8 HYDROLOGY AND FLOOD RISK

8.1 Introduction

8.1.1 This chapter of the Environmental Statement (ES):

- presents the existing baseline in terms of hydrology and flood risk;
- reports on the potential effects of the proposed development on local flood risk (including the effects of site drainage) and the effects on water resouces including water quality;
- identifies the proposed mitigation measures during construction; and

8.1.2 summarises the outline drainage strategy for managing site runoff during the operation of the Redcar Energy facility (REC). This chapter should be read in conjunction with the Flood Risk Assessment and Outline Drainage Strategy, which are enclosed in Appendix 8.1 and 8.2 respectively.

8.2 Assessment Methodology

Legislation and Planning Policy Context

Legislation

8.2.1 The principal legislative drivers relevant to assessing flood risk and water quality are:

- Coast Protection Act 1949;
- Environment Act 1995;
- Floods Directive, 2007;
- Flood and Water Management Act 2010;
- Land Drainage Act 1991 (as amended);
- The Environmental Permitting (England and Wales) Regulations 2010 (as amended 2016);
- The Groundwater Directive 2006;
- The Water Framework Directive 2000;
- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017; and
- Water Resources Act 1991 (as amended 2003).

8.2.2 The Environment Act (1995) set the standard for environmental management and made provision for the establishment of the Environment Agency.

8.2.3 The objective of the Floods Directive (2007) is to establish a framework for the assessment and management of flood risk to reduce the negative consequences of flooding on human health, economic activities, the environment and cultural heritage. The Directive which applies to all kinds of floods (river, lakes, flash floods, urban floods, coastal floods, including storm surges and tsunamis), on all of the European Union (EU) territory requires Member States to approach flood risk management in a three stage process, including preliminary flood risk assessment; develop flood risk maps and produce flood risk management plans. The Directive is delivered in the IK through the Flood Risk Regulations, 2009.

8.2.4 The Flood and Water Management Act (2010) established Lead Local Flood Authorities (LLFA) with responsibilities to manage local sources of flooding.

8.2.5 The Land Drainage Act 1991 (as amended) This requires that a watercourse be maintained by its owner in such a condition that the free flow of water is not impeded. The riparian owner must accept the natural flow from upstream but need not carry out work to cater for increased flows resulting from some types of works carried out upstream.

8.2.6 The Environmental Permitting (England and Wales) Regulations (2010, as amended) set out the guidelines for environmental permitting, the circumstances in which environmental permits are required, and compliance obligations. It is relevant to, for example, any works in rivers, dewatering, and any discharges to water bodies.

8.2.7 The Groundwater Directive (2006) requires specific measures to prevent and control groundwater pollution and achieve good groundwater chemical status. These measures include criteria for assessing the chemical status of groundwater and for identifying trends in pollution of groundwater bodies. Hazardous substances must be prevented from entering groundwater.

8.2.8 The Water Framework Directive (2000) requires that environmental objectives are set for all surface and groundwater bodies. The Water Framework Directive needs to be taken into account in the planning of new activities in the water environment, The Environment Agency is responsible for delivering the Directive through the Environment (Water Framework Directive) (England and Wales) Regulations 2017.

8.2.9 The Water Resources Act (1991, as amended) regulates water resources, water quality, water pollution, flood defence, and provides for the general management of water resources, the standards expected for controlled waters, and mitigation through flood defence

National Planning Policy

8.2.10 The National Planning Policy Framework (NPPF) (Ministry of Housing, Community and Local Government, 2019a) sets out the planning policies for England. It describes how these should be applied and aims to contribute towards sustainable development.

8.2.11 Section 14 of the NPPF: 'Meeting the challenge of climate change, flooding and coastal change' is relevant to the water environment and considers the impact of climate change to flood risk, coastal change and water supply.

8.2.12 The National Planning Practice Guidance (NPPG) (Ministry of Housing, Communities and Local Government, 2019b) supports the NPPF and provides guidance across a range of topic areas. These include climate change, EIA, flood risk and coastal change, the natural environment, water supply, wastewater and water quality.

Local Planning Policy

8.2.13 The site is located within the administrative boundary of Redcar and Cleveland Borough Council and is covered by the Redcar and Cleveland Local Plan which was adopted in May 2018.. The policies relating to flood risk and drainage are;

Policy SD 4 General Development Principles

'In assessing the suitability of a site or location, development will be permitted where it:

- *Meets the requirements of the Local and National Policy and accords with other Local Plan policies and designations;*
- *Avoids locations that would put the environment, or human health or safety, at unacceptable risk; and*

- *Will not increase flood risk either on site or downstream of the development.'*

Policy SD7 Flood Risk and Water Management

'Flood risk will be taken into account at all stages in the planning process to avoid inappropriate development in areas at current or future risk. Development in areas at risk of flooding, as identified by the Environment Agency flood risk maps, will only be granted where all of the following criteria are met:

a. The proposal meets the sequential and exception tests (where required) in relation to the National Planning Policy Framework;

b. A site specific flood risk assessment demonstrates that the development will be safe, including the access and egress, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall; and

c. New site drainage systems are well designed, taking account of events that exceed the normal design standard (e.g. consideration of flood flow routing and utilising temporary storage areas).

8.2.14 Full details of Policy SD7 can be found within Appendix 8.1: Flood Risk Assessment.

Relevant Guidance

8.2.15 The assessment of the effects of the proposed development on hydrology and flood risk has taken into account the guidance set out below:

- Environment Agency (2019) Guidance Flood Risk Assessments: climate change allowances;
- National SuDS Working Group, Interim Code of Practice for Sustainable Drainage Systems, 2004;
- CIRIA C532 (2001) Control of Water Pollution from Construction Sites;
- CIRIA C753 (2015a) The SUDS Manual; and
- CIRIA C741 (2015b) Environmental Good Practice on Site fourth edition.

Study Area

8.2.16 The hydrology and flood risk study area is shown in Figure 8.1 and comprises a 500 metre buffer around the Application Site, which includes the access road.

8.2.17 The 500 metre study area is considered appropriate for data collection taking into account the nature of the proposed development and likely zone of influence on hydrological receptors. Given the landscape surrounding the Application Site and local land use activities, it is difficult to ascertain the exact source of any impacts on water quality beyond 500 metres.

Baseline Methodology

8.2.18 Determination of the baseline conditions at the proposed development site has been established through a review of the literature and data from publicly available sources including the Environment Agency, British Geological Survey (BGS) and Redcar and Cleveland Borough Council This provided an insight into surface water features and the existing land use of the hydrological features within the immediate vicinity of the Application Site.

8.2.19 The baseline assessment has included a review of available historical information, available data and technical reports relating to the Application Site, the surroundings and environmental

sensitivity. The baseline assessment is based on data sourced from a number of different organisations / authorities including:

- Ordnance Survey;
- BGS 1:50,000 geological mapping;
- BGS Geoindex Onshore [http://mapapps2.bgs.ac.uk/geoindex/home.html];
- BGS Aquifer Designation Maps;
- Environment Agency website (2020) [www.environment-agency.gov.uk];
- Natural England;
- The Centre for Ecology and Hydrology (CEH);
- Met Office: climate data (2020) [www.metoffice.gov.uk];
- Redcar and Cleveland Borough Council;
- Northumbrian Water; and
- Groundsure Ltd.

8.2.20 The following baseline studies have been used to inform the baseline conditions:

- Flood Risk Assessment (see Appendix 8.1); and
- Outline Drainage Strategy (see Appendix 8.2).

8.2.21 In addition to the above, site specific hydrological data has been obtained via consultation with the Environment Agency, Redcar and Cleveland Borough Council as the Lead Local Flood Authority (LLFA), and other stakeholders. An environmental data request was submitted to the Environment Agency with the responses attached within the supporting Flood Risk Assessment (Appendix 8.1).

Consultation

8.2.22 Formal pre-application and consultation was undertaken during the scoping opinion phase of this ES. Additional consultation has been undertaken during the course of this assessment. Table 8.1 sets out consultation responses received in relation to hydrology and flood risk.

Table 8.1: Consultation Responses Relevant to Hydrology and Flood Risk

Date	Consultee and Issues Raised	How/ Where Addressed
	Redcar and Cleveland Borough Council	
May 2020 (Scoping Response)	***Natural Heritage*** Natural Heritage Manager outlined no objections based upon ecological / environmental proposals.	Noted.
April 2020 (Pre-application enquiry)	***Lead Local Flood Authority*** Any major application should eb accompanied by a site-specific Flood Risk Assessment and Drainage Strategy. The Tees Valley authorities do not allow for infiltration to be the primary method of disposal of surface water. Tees Valley SuDS Design Guide and Local Standards **LS1** the Tees Valley area is predominantly underlain with clay and silt soils therefore infiltration is considered a suitable method for the primary method of the disposal of surface water.	Comments used to inform the Flood Risk Assessment (Appendix 8.1), outline drainage strategy (Appendix 8.2) and the baseline conditions section of this chapter.

Date	Consultee and Issues Raised	How/ Where Addressed
	Policy SD7 of the Redcar and Cleveland Borough Council Local Plan (2018) confirms that where it is proposed to discharge to the River Tees, it can be discharged at an unrestricted rate as long as there is no increased risk of flooding elsewhere.	
May 2020 (Scoping response	The LLFA agree with Paragraph 4.18 of the scoping assessment with regards to Climate Change and Future Flood Risk. With reference to Chapter 8 (Hydrology and Flood Risk) the LLFA had no objection principle and had no additional comments at this stage. Applicants should consider Policy SD7 of the Local Plan and also the Tees Valley Sustainable Urban Drainage System (SuDS) Guidance Design Guide & Local Standards. 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 need not apply.	
May 2020	***Contaminated Land*** No objections to the scoping proposal were raised.	
March 2020 (Pre-application enquiry)	**Environment Agency** The Environment A responded to an initial product 4 data request sent in March 2020 and supplied Tidal Flood Modelling data, flood defence information and historical flood events. The Environment Agency indicated that it is currently commissioning a new model for this location which will be released c. 2021. Any works near a main river may require approval from the Environment Agency or MMO.	Used to inform the Flood Risk Assessment (Appendix 8.1) and the baseline conditions section of this chapter. It is not anticipated that the Environment Agency's new model would materially affect the assessment or design. Agreed.
June 2020 (Scoping response)	The Environment Agency is pleased that the Chapter 8 (Hydrology and Flood Risk) state that impacts on the quality of runoff from the application site would be considered. In assessing these impacts, the applicant should consider the likely impact of the development on water quality having regard to the impacts of the WFD status of the nearby Tees Estuary before this can be scoped out. The applicant will need to submit a WFD Assessment which should be appended to the ES.	A WFD Assessment has been undertaken (Appendix 8.3) and its conclusions have been summarised in this chapter.
	The site lies within Flood Zone 1 and the Environment Agency has no formal comment on the scoping of flood risk and defers this to the LLFA to provide comment on surface water flood risk.	Noted. The LLFA has been consulted and their comments have been included in this table.
	The Environment Agency is pleased to see that the applicant has considered longer term impacts in relation to climate change and has used the most up to date climate change allowances.	Noted.

Date	Consultee and Issues Raised	How/ Where Addressed
	The preferred option for dealing with foul drainages, particularly from amenity or welfare facilities (during all phases) would be to discharge to the public sewer. If this is not feasible, then the applicant would need to apply for a Water Quality permit which could be applied for independently or incorporated into the waste/installation permit. Any outfall structure/discharge that is required to be constructed may require a flood risk activity permit under the Environmental Permitting (England and Wales) Regulations 2016. The design of any outfall should be sympathetic to the water environment and low impact design options that mimics greenfield runoff should be considered. Where this is the case, the impact of this should also be considered in your submitted ES and any implications upon water quality or relevant species. Where this is considered suitable to be scoped out, relevant information would still need to be submitted as part of the planning application which would include a red line boundary showing the full extent of the outfall and ecological assessments.	
May 2020 (Scoping response)	**Northumbrian Water** The Developer should develop their Surface Water Drainage solution by working through the Hierarchy of Preference contained within Revised Part H of the Building Regulations 2010. Namely: - • Soakaway • Watercourse, and finally • Sewer We recommend that the developer contact Northumbrian Water to agree allowable discharge rates and points to the public sewer network.	Agreed. Noting the proximity to the Tees Estuary, this is the approach adopted for the outline drainage strategy (see Appendix 8.2). .
May 2020 (Scoping response)	**Natural England** Natural England advises that the potential impact of the proposal upon features of nature conservation interest and opportunities for habitat creation/enhancement should be included within this assessment in accordance with appropriate guidance on such matters. The ES should thoroughly assess the potential for the proposal to affect designated sites. The development site is immediately adjacent to the following designated nature conservation site(s): • Teesmouth and Cleveland Coast Site of Special Scientific Interest (SSSI); • Teesmouth and Cleveland Coast Special Protection Area (SPA) and Ramsar Site.	Noted. The SSSI, SPA and Ramsar sites are considered in relation to flood risk and the water environment in this assessment.
June 2020 (Scoping response)	**South Tees Development Corporation** The site is located within Flood Zone 1. The main flood risk is tidal or coastal and STDC's Masterplan considers the site levels appropriate for development (see section 2.10.2 of the Master Plan).	Noted. STDC's Masterplan has been reviewed and information on site levels incorporated into this ES chapter and the Flood Risk Assessment (Appendix 8.1).

Assessment Criteria and Assignment of Significance

8.2.23 The criteria for determining the significance of effects is a two-stage process that involves defining the sensitivity of the receptors and the magnitude of the impacts of those receptors. This section describes the criteria applied in this chapter to assign values to the sensitivity of receptors and the magnitude of potential impacts. The terms used to define sensitivity and magnitude are based on recognised EIA methodology, which is described in further detail in Chapter 4: Environmental Impact Assessment Methodology.

8.2.24 The significance of an effect is determined based on the magnitude of an impact and the sensitivity of the receptor affected by the impact of that magnitude. This section describes the criteria applied in this chapter to characterise the magnitude of potential impacts and sensitivity of receptors.

8.2.25 The criteria for defining sensitivity in this chapter are outlined in Table 8.2

Receptor Sensitivity/Value

Table 8.2: Definitions of Sensitivity or Value

Sensitivity	Typical Descriptors
Very High	Receptor is high value or critical importance to the local, regional or national economy. Receptor is highly vulnerable to impacts that may arise from the proposed development and recoverability is long term or not possible. ***Surface water***: Water Framework Directive (WFD) Current Overall Status of High. ***Flood risk***: Land within Flood Zone 3 or more than one hundred residential properties protected from flooding by flood defence infrastructure or by natural floodplain storage.
High	Receptor is of moderate value with reasonable contribution to the local, regional or national economy. Receptor is generally vulnerable to impacts that may arise from the proposed development and recoverability is slow and/or costly. ***Surface water***: WFD Current Overall Status of Good. ***Flood risk***: Land within Flood Zone 3 and/or 2 or between one and one hundred residential properties or industrial premises protected from flooding by flood defence infrastructure or by natural floodplain storage.
Medium	Receptor is of minor value with small levels of contribution to the local, regional or national economy. Receptor is somewhat vulnerable to impacts that may arise from the proposed development and has moderate to high levels of recoverability. ***Surface water***: WFD Current Overall Status of Moderate. ***Flood risk***: Land within Flood Zone 2 and/or 1 or limited constraints and a low probability of flooding of residential and industrial properties.
Low	Receptor is of low value with little contribution to the local, regional or national economy. Receptor is not generally vulnerable to impacts that may arise from the proposed development and/or has high recoverability. ***Surface water***: WFD Current Overall Status of Poor. ***Flood risk***: Flood plain within Flood Zone 2 and/or 1 or limited constraints and a very low probability of flooding of residential and industrial properties.
Negligible	Receptor is of negligible value with no contribution to local, regional or national economy. Receptor is not vulnerable to impacts that may arise from the proposed development and/or has high recoverability. ***Surface water***: WFD Current Overall Status of Bad. ***Flood risk***: Flood Zone 1 over 250 metres from assessed flood risk area.

8.2.26 The criteria for defining magnitude in this chapter are outlined in Table 8.3.

Magnitude of Impact

Table 8.3: Definitions of Magnitude

Sensitivity	Typical Descriptors
High	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Medium	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Low	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse).
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse).
	Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

8.2.27 Impact magnitude must take into account the impact duration. The following definitions have been used in the assessment:

- Temporal Scale
  - Short Term: A period of months, up to one year;
  - Medium Term: A period of more than one year, up to five years;
  - Long Term: A period of greater than five years.
- Adverse or Beneficial – whether the nature of the effect increases or decreases potential contamination risks to sensitive receptors;
- Temporary – effects that persist for a limited period only (due for example, to particular activities taking place for a short period of time);
- Permanent – effects that result from an irreversible change to the baseline environment (e.g. land-take) or which persist for the foreseeable future (e.g. noise from regular or continuous operations or activities);
- Direct – effects that arise from the impact of activities that form an integral part of the proposed development (e.g. direct employment and income generation);
- Indirect – effects that arise from the impact of activities that do not explicitly form part of the proposed development (e.g. off-site infrastructure upgrades to accommodate the development);
- Reversible/irreversible effect: effects can be reversed by mitigation measures or by natural environmental recovery within reasonable timescales (5-10 years following cessation of construction);

- Secondary – effects that arise as a consequence of an initial effect of the proposed development (e.g. induced employment elsewhere);
- Cumulative – effects that can arise from a combination of different effects at a specific location or the interaction of different effects over different periods of time; and
- Geographical scale: whether the effect would be experienced at the local, regional or national level.

Significance of Effects

8.2.28 The significance of predicted effects has been determined using publicly available environment data to take into account the sensitivity of the receptor and the magnitude of each impact. Table 8.4 below is used to inform the evaluation of the significance of effects.

Table 8.4: Assessment Matrix

Sensitivity	Magnitude of Impact				
	No Change	Negligible	Low	Medium	High
Negligible	No change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No change	Minor	Minor or Moderate	Moderate or Major	Major or Substantial
Very high	No change	Minor	Moderate or Major	Major or Substantial	Substantial

8.2.29 The overall significance of an effect is expressed as negligible, minor, moderate, major or substantial based on the definitions below.

- **Substantial**: Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.
- **Major**: These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
- **Moderate**: These beneficial or adverse effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor.
- **Minor**: These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project.
- **Negligible**: No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

8.2.30 For the purpose of this assessment any effect that is moderate, major or substantial is considered to be significant. Any effect that is minor or below is not significant.

Limitations of the Assessment

8.2.31 The assessment within this chapter is based on publicly available data obtained from the Environment Agency, BGS, Northumbrian Water, Redcar and Cleveland Borough Council and commercial data supply companies (Groundsure). Additional information was also supplied from stakeholders during the scoping stage. The information has been supplemented with publicly available data (online website searches) and Groundsure searches and the information received is considered sufficient to characterise the baseline environment.

8.2.32 It is also noted that the Environment Agency Flood Zone risk maps do not take into account the impact of local flood defences and climate change on flooding, and does not provide information on flood depth, speed or volume of flow. The maps do not show flooding from other sources such as groundwater or overflowing sewers. However, a description of these sources of flooding is provided in the Flood Risk Assessment (see Appendix 8.1), such that sufficient baseline information is available.

8.2.33 The assessment is limited to a degree by a lack of detailed information on:

- Flow data for watercourses and drainage channels;
- Site specific hydraulic model levels;
- Up to date sea level / coast erosion information;

8.2.34 These limitations have been taken into account in undertaking the assessment and notwithstanding these, overall a moderate to high level of certainty has been applied to the baseline and assessment presented in this chapter. Where available, catchment data regarding water quality has been used to inform the assessment as well as consultation with appropriate stakeholders to obtain data. The information which was available is considered sufficient to establish the baseline within the hydrology and flood risk study area, therefore, there are no data limitations that affect the conclusions of this assessment.

8.3 Baseline Environment

8.3.1 This section describes the hydrological resources and flood risk within the hydrology and flood risk study area.

Site Description

8.3.2 The Application Site is located approximately 4.5 km west of Redcar town centre and 8.5 km to the north east of Middlesbrough city centre, within the Redcar and Cleveland Council borough.

8.3.3 The Application Site forms part of the demise of Redcar Bulk Terminal and occupies an area of approximately 10.1 hectares (ha) of industrial land. Redcar Bulk Terminal is a privately-run dock at the mouth of the Tees Estuary in North Yorkshire. The port is used for the transhipment of coal and coke (both inward and outward flows).

8.3.4 The north and north eastern boundaries to the site are formed by a 2 to 3 metre high earth bund beyond which is an area of sand dunes associated with Bran Sands, situated at the mouth of the Tees Estuary and Coatham Sands facing onto the North Sea, with the reclaimed land and breakwater of South Gare separating them. The Teesmouth and Cleveland Site of Special Scientific Interest (SSSI) is adjacent to the Application Site's northern boundary.

8.3.5 The southern and eastern boundaries of the site are delineated by the Teesside Steel Works buildings and coke ovens. To the west of the Application Site are storage areas associated with the Redcar Bulk terminal. Further industrial uses are present to the south of the Steel works with the residential villages of Coatham and Dormanstown to the east and south east.

8.3.6 The DEFRA 1 m Digital Terrain model (DTM) (2019) indicates that the topography of the Application Site is relatively flat ranging from 7.1 metres Above Ordnance Datum (m AOD) in the northern extent to 7.6 m AOD with localised spoil heaps in the western extent. A localised area within the southern extent of the Application Site, associated within the internal road, is at approximately 6.5 m AOD.

Hydrological Setting

8.3.7 The hydrology and flood risk study area runs through the Tees Management Catchment and the Tees Lower and Estuary Operational Catchment (as designated by the Environment Agency), which covers an area from Croft-on-Tees in the west to the North Sea in the east.

8.3.8 The hydrology and flood risk study area includes a number of Environment Agency designated Main Rivers and LLFA ordinary watercourses. Definitions of these hydrological features are provided below:

- Main Rivers – watercourses where the Environment Agency has permissive powers over their management; and
- Ordinary watercourses – includes rivers, streams, ditches and drains which do not form part of a main river are managed by Redcar and Cleveland Borough Council, as LLFA.

8.3.9 The closest watercourse to the Application Site is the River Tees, which flows in a northerly direction approximately 870 metres to the west of the site and discharges into the North Sea. The River Tees is fed by a complex network of Main Rivers, ordinary watercourses and drainage ditches with water features (ponds, drainage ditches) falling within a 1 km radius of the Application Site. The River Tees forms part of the Teesmouth and Cleveland Coast Special Protection Area and Ramsar.

8.3.10 A number of ponds are present 450 metres to the north east of the Application Site within the Teesmouth and Cleveland Coast SSSI. Further details of the ecological designated sites, including the Teesmouth and Cleveland Coast SSSI , are detailed within Chapter 6 (Ecology and Ornithology).

8.3.11 Further descriptions of the key hydrological and flood risk characteristics within the study area are set out below.

Fluvial and Tidal Flood Risk

8.3.12 The Environment Agency Flood Zone risk maps use four categories to describe the risk of flooding. These categories are set out in Table 8.5.

Table 8.5: Environment Agency Flood Zone definitions

Flood Zone	Flood Zone Definition
Flood Zone 1	This land comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
Flood Zone 2	This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% - 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5 – 0.1%) in any year.
Flood Zone 3(a)	This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
Flood Zone 3(b)	This zone comprises land where water has to flow or be stored in times of flood.

8.3.13 The Environment Agency Flood Map for Planning (Appendix 8.1: Flood Risk Assessment) indicates that the entire Application Site is situated within an undefended Flood Zone 1.

8.3.14 Appendix 8.1: Flood Risk Assessment shows the Environment Agency Flood Map for Planning for the hydrology and flood risk study area. The maps are the first stage in identifying the flood risk for a particular location and depict the 'no defence' scenario. A description of other flood sources (i.e. groundwater, direct runoff from fields or overflowing sewers) are presented in Appendix 8.1: Flood Risk Assessment.

Flood Risk Data / Modelling

8.3.15 As the site is located in proximity to Flood Zone 3 the Environment Agency was consulted to provide more detailed flood data to verify the site's location within Flood Zone 1. The Environment Agency provided modelled flood data extracted from the 2011 Tidal Tees Integrated Flood Risk Modelling Study and 2015 Tidal Tees Integrated Flood Risk Modelling Study. Modelled flood extents for a 1 in 1,000-year event plus climate change (undefined allowance) indicates the site is predicted to be unaffected during any such event.

8.3.16 The Environment Agency and Redcar and Cleveland Borough Council SFRA confirmed that the main potential risk to the Application Site is from tidal flooding from the Tees Estuary. The fluvial flood risk across the Borough is minimal, with the main source of fluvial risk coming from several relatively small watercourses that pass through some towns and villages. Due to the minimal risk of fluvial flooding it has not been considered further within this chapter.

8.3.17 The Environment Agency also provided modelled flood levels extracted from flood nodes. The modelled water levels extracted from the node nearest the site, reference point 328, are given in Table 8.6 with the full dataset included within Appendix 8.1: Flood Risk Assessment.

Table 8.6. Undefended and Defended modelled Water Levels

	Undefended modelled water level (m AOD)				Defended modelled water level (m AOD)		
Node Point	1 in 2	1 in 200	1 in 1,000	1 in 1,000 + CC*	1 in 200	1 in 1,000	1 in 1,000 + CC*
328	3.47	4.11	4.37	5.26	4.11	4.38	5.26

* CC = climate change allowance

8.3.18 The undefended modelled flood water level at the node closest to the Application Site indicates a flood water level of 4.11 m AOD. DTM data at the Application Site indicates that the average topography is approximately 7.1 m AOD, with the lowest site level being approximately 6.5 m AOD within the southern extent of the site. Therefore, the average site level is located approximately 2.99 metres above the approximate 1 in 200-year flood level and 1.84 metres above the 1 in 1,000 year plus climate change level. The lowest site level is located approximately 2.39 metres above the 1 in 200-year flood level.

8.3.19 The 1 in 1,000-year undefended water levels including climate change for the Application Site is 5.26 m AOD. It is assumed that the modelled water levels within the Tidal Tees Integrated Flood Risk Modelling Study incorporated the cumulative rise of sea levels outlined within UK Climate Projections 2009 (UKCP09) (0.99 metres) due to the study post-dating the climate change allowances. When we compare the modelled water levels with the new climate change allowances in UK Climate Projections 2018 (UKCP18), it is likely that any modelled water level would increase with the cumulative sea level rise for Northumbria now being 1.43 metres. Due to the site being at approximately 7.1 m AOD it is unlikely that the modelled water levels would flood the Application Site with the UKCP18 allowances during the 1 in 200 year and 1 in 1,000 year plus climate change events.

Historic Flood Events

8.3.20 The Environment Agency historic flood map and recorded flood outline dataset indicates that no historic flooding has occurred within the Application Site.

8.3.21 The Environment Agency has confirmed that they hold no record of any historic river flooding at the Application Site.

8.3.22 Groundsure data indicates that an area approximately 71 metres north west of the Application Site was flooded in December 2013. The cause of the flooding was due to operational failure and breach of defences by tidal sources.

Flood Defences

8.3.23 The Environment Agency spatial flood defences dataset indicates that a number of natural flood defences are present to the west of the Application Site. The flood defences have a design standard of two years. Table 8.7 below presents further details of the local flood defences.

Table 8.7: Spatial Flood Defence Information

Protection Type	Asset Type	Description	Condition	Design Standard
Tidal	High Ground	Natural ground	3	2
Tidal	High Ground	Natural and industrial high ground	3	2

8.3.24 The Environment Agency confirmed that there are no defences in the area that are owned or maintained by them, indicating the defences present are privately owned.

Surface Water Flood Risk

8.3.25 The Environment Agency's surface water flood map indicates that the majority of the Application Site is at very low risk of flooding from surface water sources, with a chance of flooding each year of less than 1 in 1,000. Small localised areas within the Application Site are designated as being at low risk of surface water flooding, with a change of flooding between 1 in 1,000 and 1 in 100 each year. No overland flow pathways are present with the Application Site boundary or within the vicinity of the site. On this basis, it is not considered that there is significant risk of flooding from surface water sources.

Reservoir Flood Risk

8.3.26 The Environment Agency long term flood risk map indicates that the Application Site is not within the maximum extent of flooding from reservoir failure. It is therefore determined that the proposed development is at low risk of flooding from Reservoir failure and therefore, reservoir flood risk is not considered further.

Geology and Hydrogeology

8.3.27 Reference to the BGS Geology of Britain Viewer online mapping (1:50,000 scale) indicates that the Application Site is situated on superficial deposits of Tidal Flat Deposits (Sand , Silt and Clay). The superficial deposits are underlain by bedrock consisting of the Mercia Mudstone Group comprising mudstone and siltstone.

8.3.28 The Environment Agency Aquifer Designation Maps (Environment Agency, 2020a) indicate that the Tidal Flat Deposits are a Secondary (Undifferentiated) Aquifer and the Mercia Mudstone Group

is classified as a Secondary B Aquifer. Further details of the geological and hydrogeological nature of the Application Site can be found in Chapter 9: Geology, Hydrogeology and Contamination.

Existing Drainage

8.3.29 The Application Site is currently characterised as industrial land use comprising cleared industrial land and, based on the available information, it is considered unlikely that any main drainage features are present. However, if any sewer network is present on the Application Site it is assumed that it has been designed to industry standards (e.g. Sewers for Adoption). Should flooding from sewers occur (e.g. as a result of water inflow from rivers or the sea, or sewer collapse) there is a risk of flooding by surcharge where the flood is in excess of the sewer capacity (usually 1 in 30 year event or greater). If found existing sewers are identified during construction, they can be isolated or removed.

Surface Water Abstractions

8.3.30 The abstraction licence records taken from Groundsure data (Groundsure, 2020) indicate that there are no current or historical licences within 500 metres of the Application Site. Historical surface water abstraction licences within 1 km of the Application Site are detailed below.

Table 8.8: Surface water abstraction licence within a 1 km search area of the Application Site.

Name of Holder	Licence Number	Grid Reference (x,y)	Distance from site (m)	Maximum daily volume (m^3)
British Steel PLC	-	454700, 525900	924 m west	-
Corus UK LTD	-	454700, 525900	924 m west	722,828

Surface Water Quality

8.3.31 Table 8-9 lists the watercourse and associated Water Framework Directive (WFD) classification grades within the hydrology and flood risk study area as set out in the Northumbria River Basin Management Plan. The objective dates are explained as follows.

- 2015: status matches the predicted future status or potential. The main environmental objective is to prevent deterioration in status between 2015 and 2021.
- 2021: there is confidence that as a result of the programme of measures, the water body will improve from its 2015 status to achieve the predicted future status by 2021. The environmental objective is for water bodies and elements to make an improvement from the reported 2015 status to achieve the predicted future status by 2021.
- 2027: the deadline for achieving the status or potential has been extended to 2027. For a 2027 date, there is currently not enough confidence that the improvement in status can be achieved by an earlier date

Table 8-9: WFD Water Quality Data.

Name of Catchment	Overall Status 2015	Overall Status 2016	Overall Status 2027
Tees Estuary (S Bank)	Moderate	Moderate	-
Tees	Moderate	Moderate	-

Name of Catchment	Overall Status 2015	Overall Status 2016	Overall Status 2027
Marton West Beck Catchment (trib of Tidal Tees)	Moderate	Moderate	-

8.3.32 The records show that the watercourses within the hydrology and flood risk study area have a WFD status of Moderate. The issues preventing the Tees transitional water body from reaching good status are pollution from waste water, physical modifications and pollution from towns, cities and transport. The key sectors identified as contributing to these issues are industry navigation, water industry and local and central government. All lower status waterbodies have objectives to improve, with most aiming to achieve Moderate to Good status by 2027, and many of the measures needed to achieve the improvement in status are either already in place or will be in place by 2021.

8.3.33 A full description of the WFD classification process and associated definitions are available at: https://www.gov.uk/government/consultations/river-basin-management-planning-ministerialguidance-and-standards

Discharge Consents

8.3.34 The Environment Agency data confirms there are no discharge consents within 1km of the Application Site. The closest discharge consent is approximately 1.4 km from the Application Site and relate to surface water and treated sewage effluent.

Pollution Incidents

8.3.35 Pollution incident mapping has been used to identify if the quality of watercourses within the hydrology and flood risk study area may have been affected by pollution.

8.3.36 A review of Groundsure data (Groundsure 2020) identified one pollution incident occurring within 500 metres of the Application site. The Incident was reported as category 4 (no impact), dated December 2002approximately 273 metres north of the Application Site and was associated with the release of general biodegradable materials and waste.

Ecological Designations

8.3.37 The Teesmouth and Cleveland Coast SSSI is located adjacent to the northern boundary of the Application Site and the Teesmouth and Cleveland Coast SPA and Ramsar is located approximately 78 metres to the north west and includes the River Tees.

Future Baseline Conditions

8.3.38 In the event that the proposed development does not come forward, an assessment of the future baseline conditions has been carried out and is described within this section.

8.3.39 The main change to the hydrology and flood risk future baseline is associated with the potential effects of climate change, which may impact on future peak river flow rates, sea level rise and rainfall intensity. A summary of potential climate change allowances as outlined by the Environment Agency (2016, updated 2019) is presented below. Further details of climate change allowances can be found at https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances.

8.3.40 The increase in sea level rise, peak river flow rates and rainfall intensity as outlined within UKCP18 is likely to significantly affect the Northumbria District. However, as the Application Site is

located significantly higher than the coastline and River Tees at approximately 7.1 m AOD it is unlikely that any increase in sea level risk or peak river flow would cause flooding at the site. The increase in rainfall intensity has the potential to increase the risk of surface water flooding at the Application Site. However, the appropriate UKCP18 rainfall intensity allowances have been incorporated within the surface water drainage system design in order that the drainage network has capacity to store any increase in rainfall.

Climate Change

8.3.41 In February 2016 the Environment Agency published advice on climate change allowances. In December 2019 the Environment Agency updated guidance requirements to be used for Flood Risk Assessments and SFRAs, where appropriate, using the UKCP18 projections. The allowances outline increases in rainfall intensity, peak river flows and sea level rise.

8.3.42 Table 8.10 below identifies the range of increase per epoch for peak rainfall intensity. Assessments should consider both the central and upper end allowances to understand a range of impact.

Table 8.10: Peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)

Applies across all of England	Total potential change anticipated for 2015 to 2039	Total potential change anticipated for 2040 to 2069	Total potential change anticipated for 2070 to 2115
Upper End	10%	20%	40%
Central	5%	10%	20%

8.3.43 Table 8.11 outlines the anticipated sea level rise associated with climate change per defined epoch. The Environment Agency expect sea level rise to increase the rate of coastal erosion.

Table 8.11: Sea level allowance for each epoch (mm) per year (use 1990 baseline)

Area of England	Allowance	2000 to 2035	2036 to 2065	2066 to 2095	2096 to 2125	Cumulative rise 1990 to 2115 / metres (m)
Northumbria	Higher Central	4.6 mm /yr. (161 mm)	7.5 mm/yr (225 mm)	10.1 mm/yr (303 mm)	11.2 mm/yr (336 mm)	1.03 m
	Upper End	5.8 mm /yr. (203 mm)	10 mm/yr (300 mm)	14.3 mm/yr (429 mm)	16.5 mm/yr (495 mm)	1.43

8.3.44 The climate change guidance notes that the allowances provided have been derived from national scale research. There may be cases where evidence supports the use of other local climate change allowances. The allowances account for slow land movement. This is due to 'glacial isostatic adjustment' resulting from the release of pressure at the end of the last ice age. The northern part of the country is slowly rising and the southern part is slowly sinking.

8.3.45 Table 8.12 outlines the anticipated increase in the peak river flow within the river basin district. The EA expect the peak river flow to increase with climate change.

Table 8.12: Peak river flow allowance by river basin district (use 1961 to 1990)

River Basin District	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)
Northumbria	Upper end	20%	30%	50%
	Higher Central	15%	20%	25%
	Central	10%	15%	20%

8.4 Mitigation Measures Adopted as Part of the Project

8.4.1 As part of the design process, a number of mitigation measures have been proposed to reduce the potential for impacts on flood risk and hydrology. These measures are considered best industrial practice for this type of development and therefore have been incorporated in the scheme design as assessed within the potential impacts.

Construction Phase

8.4.2 A Code of Construction Practice (CoCP) would be prepared post consent in order to ensure good practice guidance is adhered to throughout the construction phase and to ensure that likely effects during the construction phase are mitigated as far as reasonably possible.

8.4.3 The CoCP would set out pollution prevention / construction best practice methods in accordance with the following guidance:

- Environment Agency guidance for discharge to surface water and groundwater environmental permits (Environment Agency 2016b);
- Environment Agency guidance for oil storage regulations for businesses (Environment Agency, 2015b);
- Environment Agency guidance for work on a river, flood defence or sea defence (Environment Agency, 2016c);
- Environment Agency, Pollution Prevention Guidance Note 6: Pollution Prevention Guidelines – Working at Construction and Demolition Sites (Environment Agency, 2012) now withdrawn, however still provides valid best practice guidance
- Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors CIRIA (C532) (Construction Industry Research and Information Association (CIRIA), 2001);
- CIRIA – SuDS Manual (CIRIA, 2015a);
- CIRIA (C741) Environmental good practice on site guide (CIRIA, 2015b); and
- CIRIA (C648) Control of water pollution from linear construction projects (CIRIA, 2001).

Pollution Prevention Measures

8.4.4 The following measures would be incorporated in the CoCP:

- All construction staff would be briefed on the location of the nearby watercourses and pollution prevention measures would be included within the site induction.

- Areas with prevalent run-off would be identified and drainage would be actively managed, e.g. bunding of stockpiled material and/or temporary drainage.
- A buffer would be established to exclude construction activity within 2 metres of the foot of the existing boundary.
- Machinery would be routinely checked to ensure that it is in good working condition. Refuelling of machinery would only be undertaken within a designated area of the site where spillages can easily be contained. Any storage tanks and associated pipe work containing fuels would be double skinned or bunded, provided with leak detection equipment and inspected daily.
- Storage areas of hazardous substances (including oils and chemicals) would be bunded to minimise the risk of hazardous substances entering the drainage system or the local watercourses. Additionally, the bunded areas would have impermeable bases to limit the potential for migration of contaminants into groundwater following any leakage/spillage. The bunding systems for oil/chemical storage would have a capacity of 110% of the oil/chemical volume stored and ideally would be covered to prevent ingress of rainwater. Oil/chemical storage areas would be visually inspected on a daily basis.
- Designated areas for the unloading, storage and handling of materials (including the storage of oils/fuels/chemicals) would be sited away from the northern boundary of the Application Site and surface watercourses. Storage containers would be appropriate for the materials being stored and all products would be clearly marked.
- Any leaks or spillages of potentially polluting substances would be contained, collected and then removed from site in an appropriate manner, e.g. use of absorbent material or bunding. Spill kits would be provided at agreed locations on the Application Site and all construction staff would be trained in their use.
- Measures would be installed to manage the surface water runoff from the Application Site to prevent silty water entering the ponds to the north east or the River Tees to the west. Silty water will be treated to allow suspended solids to settle out before disposal. Treatment is likely to include settlement tanks (e.g. siltbuster) or lagoons or a combination of both.
- Washing out concrete would only take place in dedicated areas on the site: the wash out areas would be bunded and the water removed for treatment.
- Site wheel washing facilities would be located away from watercourses and any waste water would undergo settlement and reused where possible.
- No direct discharges of liquids or materials into the ponds or River Tees would be permitted.
- Dust suppression equipment would be used to reduce the migration of sediment within the Application Site. The dust suppression equipment would be used in areas where construction drainage systems has features to remove sediment and therefore, reduce the risk of sediment discharging into the surrounding watercourses or the adjacent designated ecological areas.
- The construction phase would include temporary drainage mitigation techniques including, but not limited to, run-off interceptor channels installed prior to the construction of the formal drainage to ensure that discharges from the proposed development are controlled in quality and volume during construction. This may include the use of settling tanks and /or ponds to remove sediment, temporary interceptors and hydraulic brakes.

Operation Phase

8.4.5 Surface water during the operation phase would be managed in accordance with the outline drainage strategy (Appendix 8.2) which would be approved by the LLFA prior to construction commencing.

8.4.6 For clean runoff, the outline drainage strategy includes the collection of surface water via traditional slot / channel drains before discharging via suitable oil interceptors to an attenuation pond and onward via an off-site gravity discharge to the River Tees at an uncontrolled rate.

8.4.7 No process effluent or boiler water would be discharged to the clean water surface water system and a separate system to deal with this water would be provided. Any excess process water produced in planned outages of the proposed development would be directed to an onsite wastewater tank and any surplus would be tankered off site.

8.4.8 The process drainage would be recycled in the waste to energy process as follows:

- Rainwater Harvesting – Roof water from the proposed REC would be collected and stored in a rainwater tank, where the water would feed the top up of the process washing system.
- Fire Water Containment - Fire water runoff from the sprinkler discharge would be managed principally by containment within the REC.
- IBA Storage Area – A continuous perimeter concrete upstand bund will allow full containment of IBA material washout during rainfall events. Surface water drainage runoff from IBA process areas would be collected via an underground gravity drainage system and discharged to a concrete lined settlement lagoon. Excess surface water in the IBA area would be retained and recycled into ash as a dust suppressant. No surface water drainage from the IBA area would be discharged to the Tees Estuary via the uncontrolled discharge.

8.4.9 The operation of the Redcar Energy Centre would be managed via the Environmental Permit. The Permit would include an emergency spill response procedure and a site storage procedure.

8.4.10 The proposed development would incorporate water efficiency measures such as water efficient fixtures and fittings (dual flush WCs, white goods with low demand), and noting the extensive roof areas and demand for water in the process and amenity areas, use of greywater or rainwater harvesting to reduce potable / mains water consumption would be considered at detailed design stage.

8.5 Assessment of Construction Effects

8.5.1 Temporary impacts during the construction phase are mainly due to the alteration to the current surface water flow regimes as a consequence of the proposed development.

8.5.2 A description of the significance of impacts upon hydrology and flood risk receptors caused by each identified impact is given below.

Impact of Construction on Temporary Flood Risk

8.5.3 The Application Site has been assessed as being at ‘low’ risk (Flood Zone 1) of tidal flooding due to the presence of flood defences along the River Tees to the west and the South Gare and Coatham Dunes to the north.

8.5.4 As outlined in the baseline conditions, the area proposed for construction activities is currently made ground comprising of steel slag from local industrial processes. An increase in less permeable and impermeable surfacing may occur due to the construction compounds potentially increasing the temporary flood risk to the surrounding area.

8.5.5 Any increase in permanent low permeability surfacing within the development area (asphalt pavement, concrete pavement and building area etc.) would increase run-off rates, increasing the surface water flood risk within the Application Site and to adjacent land area.

8.5.6 Land adjacent to the Application Site comprises industrial uses, therefore sensitive receptors include staff and workers within the Redcar Bulk Terminal. Staff and workers are considered to be of medium sensitivity.

8.5.7 Impacts on flood risk arise from any temporary change in less permeable areas, in turn changing run-off rates/characteristics over areas affected during construction. The initial site preparation, piling and bunker excavation associated with the proposed development would change the natural hydrological characteristics of the Application Site.

8.5.8 With the implementation of measures set out in paragraph 8.4.4 and the CoCP the impact is predicted to be of local spatial extent, short term duration, intermittent and reversible and would not affect surrounding local receptors directly. The magnitude is therefore, considered to be low adverse.

8.5.9 On this basis, the level of the effect is assessed as minor adverse, which is not significant.

Impact on Surrounding Ecological Areas

8.5.10 The Teesmouth and Cleveland Coast SSSI is adjacent to the north of the Application Site. Although proposed construction activities could increase the surface water runoff from the site with a potential increase in sediment being present within the runoff, there is no obvious pathway to the dunes, given the earth bund wall that separates the site from the dunes.

8.5.11 The SSSI is considered to be highly vulnerable and high value and its sensitivity is considered to be high.

8.5.12 Designed-in mitigation measures would be implemented to reduce any potential increase in uncontrolled surface water runoff during the construction phase. This would include bunding of any stockpiled material, positioning potential contaminants such as fuel storage away from the SSSI and providing suitable temporary drainage network including oil / sediment interceptors.

8.5.13 With the implementation of measures set out in paragraph 8.4.4 and the CoCP the impact is predicted to be of local spatial extent, short term duration, intermittent and reversible and would not affect surrounding local receptors directly. The magnitude is therefore, considered to be low adverse.

8.5.14 On this basis, the level of the effect is assessed as minor adverse, which is not significant

The Impact on Surrounding Water Resources

8.5.15 During construction, there is a potential risk of accumulation of standing water on the Application Site and accidental discharges of untreated run-off whilst the temporary and the operational surface water drainage system is being constructed.

8.5.16 There are a number of potential pollutants which could arise during construction, and hence which may affect the water quality of receiving watercourses. These are outlined below:

- fine particulate materials (e.g. silts and clays);
- cement;
- oil and chemicals (from plant machinery and processes); and
- other wastes such as wood, plastics, sewage and rubble.

8.5.17 These pollutants may be present as a result of normal site activities, incorrect storage of oils and chemicals and/or accidental spillage. The significance of the incident is dependent on the nature of the pollutant, on the mitigation measures adopted and their timing and effectiveness, and on the sensitivity of the receiving watercourse.

8.5.18 Surface water resources are considered to be highly vulnerable and high value. Noting that the Tees has a substantial flow and mixes with the sea at its estuary, its sensitivity is nonetheless considered to be high.

8.5.19 Activities associated with machinery during the construction could lead to an increase in turbid runoff and spillages/leaks of fuel, oil etc. This could cause a direct loss, disturbance or other effects on aquatic habitats and species of nature conservation value.

8.5.20 The construction process includes measures to intercept run-off and ensure that discharges from the site are controlled in quality, as well as water quality monitoring carried out throughout the construction phase to ensure no discharge of pollutants or increase in suspended sediment occurs. The impact is predicted to be of low adverse magnitude. The WFD Assessment in Appendix 8.3 confirms that there will be no risk of deterioration in status or the prevention of the achievement of the objectives for the relevant surface water bodies.

8.5.21 The significance of effects in relation to run-off from construction sites and spillages, including the integration of construction measures adopted in would be minor adverse, which is not significant.

Further Mitigation

8.5.22 As no significant adverse effects are predicted further mitigation is unlikely to be required.

Future Monitoring

8.5.23 No future monitoring is considered necessary.

Accidents and/or Disasters

8.5.24 As with most construction sites, there is potential for a spillage of fuel or oil onsite during the construction phase of works. A CoCP would be developed post consent recommending practicable onsite management strategies to mitigate any such incidence.

8.6 Assessment of Operational Effects

8.6.1 The effects of the operation and maintenance of the proposed development has been assessed in relation to hydrology and flood risk within the defined study area.

8.6.2 A description of the significance of effects upon hydrology and flood risk receptors caused by each identified impact is given below.

Impact on Flood Risk

8.6.3 Due to the existing elevation of the Application Site (c. 7.1 mAOD) in comparison to the River Tees and the surrounding coastline, the proposed development is located within Flood Zone 1, at low risk of tidal flooding.

8.6.4 The land adjoining the Application Site to the south and east consists of industrial units therefore sensitive receptors includes staff and workers within these units. The sensitivity of these receptors is considered to be medium.

8.6.5 The proposed development would increase the impermeable surfaces within the Application Site boundary. The uncontrolled discharge of surface water runoff from the site as a result of changes to impermeable areas would lead to a minor increase in flood risk.

8.6.6 Operational activities would incorporate appropriate drainage solutions in the design of the proposed development in line with local and national standards. As set out in the outline drainage strategy (Appendix 8.2) the proposed development would discharge clean surface water with an uncontrolled discharge rate into the River Tees. The on-site drainage system would include an on-site attenuation pond, which would be designed to accommodate the 1 in 30 year critical event, with safe flooding of designated areas in the 1 in 100 year storm, including a +20% allowance for climate change. Therefore, any increase in surface water runoff (flooding) would be appropriately managed in line with the LLFA design criteria outlined within Policy SD7 of the Local Plan.

8.6.7 The proposed development has been subject to a Flood Risk Assessment (Appendix 8.1) in order to meet the requirements of planning policy and best practice. As the proposed development would direct flows into the River Tees, no requirement for a reduction of existing runoff rates is required. However, sufficient attenuation storage would be provided taking into account UKCP18 and LLFA guidance.

8.6.8 With the operational measures proposed the impact of the proposed development on flood risk is predicted to be of local spatial extent, short term duration, intermittent and highly reversible and would not affect surrounding local receptors directly. The impact of the proposed development is therefore considered to be negligible.

8.6.9 On this basis, the level of effect is assessed as minor adverse, which is not significant.

Impact on Surface Watercourses

8.6.10 During the operation of the site there are a number of potential pollutants, which may give rise to water quality effects on the surrounding surface watercourses

8.6.11 A new surface water drainage network would be constructed as part of the proposed development, which would incorporate a combination of proprietary pollution interceptors, filter drains and permeable paving. No process or ‘dirty’ water would be discharged into the River Tees. The Environmental Permit would incorporate a number of emergency procedures in the operational phase which would be used in the case of accidental spillage.

8.6.12 The sensitivity of the Tees and surrounding ecologically sensitive areas is are taken to be high. With the implementation of the drainage strategy (see Appendix 8.2) and the regulation of operation via the Environmental Permit the magnitude of impact to surface water quality is considered to be low adverse. On this basis, the level of effect would be minor adverse, which is not significant. The WFD Assessment in Appendix 8.3 confirms that there will be no risk of deterioration in status or the prevention of the achievement of the objectives for the relevant surface water bodies.

Further Mitigation

8.6.13 As no significant adverse effects are predicted, further mitigation is unlikely to be required.

Future Monitoring

8.6.14 Ongoing water quality monitoring of the discharge from the Application Site would be undertaken throughout the lifetime of the development with testing requirements as specified in the Environmental Permit in line with the Outline Drainage Strategy (Appendix 8.2).

Accidents/Disasters

8.6.15 Potential direct effects on hydrology and flood risk (from a catastrophic failure of fuel and oil storage) are limited as the proposed development, which incorporates interceptor channels, settlement pits and separators to mitigate any such event. As a result, any direct and/or indirect water quality effects associated with the proposed development are unlikely.

8.6.16 On the above basis, in the event of an accident/disaster, the proposed development includes a number of features and measures to contain, treat and manage pollution risk. Overall, the risk to population health and water quality is not considered significant.

Potential Changes to the Assessment as a Result of Climate Change

8.6.17 The assessment has demonstrated that the proposed development would not cause any exceedances of the hydrology and flood risk objectives including an appropriate allowance for climate change (40%) as detailed in the NPPF (MHCLG, 2019), UKCP18 and NPPG (DCLG, 2014 as amended).

8.6.18 The effects of climate change have been taken into account during the production of the Flood Risk Assessment (Appendix 8.1) and the Outline Drainage Strategy (Appendix 8.2). The Flood Risk Assessment determined that no increase in tidal flood risk would be caused at the Application Site. The Outline Drainage Strategy (Appendix 8.2) has been developed in order that any increase in rainfall volume and intensity can be sufficiently attenuated.

8.7 Assessment of Decommissioning Effects

8.7.1 Decommissioning impacts are those which would occur as a result of the decommissioning of the proposed development and associated infrastructure.

8.7.2 The decommissioning impacts have been determined to be similar and no worse than construction impacts in relation to hydrology and flood risk, and therefore, are at worse minor adverse and unlikely to be significant subject to implementation of appropriate mitigation measures.

8.8 Assessment of Cumulative Effects

8.8.1 The assessment of cumulative effects considers the impacts associated with the REC together with other developments and plans. The developments and plans selected as relevant to the cumulative assessment presented within this chapter are based upon the cumulative screening exercise described in Chapter 4 (Environmental Assessment Methodology) and Appendix 4.XX).

8.8.2 There are no cumulative developments located within the hydrology and flood risk study area therefore, no cumulative effects are envisaged. There are elements of the Net Zero Teeside Project Cluster Carbon Capture and Usage that are shown to be on and adjacent to the Application Site. These elements are related to the associated infrastructure and would be underground and therefore, would not have a cumulative effect on hydrology and flood risk.

8.9 Inter-relationships

8.9.1 There are inter-relationships between hydrology and flood risk and other topics within the ES. These include synergies with geology, hydrogeology and contamination and to some extent, with ecology and ornithology where surface water influences important habitats.

Summary of Effects

8.9.2 The proposed development site is shown on the Environment Agency flood maps as being located within Flood Zone 1 (i.e. low probability of flooding) and is not directly at risk of flooding from fluvial and tidal sources.

8.9.3 The hydrology and flood risk study area includes the River Tees, to the west of Application Site. A number of designated ecological habitats are present to the north and north west of the Application Site and include the River Tees.

8.9.4 There is the potential for temporary flood risk during construction as there is an increase in low permeability surfacing on the site. The effect is considered to be of minor adverse significance.

8.9.5 Although construction has the potential to cause a degradation of water quality to main watercourses through accidental release of sediment, appropriate mitigation measures have been identified to minimise potential impacts. The effect is considered to be of minor adverse significance.

8.9.6 The operation of the REC has the potential to increase the surface water runoff rate and in turn increase the flood risk to the site and the surrounding areas. A Flood Risk Assessment (Appendix 8.1) and Outline Drainage Strategy (Appendix 8.2) have been prepared which identified that the site is located at low risk of tidal flooding, low risk of surface water flooding and no risk of flooding from reservoir failure. The proposed development is classified as 'Less Vulnerable' in the NPPF and suitable for the present Flood Zone conditions (Zone 1) including climate change.

8.9.7 The principles of the drainage strategy (as set out in Appendix 8.2: Outline Drainage Strategy) would be incorporated into the design to reduce the adverse impacts and attenuate any increase in surface water runoff. The Flood Risk Assessment demonstrates that the proposed development meets the requirements of the NPPF. The effects to flood risk during the operation and maintenance phase in relation to the proposed development are therefore considered to be minor adverse which is not significance.

8.9.8 The operation of the project requires routine maintenance of key elements. Maintenance may involve the use of chemicals, oils and greases and, if outside, there is the potential for spillages to occur which may affect the water quality of surrounding watercourses Operational practices would be managed under the Environmental Permit and would include spill procedures, clean up and water quality monitoring in order to mitigate against any decrease in water quality status or damage to significant habitats. The effects of operation and maintenance on surrounding watercourses are considered to be of minor adverse significance, which is not significant.

8.9.9 With regards to cumulative effects, elements of the infrastructure associated with the Net Zero Teeside Project Cluster Carbon Capture and Usage may extend onto or adjacent to the Application Site. This is likely to comprise subsurface works and are unlikely to lead to any cumulative effects. There are no other cumulative developments within the hydrology and flood risk study area.

8.9.10 A summary of the findings of the hydrology and flood risk ES are presented in Table 8.13.

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Table 8.13: Summary of Likely Environmental Effects on Hydrology and Flood Risk

Receptor	Sensitivity of receptor	Description of impact	Mitigation measure	Magnitude of impact	Significance of effect	Significant / Not significant
Construction						
Temporary (construction) flood risk	Medium	Risk to site users and infrastructure	Temporary construction drainage measures would be constructed around construction compounds.	Low Adverse	Minor Adverse	Not significant
Surrounding ecological areas	High	Risk of pollution of surrounding ecological areas.	Mitigation measures including but not limited to bunding of maintenance areas / hazardous substances stores and position of construction materials away from highly sensitive receptors.	Low Adverse	Minor Adverse	Not significant
Surface water quality – River Tees	High	Pollution of surface water courses.	Mitigation measures including but not limited to bunding of maintenance areas / hazardous substances (e.g. fuel, cement) stores and position of construction materials away from highly sensitive receptors.	Low Adverse	Minor Adverse	Not significant
Operation and maintenance						
Flood Risk	Medium	Alteration of surface water flow regimes	Designed in mitigation measures incorporating a	Negligible	Minor Adverse	Not significant

Receptor	Sensitivity of receptor	Description of impact	Mitigation measure	Magnitude of impact	Significance of effect	Significant / Not significant
			suitable sustainable drainage system.			
Surface water quality – River Tees	High	Pollution of surface watercourses	Designed in mitigation measures including a sustainable drainage system (with pollution prevention measures) and pollution / emergency management plans.	Low Adverse	Minor Adverse	Not significant
Decommissioning						
Flood risk	Medium	Risk to site users and surrounding areas from an increase in flood risk	Decommissioning would be planned so that the on-site drainage system will not be damaged.	Negligible	Minor Adverse	Not significant
Surface water quality – River Tees	High	Pollution of local watercourses and significant ecological habitats	Measures including but not limited to bunding of maintenance areas / hazardous substances stores and position of demolition materials and equipment away from highly sensitive receptors.	Low Adverse	Minor Adverse	Not significant