to be followed are set out below which, in summary, are designed to ensure that if there are better sites in terms of flood risk, or a proposed development cannot be made safe, it should not be permitted.
- G2.9 The NPPF is accompanied by PPG notes (Ref 38) which are updated to reflect changes to NPPF.
- G2.10 The key changes in the 2019 NPPF compared to the 2012 NPPF include:
- 1 Strategic policies should also now consider the 'cumulative impacts in, or affecting, local areas susceptible to flooding' (para 156), rather than just to or from individual development sites (see Section 6.5 of the main report);

- 2 Future risk from climate change. The 'sequential approach should be used in areas known to be at risk now or in the future from any form of flooding' (para 158) (see Sections 6.6 of the main report and Appendix B);
- 3 Natural Flood Management. 'Using opportunities provided by new development to reduce the causes and impacts of flooding (where appropriate through the use of natural flood management techniques)' (para 157c) (see Section 5.7.4 of the main report and Appendix B);
- 4 Sustainable Drainage Systems (SuDS). 'Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate' (para 165) (see Section 6.7 of the main report);
- 5 Emergency planning. Emergency plans are required as part of an FRA that includes safe access and egress routes (para 163e) (see Section 7 of the main report); and
- 6 The Flood Risk and Coastal Change Planning Practice Guidance (FRCC-PPG) sits alongside the NPPF and sets out detailed guidance on how this policy should be implemented.

Flood Risk and Coastal Change Planning Practice Guidance (FRCC-PPG)

- G2.11 At the time of writing, the current FRCC-PPG was published on 6 March 2014 (Gov.uk, 2014) (Ref 32).
- G2.12 Whilst the NPPF concentrates on high level national policy, the FRCC-PPG is more detailed. The practice guidance advises on how planning can take account of the risks associated with flooding and coastal change in plan making and the development management process. This is in respect of local plans, Strategic Flood Risk Assessments (SFRAs), the sequential and exception tests, permitted development, site-specific flood risk, Neighbourhood Planning, flood resilience and resistance techniques and the vulnerability of development to make development safe from flooding.

Local Flood Risk Management Policy and Guidance

Strategic Flood Risk Assessment

- G2.13 Redcar and Cleveland Borough Council published the following:
- G2.14 A Level 1 SFRA (Ref 50) in 2010 - this was then revised in 2016 using up-to-date flood risk information together with the most current flood risk and planning policy available from the NPPF and Flood Risk and Coastal Change Planning Practice Guidance² (FRCC-PPG). The purpose of the SFRA was to initiate the sequential risk-based approach to the allocation of land for development and inform the Adopted Local Plan and Detailed Policies.
- G2.15 As Level 2 SFRA (Ref 49) in 2010 - a detailed model was created to supersede the broad scale EA tidal flood risk mapping. The new model took into account natural and manmade restrictions to tidal flooding including the sand dune system at Coatham Sands and the disused railway embankment at Warrenby.
- G2.16 In the Level 2 SFRA (Ref 49), when these natural and manmade barriers to flooding are modelled, this 'existing risk' scenario shows that the majority of the site is at very low risk from coastal flooding, however there are areas mapped at risk of flooding during a 1 in 200 year tidal flood event where defences were removed (tidal level was projected over the topography). Modelling indicated that flooding at the site is in relation to the presence of the on-site watercourses however during this scenario, flooding is expected to remain within the watercourse channels. There is also a residual risk of surface water flooding and therefore the

proposed development may increase the rate and volume of runoff. Fluvial flooding has not been considered as part of the Level 2 SFRA. Based on the Level 2 SFRA, the flood risk to the site cannot be classed as residual however there are large sections of the site which can be developed outside the predicted tidal flood events. In conclusion, the site as assessed in the Level 2 SFRA should be suitable for the proposed development subject to a detailed flood risk assessment (FRA).

Redcar and Cleveland Local Plan

- G2.17 The Redcar and Cleveland Local Plan (Ref 51) was adopted in May 2018 and the SFRA provides the evidence base to make decisions on where to direct new development to ensure development is located in sustainable locations. The adopted Local Plan sets out the long-term land allocations and other planning policies that will guide development proposals in the borough and against which planning applications are determined.
- G2.18 Policy outlined in the Local Plan, in relation to flood risk and water management, aim to reduce flood risk, promote water efficiency measures, and protect and enhance water quality through mechanisms.

Local Plan Key Policies

- G2.19 There are multiple policies within the Local Plan (Ref 51) that are applicable to the site. A selection of the key policies is highlighted below:
- 1 “All development proposals will be expected to be designed to mitigate and adapt to climate change, taking account of flood risk by:” “ensuring opportunities to contribute to the mitigation of flooding elsewhere are taken”; “prioritising the use of sustainable drainage systems (SuDS)”; “ensuring the full separation of foul and surface water flows” and “ensuring development is in accordance with the Redcar and Cleveland Strategic Flood Risk Assessment”.
 - 2 “For previously developed sites, the peak runoff rate from the development to any drain, sewer or surface water body for the 1-in-1 year rainfall event and the 1-in-100 year rainfall event, must be as close as reasonably practicable to the greenfield runoff rate from the site for the same rainfall event but should never exceed the rate of discharge from the development prior to redevelopment for that event”;
 - 3 “Where the drainage system discharges to a surface water body that can accommodate uncontrolled surface water discharges without any impact on flood risk from that surface water body (e.g. the sea or River Tees) the peak flow control standards and volume control standards [attenuation requirement] need not apply.” This may be the case for development in the Teardrop site and CLE31 region where there is discharge into drainage channels which flow directly into the River Tees without any constraints;
 - 4 “The drainage system must be designed and constructed so surface water discharged do not adversely impact the water quality of receiving water bodies, both during construction and when operational. New development should seek to improve water quality where possible, as well maintaining and enhancing the biodiversity and habitat of watercourses”;
 - 5 “The Council has a duty to have regard to the Northumbrian River Basin Management Plan [(RBMP) (Ref 36)] to ensure the protection and improvement in quality of the water environment. This is also in accordance with the overall objective of the Water Framework Directive [WFD] to achieve “good ecological status” in all waterbodies (including surface, ground and coastal waters) and not allow any deterioration from their current status”; and

- 6 “Wherever possible, measures to deal with flood risk and drainage should identify opportunities to maintain and enhance the biodiversity and habitat of watercourses through protecting or restoring natural channel morphology. Actions should also be taken to remove modifications to restore a more natural watercourse and associated biodiversity. Where such removal is not possible or not in the public interest, mitigation measures must be taken to create a more natural watercourse, improve habitats and enhance biodiversity”.

Tees Valley Sustainable Drainage Systems Design Guide and Local Standards

- G2.20 To enable the practical implementation of the policies outlined in the local plan, a working group from the Local Authorities of Darlington, Hartlepool, Middlesbrough, Redcar & Cleveland and Stockton Borough Councils (Tees Valley Authorities) published the Tees Valley Authorities Local Standards for Sustainable Drainage (2017) (Ref 41).
- G2.21 The working group have recently updated the guide to provide an overview of SuDS techniques, policy requirements and produce Tees Valley specific local standards. The document is due to be formally published in 2020 and has been produced to strongly promote the use of sustainable drainage systems and help manage increased surface water runoff from the proposed development to help mitigate flood risk.
- G2.22 A Flood Risk and Surface Water Management Strategy is currently being developed for the whole Teesworks area, due in 2021. This will provide a plan for surface water and drainage management for each site within the Teesworks Area and will include details about any changes to current water management and drainage as well as aspirations for improvements and multiple benefits which can be derived. This plan needs to align with the requirements of the Tees Valley SuDS Design Guide and Local Standards.

Climate Change Resilience

- G2.23 Addressing climate change is one of the core land use planning principles which the NPPF (Ref 37) expects to underpin both plan-making and decision-taking. The NPPF states that planning should proactively help the mitigation of, and adaptation to, climate change including the management of water and flood risk. These requirements are then filtered to a development level through the Local Plan (Ref 51) and SFRA (Ref 49 & 50) which outline the key factors developments must meet in order to gain planning permission.

Flood Risk and Water Management

- G2.24 In terms of flood risk, the NPPF sets the current best practice for the application of allowance for climate change. The climate change allowances (prediction) of anticipated change are provided for:
- 1 Peak River Flow;
 - 2 Peak Rainfall Intensity; and
 - 3 Sea level Rise.
- G2.25 Climate change allowances are used for flood risk assessments and design parameters.

Peak River Flows

- G2.26 Peak river flow allowances show the anticipated changes to peak flow by river basin district. Redcar is located within the Northumbria river basin district. The application of allowance category is subject to the Flood Risk Vulnerability Classification and Flood Zone, now and in the

future.

Table G2.3 EA Peak river flow allowances, Northumbrian River Basin District (use 1961 to 1990 baseline)

Allowance category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	20%	30%	50%
Higher central	15%	20%	25%
Central	10%	15%	20%

Rainfall Intensity

G2.27

With respect to surface water flood risk mapping and design of drainage systems (including blue-green networks and minor watercourses with a catchment of less than 5 km²) the allowances outlined in Table G2.4 below shall be used. The proposed development design life is to be taken as a minimum of 50 years and construction is due to commence in 2021 and is anticipated to be completed in 2032. Current climate change predictions extend to 2115 which is beyond the proposed life of the development. However, as a conservative approach, and because the proposed development has a design life of a minimum of 50 years, the default design parameters are to design for the 20% total potential change in peak rainfall intensity and sensitivity check for the 40%, to consider the future impacts in relation to water management and drainage.

Table G2.4 Peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

Drought Resistance

G2.28

Current climate predictions show an increased likelihood both in frequency and length, of periods of rainwater scarcity and potential drought conditions. The ability to harvest and reuse rainwater could help in adding resilience by maintaining business continuity during these periods. The rainwater harvesting must be designed using rainfall data and shall take into account the different potential requirements of rainwater by the different businesses which will operate on the site. Improved rainwater harvesting will produce resilience and reduce reliance on piped water infrastructure.

Sea Level Rise

G2.29

There are a range of allowances for each epoch for sea level rise in Northumbria derived from the EA table are shown in Table G2.5.

Table G2.5 EA Sea level allowance for each epoch for Northumbria

Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (metres)
Higher central	4.6 (161)	7.5 (225)	10.1 (303)	11.2 (236)	1.03

Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (metres)
Upper end	5.8 (203)	10 (300)	14.3 (429)	16.5 (495)	1.43

G2.30

Since the original Tees tidal model was developed by the EA and the above table was published JBA has undertaken an update to the model on behalf of the EA. The update to the model was based on the UKCP18 uplift values utilising 2017 for a base year for extreme sea levels. The tables below summarise the results of the updated modelling on the uplift (mm) per epoch.

Table G2.6 Tees Tidal UKCP18 Tees Tidal Uplift Value

Uplift	Epoch	Updated uplift value (mm)
Present day uplift	2017-2019	0.011
UKCP18 2030 uplift	2019-2030	0.071
UKCP18 2050 uplift	2019-2050	0.249
UKCP18 2070 uplift	2019-2070	0.488
UKCP18 2100 uplift	2019-2100	0.947

Table G2.7 Tees Tidal UKCP18 Tees Tidal Climate Change Uplift Levels

Events	2017-2019 (present day)	2030	2070	2100
T2 (2 year)	3.45	3.52	3.94	4.40
T100 (100 year)	3.98	4.05	4.47	4.93
T200 (200 year)	4.08	4.15	4.57	5.03
T1000 (1000 year)	4.33	4.40	4.82	5.28

Roles and Responsibilities

G2.31

The responsibilities for the Risk Management Authorities (RMA) under the Flood and Water Management Act (Ref 30) and the Flood Risk Regulations (Ref 28) are summarised below

Environment Agency as an RMA

- 1 Has a strategic overview role for all forms of flooding at the national level;
- 2 Has the power to request information from any partner in connection with its risk management functions;
- 3 Must exercise its flood or coastal erosion risk management functions in a manner consistent with the National Strategy and Local Strategies;
- 4 Must be consulted on Local Strategies, if affected by the strategy, by the LLFA; and
- 5 Must help advise on sustainable development.

RCBC LLFA as an RMA

- 1 Must develop, maintain, apply and monitor a strategy for local flood risk management. This must be consulted on with all RMAs, the public and all other partners with an interest in local flood risk, and must comply with the national strategy;
- 2 Is required to coordinate and share information on local flood risk management between relevant authorities and partners;
- 3 Is empowered to request information from others when it is needed in relation to its flood risk management functions;

- 4 Must investigate flooding incidents in its area where it considers it necessary or appropriate;
- 5 Has a duty to establish and maintain a record of structures within its area that have a significant impact on local flood risk;
- 6 Is empowered to designate structures and features that affect flooding;
- 7 Has powers to undertake works to manage flood risk from surface runoff, groundwater and ordinary watercourses;
- 8 Must exercise its flood and coastal erosion risk management functions in a manner consistent with the National Strategy and the Local Strategy;
- 9 Must aim to contribute to sustainable development;
- 10 Is a statutory consultee on planning applications for major developments with surface water drainage considerations; and
- 11 Should consider flooding issues that require collaboration with neighbouring LLFAs and other RMAs.

Northumbrian Water as an RMA

- 1 Has a duty to act in a manner that is consistent with the National Strategy and have regard to Local Strategies;
- 2 Must be consulted on Local Strategies, if affected by the strategy, by the relevant LLFA;
- 3 Has a duty to be subject to scrutiny from LLFAs;
- 4 Has a duty to cooperate and share information with other RMAs;
- 5 Is responsible for managing the risks of flooding from surface water and foul or combined sewer systems providing drainage from buildings and yards.

Highways Service (RCBC) as an RMA

- 1 Has a duty to act consistently with the National Strategy and Local Strategies;
- 2 Has responsibility for ensuring effective drainage of local roads in so far as ensuring drains and gullies are maintained; and
- 3 Must be consulted on Local Strategies, if affected by the Strategy, by the relevant LLFA.

The Local Community

- 1 Must be consulted on Local Strategies by the LLFA; and
- 2 Have a key role in ensuring local strategies are capable of being successfully delivered within the community. They should actively participate in this process and be engaged by the LLFA.

Riparian Owners

- 1 A riparian owner is someone who owns land or property alongside a river or other watercourses including a culvert; and
- 2 Riparian owners have statutory responsibilities including maintaining riverbeds and banks; allowing the flow of water to pass without obstruction; and controlling Invasive Non-Native Species (INNS).

Developers

G2.32 Have a vital role in ensuring effective local flood risk management by avoiding development in areas at risk of flooding. Local Strategies should form a key element of local planning guidance.

G3.0 **Assessment Methodology & Significance Criteria**

Assessment Methodology

- G3.1 This chapter provides an assessment of water management and flooding, incorporating the elements required for an FRA (see Appendix G2 of the ES) as well as examining drainage and hydrogeology. It will therefore closely relate to and reference details included in the Ground Conditions and Remediation chapter (Chapter H) of the ES.
- G3.2 The assessment entails a review of existing baseline conditions, consideration of future baseline conditions and an assessment of the beneficial and adverse effects which will result from the change in conditions. Due to the outline nature of the planning application which this ES accompanies, the details of the proposed development are not currently defined and so a number of assumptions have been made (detailed in paragraph G3.14).
- G3.3 The assessment is necessary to meet the requirements of the NPPF (Ref 37), the EIA Regulations (Ref 33 & 39) and to support the outline planning application. It will therefore contain necessary details to be consistent with the reporting requirements detailed within the NPPF. The aim of this document is to present relevant information in a clear format that can be reviewed by the Local Planning Authority and the EA to enable them to make an informed decision in commenting on and determining the planning application. It does not guarantee that planning permission will be granted, or that proposed development will be acceptable to the EA.

Data Gathering Methodology

- G3.4 The assessment undertaken for water management and flooding is desk-based. Data gathered for the assessment originates from three main sources:
- 1 The most up to date information available on publicly accessible websites and mapping has been used to determine the existing baseline conditions on the site, and in the immediate surrounding area. This has allowed identification of sensitive receptors in both the surface water and groundwater environment, which will need consideration during the design of the site.
 - 2 The assessment is supported by the collection and interpretation of data and information requested from the EA (Environment Agency, 2020a) (Ref 17) and the Roads Department at RCBC (Hill, 2020) (Ref 59) as part of the data request submitted for the preparation of the Teesworks Flood Risk and Surface Water Management Strategy (see Paragraph G2.20). They both provided hydrological information in January 2020 in relation to a different planning application within the Teesworks area. The information they provided related to a 2 km radius around the application site for the proposed Grangetown Prairie, Energy Recovery Facility Development (planning reference R/2019/0767/OOM). The request included groundwater abstractions, surface water abstractions, water quality data, discharges and private water supply records. Since the data is publicly available, the data have also been used for the site. The key data and sources of information collected are listed in Table G3.1.
 - 3 The assessment also draws on information provided in previous reports and site investigations which have been completed for the site. Details of these are provided in the table below, referenced where noted in the text and listed in the References section at the end of this chapter.

Table G3.1 Sources of information used for the Hydrology, Hydrogeology and Geology

Source	Data
Ordnance Survey (OS) mapping at 1:50,000 and 1:25,000 scales (Ref 46).	Topography: elevation, relief.
Cranfield University's National Soils Resources Institute Soilscales website (Ref 10).	Soil type and land use.
Magic Map (Ref 43) Natural England website (Ref 47)	Nature Conservation Sites: Special Areas of Conservation (SACs). Special Protection Areas (SPAs). Sites of Special Scientific Interest (SSSI). EA groundwater vulnerability
The National River Flow Archive (Ref 4)	Climate: rainfall.
EA maps (Ref 14) EA Catchment data explorer (Ref 15) The National River Flow Archive	Surface Water. Surface water courses and flood risk Water quality. River flows.
British Geological Survey (BGS) GeoIndex (Ref 2) Wood (2019), Former Steelworks Land, South Tees - Outline Remediation Strategy (Ref 57) Enviros (2007). Corus Cleveland Prairie Teesside Site Phase 1 Environmental Review. Graphite Resources Ltd. (Ref 27) Wardell (2007). Ground Contamination. Graphite Resources Ltd. (Ref 55)	Solid and drift geology. Site geology and historic land use.
Wood (2019), Former Steelworks Land, South Tees - Outline Remediation Strategy (Ref 57) Enviros (2004), Soil and Groundwater Baseline Characterisation Study Teesside Works - Interpretive Report (Ref 20) Allied Exploration & Geotechnics (2018), The Former SSI Steelworks, Redcar – Ground Investigation Contract – Final Factual Report (Ref 1). Data requested from the EA (2020b, 2020c) (Ref 18 & 19) EA Source Protection Zones and 2009 River Basin Management Plans (Groundwater) (Ref 14)	Groundwater levels. Groundwater vulnerability. Groundwater quality. Abstractions and discharges.
Data requested from RCBC (email from David Kettlewell, 16/11/20).	Private water supplies
EA Flood Risk and Coastal Change guidance (Ref 32).	Peak flow allowances for the Northumbrian River Basin District, sea level rise (SLR), offshore wind speed and extreme wave height allowance tidal uplift and peak rainfall intensity allowances
British Hydrological Society, Chronology of British Hydrological Events Google Newspaper Archives SFRA reports for Redcar, 2010 and 2016 (Ref 50 & 51) National Library of Scotland online mapping (Ref 48)	Flood history and historical land use

Source	Data
Defra / EA Flood and Coastal Defence R&D Programme: R&D Outputs: Flood Risks to People, FD2321/TR2 Guidance Document, 2006 (Ref 11)	Emergency access and egress best practice guidance

Significance Criteria

G3.5

The methodology for the assessment of potential impacts follows the generic EIA methodology guided by IEMA (2016) (Ref 40) and current government guidance (Gov.uk, 2020) (Ref 39), and is based on the following principles:

- 1 Receptor sensitivity (very high, high, medium, low, very low) (see Table G3.2);
- 2 The magnitude (severity) of the effect (major, moderate, minor, no change) (Table G3.3)
- 3 The type of effect (long-term, short-term, or intermittent; positive, negative or neutral); and
- 4 The probability of effect occurring.

Table G3.2 Receptor sensitivity

Sensitivity	Criteria	Examples
Very High	Feature with a high quality and rarity at an international scale, with little potential for substitution. Medium to high flood risk.	Conditions supporting sites with international conservation designations (SAC, SPA, Ramsar sites), where the designation is based specifically on aquatic features. Land use types defined as essential civil infrastructure such as hospitals, fire stations, emergency depots etc.
High	Feature with a high yield and / or quality and rarity at a national scale, with a limited potential for substitution. Low to medium flood risk.	Highly productive aquifers and surface water resources typically used for public water supplies. Public water supplies. Conditions supporting a SSSI. Sites with freshwater fish protected areas. Water quality of receptor water body: Supporting WFD element type (e.g. Priority Substances) classified as 'High', 'Good' or 'Pass'. Land use types defined as schools, care homes, ground-based electrical and telecommunications equipment.
Medium	Feature with a medium yield and/or quality at a regional scale, or good quality at a local scale, with some potential for substitution.	Medium productivity aquifer and surface water resources typically used for smaller public water supplies or industrial water supplies. Industrial water supplies.

Sensitivity	Criteria	Examples
	<p>Low flood risk.</p>	<p>Conditions supporting local nature conservation interest (e.g. Local Nature Reserve [LNR]), where the interest features are water dependent.</p> <p>Water quality of receptor water body: Supporting WFD element classified as at least 'Good' in all cases.</p> <p>Other property types, including dwellings.</p>
<p>Low</p>	<p>Feature with variable yield and/or quality at a local scale, with potential for substitution.</p> <p>Negligible flood risk.</p>	<p>Low productivity aquifer and surface water resources typically used for private water supplies or not utilised. Livestock supplies; springs; ponds/lagoons; non-statutory groundwater-dependent conservation sites.</p> <p>Water quality of receptor water body: Supporting WFD element type classified as less than 'Good' in any situation (any supporting element).</p> <p>Undeveloped or agricultural land from a flood risk point of view.</p>
<p>Very Low</p>	<p>Feature with poor yield and / or quality at a local scale, with good potential for substitution.</p>	<p>Unproductive strata.</p> <p>Water quality of receptor water body: Supporting WFD element type classified as 'Poor' or 'Bad', with severely restricted ecosystems and pollution.</p> <p>Small surface water bodies such as drainage ditches and ephemeral ponds that are too small to be classified under WFD and have limited ecological potential due to being artificial or heavily modified.</p>

Table G3.3 Overview of magnitude of change

Magnitude	Criteria	Examples
Major	Results in complete loss of receptor or major impact on feature, of sufficient magnitude to affect its use / integrity, and which may be irrecoverable or slow to recover.	<p>Major reduction in groundwater levels, flow or quality, reducing use and water body status.</p> <p>Major reduction in groundwater levels or water quality leading to a marked deterioration in conditions that support groundwater dependent terrestrial ecosystem (GWDTE) features.</p> <p>Deterioration in river flow regime, morphology or water quality, leading to sustained, permanent or long-term breach of relevant SSSI conservation objectives (COs), or downgrading of WFD status (deterioration in current thresholds as defined by current WFD status, including supporting WFD elements).</p> <p>Complete loss of resource or severely reduced resource availability to other water users.</p> <p>Change in flood risk resulting in potential loss of life or damage to nationally critical infrastructure.</p>
Moderate	Results in some loss of receptor, or noticeable impact on feature, of sufficient magnitude to affect its use / integrity in some circumstances. Has limited potential to recover.	<p>Moderate reduction in groundwater levels, flow or quality, reducing use and water body status in some circumstances.</p> <p>Moderate reduction in groundwater levels or water quality leading to some deterioration in conditions that support GWDTE features.</p> <p>Deterioration in river flow regime, morphology or water quality, leading to periodic, short-term and reversible breaches of relevant SSSI conservation objectives, or downgrading of WFD status (deterioration in current thresholds as defined by current WFD status, including supporting WFD elements). Water quality status may impact upon potential future thresholds in relation to objective WFD status – potential for prevention of waterbody reaching its future WFD objectives.</p> <p>Minor reduction in resource availability for other water users.</p> <p>Change in flood risk resulting in potential for major damage to property and infrastructure.</p>

Magnitude	Criteria	Examples
Minor	Results in minor impact on feature, with insufficient magnitude to affect its use / integrity in most circumstances. May be fully recoverable.	<p>Measurable reduction in groundwater levels, flow or quality, but with limited consequences in terms of use and water body status.</p> <p>Measurable reduction in groundwater levels or water quality, leading to a minimal change in conditions that support GWDTE features.</p> <p>Measurable deterioration in river flow regime, morphology or water quality, but remaining generally within SSSI COs, and with no change of WFD status (of overall status or supporting element status) or compromise of Environmental Quality Standards (EQSs).</p> <p>No change in resource availability for other water users.</p> <p>Increase in flood hazard in areas with no flood risk receptors e.g. increased flooding of agricultural land.</p> <p>Change in flood risk resulting in potential for minor damage to property and infrastructure.</p>
No/ Negligible change	No perceptible change in the baseline situation.	N/A

G3.7 In terms of the EIA Regulations (Ref 33), it is only those impacts that are likely to have significant positive and/or negative environmental effects that require detailed assessment. As the EIA Regulations guide the assessor to focus on effects that are likely to be significant, the outcome of the assessment of a given effect on a particular receptor in its simplest form would be that it is significant or not significant. However, there may be instances where it is appropriate to further sub-divide the category of ‘Not Significant’, for example by use of the terms ‘Negligible’ in terms of the level of effect. The use of the category of ‘Negligible’ may for example be used in acknowledgement that there are instances whereby there may be an effect, albeit that this is not likely to be significant - and this approach may better facilitate assessment of cumulative effects where cumulatively several slight effects could be significant. With this consideration in mind, Table G3-4 illustrates a matrix, which has been used for guidance in the assessment of significance. Where 'Substantial', 'Moderate' or 'Minor' is referenced as a level of effect, this can be either Beneficial or Adverse.

G3.8 Having defined a level of effect, professional judgement, in combination with guidance and standards are then applied to identify which of those levels of effect are then considered to be equivalent to significant effects when discussed in terms of the EIA Regulations (Ref 33). Those levels of effect which are shaded in Table G3-4 equate to those considered ‘Significant’ under the EIA Regulations with the others constituting no effect or an effect which is ‘Not Significant’.

Table G3.4 Derivation of the level of effect

		Receptor sensitivity				
		Very High	High	Medium	Low	Very Low
Magnitude of change	Major	Substantial	Substantial	Substantial	Moderate	Minor
	Moderate	Substantial	Substantial	Moderate	Minor	Neutral/ Negligible
	Minor	Moderate	Moderate	Minor	Neutral/ Negligible	Neutral/ Negligible
	No/ Negligible Change	Neutral/ Negligible	Neutral/ Negligible	Neutral/ Negligible	Neutral/ Negligible	Neutral/ Negligible

Key:

Shaded Cell = Significant in terms of EIA Regulations.

Unshaded cell = Not significant in terms of EIA Regulations.

G3.9 Effects that are forecast to be Moderate or Substantial are considered to be Significant for the purpose of this assessment.

G3.10 It should be noted that the type of categorisations illustrated in Table G3-4 provide a guide only and may be moderated based upon professional judgement and experience. In particular, the divisions between categories of receptor sensitivity, magnitude of change, and level of effect should not be interpreted as definitive, and the lines that represent the boundaries between categories should in many cases be considered as ‘blurred’. Where the level of effect is considered to be minor or less, these are generally not deemed significant in terms of the EIA Regulations (Ref 33). However, depending on the receptor being considered, it is possible that some potentially minor effects could be judged as significant in terms of the EIA Regulations, and where this is judged to be the case, the rationale for this conclusion has been provided in this chapter.

Consultation

G3.11 Lichfields has informally scoped the proposed development with Officers at RCBC, agreeing that Water Management and Flooding during the construction and operational phases should be scoped into the assessment. This is not a formal Scoping Opinion under the EIA Regulations. A description of this scoping is provided in Chapter A of the ES and the Scoping Note issued to RCBC and relevant correspondence is provided at Appendix A2.

G3.12 Consultation has also been undertaken with Northumbrian Water, the Environment Agency and Natural England, as discussed in Table G3-5 below. It should be noted that the consultation initially focussed on the Flood Risk and Surface Water Management Strategy for the wider Teesworks area, which is being developed concurrently with this ES for the proposed development. Therefore, consultation consists of high-level comments provided for the strategy and the confirmation that these comments can be applied to this site. These have also been referenced in the FRA (see Appendix G2 of the ES). It is anticipated that further consultation will be undertaken with these organisations during the strategy and the detailed design development of the proposed development.

G3.13 Full details of the information provided in the informal scoping note are provided in Appendix A2 and the responses received in relation to Water Management and Flood Risk are provided in Appendix G1 to the ES.

Table G3.5: Summary of relevant consultee consultation

Consultee	Consultation
<p>Redcar and Cleveland Borough Council²</p>	<p>Drainage - proposals will be determined and included as part of the Flood Risk and Surface Water Management Strategy and further developed at design stage of the project. Noted to be acceptable in principle</p> <p>Flooding - The proposed finished floor level for the site is to be a minimum of 5.03mAOD which is equivalent to the 1 in 200-year coastal flood risk and sea level rise allowance to the 2100 design scenario. The majority of the site currently lies within Flood Zone 1 which means it has a chance of flooding of less than 0.1% - equivalent to the 1000-year event, however there are there are areas located within Flood Zone 2 due to the dissection of the site by The Fleet. Current ground levels range from 4mAOD to 20mAOD which would mean that there are areas of the site which could be susceptible to flooding. A high-level site-specific FRA is being undertaken for the site. Noted to be acceptable in principle</p> <p>Local and National plans and policies - have been considered. Noted.</p> <p>Climate change – the ES will consider the impact of climate change on water levels (as per the baseline assessment using government guidance). Need confirmation that wave overtopping, and freeboard are not considered significant. Noted.</p> <p>Water quality – In line with the Tees Valley design guidance (Ref 53) all surface water runoff will require SuDS treatment and attenuation prior to discharge into the Tees or local watercourses. Pollution control measures advised in the water strategy, such as bunding of potential sources of contamination, will be implemented in order to prevent potential contamination incidents to the Tees. Note that SuDS are a general aspiration for the Teesworks area, and the feasibility of SuDS will be commented on in the below sections of this ES chapter.</p>
<p>Northumbrian Water</p>	<p>Blue green strategies need to be discussed with the Lead Local Flood Authority for this area as they are responsible for the governance on the management of surface water.</p> <p>In terms of ascertaining available capacity available in Northumbrian Water’s network to accommodate flows from the proposed development, a request should be submitted to the Northumbrian Water Pre-Planning Enquiry Application should be made which will incur a fee. It is anticipated that this will be undertaken by the team developing the Flood Risk and Surface Water Management Strategy for the site (out with this project scope for the Teardrop and CLE31 site).</p>
<p>Natural England</p>	<p>Consultation has not been undertaken to date with Natural England in relation to Water Management and Flood Risk, however it is anticipated that an assessment of cumulative effects will need to be considered as well as the impact of climate change on the water environment. Consultation with Natural England shall therefore be undertaken when details are known about the drainage strategy. Consultation shall be undertaken as part of the required assessments (WFD Assessment) that shall be undertaken prior to construction (as detailed in the Mitigation Section of this Chapter).</p>
<p>Environment Agency³</p>	<p>Consultation has been sought with the EA. As full details of the proposed development are not available at this time, further consultation will be required as the site develops.</p> <p>The EA’s 'Planning advice for developers - Frequently Asked Questions' document, n summarises the environmental issues for which the EA are responsible and forms free advice at the pre-application stage. Further guidance and site-specific advice can be provided for a fee chargeable per hour, but as the form for this requires details of the site layout and proposed works (details which are not yet available), this has not been undertaken for this high-level assessment for the site.</p> <p>The key points in the guide are: that a FRA is required; LLFA consultation is required for surface water management; SuDS should be carefully considered; land contamination and pollution prevention needs to be considered; if a proposal affects surface waterbodies a WFD assessment is required demonstrating how the development will prevent deterioration and improve the waterbody’s ecological status; the opposition of the EA to culverting.</p>

² Email from Nigel Hill of Redcar and Cleveland Borough Council dated 24th Nov 2020.

³ Email from Caitlin Newby of the Environment Agency dated 26th Nov 2020.

Consultee	Consultation
	<p>It is therefore anticipated that a WFD assessment will be requested once Flood Risk and Surface Water Management Strategy and design is developed, to assess the impact of discharges to the Tees and protected areas in and surrounding the site. Also, an environmental permit is required for any activity that may pollute the air, water or land; increase flood risk; or adversely affect land drainage and work on or near main rivers requires a permit. The River Tees is designated as a main river but as the other watercourses (open and culverted) across the site are not main rivers, the EA guidelines advise contacting the local council or internal drainage board to check if land drainage consent is required. Permits are generally required for: any activity within 8 metres of the bank of a main river (or 16 metres if it is a tidal main river) and any activity within 8 metres of any flood defence structure or culvert on a main river (or 16 metres on a tidal river).</p>

Assumptions and Limitations

G3.14 The following assumptions and limitations have been made when considering the future baseline conditions as well as the design and construction of the proposed development: -

- 1 As the planning application is submitted in outline, the final site layout and drainage details are not known at this stage. The chapter is therefore a high-level assessment of water management and flooding and the detailed drainage and Flood Risk and Surface Water Management Strategy will be considered at the reserved matters stage of the planning process. This point is picked up in Section G6.o: Mitigation and Monitoring;
- 2 The Flood Risk and Surface Water Management Strategy and drainage plan, with the exception of modified discharge infrastructure, will not change the physical nature of the Tees bank;
- 3 Construction works are not anticipated to be undertaken within 16m of the tidal Tees (the minimum limit under which an Environmental Permit for construction works near a tidally influenced river is required) as the site lies more than 16m from the Tees;
- 4 Environmental Permits will likely be required for the proposed activities on site including for the drainage and discharge of surface water to the Tees and possibly including industrial or manufacturing activities on site; and
- 5 Ground conditions will not have significantly changed from the latest contamination and ground investigation reports undertaken prior to 2019.

G4.0 **Baseline Conditions**

Existing Conditions

Location and Topography

- G4.1 The site is located in the Teesworks area known as Long Acres as part of the Teardrop site and CLE31 region. The site is 67ha (670,000m²) in size and is located on the River Tees estuary, approximately 5km north west of Redcar Town Centre.
- G4.2 The site topography varies across the site. The former Hot Metals Transfer Railway line and adjacent road which bisects the site from north to south has an embankment which is raised approximately 4m above surrounding ground levels. Elevations from this embankment gradually fall to meet existing ground levels at its northern end. The area to the east of the former Hot Metals Transfer Railway line includes the area which was previously used as a landfill and is now a steep sided mound with a flat plateau at approximately 20m AOD. The ground levels surrounding the mound vary from 4m AOD to 9m AOD. The area north of the Darlington to Saltburn Railway line has little variation in the ground levels which are approximately 6m AOD throughout.
- G4.3 The area to the west of the former Hot Metals Transfer Railway line contains former internal road infrastructure at its southern end. Ground elevation ranges from 11m AOD at the road embankment on the north western boundary of the site to 6m AOD in a relatively large flat area in the centre of this part of the site.
- G4.4 This description is detailed in Section 2.1 of the FRA (Appendix G2).

Climate

- G4.5 The Flood Estimation Handbook ('FEH') gives the Standard Percentage Runoff ('SPR') near the site as being between 38%-39%. The SPR is the percentage of rainfall responsible for the short-term increase in river flow during and/or following a rainfall event.
- G4.6 The Baseflow Index ('BFI') for the area (excluding the Estuary) is 0.33 for The Fleet and 0.35 for Dabholm Beck. This is the proportion of total local streamflow which is mostly groundwater input.
- G4.7 The FEH also includes long-term average rainfall data for catchments in the UK. For the catchment in which the site is located, the Standard Annual Average Rainfall ('SAAR') is 614-615 mm/yr.
- G4.8 In summary, the area experiences less rainfall than the national average (885 mm), with moderate runoff rates and a moderate proportion of groundwater input to river flow.

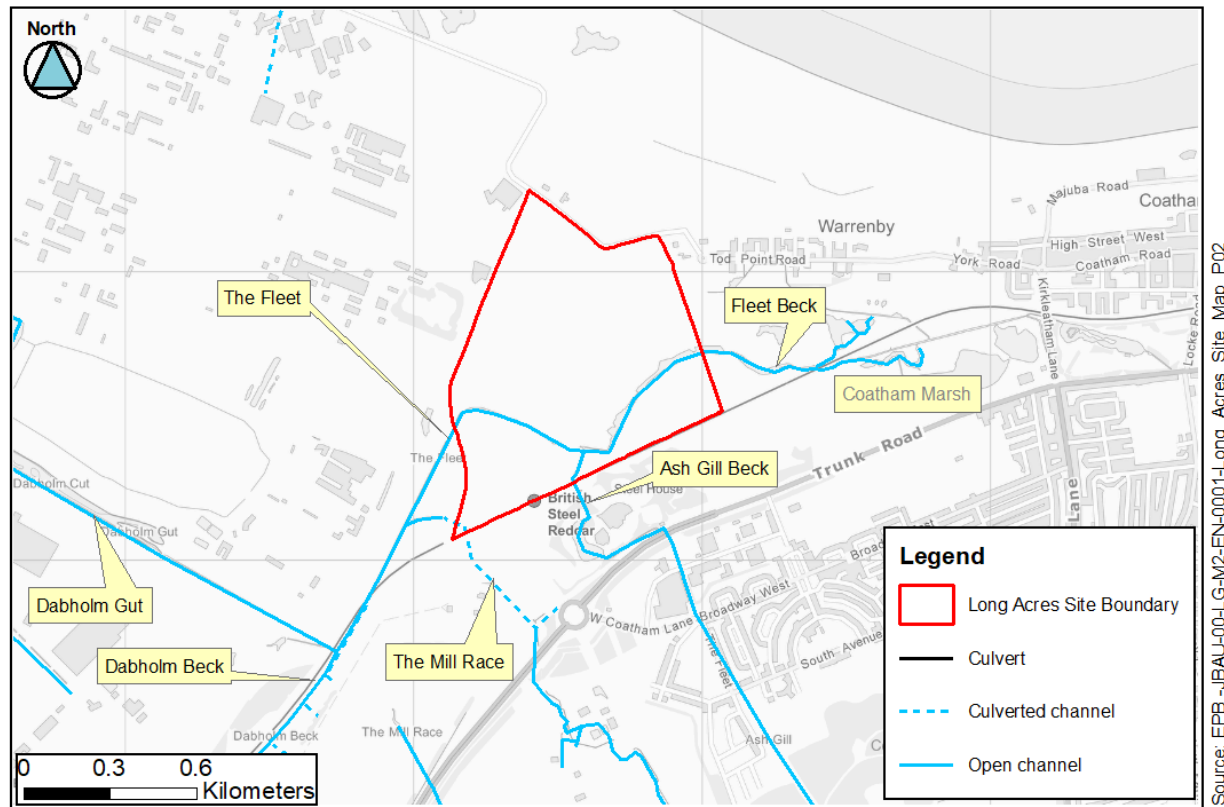
Surface Water Bodies

- G4.9 The site is located within the catchment of the River Tees, which flows to the west of the site. The southern and central areas of the site is also included within the catchments of two other watercourses: The Fleet and Dabholm Beck. The Fleet watercourse dissects the site in an east-west direction. The Fleet watercourse enters the site in a westerly direction from Coatham Marsh and arcs round in south westerly direction.
- G4.10 The FARL (FEH index of flood attenuation due to reservoirs and lakes) values for both The Fleet and Dabholm Beck catchments range between 0.94-0.95 which indicates that, while there may be some reservoir influence within both catchments, the influence is not considered major.

URBEXT values of 0.1-0.2 also indicates that urban cover within the catchment is not considered extensive in hydrological terms

G4.11 Figure G4-1 below shows the open and culverted waterbodies in the region of the site.

Figure G4-1 Open and culverted waterbodies at and surrounding the site



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G4.12 The catchment of The Fleet (up to OS NGR NZ 57002 24231) drains an area of 10.0km² in a north westerly direction. The source of the watercourse is Fleet Beck, which flows through Coatham Marsh to the north of Redcar. The Fleet is then culverted in a north westerly direction under the former Hot Metals Transfer Railway and internal road then continues in a straight culvert in a south west direction. Approximately 0.6km downstream of the site, The Fleet joins the Dabholm Beck and becomes tidal within the Dabholm Gut and Dabholm Cut before flowing into the River Tees. Both channels discharge to the River Tees via Dabholm Beck which becomes tidal within the Dabholm Gut. Adjacent to Dabholm Gut is Bran Sands Lagoon that is connected to a small drain in the shape of a ‘horseshoe’ around land to the east with both ends connected to the eastern side of the lagoon.

G4.13 The catchment of Dabholm Beck (up to OS NGR NZ 56135 24005) drains an area of 20.3km² in a northerly direction while the channel of Dabholm Beck flows in a north easterly direction. Minor culverts drain into Dabholm Beck, likely used to drain run-off from the A1085. The catchment of Dabholm Beck includes the sub-catchment of The Fleet as well as the sub-catchments of two minor watercourses which contribute the Dabholm Beck before its confluence with The Fleet: an unnamed drainage channel and The Mill Race watercourse. The catchment topography slopes from south to north, with ground levels within the catchment dropping to 2.20m AOD from an elevation of 234m AOD to the top of the catchment. Dabholm Beck, at its closest point, is located approximately 575m away from the southern site boundary. At the confluence with The Fleet, Dabholm Beck is diverted to flow from a north easterly direction to a

north westerly direction as the watercourse flows into the River Tees via Dabholm Gut (part of Dabholm Beck that is tidal in nature).

Flood Risk

Introduction

- G4.14 There are several potential sources of flooding that could impact any site; these are fluvial (originating from a watercourse), coastal, groundwater, surface water (pluvial), sewers and blocked culverts and infrastructure failure.
- G4.15 The Flood Risk Assessment undertaken for the site forms Appendix G2 of this chapter. The key findings from the assessment are summarised below.

Fluvial Flooding

- G4.16 The majority of the site is at very low risk from fluvial flooding and is in Flood Zone 1, meaning it has a less than 1 in 1000-year annual probability of flooding from river or sea. The flood extents for this mapping are created using coarse scale UK wide fluvial modelling, and incorporates more detailed modelling of specific rivers undertaken for the EA. The watercourses through the site are too small to be included in the coarse modelling and will not have previously been modelled by the EA so any fluvial flooding from these will not be captured in this mapping.
- G4.17 There are areas of the site to the south, where the site is dissected by The Fleet, in Flood Zone 2. None of the site is mapped by the Environment Agency as being in Flood Zone 3. The NPPF (Ref 37) states that, ignoring the presence of any defences, land located within a Flood Zone 1 is considered to have a low probability of flooding. Therefore, development of all land uses is considered to be appropriate within Flood Zone 1. Land located within a Flood Zone 2 is considered to have a moderate probability of flooding, with a 1 in 100-year to a 1 in 1000-year annual probability of fluvial or coastal flooding in any one year. Development is permitted within Flood Zone 2 subject to National planning policy and guidance, discussed further in Appendix G2 (FRA).
- G4.18 Flood levels for the area included within the Environment Agency Flood Zone 2 extent have not been obtained at this stage of the assessment. The results of The Fleet model comprising the Fleet and its main tributaries (JBA, 2015) was assessed which covers the stretch of The Fleet which is not included within Flood Zone 2 mapping. Based on the 100yr fluvial (Fleet Model) extents, the site is not expected to be inundated from The Fleet during an event of this magnitude from the upper reaches of The Fleet within the site boundary. The extent of flooding is largely constrained in the channel of The Fleet except minor sections along the channel bank however the flood extent would not impact the proposed development.
- G4.19 At this stage it is assumed that, as both The Fleet and Dabholm Beck receive flows from culverted watercourses, the inflows are limited to the capacity of the on-site and downstream culverts. Both channels are large open channels with significant capacity. The main flood risk relates to the 1 in 1000-year flood event upstream of the Fleet which has not been modelled and on the performance of the on-site and downstream culverts before and after the confluence of The Fleet and Dabholm Beck into the River Tees, particularly when under tidal influence.
- G4.20 There are three egress routes available from the site which will allow for re-location into urban areas: Tod Point Road which bounds the site to the north and two minor access roads – one bounding the site along the west and one to the south. It is likely that a primary access from the site will be via Steel House roundabout. This egress route has sections which are mapped within Flood Zone 2 as the access road involves crossing over The Fleet in order to gain access to the

A1085 and may be inundated during a fluvial flood event. The potential primary access road can be utilised during a flood event, but care should be taken in design of the bridging structure.

Coastal and Tidal Flooding

- G4.21 The majority of the site is at a low risk from coastal flooding. The modelling shows there are areas mapped at medium to high risk of tidal flooding (with consideration to climate change allowances) in the southern and western sections of the site. Inundated areas have flood depths over 1m and are therefore considered to be at high risk however these areas are largely associated with the channel of The Fleet except two isolated areas. The remainder of the tidal flood extent is classed as moderate risk, where flood depths are below 1m.
- G4.22 The coastal flood modelling does not take into account the presence of tidal limiting structures such as flap valves and weirs. As such there is a lower confidence in the flood mapping of the inland areas.

Surface Water Flooding

- G4.23 The site is at a moderate risk from surface water flooding. The EA flood map (in the FRA in Appendix G2) shows the site is at some risk from surface water flooding. There is no clear area of flow path present, just many small areas of isolated extent in low spots. High level modelling of surface water undertaken as part of the Phase 1 study for the Teesworks Water Management Strategy indicates there are areas of the site that may be susceptible to surface water flooding, due to variations in surface elevations. These areas are also shown on the Level 2 SFRA (Ref 49).

Climate Change

- G4.24 Tidal flood levels, fluvial flows, sea level and rainfall are all predicted to increase with climate change, in accordance with EA defined flood risk guidance (Ref 32). Climate change allowances have been considered. 5.03mAOD represents the 200-year Coastal Flood Risk + Sea Level Rise Allowance to 2100 design scenario (Table G2-6). As previously noted, the proposed development design life is to be taken as 50 years but as a conservative approach these climate change projections to 2100 and beyond have been used to consider the future impacts in relation to water management and drainage. While there are currently sections of the site below 5.03mAOD, according to the detailed model created to supersede the broad scale EA tidal flood risk mapping (which takes into account sea level rise), the risk mapped is due to topographic depressions in the DTM data used within the model.
- G4.25 In accordance with Planning Practice Guidance (Ref 38), the proposed development is considered to be in the 'Less vulnerable' category, therefore, the proposed development is appropriate in Flood Zone 1 (outside of 1000-year flood).

Water Framework Directive (WFD)

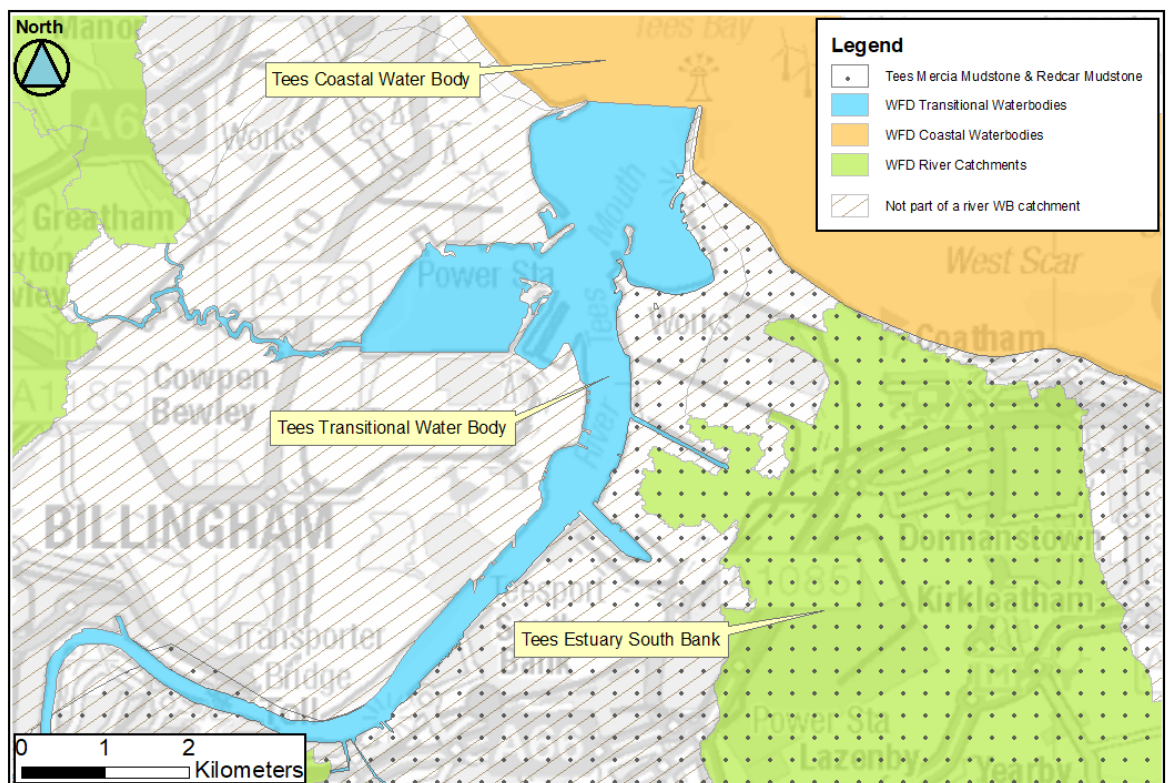
- G4.26 Any activity which has the potential to have an impact on the ecology of a water body will need consideration in terms of whether it could cause deterioration in its Ecological Status or Potential and impact the water body's ability to achieve its WFD Objectives through a Water Framework Directive (WFD) Assessment. For each water body, three different status objectives are identified within the River Basin Management Plan (RBMP) (Ref 36). These are the overall status objective, the ecological status or potential objective and the chemical status objective. A default objective for all water bodies is to prevent the deterioration in the Ecological Status (or Ecological Potential for Heavily Modified and Artificial Water Bodies) of the water body, as detailed in the Water Framework Directive (Directive 2000/60/EC) (Ref 35).
- G4.27 The four WFD water bodies relevant to the site are outlined in the table below.

Table G4.1 WFD Water Bodies

Water Body ID	Water Body Name	Hydromorphological designation	Current Overall Status	Overall Status Objective
GB40302G701300	Tees Mercia Mudstone and Redcar Mudstone	N/A (Groundwater Body)	Poor	Poor (2015)
GB103025072320	Tees Estuary (S Bank)	Heavily modified	Moderate	Good (2027)
GB510302509900	Tees	Heavily modified	Moderate	Moderate (2015)
GB650301500005	Tees Coastal	Heavily modified	Moderate	Good (2027)

G4.28 The site is located within the Tees Mercia Mudstone and Redcar Mudstone Groundwater water body (GB40302G701300), 1.3km south east of the Tees (transitional water body) (GB510302509900), 4.4km south west of Tees Coastal water body (GB650301500005) and is 0.1km north west of Tees Estuary (S Bank) water body (GB103025072320) as shown below in Figure G4-2. The Tees Estuary (S Bank) WFD water body is facing pressures from priority hazardous substances and physical modification from urbanisation.

Figure G4-2 WFD waterbodies surrounding the site



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G4.29 Under the WFD, the EA has produced nine 'RBMP' for England to manage water quality targets and river basin planning, with the Northumbrian River Basin Management Plan being relevant to the site.

Geology and Soils

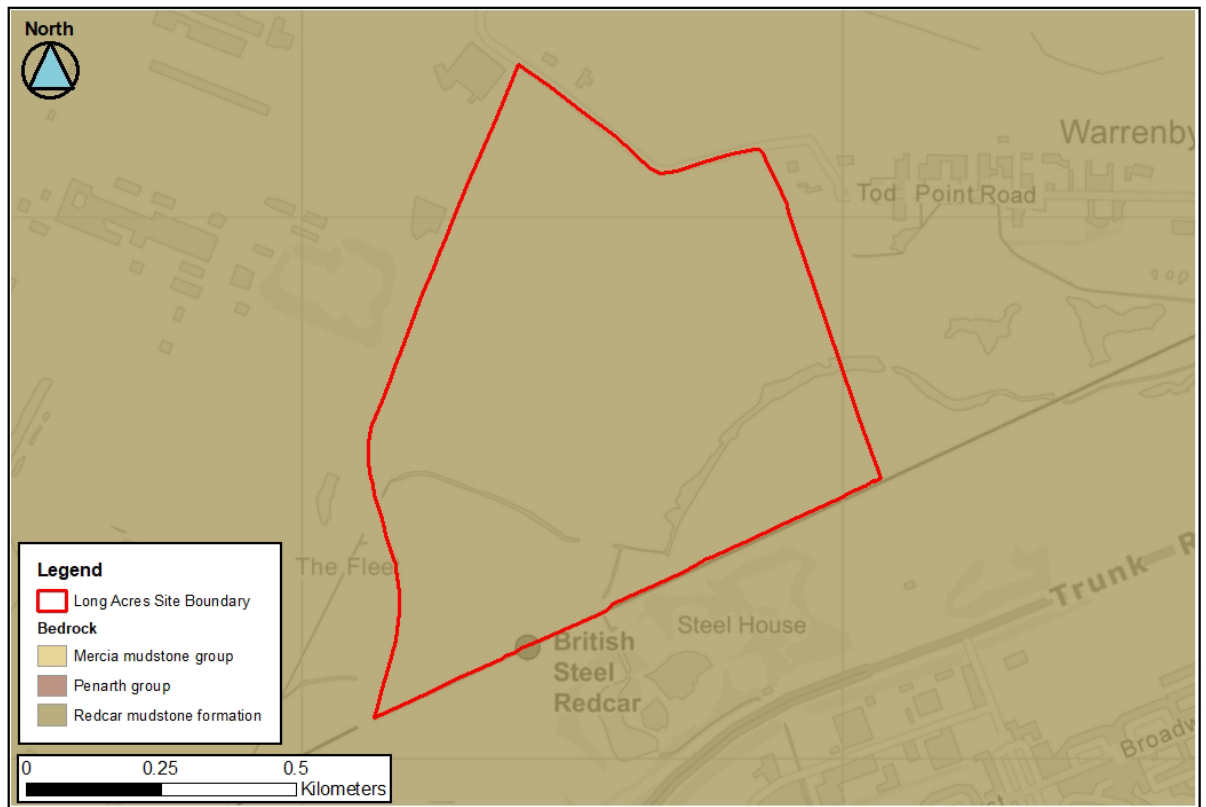
- G4.30 Whilst the underlying geology is not considered to be a receptor, the geological environment controls the behaviour and quality of the groundwater and potential pathways to receptors and is, therefore, described as part of the baseline conditions at the site. A more detailed description is found in Chapter H (Ground Conditions) which also considers existing contamination sources and their impacts on water body receptors.
- G4.31 The site lies on ground reclaimed from the sea and is covered by a layer of Made Ground predominantly comprising deposits of slag of variable thickness and composition. This reflects the historic development of the site for the iron and steel making industry along the South Tees corridor (for more details of ground conditions and remediation, see Chapter H of this ES).
- G4.32 Made Ground deposits on site includes an area of land raise which is the former Cleveland Landfill 31(CLE31), which is also known as the Warrenby Landfill. It is estimated to have a current approximate volume of 1 million cubic metres, comprising mixed steel making by-product slag with the outstanding other non-hazardous industrial waste such as clay, subsoil, topsoil, paper, and canteen waste. Material recovered from the landfill will be removed as part of the first phase of development and recovered and reused to level the site or removed to other parts of the Teesworks development (for more details of the landfill and proposed re-use of materials, see Chapter H of this ES).
- G4.33 Below the Made Ground, the BGS Geoindex (Ref 2) indicates that the superficial deposits across the site comprise Tidal Flat deposits (of sand, silt and clay) overlain by Blown Sand deposits orientated north south, in the western part of the site (Figure G4.2). To the south, deposits comprise Glaciolacustrine Till deposits (of clay, sand and gravel) overlain by Made Ground.
- G4.34 There are four borehole records within the site boundary (NZ52SE13551/13-14, NZ52SE127, NZ52SE156). Borehole records indicate that deposits of Made Ground (brick, rubble and clay) extend to ~3.25 m below ground level (mbgl), which overlies laminated brown silty clays (Tidal Flat deposits) that extend to ~10 mbgl, where rock head is reached. Both the Made Ground and Tidal Flat deposits are notably thicker than at Steel House to the south-west, which is most likely a consequence of Long Acres' proximity to the Tees estuary.
- G4.35 Historical data indicate that the boundary between the Glaciolacustrine and Tidal Flat deposits lies further north than that indicated by the BGS (Ref 5).
- G4.36 The UK Soil Observatory viewer indicates that the Soils Mapping for England and Wales category for the eastern half of the site is for slowly permeable, seasonally wet, slightly acid but base-rich loamy and clayey soils. However, in the western part of the site, there are loamy and clayey soils of coastal flats with naturally high groundwater.
- G4.37 The bedrock geology of the site comprises mudstones of the Redcar Mudstone Formation (Figure G4.3). The Redcar mudstones overlie the Penarth Group mudstones which occur at some 250 mbgl. The Sherwood Sandstones occur at some 400-500 mbgl.
- G4.38 Intrusive investigations have been undertaken across the site, associated with historic phases of work on the site (e.g. Corus, 2004 (Ref 10) and is summarised by CH2M (2017, Ref 5). A more detailed summary of the ground conditions reported from this investigation is provided within their reports.
- G4.39 A summary of the geological units is presented in Table G4.2.

Table G4-2: Summary of geological units present at site

Unit	Description	Average Depth (mbgl)	Aquifer Type
Made Ground	Variable Light grey to dark grey slag with cobbles and boulders	Up to ~4	N.A.
Blown Sands	N.A.	N.A.	Secondary A
Tidal Flat deposits	Firm laminated brown silty CLAY	Up to ~6	Undifferentiated Secondary Aquifer
Glacial Till	Firm or stiff, locally soft to firm, locally hard, reddish brown, locally dark brown locally fissured silty sandy gravelly CLAY with rare sand layers	Up to ~4 (Indicated by British Steel 1975 boreholes)	Unproductive
Redcar Mudstone Formation	Grey fossiliferous fissile MUDSTONES and SILTSTONES	To depth	Secondary undifferentiated
Penarth Group	Grey/black MUDSTONES, some LIMESTONES/SANDSTONES	To depth	Secondary B

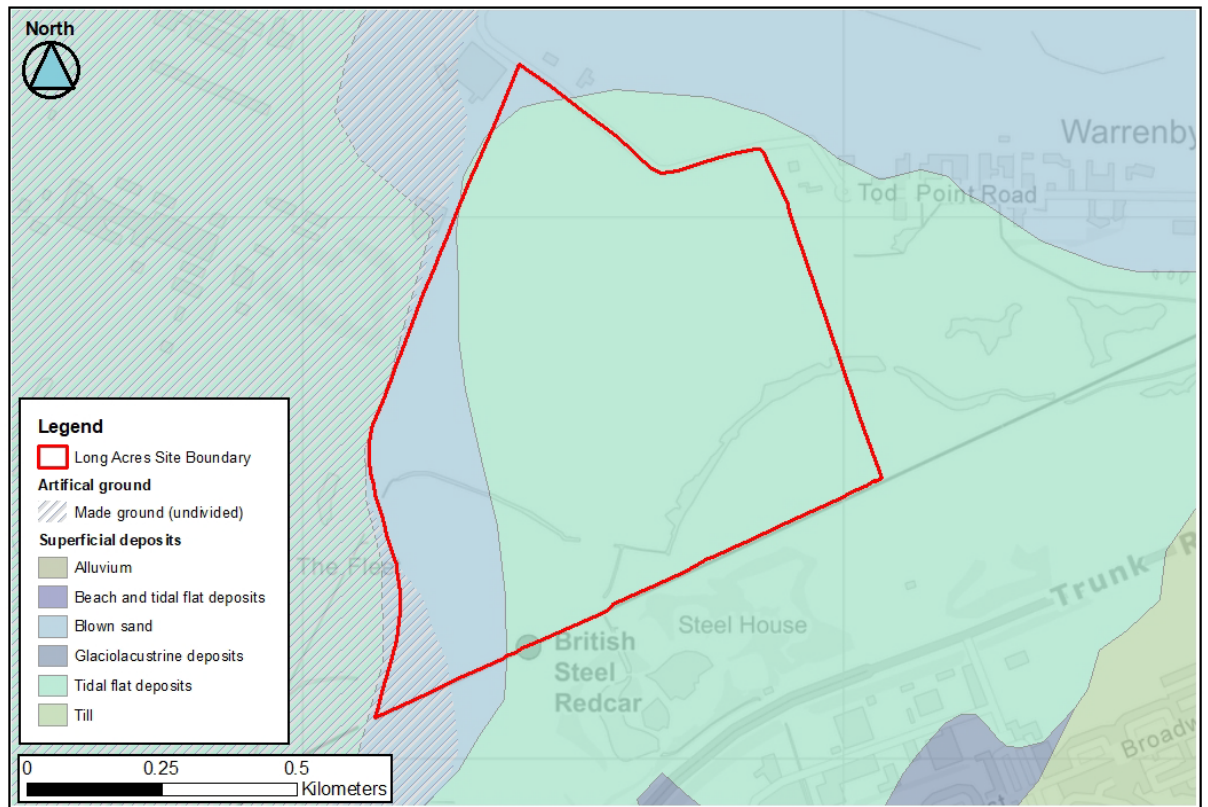
G4.40 The area is identified as being of low geological hazard risk (shrink swell, running sands, landslide), and is not located within a Coal Mining Area.

Figure G4-3 Bedrock Geology



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Figure G4-4 Superficial Geology



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Land Quality

- G4.41 Existing land quality and its potential impacts on receptors is considered in the ground conditions and remediation chapter (Chapter H of this ES). The site is covered with extensive deposits of Made Ground and contains a number of potential sources of contamination.

Hydrogeology

Aquifer Classification

- G4.42 The Redcar Mudstone Formation is classified as a Secondary (undifferentiated) aquifer, which 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 lithology. Here, the largely mudstone dominated sequence forms only local aquifers yielding small supplies. The underlying Penarth Group is classified as a Secondary B aquifer, defined by the EA as predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers. In this case, the largely argillaceous sequence with occasional sandstones yields less than 0.5 L/s of water that can be highly mineralised.
- G4.43 The Tidal Flats deposits are also classified as a Secondary (undifferentiated) aquifer. The Blown Sands are classified as a Secondary A aquifer, comprising permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an

important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

- G4.44 Borehole records within the site infer the water table is approximately 2.7mbgl, which would place it within the Made Ground. This concurs with the estimates made by Wood (2019), which suggests the water table is perched on the underlying deposits, with a limited gradient due to the flat topography. Enviro (2004) also note that groundwater varies between 1.5 and 4.5 mAOD (with an average 3.7 mbgl). Whilst limited site groundwater level data are available for the site itself, elsewhere (e.g. the Foundry site) groundwater flow direction is noted to be towards Fleet Beck and to the north towards Coatham Sands. Whether groundwater flow is towards Coatham Marshes (see Nature Conservation Sites, below) is unknown.
- G4.45 The conceptual understanding of the overall groundwater functioning of the site is for direct recharge through the Made Ground, which is of varying permeability. Below this, the ground is likely to be mainly saturated within the Tidal Flat deposits and underlying Glacial Till and bedrock mudstone. Groundwater heads within the more permeable units are likely to vary across the site and the more permeable horizons may not be laterally continuous across the site, so there may be local variations in groundwater elevation. Nonetheless, parts of the site are likely to be in hydraulic connectivity with the River Tees or the coast, particularly through the Tidal Flat sand/gravel horizons and Blown Sands, and a potential pollution linkage may exist between the two. There is unlikely to be any discharge of baseflow from the Redcar Mudstone Secondary (undifferentiated) aquifer to the River Tees or the coast, which is likely to form the most significant groundwater discharge boundary in this area for all permeable strata.

Groundwater Quality

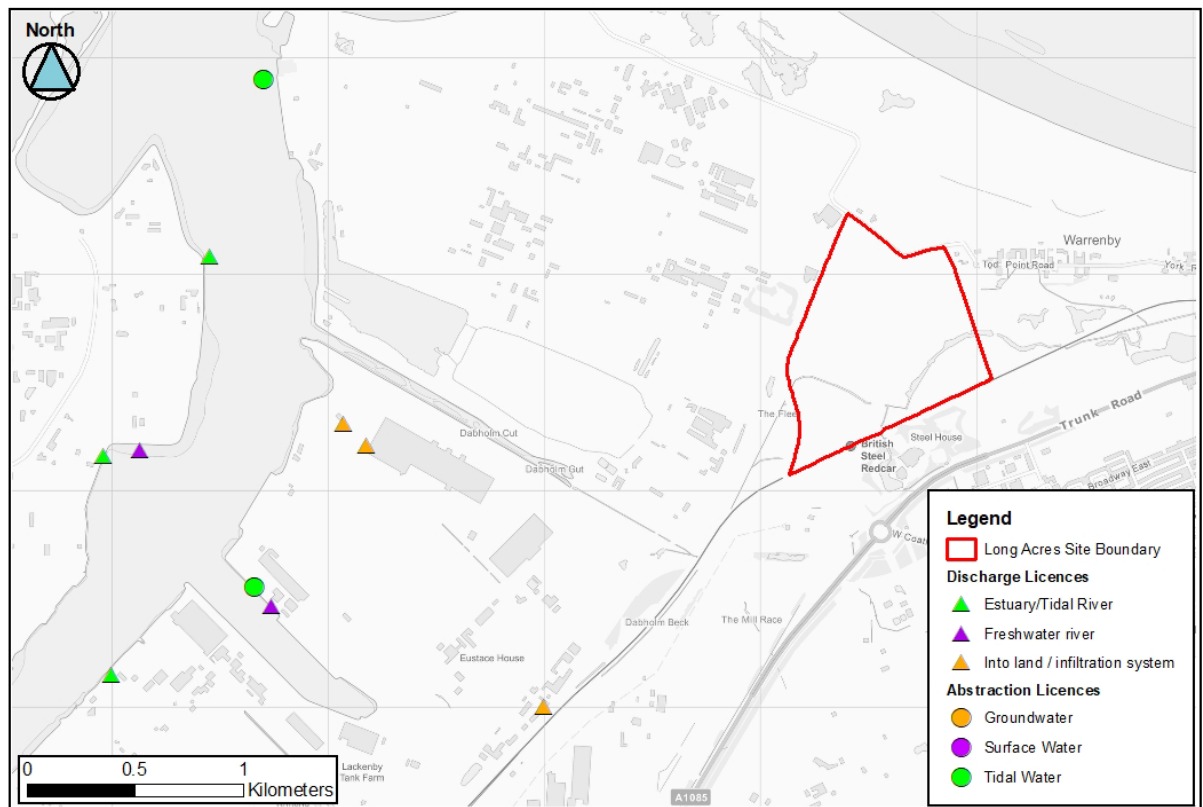
- G4.46 Groundwater vulnerability beneath the site is medium-high. This relates to the vulnerability of the Secondary A Blown Sands deposits aquifer.
- G4.47 The groundwater quality of the Redcar Mudstone groundwater body (ID GB40302G701300) has been assessed by the Environment Agency in 2016 as having a WFD status of 'Poor' in the Northumbrian RBMP (Ref 15). This appears to be due to the general chemical status in relation to the ironstone mining history of the area and due to risk of nitrate contamination (Ref 16).
- G4.48 Source Protection Zones (SPZs) (inner, outer and total catchment) are defined around abstraction boreholes that are used for public water supply (see below), to help monitor the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk is likely to be. The zones are used in conjunction with the EA's GP3 to set up pollution prevention measures and monitor the activities of potential polluters near public water supply boreholes. The site does not lie within a defined SPZ, nor is within 5 km of one.
- G4.49 There is a lack of previous investigations into groundwater quality at this site. However, CH2M (Ref 5) assumes the groundwater quality within the Made Ground and superficial deposits is poor overall, reflecting the protracted history of industrial activities on the site.

Abstractions and Discharges

- G4.50 Available information from the EA indicates that there are several abstractions within 5 km of the site (Ref 19) and these are shown on Figure G4.5. Of these, the groundwater abstractions are all located on the north side of the River Tees and, due to the hydraulic barrier formed by the River Tees, it is unlikely that any of these abstractions have their catchment within the site of the proposed development.

- G4.51 The nearest licenced abstraction lies on the south bank of the River Tees, downgradient of the site. The abstraction on the south bank of the River Tees is for general power station cooling.
- G4.52 Discharge data provided by the EA indicate that there are numerous active consented permits within the vicinity of the site which are shown on Figure G4-5. None of the discharges lie within the site. All the discharges are for sewage or trade effluent, issued to ground/infiltration, surface water or tidal water receiving water bodies.
- G4.53 On the basis of the above information, no abstractions or discharges are deemed to be potentially impacted by the proposed development. None of the other discharge-receiving waterbody locations are likely to have their flows or water quality altered by the proposed development.
- G4.54 RCBC confirmed that there are no abstractions for private water supply within 2 km of the site. Whilst every effort has been made to locate private water supplies, there is the potential for unrecorded private supplies to be present but this unlikely given the local hydrogeological conditions (e.g. historic contamination and poor aquifers).

Figure G4-5 Abstractions and Discharges



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Nature Conservation Sites

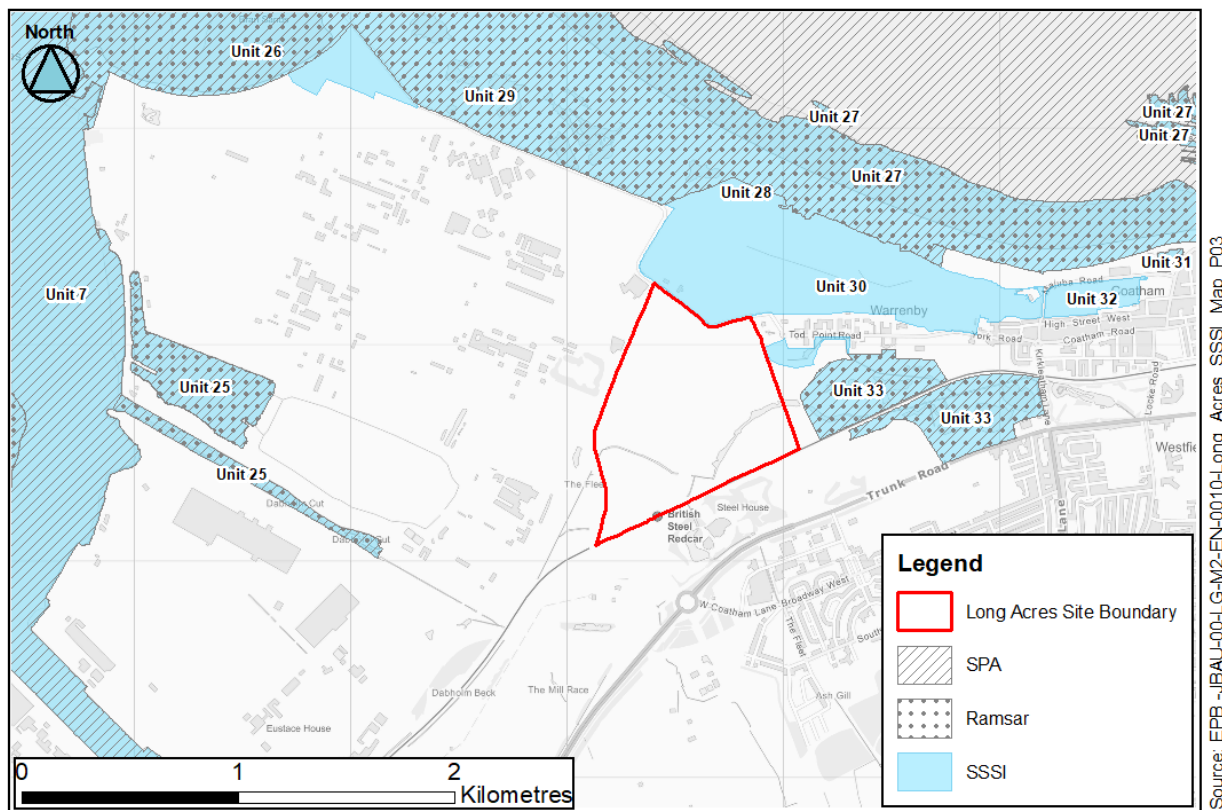
- G4.55 To the east of the site boundary lies Unit 33 (Coatham Marshes) of the Teesmouth and Cleveland Coast SSSI, designated for its ornithological interests. Further north is Unit 30 (Cleveland Golf Course; dunes, favourable status in March 2018) and Unit 28 (South Gare and Coatham Dunes; salt marsh and dunes, favourable status in March 2018).
- G4.56 North of this unit lies Units 27 (South Gare to Marske; salt marsh and dunes, unfavourable declining status in March 2018) and to the north-west is Unit 29 (Coatham Quarries and

Lagoons; dunes, favourable status in March 2018). These three units are part of the saltmarsh and sand dune habitats (Coatham Dunes system) for this designated site (Natural England, 2018 (Ref 47)). Unit 25 comprises Dabholm Gut and Dabholm Cut which lie to the west of the site. Whilst the boundary of the SSSI does not extend into the site boundary itself, due to the proximity of the site to the boundary, the site is mapped within an area designated as a SSSI Impact Risk Zone.

G4-57 In addition to the SSSI designations, the coastline from Teesmouth to Redcar is part of the Teesmouth and Cleveland Special Protection Area (SPA) designated for ornithological importance (nationally and internationally) and presence of invertebrates. This also covers SSSI unit 25 (Bran Sands and Dabholm Gut/ Cut).

G4-58 The Teesmouth and Cleveland Coast also has a Ramsar designation along the coast and estuary. These designations are shown in the figure below.

Figure 4-6 Designations in proximity to the site



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G4-59 Planning applications will be required to be assessed for likely impacts on the SSSI/ SPA/ Ramsar. There are a number of damp depressions (slacks) which support a range of wetter vegetation types such as NVC type SD16 (*Salix repens* – *Holcus lanatus*), which can develop under wetland water supply mechanism (WETMEC) dune Type B, C or E. Wet dune slacks experience seasonally fluctuating water levels, with amplitudes ranging from dry at considerable sand depth in summer to permanently flooded and are therefore highly sensitive water environments. There are five WETMEC dune types which are a combination of rain-fed and groundwater-fed (Davy et al., 2010, (Ref 12)). In terms of management in relation to hydrological functioning, Natural England’s Views About Management for the dunes include avoidance of works which would change hydrology and drainage.

- G4.60 Given the likely hydraulic connectivity of the groundwater within the surrounding aquifers with the estuary and the coast, in the absence of detailed monitoring data for the dunes close to the site, a precautionary approach is needed to evaluate the potential for impacts on this aspect of the water environment. Nonetheless, it was noted in discussions with the authors of Chapter D, that water levels in the shallow pools adjacent to the dune system have been observed to have fallen in the years since the cessation of operations at the steel works, in 2015. The favourable status of Unit (33), to the east of the site, in 2018 indicates that the designation does not depend on the previously higher water levels.
- G4.61 Further details regarding the ecology of these Units are presented in Chapter D of this ES. There are no sites designated for geological importance within the footprint of the proposed development.

Summary of Receptors and their Sensitivity

- G4.62 From consideration of the baseline characterisation, a sensitivity classification has been allocated to each identified water environment receptor, and these are set out in Table G4.2. The receptor sensitivity allocated is based upon the definitions set out within Table G3.2 and utilising professional judgement.

Table G4.2 Sensitivity of water environment and human health receptors

Receptor	Rationale	Sensitivity
Surface water		
River Tees estuary	Under the EA’s Catchment Explorer, as noted in Section G5, the Tees estuary is classified as being of ‘Moderate’ ecological potential and ‘Failing’ chemical status with an overall classification of ‘Moderate in 2016. Reasons for the classifications include diffuse and point source pollution from contaminated water body bed sediments, trade / industrial activity and sewage discharge. In addition, the whole estuary area holds a national designation (Teesmouth and Cleveland Coast SSSI) and the site lies within a zone of interest for the SSSI. Teesmouth and Cleveland Coast also has international designations – SPA and Ramsar designations. Therefore, the sensitivity of the Tees is considered to be very high.	Very high
The Fleet	The Fleet is classified under the WFD but is too small to be assigned a WFD element type. As such the sensitivity of the watercourse is considered to be low.	Low
Dabholm Beck, Dabholm Cut & Dabholm Gut	In regard to the four watercourses/culverts, the channels are too small to be classified under WFD as they have limited ecological potential. As such, the sensitivity of these watercourses is considered to be very low in relation to WFD. Dabholm Cut & Dabholm Gut are interconnected, and therefore taken together as one receptor. However, since Dabholm Gut is part of Unit 25 of the Teesmouth and Cleveland Coast SSSI. The region is of special interest due to the presence of: Jurassic and Quaternary geology; sand dunes; salt marshes; breeding harbour seals; A diverse assemblage of breeding birds of sand dunes, saltmarsh and lowland open waters and their margins; a diverse assemblage of breeding birds of sand dunes, saltmarsh and lowland open waters and their margins; a diverse assemblage of invertebrates associated with sand dunes and a variety of other bird species. Dabholm Gut is part of Unit 25 of the wider	Very high

Receptor	Rationale	Sensitivity
	Teesmouth and Cleveland Coast SSSI and is also located within the Teesmouth and Cleveland Coast SPA and Ramsar designations.	
Ash Gill Beck	The channel is too small to be classified under WFD and have limited ecological potential. As such, the sensitivity of this watercourse is considered to be very low.	Very low
Coatham Marshes	Unit 33 of the Teesmouth and Cleveland Coast SSSI (described above) which supports ornithological interests.	Very high
Groundwater		
Mudstone bedrock aquifers	The site sits on a bedrock aquifer of low-moderate groundwater potential. Although the current overall status of the WFD groundwater body which dominates the site is 'Poor', the overall groundwater resource only yields limited amounts of groundwater, as a Secondary B/ undifferentiated aquifer, and is therefore regarded as of low sensitivity.	Low
Superficial aquifers (Made Ground and Blown Sands)	The site sits on superficial deposits overlying the bedrock, some of which are classified as a Secondary A aquifer (Blown Sands). Due to the international designation (Teesmouth and Cleveland Coast SSSI/SPA/Ramsar) of the dunes units which comprise these strata, adjacent to the site, the sensitivity of the Made Ground /Blown Sands, as a proxy for the shallow pools adjacent to the dune system, is considered to be very high.	Very high
Superficial aquifers (Tidal Flats and Glacial Till)	The site sits on superficial deposits overlying the bedrock which are classified as a Secondary (undifferentiated) aquifer. Due to the Poor aquifer status, lack of resource potential, and presence of known contaminants at the site, and lack of local use for abstraction, it is therefore regarded as being of low sensitivity.	Low
Coatham Marshes	The hydrological aspect of this unit (Unit 33) of the Teesmouth and Cleveland Coast SSSI/SPA/Ramsar (which in turn supports ornithological interests) may or may not be supported by groundwater input from the southwest of the site. However, the degree of hydraulic connectivity is not known. Due to the designated nature of this site, it is therefore regarded as being of very high sensitivity.	Very high

G4.63 The Fleet, Dabholm Beck, Dabholm Cut & Dabholm Gut flow into the Tees transitional WFD waterbody that is then connected to the Tees Coastal WFD waterbody. This Tees Coastal WFD Water body is located some distance (4.9km) downstream of the Tees transitional water body. Thus, due to the extent of distance between the Tees Coastal WFD water body and The Fleet, Dabholm Beck, Dabholm Cut and Dabholm Gut, the hydrology is unlikely to be connected and so the Tees Coastal WFD water body is therefore scoped out of further assessment.

G4.64 In addition, the Tees Estuary (S Bank) WFD waterbody is also scoped out of further assessment since the site or the waterbodies which run through the site are not hydrologically connected to the Tees Estuary (S Bank) WFD waterbody (As shown in Figure G4-2).

G4.65 The Tees (transitional) WFD waterbody remains scoped into this assessment since The Fleet and Dabholm Beck discharge to the Tees (transitional) WFD waterbody via Dabholm Cut and Dabholm Gut, thus the site is hydrologically connected.

- G4.66 Whilst the watercourses to the east of the site (Mill Race Watercourse) shown in Figure G4.1 drain to the Dabholm Gut along with The Fleet, this waterbody is not directly connected and so have not been listed as receptors in this assessment for the site.
- G4.67 Previous intrusive investigations and site history in the wider area has confirmed that, the site is generally devoid of natural surface soil resources, and that significant deposits of Made Ground are present across the entire site and surrounding landholding. Therefore, due to the historic industrial nature of the site and absence of natural surface soils, soils are not an agricultural resource and are not considered to be a sensitive receptor in this respect. Therefore, a soils impact assessment has not been carried out.

Future Baseline

- G4.68 The two main influences on the future hydrological and hydrogeological regime of the site and surrounding area are climate change and local land use change, which have the potential to change the river flow regime (through changes in rainfall patterns and storm surges as a result of climate change and sea level rises) and ground permeability and runoff/infiltration (through changes in land use).
- G4.69 The UK Climate Projections (UKCP18) (Ref 45) indicate that as a result of climate change, it is projected that, in general, winters will become wetter and summers drier. The EA via the Gov.UK website provides recommended climate change sensitivities for peak river flow, peak rainfall intensity and sea level rise. Potential climate change sensitivities can be used to derive appropriate design levels above which the proposed development shall be constructed. The lifespan of the proposed development is assumed to be at a minimal 50 years, but as the final layout and design is yet to be finalised, a conservative approach has been taken and the data examined up to 2100. Details of the estimated increases to peak river flow, peak rainfall intensity and sea level rise are provided from Paragraph 2.25.
- G4.70 The effect of these projections regarding decreased summer rainfall and increased winter rainfall is likely to be greater seasonality of flows and water levels, with greater susceptibility to both drought and extreme flood events. The increased frequency of floods increases the likelihood of morphological changes in watercourses.
- G4.71 In the absence of the proposed development, or any other development, proceeding, it is anticipated that the land use, management of the site and condition of the water bodies at the site and in the surrounding area would remain the same as the current baseline as described above and in the FRA (Appendix G2).
- G4.72 It is considered unlikely that the site will remain in its current state given the existing permission on part of the site and the aspirations of STDC as outlined in the South Tees Regeneration Master Plan (as described in sections B4.0 and B5.0 of Chapter B of the ES (Ref 55)). It is considered likely that an employment development of similar nature and scale to the proposed development would come forward on the site in the absence of the proposed development. It is likely that this would have similar effects on the future baseline as the proposed development.

G5.0 **Potential Effects**

Embedded Mitigation

G5.1 A full list of the mitigation measures embedded into the proposed development is provided in Section B8.0 of Chapter B. Those relevant to the water environment are set out below.

During Construction

G5.2 A Framework Construction Environment Management Plan ('CEMP') which sets out key measures and principles that will be adhered to during the construction phase forms part of the embedded mitigation for the proposed development during the construction phase. The measures in the Framework CEMP will be taken forward in detailed CEMPs for each phase of construction. A full list of CEMP measures and principles is provided at paragraph B7.30 in Chapter B (Site Description and Scheme Proposals), those which are relevant to the water environment are listed below.

- 1 The Environment Agency, CIRIA and Pollution Prevention Guidance will be implemented throughout the construction period; with adherence to the following in particular:
 - i EA Principles and Practice for the Protection of Groundwater (GP3) (Ref 31);
 - ii Pollution Prevention Guidance (PPG) Notes (as referenced in paragraph G2.4);
 - iii GOV.UK Pollution prevention for businesses (Ref 58);
 - iv CIRIA Report C532: Control of Water Pollution from Construction Sites (Ref 44);
 - v CIRIA Report C502: Environmental Good Practice on Site (Ref 6);
 - vi CIRIA Report 515: Groundwater Control – design and practice (Ref 7); and
 - vii CIRIA Report C753: SuDS Manual (Ref 9).
- 2 A Construction Stage Surface Water Management Plan ('SWMP') will be incorporated into the site so that run off can be carefully controlled using temporary drainage;
- 3 Mitigation will be included to prevent and mitigate against any accidents, including but not limited to, spills, storage of soils and control of construction related dust and the construction of site hoarding to reduce the impact on ecological sensitive receptors. Measures will be implemented to prevent sediment, dust, surface water run-off and other substances from entering watercourses. Details will be recorded of the soils, chemicals and oils used during the construction process;
- 4 Plant and machinery will be well maintained to reduce the risk of oil spillages or similar and electrical equipment such as transformers and switchgear are to be located above predicted flood levels as per guidance;
- 5 An emergency response protocol will be developed by contractors so that any accidents of spillages are intercepted;
- 6 Avoid site run off of water and mud; and
- 7 Any disposal of contaminated waste will be undertaken in accordance with the Waste Management Licencing Regulations 1994 and the Duty of Care Requirements.

G5.3 Of the other embedded mitigation measures that shall be in place during the construction phase the following is relevant to the water environment:

- 1 Further surveys will be undertaken in order to identify the need, or otherwise, for additional remediation work. This stage of work will include, if necessary, the submission of details to divert any watercourses and any associated ground remediation necessary as part of the diversion.
- 2 The hydrology of Coatham Marsh will not be affected by any works to The Fleet. A method statement for assessing works to alter or realign the on-site watercourses demonstrating this shall be submitted and approved by the Local Planning Authority prior to the approval of any detailed scheme of works to the watercourses.
- 3 Regarding movement of materials across the site, site activities should be undertaken to avoid the creation of contaminant/groundwater migration pathways where possible. It is noted that the site will be cut-and-fill neutral, and movement of materials would be covered within the CEMP by a Construction Transport Management Plan (CTMP).
- 4 For any piling works, a piling risk assessment will be undertaken.

During Operation

G5.4 The parameters plan includes a minimum Finished Floor Level (‘FFL’) of 5.2mAOD. This is above the level of flood risk. Recommendations for the Finished Floor Levels in relation to flood risk are detailed in Section G6.0 Mitigation and Monitoring.

Major Hazards and Accidents

G5.5 Assessment of major hazards and accidents was introduced by the 2014/52/EU EIA Directive, which was subsequently put into UK legislation in May 2017 (Ref 34). The primary objective of the relevant legislation is:

“The characteristics of development must be considered with particular regard to– (f) the risk of major accidents and/or disasters relevant to the development concerned, including those caused by climate change, in accordance with scientific knowledge; (g) the risks to human health (for example, due to water contamination or air pollution).” (Ref 33 - Pg. 71)

G5.6 A major accident is an event which results in immediate or delayed serious environmental effects to human health, welfare and/or the environment. Major accidents can be caused by disasters resulting from both man-made and natural hazards. The environmental impacts of hazards and accidents should be reported alongside the routine effects arising during construction and operation of developments. The location of proposed developments, the likelihood of accidents occurring, and the potential environmental effects must be identified and mitigated against. In accordance with the requirements of Planning Regulations, an assessment of the risk of Major Accidents and Natural Disasters relevant to the site has been undertaken, along with the identification of mitigation, where necessary, which is required in order to prevent or alleviate the adverse effects of such events on the environment.

Table G5.1 Potential major accidents and the impact level

Accident	Hazard	Risk before Mitigation	Relevance of accident to chapter	Embedded mitigation	Impact level after mitigation
Natural					
Lightning	Structure damage, potential subsequent fires, explosions	A lightning strike could cause harm to people on-site and cause damage to site	Not relevant.	N/A	N/A

Accident	Hazard	Risk before Mitigation	Relevance of accident to chapter	Embedded mitigation	Impact level after mitigation
		infrastructure. Lightning could also present a source of ignition to flammable materials. A subsequent major fire could cause harm to people both on and off-site			
Additional accidents: Earthquake/Seismic event. Landslide	Structure damage, potential subsequent fires, explosions	The impact of seismic event and/or landslide of significant magnitude could cause a major accident and damage to site infrastructure and harm to people both onsite and off-site.	Not relevant.	N/A	N/A
Man-made					
Discharge, spillage or longer-term seepage of untreated wastewater, fuel, chemicals solvents etc into watercourse or groundwater table	Equipment failure, Fuel spillage during unloading/delivery operations, Loss from pipelines and flooding of site resulting in uncontrolled discharge.	The environmental impact of an untreated wastewater and other pollutants discharging into the watercourse could impact the Teesmouth and Cleveland Coast SPA/Ramsar site and the Teesmouth and Cleveland Coast SSSI. Untreated wastewater and other pollutants reaching areas of unmade ground could contain contaminants which would be harmful to groundwater.	Relevant.	CEMP will be implemented on-site to reduce the risk of site pollution and of spillages from plant and machinery.	Low

Accident	Hazard	Risk before Mitigation	Relevance of accident to chapter	Embedded mitigation	Impact level after mitigation
Vehicle collisions on site	Employee negligence and failure of vehicular operations.	Potential for traffic accidents through construction and operation of the site. Small number of people would be affected, and its likely injuries would be minor.	Not Relevant.	N/A	N/A

G5.7 The major hazard and accidents applicable to this chapter are severe weather and climate change. Both hazards are discussed in further detail within the FRA (Appendix G2) with consideration to NPPF current best practice (Ref 37) for the application of allowance for climate change (Section 2.21-2.28) and where necessary taken into account in this chapter. As such, they are discounted from this major hazard and accident section as nothing over and above the items discussed are expected. Other major hazards identified as relevant are fire arising from Diesel and other flammable liquids used and stored on site and discharge, spillage or seepage of untreated wastewater or chemicals into the groundwater table or water course. However, the risk of both these types of major accident occurring is mitigated to ‘low’ by the measures embedded in the CEMP, and they are therefore scoped out of further assessment.

Phasing

G5.8 The outline planning permission for the proposed development at Long Acres will be brought forward by STDC in phases based on market demand for the employment uses proposed. Construction is due to commence in 2022 with the first floorspace delivered in 2023. The construction period totals 11 years with completion anticipated in 2033. The details of the phasing are not specifically relevant to the assessment of impacts during construction and operation, but are relevant in relation to the assessments which will be required for each area of phasing within the site – these will each require a detailed Flood Risk Assessment and Drainage Impact Assessment as well as WFD Assessment – as detailed in Section G6.o Mitigation and Monitoring.

During Construction

Introduction

G5.9 This section outlines the potential effects that would be anticipated to occur (from the proposed activities) on the water environment during the construction phase of the proposed development, prior to the implementation of any additional mitigation measures i.e. those not included as embedded measures within the design of the proposed development.

Surface Watercourses – Flows

G5.10 Surface water flows could potentially be impacted during the excavation and placement of site material and increase of hard surfaces (e.g. for site compounds) and compacted areas from construction vehicles. Ash Gill Beck is located within the site boundary and has a slow and minimal flow respectively and joins The Fleet from the south. The Fleet flows through the site from east to west. Dabholm Beck, Dabholm Cut and Dabholm Gut have relatively large

trapezoidal channels and are not located within the site boundary. However, the introduction of further material to these channels via on-site to off-site surface water flows could decrease the channel capacity and change the morphology of channels but by following the CIRIA and pollution prevention guidance detailed in the points of embedded mitigation in Paragraph G5.2, the effect would be reduced.

- G5.11 In addition, without the management of drainage and surface waterbodies, the potential for localised areas of surface water flooding across the site (as set out in the FRA provided at Appendix G2), remains possible at high rainfall / high flow events.
- G5.12 The magnitude of change on surface water flows during the construction phase is considered to be minor. The receptor sensitivity of Ash Gill Beck is Very Low and so the effect would be Negligible Adverse and Not Significant. The receptor sensitivity for Dabholm Beck, Dabholm Cut and Dabholm Gut is Very High and so the effect would be **Moderate Adverse** and Significant without further mitigation. The receptor sensitivity of The Fleet is Low and so the effect would be Negligible Adverse and Not Significant. The receptor sensitivity for Coatham Marshes is Very High but with the embedded mitigation detailed in Paragraph 5.3 Bullet Point 2 noting that the hydrology of Coatham Marsh will not be affected by changes to The Fleet, the effect would be Neutral and Not Significant.
- G5.13 The Tees transitional WFD waterbody has a very high sensitivity, but the magnitude of change is considered to be no/negligible change and thus there would be a Negligible Adverse and Not Significant effect.

Surface Watercourses – Water Quality

- G5.14 Ash Gill Beck, The Fleet, Dabholm Beck, Dabholm Cut and Dabholm Gut have a low to very low quality due to the levels of contamination across the Teesworks area and the heavy industry. The potential for pollution of surface water is primarily when high levels of suspended solids and/or leachates from Made Ground have the potential to enter local watercourses during earthworks, but this should be minimised through following the CRA and Pollution Prevention Guidelines detailed in embedded mitigation. A potential pollution pathway exists from the site through the shallow groundwater system, which could reach the Tees transitional WFD waterbody and other surface water bodies, such as The Fleet, Dabholm Beck, Dabholm Cut and Dabholm Gut. There is also a potential pollution pathway to Coatham Marshes as whilst upstream of the site, could be impacted through a backwater effect from The Fleet during a high flow scenario combined with an allowance for sea level rise. Pollution pathways may occur from runoff associated with construction activities e.g. through generation of silt borne run-off during groundworks, accidental spills and leaks from construction plant. The FRA (Appendix G2) notes that the groundwater vulnerability map available via the Defra MAGIC Map (Ref 43) indicates that the site is within an area of medium-high risk from groundwater (where 'high' equates to areas able to easily transmit pollution to groundwater with high leaching soils). During site preparation (where the construction compound will be developed with waste and fuel storage areas) and construction, there is the potential for spillages and leaks and so a moderate magnitude of change. Areas adjacent to The Fleet, Dabholm Beck, Dabholm Cut and Dabholm Gut are shown in the FRA flood maps to be at risk from high magnitude coastal flooding with an allowance for sea level rise. It is likely that the main access road to the site will be via Steel House roundabout to the south. Since fuels, oils and chemicals would be stored on-site during certain phases of works (e.g. for re-fuelling of plant and equipment), spillages and leakages could occur. The potential spillages and leakages are likely to be localised. However, depending on location, spillages and leakages could occur in areas at risk of surface water flooding which would present a risk to the surface water quality in times of high magnitude events.

- G5.15 The magnitude of change on surface water quality during the construction phase is considered to be minor, due to the commitment to adhere to the measures included in the CEMP during the construction phase. The receptor sensitivity of Ash Gill Beck, is very low and so the effect would be Negligible Adverse and Not Significant. The receptor sensitivity of Dabholm Beck, Dabholm Cut and Dabholm Gut is Very High and so the effect would be **Moderate Adverse** and Significant without further mitigation.
- G5.16 The receptor sensitivity for Coatham Marshes is Very High but with the embedded mitigation detailed, the effect would be Neutral and Not Significant.
- G5.17 The receptor sensitivity of The Fleet is low and so the effect would be Negligible Adverse and Not Significant.
- G5.18 The Tees transitional WFD waterbody has a very high sensitivity, however the proposed development avoids changes to the bank of the River Tees, which limits the potential for direct and thus significant impacts. The no/negligible magnitude of change means there will be a Negligible Adverse and Not Significant effect.

Groundwater Aquifer - Flows

- G5.19 For the anticipated construction activities, as detailed in Chapter B of this ES, the ground surface would largely be expected to remain above the groundwater table, and it is unlikely that groundwater would be encountered as part of these works. Reduced infiltration may be expected where areas of hardstanding across the site are increased and so potential adverse effects on aquifer recharge. Nonetheless, given that groundwater is not used as a resource, the magnitude of the effect of excavation on groundwater flow is deemed to be minor. Alongside a receptor sensitivity category for the superficial (Tidal Flats and Glacial Till) and bedrock aquifers of low, the level of effect is therefore Negligible Adverse and Not Significant.
- G5.20 For the very high sensitivity receptor of the superficial aquifer (Made Ground /Blown Sands) and Coatham Marshes, the magnitude of the change of excavation on groundwater flow is deemed to be minor. As such, the level of effect is therefore **Moderate Adverse** and thus Significant.

Groundwater – Water Quality

- G5.21 Effects on groundwater quality could result from excavations and earthworks as well as spillages and leaks of fuels, oils and chemicals. This could result in potential pollution to underlying aquifers with potential pathways through the Made Ground to the River Tees. This may arise from runoff associated with construction activities (e.g. through generation of silt borne run-off during groundworks, accidental spills and leaks from construction plant as well as accidental spillage from construction activities). The mudstone bedrock has limited permeability as a Secondary undifferentiated aquifer and is also overlain by both Tidal Flats and relatively low permeability Glacial Till which limits the hydraulic continuity with the shallow groundwater system and the surface waters in the Tees estuary and coast. Nonetheless, some continuity cannot be ruled out, and so potential impacts to the bedrock aquifer from pollution are deemed to be of minor magnitude without embedded mitigation. With the implementation of the CEMP, this would reduce but still be of minor magnitude. Alongside a receptor sensitivity category for the bedrock and superficial (Tidal Flats and Glacial Till) aquifers of low, the level of effect is therefore Negligible Adverse, and Not Significant.
- G5.22 For the very high sensitivity receptor of the superficial aquifers (Made Ground and Blown Sands) and Coatham Marshes, the magnitude of the effect of potential pollution on groundwater quality is deemed to be minor. As such, the level of effect is therefore **Moderate Adverse** and thus Significant.

During Operation

Surface Watercourses - Flows

- G5.23 During the operation of the site, there are potential adverse effects on drainage patterns and surface water, principally in relation to a change in runoff patterns and drainage associated with the finalised nature of the site development.
- G5.24 However, the site currently comprises areas of hard standing so the magnitude of change on surface water flows during the operation phase is considered to be minor but there is an opportunity for better attenuation (discussed in the Mitigation section). The receptor sensitivity of Ash Gill Beck, is very low and so the effect would be Negligible Adverse and Not Significant.
- G5.25 The receptor sensitivity of Dabholm Beck, Dabholm Cut and Dabholm Gut is Very High and so the effect would be **Moderate Adverse** and thus Significant without further mitigation. The receptor sensitivity for Coatham Marshes is Very high and so the effect could be **Moderate Adverse** and Significant without further mitigation. The receptor sensitivity of The Fleet is low and so the effect would be Negligible Adverse and Not Significant.
- G5.26 The Tees estuary has a very high sensitivity, but the magnitude of change is considered to be no/negligible change and thus there would be a Negligible Adverse and Not Significant effect.

Surface Watercourses – Water Quality

- G5.27 Without collection and discharge of surface water through a new drainage and water management system, the magnitude of change for water quality is considered to be moderate. The receptor sensitivity of Ash Gill Beck, is very low and so the effect would be Negligible, and Not Significant. The receptor sensitivity of Dabholm Beck, Dabholm Cut and Dabholm Gut is Very High and so the effect would be **Moderate Adverse** and Significant without further mitigation. The receptor sensitivity for Coatham Marshes is Very high and so the effect could be **Moderate Adverse** and Significant without further mitigation. The receptor sensitivity of The Fleet is low and so the effect would be Negligible Adverse and Not Significant.
- G5.28 The Tees estuary has a very high sensitivity, but the magnitude of change is considered to be no/negligible change, given the distance between the receptor and the site and thus there would be a Negligible Adverse and Not Significant effect.

Groundwater Aquifer - Flows

- G5.29 The aquifer is not used locally as a resource for abstraction and is of limited potential. The change to the ground surface (increased areas of hardstanding occupying the site) potentially limits the volume of direct recharge to the aquifer. As such, the potential magnitude of change for superficial groundwater flows during operation is moderate, and for bedrock groundwater flows is minor. The site is located near the River Tees, a very significant groundwater discharge boundary. Alteration of the potential path of rainfall-recharge is likely to occur as a result of changes to recharge on site, changing the pathway from through the contaminated ground to the Tees or coast, to via the drainage system to the Tees or coast. Both of these paths are relatively short. Hence, for the low sensitivity groundwater receptors (bedrock and superficial (Tidal Flats / Glacial Till)), the level of effect is Negligible Adverse, and Not Significant.
- G5.30 For the very high sensitivity receptor of superficial aquifers (Made Ground / Blown Sands) and Coatham Marshes, the magnitude of the effect of changes in groundwater flows from reduced recharge is deemed to be minor. As such, the level of effect is therefore **Moderate Adverse** and Significant.

Groundwater – Water Quality

- G5.31 The change in ground surface to increased hardstanding reduces the potential for any contaminated surface runoff to reach the superficial or bedrock aquifer during the operational phase. In addition, any re-placement of material in the construction phase to create the new development ground surface means that rainfall-infiltration through the Made Ground could introduce potential contaminants to groundwater. However, conversely, removal and treatment of contaminant hotspots would improve groundwater quality of the superficial aquifer at the site. Nonetheless, the potential for accidental spillage from operations remains. Overall, the magnitude of change for groundwater quality during operation is minor, and the level of effect on the low sensitivity groundwater receptors is Negligible Beneficial and Not Significant.
- G5.32 For the very high sensitivity receptor of the superficial aquifers (Made Ground and Blown Sands) and Coatham Marshes, the magnitude of the effect of potential pollution on groundwater quality is deemed to be minor. As such, the level of effect is therefore **Moderate Beneficial** and Significant.

G6.0 Mitigation and Monitoring

Introduction

- G6.1 The proposed development will likely be developed in phases starting in 2022 and with an anticipated completion in 2033. Whilst a high-level Flood Risk Assessment has been prepared to supplement this assessment (within Appendix G2), the following documentation shall be prepared for each phase of development and submitted at the Reserved Matters stage of the planning process, when detailed design of the scheme is known. As such, the documents shall be agreed in advance of construction for each phase of proposed development to mitigate significant adverse impacts:
- i A detailed FRA and Drainage Impact Assessment (DIA) with drainage strategy (for both foul and surface water and groundwater that builds on the findings of the high-level FRA (Appendix G.2));
 - ii A Surface Water Management Plan (“SWMP”); and
 - iii A WFD Assessment.
- G6.2 All of the assessments noted above shall take into account climate change for the duration of the development (50 years).
- G6.3 The SWMP will adhere to the following documents and guidance (in paragraph G6.4) to mitigate adverse effects of the development, in addition to NPPF (Ref 37), RCBC Local Plan (Ref 51) and the Regulations noted above in the Policy section of this chapter.
- G6.4 In order to inform the drainage strategy, a groundwater monitoring programme shall be undertaken to include surveys that will characterise groundwater levels across the site, as well as shallow groundwater flow direction. The outcome of these surveys will be to establish the degree to which permeable substrates on site (Made Ground and Blown Sands) may be hydraulically connected with the water-dependent designated features within the superficial aquifers underneath the dunes within the SPA, which is currently not known.
- G6.5 The outcome of the monitoring programme will inform the detailed engineering design measures within the drainage strategy which will ensure that the proposed development doesn’t alter the hydrological characteristics of the SPA and thus avoids any adverse future impacts upon it.
- G6.6 In order to avoid adverse impacts upon the SPA during the construction phase of the proposed development, a construction phase Groundwater Management Plan (“GWMP”) will be submitted to the Local Planning Authority prior to any construction works taking place. This will be informed by the groundwater monitoring programme and shall demonstrate that the construction of the proposed development doesn’t alter the hydrological characteristics of the SPA and thus avoids any adverse future impacts upon it.
- G6.7 The requirement to prepare and agree a Remediation Strategy has been set out in Chapter G and implemented with regards to groundwater through a monitoring regime. This monitoring would be subject to the design and review of relevant consultees but would typically involve recording of water levels and collection of samples encompassing seasonal variability.
- G6.8 Secondary mitigation (in addition to the documents in G6.1) shall include the following with regards to the water management at the site:
- a the design shall be prepared in line with the requirements of:
 - i CIRIA The SuDS Manual C753 (Ref 9);

- ii Sewers for Adoption (Ref 56) (Northumbrian Water currently use version SfA6 but will likely migrate to SfA8 during the time of the development of the design for the proposed development;
 - iii Local Authority SuDS Officer Organisation. Non statutory technical standards for sustainable drainage: Practice Guidance; (Ref 41) and
 - iv Tees Valley Local Authorities Local Standards for Sustainable Drainage (Ref 53).
- b The design of water management shall include consideration of design features to remove silt and other suspended solids, as well as capture any spills/oil and grease, prior to discharge;
- c Where reasonably practicable the runoff rate from the site shall be reduced as far as possible in line with drainage guidance (noted in Section 6.4 a) in light of the large extent of low permeability surfaces;
- d Confirmation will be required to be obtained for capacity of discharge to Northumbrian Water systems. This will be dealt with at the Reserved Matters stage of the planning process once the detailed design of the scheme is known.
- e Hydraulic modelling shall be undertaken as part of the site-specific design of drainage and overland and exceedance flow paths;
- f The design shall take account of climate change projections and comply with current best practice;
- g Finished floor levels for the site is to be a minimum of 5.03mAOD which is equivalent to the 1 in 200-year coastal flood risk and sea level rise allowance to the 2100 design scenario;
- h The timing of excavation and replacement of ground materials shall be sensitive to avoiding poor weather conditions;
- i New drainage will be designed to current standards with allowances for additional rainfall and surface water flows under a climate change scenario. Permits shall be obtained for works and signed off by the EA;
- j The water management and drainage design will not include infiltration SuDS such as soakaways, in order to limit mobilisation of contamination. Drainage channels and/or networks will be lined with a geomembrane to prevent connection of surface water with contaminated ground material;
- k Any harvested rainwater will need to be protected for re-use so that it is not contaminated;
- l Any activity that has the potential to have an impact upon any of the Quality Elements will need consideration in terms of whether it could cause a deterioration in the status of a water body. The activity will also need to be considered in terms of whether it will compromise the ability of the water body to reach Good Ecological Status or Good Ecological Potential. Future Environmental Permits and Reserved Matters planning applications for the site will require WFD Assessments to support them. Those assessments will determine the effects of the proposed facility on ecological, hydromorphological and chemical quality and identify any potential impacts that could cause deterioration in the current status of the water body or could hinder the water body from meeting its WFD objectives in the future. A WFD Assessment shall be undertaken for each site within The Foundry and shall be undertaken prior to construction; and

- m The design, construction and operation of the drainage will be sympathetic to the Teesmouth and Cleveland SSSI / SPA / Ramsar designation which includes Dabholm Cut and Dabholm Gut and works permits will require liaison with the Environment Agency and Natural England.

During Construction and During Operation

G6.9 The table below sets out the proposed mitigation and monitoring measures for the construction and operational phase of the proposed development.

Table G6.1 Rationale for incorporation of environmental measures

Receptor	Potential Impact	Additional Mitigation - Construction	Additional Mitigation - Operation
Tees (transitional) WFD waterbody, The Fleet, Ash Gill Beck, Dabholm Beck, Dabholm Cut & Dabholm Gut.	Increased risk of flooding from flows - increased surface runoff reaching watercourses	Site specific drainage strategy will inform the details of the CEMP. Appropriate measures to be agreed with the Council to manage localised depressions on site, which results in areas of pluvial flooding at high rainfall events until the ground surface is constructed.	Implementation of the SWMP for each phase of the proposed development will improve the management of water compared to the baseline conditions, whilst also taking into account potential changes in rainfall from climate change. The developer will need to comply with the requirements of the site-specific FRA that builds on the high -level FRA (Appendix G2). Changes to the water courses will be applied and signed off via the Environmental Permit process. It is anticipated that there may be additional discharges to the surrounding watercourses required. For any additional discharges, a flap on the outfall will control the tidal influences, however it is anticipated that additional discharges to the Tees, if applicable, will be regulated under an environmental permit (and liaison with the Environment Agency and Natural England required where works are in relation to SSSI/ SPA/ Ramsar designations).
Tees (transitional) WFD waterbody, The Fleet, Ash Gill Beck, Dabholm Beck, Dabholm Cut & Dabholm Gut.	Increased runoff to watercourses and drains due to increased roadways and areas of hardstanding could affect channel morphology.	The timing of excavation and replacement of ground materials shall be sensitive to avoiding poor weather conditions.	Through the FRA, DIA with drainage strategy and the SWMP, the potential effects of the proposed development will seek to be minimised by reducing the runoff rate from the site as far as possible in light of the large extent of low permeability surfaces. The drainage strategy will take account of climate change. Ash Gill Beck and Steel House Lake are Ordinary Watercourses, therefore proposed discharge rates (if any) must

Receptor	Potential Impact	Additional Mitigation - Construction	Additional Mitigation - Operation
			<p>be agreed with the LLFA and if required confirmation obtained for capacity of discharge to Northumbrian Water systems. This will be dealt with at the Reserved Matters stage of the planning process once the detailed design of the scheme is known.</p>
<p>Tees (transitional) WFD waterbody, The Fleet, Ash Gill Beck, Dabholm Beck, Dabholm Cut & Dabholm Gut.</p>	<p>Change in water quality from increased sediments in surface runoff.</p>	<p>The site is cut and fill neutral so ground material would be retained within the site. The timing of excavation and replacement of ground materials shall be sensitive to avoiding poor weather conditions.</p> <p>Additional mitigation in relation to the contamination of the ground is discussed in the Ground Conditions chapter.</p>	<p>The drainage strategy will include consideration of design features to remove silt and other suspended solids, as well as capture any spills/oil and grease, prior to discharge. The large extent of low permeability surface proposed for the site will 'cap' underlying contaminated land.</p> <p>The drainage strategy will not include infiltration SuDS such as soakaways, in order to limit mobilisation of contamination.</p> <p>Harvested rainwater as part of the design would need to be protected for re-use so that it is not contaminated.</p> <p>Once the site design is available, a WFD Assessment shall be undertaken for the entire site and then for each phase of the development the WFD Assessment should be updated.</p> <p>Any conveyance and storage features will be lined with a geomembrane to prevent connection of surface water with contaminated ground material and consider the risk of contamination of local groundwater through increased percolation.</p> <p>Any discharges to the Tees will require an environmental permit and should lead to an improvement in the water quality.</p>
<p>Tees (transitional) WFD waterbody, The Fleet, Ash Gill Beck, Dabholm Beck, Dabholm Cut & Dabholm Gut.</p>	<p>Change in water quality from a change in land use or drainage patterns at consented discharge locations.</p>	<p>Placement of oil-water interceptors at outfalls from the site</p>	<p>No overall changes to local drainage patterns around discharge locations are anticipated. Consultation will be required with the LLFA and the EA for direct discharges to the Tees.</p>
<p>Tees (transitional) WFD waterbody, The Fleet, Ash</p>	<p>Potential failure of wastewater</p>		<p>Infrastructure on or under the site that does not have the required capacity</p>

Receptor	Potential Impact	Additional Mitigation - Construction	Additional Mitigation - Operation
<p>Gill Beck, Dabholm Beck, Dabholm Cut & Dabholm Gut.</p>	<p>infrastructure to cope with additional flows from the proposed development resulting in a deterioration in the quality of surface waters and groundwater (affecting WFD chemical status).</p>		<p>will be required to be replaced / improved to meet guidance and planning requirements.</p> <p>New drainage will be designed to current standards with allowances for additional rainfall and surface water flows under a climate change scenario. Permits shall be obtained for works and signed off by the Environment Agency (and Natural England where works are in relation to SSSI/ SPA/ Ramsar designations).</p> <p>The drainage strategy will set out how to accommodate any groundwater input to the culverts that are present at the site.</p> <p>A WFD Assessment will need to be undertaken once the drainage strategy is developed. The WFD Assessment shall be undertaken for the entire site and then for each phase of the development the WFD Assessment should be updated.</p>
<p>Coatham Marsh (surface water)</p>	<p>Potential changes to hydrology of Coatham Marsh during re-routing of watercourse.</p>	<p>No additional mitigation identified further to embedded mitigation, detailed in Paragraph 5.3</p>	<ol style="list-style-type: none"> 1. Any works carried out to The Fleet shall not change the hydrology characteristics of Coatham Marsh unless it can be demonstrated that there would be no likely significant effect on the SPA arising from the final scheme of works for the Fleet. 2. A remediation strategy is submitted and approved that ensures any highly contaminated soils are removed in proximity to the proposed realignment of The Fleet. 3. A phasing plan of the works to realign The Fleet is submitted to and approved which confirms the timing of all works to realign The Fleet occur at an appropriate time (i.e. seasonal constraints of specific SSSI/SPA and/or Ramsar bird species) to avoid potential related pollutants occurring in the SSSI/ SPA and/or Ramsar.

Receptor	Potential Impact	Additional Mitigation - Construction	Additional Mitigation - Operation
			4. Details comprising engineering drawings including cross sections shall be submitted and approved.
Secondary bedrock and superficial aquifers (groundwater recharge)	Groundwater recharge to the Secondary aquifers may be reduced as a result of the increase in roadways, and areas of hardstanding.	A Construction phase Groundwater Management Plan will be prepared and submitted to the LPA to avoid any adverse impacts on SPA / SSSI/Ramsar designations	No additional mitigation identified.
Secondary aquifers (bedrock and superficial (Tidal Flats and Glacial Till) (groundwater quality)	Groundwater quality may be impacted by changes in pathways of soils during excavation and replacement of materials.	As above, the risk of potential mobilisation of contaminants is likely prior to excavation, and this would be managed through a remediation strategy. A Construction phase Groundwater Management Plan will be prepared and submitted to the LPA to avoid any adverse impacts on SPA / SSSI/Ramsar designations	The SWMP will not include infiltration SuDS such as soakaways, in order to limit mobilisation of contamination.
	Beneficial changes to the groundwater system during the operation phase.	A Construction phase Groundwater Management Plan will be prepared and submitted to the LPA to avoid any adverse impacts on SPA / SSSI/Ramsar designations	The remediation strategy and the drainage strategy will reduce the mobilisation of contaminants on site due to reduction in recharge.
Superficial aquifers (Made Ground and Blown Sands)	Groundwater recharge to these units may be reduced as a result of the increase in roadways, and areas of hardstanding. Groundwater flow pathways may be disrupted in the case of any deep excavation or piling. Potential for mobilisation (e.g. leaching) of contaminants from soils encountered during construction phase.	The GWMP will ensure that the construction of the proposed development doesn't alter the hydrological characteristics of the SSSI and SPA designations and thus avoids any adverse future impacts upon it	The drainage strategy will ensure that the proposed development doesn't alter the hydrological characteristics of the SSSI, Ramsar and SPA designations and thus avoids any adverse future impacts upon it.
Coatham Marsh (groundwater)	Groundwater recharge to these	The GWMP will ensure that the construction of the proposed	The drainage strategy will ensure that the proposed development doesn't

Receptor	Potential Impact	Additional Mitigation - Construction	Additional Mitigation - Operation
	<p>units may be reduced as a result of the increase in roadways, and areas of hardstanding.</p> <p>Potential for mobilisation (e.g. leaching) of contaminants from soils encountered during construction phase.</p>	<p>development doesn't alter the hydrological characteristics of the SSSI and SPA designations and thus avoids any adverse future impacts upon it</p>	<p>alter the hydrological characteristics of the SSSI, Ramsar and SPA designations and thus avoids any adverse future impacts upon it.</p>
<p>Surface waters and groundwater</p>	<p>Potential for mobilisation (e.g. leaching) of contaminants from soils encountered during construction phase.</p>	<p>No additional mitigation identified.</p>	<p>No additional mitigation identified.</p>

G7.0 **Residual Effects**

Introduction

G7.1 Embedded (including tertiary) mitigation is detailed in Section G5.0. and additional (secondary) mitigation is detailed in Section G6.0. This section contains an assessment of the residual effects which remain after this mitigation is applied during the construction and operational phases of the proposed development.

During Construction

Surface Watercourses - Flows

G7.2 The magnitude of change on surface water flows during the construction phase is considered to be beneficial; albeit negligible after additional mitigation. The receptor sensitivity of Ash Gill Beck is very low and so the effect of the improvements to the current conditions would be Negligible Beneficial and Not Significant. The receptor sensitivity of Dabholm Beck, Dabholm Cut and Dabholm Gut are Very high and so the effect of the improvements to the current conditions would be Negligible Beneficial and Not Significant.

G7.3 No further mitigation is proposed for Coatham Marshes so the effect would remain Neutral and Not Significant.

G7.4 The receptor sensitivity of The Fleet is low and so the effect would be Negligible Beneficial and Not Significant.

G7.5 The Tees estuary has a very high sensitivity, but the magnitude of change is considered to be no/negligible change and thus there would be a Negligible Beneficial and Not Significant effect.

Surface Watercourses – Water Quality

G7.6 The mitigation measures are detailed in the mitigation section (in particular the avoidance of connection between surface water and contaminated land).

G7.7 The magnitude of change on surface water quality during the construction phase with regards to residual effects is considered to be Negligible but beneficial, so for the receptors of Ash Gill Beck and Dabholm Beck, Dabholm Cut & Dabholm Gut the effect would be Negligible Beneficial, that is Not Significant, as shown in Table G3.4.

G7.8 No further mitigation is proposed for Coatham Marshes so the effect would remain Neutral and Not Significant.

G7.9 The Fleet has a sensitivity rated low and so the effect would also be Negligible Beneficial and Not Significant.

G7.10 The Tees estuary has a very high sensitivity, but the magnitude of change is considered to be no/negligible change and thus there would be a Negligible Beneficial and Not Significant effect. The additional mitigation outlined above will change the effect from adverse to beneficial.

Groundwater Aquifer - Flows

G7.11 Receptor sensitivity category for the bedrock and superficial (Tidal Flats / Glacial Till) aquifers is low, and the magnitude of the change will be minor, so the level of effect is therefore Negligible Adverse, and Not Significant. As no additional mitigation is proposed, the residual effect is the same as that assessed in the Potential Effects section.

- G7.12 Following the additional mitigation in the form of the construction phase GWMP, the magnitude of effect is no change i.e. no change in infiltration (direct recharge) or flow pathways. As such, the level of effect is therefore Neutral and Not Significant.

Groundwater Aquifer - Water Quality

- G7.13 Excavations associated with the proposed development would be of a superficial nature, within the Made Ground and are not anticipated to extend downwards into the underlying Glaciolacustrine deposits superficial aquifer. Also, the use of site-won and imported soil-based materials during construction would comply with the agreed re-use criteria, which would be set out in site construction documentation, such as the remediation strategy.
- G7.14 During future piling activities associated with construction of the proposed development, groundwater quality of the aquifer units may be affected where there is potential to generate viable pollutant linkage between the potentially contaminated shallow soils (Made Ground) and groundwater. This may impact on the aquifer units below and any surface waters to which they are hydraulically connected. However, the work would be undertaken in accordance with relevant EA guidance and a piling risk assessment for the site.
- G7.15 Given that fuels, oils and chemicals would be stored on-site during certain phases of works (e.g. re-fuelling of machinery), spillages and leakages could occur. The potential spillages and leakages are likely to be localised. However, depending on location, they may present a risk to groundwater quality. This is likely to result in no magnitude of change given the on-site management protocols that would be adopted such as the drainage strategy. For the low sensitivity aquifer receptors, this would result in a Neutral level of effect of pollution which would be deemed to be Not Significant.
- G7.16 Overall, any effects on groundwater quality are likely to be of minor magnitude of change, given the on-site management protocols that would be adopted under the CEMP. Combined with the low sensitivity receptors (the bedrock and superficial (Tidal Flats and Glacial Till) aquifers) gives a Neutral effect in relation to pollution which is Not Significant.
- G7.17 For the very high sensitivity receptor of the superficial aquifer (Made Ground / Blown Sands) and Coatham Marshes, following the implementation of additional mitigation in the form of the construction phase GWMP, the magnitude of the effect is no change. As such, the level of effect is therefore Neutral and thus Not Significant.

During Operation

Surface Watercourses - Flows

- G7.18 The magnitude of change on surface water flows during the operation phase with regard to residual effects is considered to be negligible but would have a beneficial impact to the current baseline conditions. The effect would be Negligible Beneficial and Not Significant for the receptors of Ash Gill Beck, Dabholm Beck, Dabholm Cut and Dabholm Gut.
- G7.19 The receptor sensitivity for Coatham Marshes is Very high but with secondary mitigation the effect would be Neutral and Not Significant.
- G7.20 The Fleet has a low rated sensitivity receptor and so the effect would also be Negligible Beneficial and Not Significant.
- G7.21 The Tees estuary has a very high sensitivity, but the magnitude of change is considered to be no/negligible change and thus the residual effect will be Negligible Beneficial and Not Significant effect.

Surface Watercourses – Water Quality

- G7.22 The magnitude of change on surface water quality during the operation phase with regards to residual effects is considered to be negligible for the receptors of Ash Gill Beck, Dabholm Beck, Dabholm Cut & Dabholm Gut and so the effect would be Negligible Beneficial and Not Significant.
- G7.23 The receptor sensitivity for Coatham Marshes is Very high, but with secondary mitigation the effect would be Neutral and Not Significant.
- G7.24 The receptor sensitivity of The Fleet is rated low and so the effect would be Negligible Beneficial and Not Significant.
- G7.25 The Tees estuary has a very high sensitivity, but the magnitude of change is considered to be no/negligible change and thus there would be a Negligible Beneficial and Not Significant effect.

Groundwater Aquifer - Flows

- G7.26 No additional mitigation is proposed in relation to the low sensitivity receptors of superficial (Tidal Flats / Glacial Till) and bedrock aquifers, and so the residual effect arising from the proposed development is the same as that assessed in the Potential Effects Section. Receptor sensitivity category for the superficial (Tidal Flats / Glacial Till) and bedrock aquifers is low, and the magnitude of the change will be minor, so the level of effect is therefore Negligible Adverse, and Not Significant.
- G7.27 For the very high sensitivity receptor of the superficial aquifer (Made Ground / Blown Sands) and Coatham Marshes, and following the implementation of the drainage strategy, the magnitude of the changes in groundwater flows from reduced recharge is deemed to be no change. As such, the level of effect is therefore Neutral and Not Significant.

Groundwater Aquifer - Water Quality

- G7.28 In the operational phase, the site will have been subject to the work undertaken in the construction phase remediation strategy. The SWMP should also include for the provision of non-infiltration SuDS. Together, this should reduce the overall risk from on-site contamination and its potential for mobilisation. This will result in a minor magnitude of change from the implementation of the mitigation measures and result in Minor Beneficial effect which is Not Significant for the low sensitivity receptors of superficial (Tidal Flats / Glacial Till) and bedrock aquifers.
- G7.29 For the very high sensitivity receptor of the superficial aquifer (Made Ground / Blown Sands), the magnitude of the effect of changes in groundwater quality from remediation is deemed to be minor (beneficial). As such, the level of effect is therefore **Moderate Beneficial** and Significant.

G8.0 Summary & Conclusions

G8.1 The table below summarises the receptors, potential effects, additional mitigation measures and residual effects in relation to water management and flooding.

Table G8.1 Summary of Effects

Receptor	Impact	Potential Effects (taking account of embedded mitigation)	Additional Mitigation and Monitoring	Residual Effects
During Construction				
Surface Water				
River Tees estuary (Tees WFD waterbody)	Flows - Increased runoff	Negligible Adverse and Not Significant.	<p>Implementation of the Drainage Strategy to reduce runoff rates whilst taking into account potential changes in rainfall from climate change through appropriate use of sustainable drainage during construction.</p> <p>The timing of excavation and re-placement of ground materials shall be sensitive to avoiding poor weather conditions.</p> <p>It is anticipated that there may be additional discharges to the Tees from blue green networks.</p> <p>The developer will need to comply with the requirements of the FRA that builds on the high-level FRA (Appendix G2) in order that no impacts arise from flooding due to increased surface runoff from the site to the surface water bodies.</p> <p>Appropriate measures to be agreed with the Council to manage localised depressions on site, which result in areas of pluvial flooding at high rainfall events until the ground surface is constructed.</p>	<p>Negligible Beneficial and Not Significant.</p> <p>Permanent</p>

Receptor	Impact	Potential Effects (taking account of embedded mitigation)	Additional Mitigation and Monitoring	Residual Effects
	<p>Water quality - Mobilisation of contaminants and sediment</p> <p>Water Quality - Spillages and leakages causing pollution</p>	<p>Negligible Adverse and Not Significant.</p> <p>Negligible Adverse and Not Significant.</p>	<p>The drainage strategy will inform the CEMP and remove silt and other suspended solids, as well as capture any spills/oil and grease, prior to discharge.</p> <p>The timing of excavation and re-placement of ground materials should be sensitive to avoiding poor weather conditions.</p> <p>Foul water to be directed to mains sewer.</p> <p>WFD Assessment shall be undertaken prior to construction</p>	<p>Negligible Beneficial and Not Significant.</p> <p>Permanent</p>
<p>Other surface water bodies</p> <p>-The Fleet</p> <p>-Ash Gill Beck</p> <p>-Dabholm Beck, Dabholm Cut & Dabholm Gut)</p>	<p>Flows - Increased runoff</p>	<p>-Fleet and Ash Gill Beck: Negligible Adverse and Not Significant</p> <p>- Dabholm Beck, Dabholm Cut & Dabholm Gut: Moderate Adverse and Significant</p>	<p>The drainage strategy will reduce runoff rates whilst taking into account potential changes in rainfall from climate change.</p> <p>Low permeability concrete surfaces are proposed for the majority of the ground across the site. Run off will be collected and passed through appropriate SuDS treatment that will be lined with a geomembrane to prevent connection of surface water with the contaminated ground.</p> <p>The timing of excavation and re-placement of ground materials shall be sensitive poor weather conditions and shall be managed.</p> <p>The developer will need to comply with the requirements of the FRA in order that no impacts arise on flow volumes.</p>	<p>Negligible Beneficial and Not Significant</p> <p>Permanent</p>

Receptor	Impact	Potential Effects (taking account of embedded mitigation)	Additional Mitigation and Monitoring	Residual Effects
			Ash Gill Beck is an Ordinary Watercourse, therefore, proposed discharge rates (if any) must be agreed with the LLFAs of the Environment Agency and Northumbrian Water.	
	Water Quality - Mobilisation of contaminants and sediment	-Fleet and Ash Gill Beck: Negligible Adverse and Not Significant - Dabholm Beck, Dabholm Cut & Dabholm Gut: Moderate Adverse and Significant	Implementation of Drainage Strategy to remove silt and other suspended solids, as well as capture any spills/oil and grease, prior to discharge. The timing of excavation and re-placement of ground materials shall be sensitive to avoiding poor weather conditions.	Negligible Beneficial and Not Significant
	Water Quality - Spillages and leakages causing pollution	-Fleet and Ash Gill Beck: Negligible Adverse and Not Significant - Dabholm Beck, Dabholm Cut & Dabholm Gut: Moderate Adverse and Significant	Foul water directed to mains sewer. Implementation of appropriate pollution prevention measures e.g. CIRIA guidance: Control of water pollution from construction sites. Guidance for consultants and contractors (C532D).	
Coatham Marsh	Flows - Increased runoff	Neutral and Not Significant	No additional mitigation proposed further to embedded mitigation	Neutral and Not Significant
	Water Quality - Mobilisation of contaminants and sediment	Neutral and Not Significant	No additional mitigation proposed further to embedded mitigation	Neutral and Not Significant Permanent
	Water Quality - Spillages and leakages causing pollution			
Groundwater				
Mudstone bedrock aquifer	Reduced infiltration	Negligible Adverse and Not Significant	No further mitigation is proposed.	Negligible Adverse and Not Significant

Receptor	Impact	Potential Effects (taking account of embedded mitigation)	Additional Mitigation and Monitoring	Residual Effects
	Pollution from spills	Negligible Adverse and Not Significant	Remediation Strategy	Negligible Adverse and Not Significant
	Contaminant pathways activated	Negligible Adverse and Not Significant		
Superficial aquifer (Tidal Flats / Glacial Till)	Reduced infiltration	Negligible Adverse and Not Significant	No further mitigation proposed.	Negligible Adverse and Not Significant
	Pollution from spills	Negligible Adverse and Not Significant	Remediation Strategy	Negligible Adverse and Not Significant
	Contaminant pathways created	Negligible Adverse and Not Significant		
Superficial aquifer (Made Ground/ Blown Sands)	Reduced infiltration and disrupted flow pathways	Moderate Adverse and Significant	Construction Phase GWMP.	Neutral and Not Significant
	Pollution from spills	Moderate Adverse and Significant	Construction Phase GWMP.	Neutral and Not Significant
	Contaminant pathways created			
Coatham Marshes (ground water)	Reduced infiltration and disrupted flow pathways	Moderate Adverse and Significant	Construction Phase GWMP.	Neutral and Not Significant
	Pollution from spills	Moderate Adverse and Significant	Construction Phase GWMP.	Neutral and Not Significant
	Contaminant pathways created			
During Operation				
Surface Water				
River Tees estuary (Tees WFD waterbody)	Flows - Increased runoff	Negligible Adverse and Not Significant.	An FRA, DIA and Surface Water Management Plan, environmental permits for each phase of the proposed development prior to construction. Runoff rate to be reduced through implementation of drainage strategy as far as possible in light of the large extent of impermeable surfaces.	Negligible Beneficial and Not Significant. Permanent

Receptor	Impact	Potential Effects (taking account of embedded mitigation)	Additional Mitigation and Monitoring	Residual Effects
			<p>A drainage strategy shall take account of climate change. New drainage will be designed to current standards with allowances for additional rainfall and surface water flows under a climate change scenario. Permits shall be obtained for works and signed off by the Environment Agency (and Natural England where works are in relation to SSSI/ SPA/ Ramsar designations).</p>	
	<p>Water Quality - Spillages and leakages causing pollution</p>	<p>Negligible Adverse and Not Significant.</p>	<p>The drainage strategy will not include infiltration SuDS such as soakaways, in order to limit mobilisation of contamination. Any conveyance and storage features will be lined with a geomembrane to prevent connection of surface water with contaminated ground material and consider the risk of contamination of local groundwater through increased percolation.</p> <p>Harvested rainwater will need to be protected for re-use so that it is not contaminated.</p> <p>A WFD Assessment shall be undertaken for each phase of the development prior to construction.</p> <p>Discharges to the Tees will require an environmental permit and liaison with Marine Management Organisation (MMO) and should lead to an improvement in the water quality.</p>	<p>Negligible Beneficial and Not Significant.</p> <p>Permanent</p>

Receptor	Impact	Potential Effects (taking account of embedded mitigation)	Additional Mitigation and Monitoring	Residual Effects
Other surface water bodies -The Fleet -Ash Gill Beck -Dabholm Beck, Dabholm Cut & Dabholm Gut)	Flows - Increased runoff	-The Fleet and Ash Gill Beck: Negligible Adverse and Not Significant -Dabholm Beck, Dabholm Cut & Dabholm Gut: Moderate Adverse and Significant	An FRA, DIA and Surface Water Management Plan, environmental permits for each phase at Long Acres development prior to construction. Runoff rate to be reduced as far as possible in light of the large extent of impermeable surfaces. The drainage strategy shall take account of climate change. New drainage will be designed to current standards with allowances for additional rainfall and surface water flows under a climate change scenario. Permits shall be obtained for works and signed off by the Environment Agency (and Natural England where works are in relation to SSSI/ SPA/ Ramsar designations). A WFD Assessment shall be undertaken for each phase of the development prior to construction.	Negligible Beneficial and Not Significant. Permanent
	Water Quality - Spillages and leakages causing pollution	-The Fleet and Ash Gill Beck: Negligible Adverse and Not Significant. -Dabholm Beck, Dabholm Cut & Dabholm Gut: Moderate Adverse and Significant	Any Surface water channels would be lined with a geomembrane. This will mitigate the potential pollution pathway to the surface water and so there would be no contact with contaminated ground. In addition, harvested rainwater will need to be protected. As most of the site is made ground the proposed SuDS and any new drainage shall be lined or subject to local investigation to minimise	Ash Gill Beck, Dabholm Beck, Dabholm Cut & Dabholm Gut Negligible Beneficial and Not Significant Permanent The Fleet Negligible Beneficial and Not Significant Permanent

Receptor	Impact	Potential Effects (taking account of embedded mitigation)	Additional Mitigation and Monitoring	Residual Effects
			<p>infiltration into contaminated parts and translocation of the contaminants into wider environment.</p> <p>Any storage for rainwater shall be lined or in tanks that are suitably protected against ingress from contaminated soils. This will prevent contamination during storage.</p> <p>A WFD Assessment shall be undertaken for each phase of the development prior to construction.</p>	
Coatham Marsh	Flows - Increased runoff	Moderate Adverse and Significant	<p>Any works carried out to The Fleet shall not change the hydrology characteristics of Coatham Marsh unless it can be demonstrated that there would be no likely significant effect on the SPA arising from the final scheme of works for the Fleet.</p> <p>Hydraulic modelling shall be undertaken as part of site-specific drainage, overland and exceedance flow paths.</p> <p>Details comprising engineering drawings including cross sections shall be submitted and approved.</p>	Neutral and Not Significant Permanent
	<p>Water Quality - Mobilisation of contaminants and sediment</p> <p>Water Quality - Spillages and leakages causing pollution</p>	Moderate Adverse and Significant	<p>A remediation strategy is submitted and approved that ensures any highly contaminated soils are removed in proximity to the proposed realignment of The Fleet.</p> <p>A phasing plan of the works to realign The Fleet is submitted to and approved which confirms the timing of</p>	Neutral and Not Significant Permanent

Receptor	Impact	Potential Effects (taking account of embedded mitigation)	Additional Mitigation and Monitoring	Residual Effects
			<p>all works to realign The Fleet occur at an appropriate time (i.e. seasonal constraints of specific SSSI/SPA and/or Ramsar bird species) to avoid potential related pollutants occurring in the SSSI/ SPA and/or Ramsar.</p> <p>The timing of excavation and re-placement of ground materials shall be sensitive to avoiding poor weather conditions.</p>	
Groundwater				
Mudstone bedrock aquifer	Reduced infiltration resulting in lower flows	Negligible Adverse and Not Significant	No further mitigation proposed.	Negligible Adverse and Not Significant
	Pollution from spills	Negligible Beneficial and Not Significant	Remediation strategy and presence of future hardstanding will reduce the potential for generation of contaminated groundwater.	Minor Beneficial and Not Significant
Superficial aquifer (Tidal Flats / Glacial Till)	Reduced infiltration	Negligible Adverse and Not Significant	No further mitigation proposed.	Negligible Adverse and Not Significant
	Pollution from spills Reduced generation of contaminated groundwater from Made Ground	Negligible Beneficial and Not Significant	Remediation strategy and presence of future hardstanding will reduce the potential for generation of contaminated groundwater.	Minor Beneficial and Not Significant
Superficial aquifer (Made Ground / Blown Sands)	Reduced infiltration resulting in lower flows and disrupted flow pathways	Moderate Adverse and Significant	The drainage strategy will ensure that the proposed development doesn't alter the hydrological characteristics of the SPA and thus avoids any adverse future impacts upon it.	Neutral and Not Significant
	Pollution from spills	Moderate Adverse and Significant	The drainage strategy will ensure that the proposed development doesn't alter the hydrological characteristics of the SPA	Moderate Beneficial and Significant

Receptor	Impact	Potential Effects (taking account of embedded mitigation)	Additional Mitigation and Monitoring	Residual Effects
			and thus avoids any adverse future impacts upon it.	
Coatham Marshes (ground water)	Reduced infiltration resulting in lower flows	Moderate Adverse and Significant	The drainage strategy will ensure that the proposed development doesn't alter the hydrological characteristics of the SPA and thus avoids any adverse future impacts upon it.	Neutral and Not Significant
	Pollution from spills	Moderate Adverse and Significant	The drainage strategy will ensure that the proposed development doesn't alter the hydrological characteristics of the SPA and thus avoids any adverse future impacts upon it.	Moderate Beneficial and Significant

- G8.2 There will be no significant Adverse effects remaining after mitigation and there will be Negligible Beneficial effects for the River Tees Estuary during construction and operation. The straightened and culverted watercourses through and surrounding the site present constraints to the proposed development but can also provide significant opportunities. The drainage strategy for the site will seek to provide a plan for managing and improving the current baseline conditions on site with respect to the water environment. Works shall be done under an environmental permit.
- G8.3 In relation to groundwater, the site has limited groundwater resource potential. The proposed development should lead to an overall improvement of groundwater conditions through the implementation of a remediation strategy and other embedded mitigation. SuDS shall also be used to protect and enhance the environment. As most of the site consists of Made Ground, the proposed SuDS and any new drainage shall be lined or subject to local investigation to minimise infiltration into potentially contaminated soils. Any storage for rainwater shall be lined or in tanks that are suitably protected against ingress from contaminated soils. This will prevent contamination during storage. There is a potential connection between groundwater below the site and the dune slacks and Coatham Marshes of Teesside and Cleveland Coast SSSI/SPA/Ramsar. Groundwater monitoring outcomes identified in the additional mitigation will serve to establish the degree of any connectivity that exists and inform the detailed engineering design measures needed for the site to avoid any adverse future impacts.
- G8.4 This assessment has been undertaken as a high-level analysis of flood risk to the site. Consultation with the Risk Management Authorities – Redcar and Cleveland Council LLFA, Northumbrian Water, Environment Agency, Highways Services is being undertaken as part of the development of the Flood Risk and Surface Water Management Strategy and engagement with these organisations should continue throughout the design of the proposed development.

G9.0 **Abbreviations & Definitions**

- 1 AEP Annual Exceedance Probability
- 2 ALTBAR Mean catchment altitude (m above sea level)
- 3 ASCII American standard character set for information interchange
- 4 BFIHOST Base Flow Index estimated from soil type
- 5 BGS British Geological Survey
- 6 CEMP Construction Environment Management Plan
- 7 CTMP Construction Transport Management Plan
- 8 DEFRA Department of the Environment, Food and Rural Affairs (formerly MAFF)
- 9 DPLBAR Index describing catchment size and drainage path configuration
- 10 DPSBAR FEH index of mean drainage path slope
- 11 DTM Digital Terrain Model
- 12 EA Environment Agency
- 13 EIA Environmental Impact Assessment
- 14 FARL FEH index of flood attenuation due to reservoirs and lakes
- 15 FEH Flood Estimation Handbook
- 16 FRA Flood Risk Assessment
- 17 GWDTE Groundwater Dependent Terrestrial Ecosystem
- 18 LiDAR Light Detection and Ranging
- 19 mAOD metres Above Ordnance Datum
- 20 NGR National Grid Reference
- 21 NPPF National Planning Policy Framework
- 22 OS Ordnance Survey
- 23 OS NGR Ordnance Survey National Grid Reference
- 24 PDF Portable Document Format
- 25 PPG Planning Policy Guidance
- 26 PROPWET FEH index of proportion of time that soil is wet
- 27 Ramsar the intergovernmental Convention on Wetlands, signed in Ramsar, Iran, in 1971
- 28 SAAR Standard Average Annual Rainfall (mm)
- 29 SFRA Strategic Flood Risk Assessment
- 30 SPRHOST Standard percentage runoff estimated from soil type
- 31 SSSI Site of Special Scientific Interest

G10.0

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