CONTENTS

TABLES

12.0 WATER ENVIRONMENT & FLOOD RISK

12.1 Introduction

12.1.1 This chapter of the Environmental Assessment (ES) provides an assessment of likely significant effects on the water environment and flood risk as a result of construction, operational and decommissioning phases of the Proposed Development, as described in **Chapter 4**: The Proposed Development (ES Volume I - **Application Document Ref. 6.2**), hereafter referred to as 'Proposed Development'.

12.1.2 The surface water environment includes water quality, water resources, hydromorphology, flood risk, and drainage. Groundwater and hydrogeology is considered in **Chapter 13**: Geology, Hydrogeology and Land Contamination (ES Volume I - **Application Document Ref. 6.2**).

12.1.3 The cumulative effects on the water environment, including flood risk of the Proposed Development, considering other committed developments in the vicinity are described in **Chapter 19**: Cumulative and Combined Effects (ES Volume I - **Application Document Ref. 6.2**).

12.1.4 Due to the interdisciplinary nature of effects, this chapter cross references other chapters including **Chapter 8**: Air Quality, **Chapter 11**: Biodiversity and Nature Conservation and **Chapter 13**: Geology, Hydrogeology and Land Contamination (ES Volume I - **Application Document Ref. 6.2**) and is supported by the following appendices (refer to ES Volume II - **Application Document Ref. 6.3**):

- **Appendix 12A**: Flood Risk Assessment (FRA) (including Section 5- Conceptual Drainage Strategy);
- **Appendix 12B**: Water Framework Directive (WFD) Assessment Report (including Annex C - Water Quality Data; and
- **Appendix 12C**: Navigational Risk Assessment.

12.1.5 **Figure 12-1 – Figure 12.6** (ES Volume III - **Application Document Ref. 6.4**) provide information on surface and groundwater features, ecological designations, and flood risk and the location of the relevant assets.

12.2 Legislation Planning Policy and Guidance

12.2.1 An overview of the legislative and policy context that is relevant to the Proposed Development is provided within **Chapter 7**: Legislative Context and Planning Policy (ES Volume I - **Application Document Ref. 6.2**).

12.2.2 A summary of the legislation and planning policy relevant to the assessment of potential impacts on the water environment from the Proposed Development is provided in this section. These have been taken into account

in the assessment, with particular regard given to potential impacts in relation to flood risk and water quality.

Legislation

12.2.3 The following UK Legislation is of relevance to the Proposed Development:

- Water Act (HMSO) 2014;
- Floods and Water Management Act (HMSO) 2010;
- Marine and Coastal Access Act (HMSO) 2009;
- Environment Act (HMSO) 1995;
- Land Drainage Act (HMSO) 1991;
- Water Resources Act (HMSO) 1991;
- Water Industry Act 1991;
- Environment Protection Act (HMSO) 1990;
- Salmon and Freshwater Fisheries Act (HMSO) 1975 (as amended);
- The Water Environment (Water Framework Directive) (England Wales) Regulations (HMSO) 2017;
- Environmental Permitting (England and Wales) Regulations (HMSO) 2016;
- Control of Major Accident Hazards (COMAH) Regulations (HMSO) 2015;
- Environmental Damage (Prevention and Remediation) Regulations (HMSO) 2015;
- Bathing Water (Amendment) (England) Regulations (HMSO) 2018;
- Eels (England and Wales) Regulations (HMSO) 2009;
- Groundwater (England and Wales) Regulations (HMSO) 2009;
- Floods and Water (Amendment) (EU Exit) Regulations 2019;
- Control of Pollution (Oil Storage) (England) Regulations (HMSO) 2001; and
- Control of Substances Hazardous to Human Health (COSHH) Regulations (HMSO) 2002.

12.2.4 Under the various acts and regulations listed above, consents would be required from the Environment Agency for temporary construction and permanent operational discharges (i.e. water activity permits), and for certain

works affecting main rivers[1] (i.e. flood risk activity permits (FRAP)), as well as any temporary dewatering, abstractions or impoundments and in-channel works related to construction activities (i.e. abstraction, impoundment or transfer licences).

12.2.5 Under the Environmental Permitting (England and Wales) Regulations (2016) a FRAP is required from the Environment Agency if a regulated activity is to be undertaken on or near a main river, on or near a flood defence structure, or in a floodplain[2]. Exemptions do not generally apply; however, the Environment Agency may seek to 'disapply' the requirement for a FRAP where a separate regulatory approval process adequately considers flood risk. Typically, this can include the Marine Licensing assessment and consultation process under the Marine and Coastal Access Act 2009.

12.2.6 Whether assessed by the Environment Agency or considered under a parallel regulatory approval, the scope of the FRAP process includes any activity within 8m of the bank of a main river, flood defence structure or culvert on a main river, or activities carried out on the floodplain of a main river, more than 8m from the river bank, culvert or flood defence structure.

12.2.7 If water is required for construction works, then depending on the source of water, volumes required and duration of abstraction, an abstraction licence may be required from the Environment Agency. This can include dewatering of excavations unless exemptions apply (e.g. for emergency situations) or for small volumes under 20 cubic metres per day (m^3/d). A temporary abstraction licence is required to abstract more than 20 m^3 of water per day lasting less than 28 consecutive days, and a full abstraction licence is required to abstract more than 20 m^3 of water per day for a period of more than 28 days. Any licence issued could contain conditions requiring abstraction to cease at times of low flows or at sensitive times of the year for relevant aquatic ecology, where water is being taken from a watercourse.

12.2.8 Land drainage consent will be required from Lead Local Flood Authority (LLFA) (for the Proposed Development Site - North Lincolnshire Council), or in some cases consent from the Internal Drainage Board (IDB). In this case, the IDB responsible for consent would be the Isle of Axholme and North Nottinghamshire Water Level Management Board (IoAaNNWLMB) which is responsible for certain works that may affect the flow in ordinary

[1] A river maintained directly by the Environment Agency. Main Rivers are often larger watercourses.

[2] Floodplain refers to land adjacent to a watercourse that is subject to flooding

watercourses[3] under The Floods and Water Management Act 2010 and The Land Drainage Act 1991.

12.2.9 Regulated activities which are proposed to take place within the 'UK Marine Area' (Section 42, Marine and Coastal Access Act) may require a marine licence from the Marine Management Organisation (MMO) in accordance with the Marine and Coastal Access Act 2009. This includes works below mean high water springs[4] (MHWS). A draft Deemed Marine Licence (DML) has been subject to MMO review and is provided with the draft Development Consent Order (DCO) (**Application Document Ref. 2.1**).

Planning Policy Context

National Policy Statements

12.2.10 The Overarching National Policy Statement (NPS) for Energy (EN-1) (Department of Energy and Climate Change (DECC), 2011a) is relevant to this assessment with the main sections being:

- Section 4.10: Pollution control and other environmental regulatory regimes;
- Section 5.15: Water Quality and Resources. Stating that: "*Where the project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of, and impacts of the proposed project on, water quality, water resources and physical characteristics of the water environment as part of the ES or equivalent.*" (Paragraph 5.15.2); and
- Paragraph 5.15.3 which provides advice on what an Environmental Statement (ES) should describe in the baseline.

12.2.11 The NPS for Fossil Fuel Electricity Generating Infrastructure (NPS EN-2) (DECC 2011b) is also of relevance which states that where a project is likely to have effects on water quality or resources, the applicant for development consent should undertake an assessment which should particularly demonstrate that appropriate measures will be put in place to avoid or minimise adverse impacts of abstraction and discharge of cooling water. The applicant for development consent should demonstrate measures to minimise adverse impacts on water quality and resources.

[3] Ordinary watercourses are defined as all watercourses that are not main rivers

[4] The height of mean high-water springs is the average throughout the year of two successive high waters during those periods of 24 hours when the range of the tide is at its greatest

12.2.12 The NPS for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (DECC, 2011c) is also relevant in that it describes the need for assessment of the water environment and potential mitigation measures.

12.2.13 Table 12.1 provides a summary of relevant NPS advice regarding the water environment and presents an assessment of where matters are assessed within this chapter.

Table 12.1: Summary of relevant NPS advice regarding the water environment

Summary of NPS	Consideration within the Chapter
NPS EN-1	
Paragraph 5.15.2 states: "Where the project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of, and impacts of the proposed project on, water quality, water resources and physical characteristics of the water environment as part of the ES or equivalent."	This chapter (**Chapter 12**) of the ES considers the existing status of, and impacts of the Proposed Development on water quality, water resources and physical characteristics of the water environment.
Paragraph 5.15.3 states: "The ES should in particular describe: the existing quality of waters affected by the proposed project and the impacts of the proposed project on water quality, noting any relevant existing discharges, proposed new discharges and proposed changes to discharges; existing water resources affected by the proposed project and the impacts of the proposed project on water resources, noting any relevant existing abstraction rates, proposed new abstraction rates and proposed changes to abstraction rates (including any impact on or use of mains supplies and reference to Catchment Abstraction Management Strategies); Existing physical characteristics of the water environment (including	Baseline conditions describing the existing quality of waters (including discharges), water resources (including abstractions), and existing physical characteristics of the water environment have been presented in Section 12.4. The likely impacts and effects of the Proposed Development are assessed in Section 12.6. A Water Framework Directive assessment is provided in Appendix 12B (ES Volume II - **Application Document Ref. 6.3)**.

Summary of NPS	Consideration within the Chapter
quantity and dynamics of flow) affected by the proposed project and any impact of physical modifications to these characteristics; and Any impacts of the proposed project on waterbodies or protected areas under the Water Framework Directive and source protection zones (SPZs) around potable groundwater abstractions."	
NPS EN-2	
Paragraph 2.10.2 states: "Where the project is likely to have effects on water quality or resources the applicant should undertake an assessment as required in EN-1 Section 5.15. The assessment should particularly demonstrate that appropriate measures will be put in place to avoid or minimise adverse impacts of abstraction and discharge of cooling."	This chapter (**Chapter 12**) of the ES considers the existing status of, and impacts of the Proposed Development on water quality, water resources and physical characteristics of the water environment. Mitigation of construction, operational and decommissioning impacts is discussed in Section 12.7.

UK Marine Policy Statement

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

12.2.15 The East Inshore and East Offshore Marine Plans (DEFRA, 2014) establishes the plan led system for the marine area in which the riverine parts of the Proposed Development Site are located. Both the MPS and the East Inshore Marine Plan are discussed further in **Chapter 7:** Legislative Context and Planning Policy (ES Volume I - **Application Document Ref. 6.2**).

National Planning Policy Framework

12.2.16 The National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government (MHCLG) 2019), has three overarching objectives to contribute to the achievement of sustainable development, one

of which is the 'environmental objective'. This objective includes the requirement of "helping to improve biodiversity, using natural resources prudently, and minimising waste and pollution" (Paragraph 8c). The NPPF also contains a number of statements which are relevant to water quality. These include:

- strategic policies should set out an overall strategy for the pattern, scale and quality of development, and make provision for conservation and enhancement of the natural, built and historic environment. This includes landscapes and green infrastructure, and planning measures to address climate change mitigation and adaptation (paragraph 20d);
- plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts. Development should not cause unacceptable levels of water pollution and should help improve water quality wherever possible (paragraph 149); and
- planning policies should contribute and enhance the natural environment by preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as water quality, taking into account relevant information such as river basin management plans (RBMP) (paragraph 170e).

National Planning Practice Guidance

12.2.17 National Planning Practice Guidance (NPPG) (MHCLG, 2019) Water supply, wastewater and water quality provides guidance for local planning authorities on assessing the significance of water environment effects of proposed developments. The guidance highlights that adequate water and wastewater infrastructure is needed to support sustainable development.

12.2.18 The NPPF and the Flood Risk and Coastal Change guidance within the NPPG (published 2014) (MCHLG, 2014b) recommends that Local Plans should be supported by a Strategic Flood Risk Assessment (SFRA) and should develop policies to manage flood risk from all sources taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as LLFA and IDB. Local Plans should apply a sequential, risk-based approach to the location of development to avoid, where possible, flood risk to public and property and manage any residual risk, taking account of the impacts of climate change.

Defra's '25 Year Environment Plan'

12.2.19 In 2018, Defra published the 25 Year Environment Plan (DEFRA, 2018) setting out the UK Government's goals for improving the environment within a generation and leaving it in a better state than we found it. The plan covers the provision of clean water; protection and enhancement of habitats, reducing the risk from environmental hazards and mitigating and adapting to climate change; using resources more sustainable and efficiently, managing exposure to chemicals and engagement with the natural environment.

12.2.20 The Plan includes specific goals to achieve good environmental status in our seas, reduce the environmental impact of water abstraction, meet the objectives of RBMP under the WFD implemented in England by the Water Environment (Water Framework Directive) (England Wales) Regulations 2017 reduce leakage from water mains, improve the quality of bathing waters, restore protected freshwater sites to a favourable condition, and do more to protect communities and businesses from the impact of flooding, coastal erosion and drought. At the heart of the Plan's delivery is the natural capital approach with the aspiring goal of a net gain in biodiversity from new development.

Future Water, The Government's Water Strategy for England

12.2.21 'Future Water - The Government's Water Strategy for England' (DEFRA, 2011b) sets out the Government's long-term vision for water and the framework for water management in England. It aims to enable sustainable and secure water supplies whilst ensuring an improved and protected water environment. 'Future Water' brings together the issues of water demand, supply and water quality in the natural environment as well as surface water drainage and river/ coastal flooding into a single coherent long-term strategy, in the context of the need to reduce greenhouse gas emissions.

12.2.22 The strategy also considers the issue of charging for water. The water environment and water quality have great economic, biodiversity, amenity and recreational value, playing an important role in many aspects of modern-day society, and thus the functions provided must be sustainably managed to ensure they remain available to future generations without compromising environmental quality.

Cooling Water Abstraction

12.2.23 There are a number of sources of guidance relating to optimal operation of direct cooled and cooling tower-cooled power stations in coastal and estuarine UK environments including 'Screening for Intake and Outfalls: a best practice guide' (Environment Agency, 2005) that have been considered, where appropriate, in the design development process for the Proposed Development . Other relevant guidance considered in the Best Available Techniques (BAT) assessment for cooling technology includes:

- EU Best Available Techniques (BAT) Reference Document for Large Combustion Plants (July 2017);
- EU Reference Document on the application of Best Available Techniques to Industrial Cooling Systems (December 2001);
- Environment Agency: Risk assessments for your environmental permit (February 2020); and
- Environment Agency Evidence Document SC070015/SR3 Cooling Water Options for the New Generation of Nuclear Power Stations in the UK (June 2010).

12.2.24 The choice of cooling technique and the associated water source has been selected in accordance considering the BAT hierarchy and evaluating the efficiency benefits and environmental effects of the different techniques available. An Assessment of BAT for Energy Efficiency has been completed in support of the Environmental Permit Application for the Proposed Development.

Sustainable Drainage Systems Guidance

12.2.25 Planning policy encourages developers to include sustainable drainage systems (SuDS) in their proposals where practicable. SuDS provide a way to attenuate runoff from a site to the rate agreed with the Environment Agency to avoid increasing flood risk, but they are also important in reducing the quantities and concentration of diffuse urban pollutants found in the runoff.

12.2.26 DEFRA published 'Non-statutory technical standards for sustainable (urban) drainage systems (SuDS)' in 2015 (DEFRA, 2015).

12.2.27 The non-statutory technical standards set out that the peak runoff rates should be as close as is reasonably practicable to the greenfield rate but should never exceed the pre-development runoff rate. The standards also set out that the drainage system should be designed so that flooding does not occur on any part of a development site for a 1 in 30 year rainfall event, and that no flooding of a building (including basement) would occur during a 1 in 100 year rainfall event. It is also noted within the standards that pumping should only be used when it is not reasonably practicable to discharge by gravity.

12.2.28 Industry good practice guidance on the planning for and design of SuDS is provided by:

- C753 - The SuDS Manual (Construction Industry Research and Information Association (CIRIA), 2015);
- Design Manual for Roads and Bridges (DMRB) (Highways England, 2020a) – CD 532: Vegetated Drainage Systems for Highway Runoff; and

- DMRB CG 501: Design of Highway Drainage Systems (Highways England, 2020b).

River Basin Management Plan

12.2.29 RBMP are prepared by the Environment Agency for six-year cycles and set out how organisations, stakeholders and communities will work together to improve the water environment. The most recent plans were published in 2015 (the second cycle) and will remain in place until after 2021. The waterbodies within the study area fall under the Trent Lower and Erewash and Idle and Torne Management Catchments within the Humber RBMP (DEFRA/ Environment Agency, 2018). Further details are provided in the Preliminary WFD Assessment (**Appendix 12B** in ES Volume II - **Application Document Ref. 6.3**).

Local Planning Policy

12.2.30 The Proposed Development is within the administrative area of North Lincolnshire Council. The existing North Lincolnshire Local Development Framework (North Lincolnshire Council, 2011a) includes the following saved policies that are of relevance to the water environment:

- CS16: North Lincolnshire's Landscape, Greenspace and Waterscape – Requirement for development proposals to improve and address local deficiencies in the quality and quantity of accessible landscape, greenspace and waterscape, where appropriate;
- CS17: Biodiversity - Stewardship of North Lincolnshire's wildlife will be promoted through safeguarding protected sites, maintaining a network of local sites and corridors, ensuring development retains, protects and enhances biological features and ensuring development seeks a net gain in biodiversity;
- CS18: Sustainable Resource Use and Climate Change – Development will need to meet high water efficiency standards, incorporating new technology to recycle and conserve water. SuDS should be used where possible. The council will prevent development in high flood risk areas wherever possible and practicable. The council will ensure that development and land use in areas close to rivers responds appropriately to the character of the area, in the interests of preserving and making best use of limited resources; and
- CS19 Flood Risk - The council will support development proposals that avoid areas of current or future flood risk, and which do not increase the risk of flooding elsewhere. Development in areas of high flood risk will only be permitted where it meets the following prerequisites:

- it can be demonstrated that the development provides wider sustainability benefits to the community and the area that outweigh flood risk;
- the development should be on previously used land. If not, there must be no reasonable alternative developable sites on previously developed land; and
- a FRA has demonstrated that the development will be safe, without increasing flood risk elsewhere by integrating water management methods into development. In addition, development will be required, wherever practicable, to incorporate SuDS to manage surface water drainage.

12.2.31 A new Local Plan (North Lincolnshire Council Local Plan 2017 – 2036) is being prepared to replace the current North Lincolnshire Local Plan (North Lincolnshire Council, 2020), including a Core Strategy and the Housing and Employment Land Allocations Development Plan Documents. The new Local Plan policies and proposals will guide decisions and investment on development and regeneration up to 2036. The following policies of the draft Local Plan are of relevance to the water environment:

- Policy SS1p: Presumption in Favour of Sustainable Development – Creating and delivering sustainable growth lies at the heart of the spatial strategy for North Lincolnshire, with all new development contributing towards sustainable development;
- Policy DQE3p: Biodiversity and Geodiversity – All schemes shall, as appropriate to their nature and scale, protect, manage and enhance the network of habitats, species and sites of international, national and local importance (statutory and non-statutory), including sites that meet the criteria for selection as a Local Site. They shall also minimise and mitigate against impacts on biodiversity and geodiversity, deliver a net gain in biodiversity and/or geodiversity, and retain and enhance natural features such as river banks, watercourses, waterbodies and natural features;
- Policy DQE6p: Managing Flood Risk – development will be supported where it avoids areas of current or future flood risk, and which do not increase the risk of flooding elsewhere. Development will be permitted provided that:
  - peak rate of runoff over the lifetime of the development, allowing for climate change, is no greater for the developed site than it was for the undeveloped site;
  - the post-development volume of runoff, allowing for climate change over the development lifetime, is no greater than it would have been for the undeveloped site. If this cannot be achieved, then the maximum discharge from the site should not exceed the calculated greenfield run off rate for all rainfall events up to and including the 1 in 100 year event plus allowance for climate change;

- the development is designed so that the flooding of property in and adjacent to the development, would not occur for a 1 in 100 year event, plus an allowance for climate;
- the final discharge locations have the capacity to receive all foul and surface water flows from the development, including discharge by infiltration, into waterbodies and into sewers;
- there is a management and maintenance plan for the lifetime of the development, which shall include the arrangements for adoption by any public authority, statutory undertaker or management company and any other arrangements to secure the operation of the Proposed Development throughout its lifetime;
- the final destination of the discharge complies with the following priority order: firstly, to ground via infiltration; secondly, to a waterbody; and thirdly, to a surface water sewer;

- Policy DQE7p: Sustainable Urban Drainage Systems – Development proposals must include SuDS appropriate to the nature of the site. Compliance must be demonstrated with the Sustainable Drainage Systems and Flood Risk Guidance Document or successor documents. Furthermore, developers must take opportunities to integrate sustainable drainage with the development, create amenity, enhance biodiversity, and contribute to a network of green (and blue) open space. Surface water should be managed close to source and on the surface where practicable. Appropriate pollution control measures should be incorporated into drainage designs including multiple component treatment trains, and whole life management and maintenance of the drainage systems must be demonstrated; and
- Policy DQE12p: Green Infrastructure Network - Development proposals must protect the linear features of the green infrastructure network that provides connectivity between green infrastructure assets, including public rights of way, bridleways, cycleways and waterways, and take opportunities to improve such features.

North Lincolnshire Council's SuDS and Flood Risk Guidance Document

12.2.32 North Lincolnshire Council, as LLFA, has produced a SuDS and Flood Risk Guidance Document Supplementary Guidance Document (SGD) (North Lincolnshire Council, 2017) providing developers and designers with guidance on SuDS and guidance on what type of SuDS are appropriate to a particular development, depending on the size and location. It also provides advice regarding adoption and maintenance of SuDS, riparian responsibilities and specific North Lincolnshire Council requirements. Additional guidance in relation to the SGD is provided in **Appendix 12A**: Flood Risk Assessment (ES Volume II – **Application Document Ref. 6.3**) and other sources of regional guidance including:

- North Lincolnshire Preliminary Flood Risk Assessment (PFRA);

- North and North East Lincolnshire Strategic Flood Risk Assessment (SFRA); and
- North Lincolnshire Council Local Flood Risk Management Strategy (LFRMS).

Isle of Axholme and North Nottinghamshire Water Level Management Board Byelaws

12.2.33 IDB operate in the low lying fen and valley areas, maintaining pumping stations and drainage channels to ensure that people are safe, and the risk of flooding is greatly reduced. The IoAaNNWLMB (the IDB) covers an area of 28,737ha running from the Ouse following the west bank of the Trent moving south-west down to Markham Moor.

12.2.34 The Isle of Axholme and North Nottinghamshire Water Level Management Board Byelaws and Land Drainage Act 1991 allow the Board to take action to ensure that free flow of water is unrestricted. The IDB jurisdiction in relation to the study area and Proposed Development Site includes areas relevant ordinary watercourses north of the Stainforth and Keadby Canal as shown on **Figure 12.6** (ES Volume III – **Application Document Ref. 6.4**). Watercourses south of the Stainforth and Keadby Canal within the study area are not maintained by any IDB. Watercourses maintained by the Board are cleaned out annually and it is important that access is preserved for machinery to enable this work to be undertaken. The Board's Byelaws prevent the erection of any building, structure (whether temporary or permanent) or planting of trees/ shrubs etc. within nine metres either side of a Board maintained watercourse irrespective of any planning permission. The Board's consent will be required to undertake works such as:

- works in, over, under or within nine metres of a Board maintained watercourse;
- installation of a culvert, weir or other like obstruction within any watercourse; and
- any works that increase the flow of surface water or treated foul effluent to any watercourse within the Board's district.

12.3 Assessment Methodology

Consultation

12.3.1 The consultation undertaken with statutory consultees to inform this chapter, including a summary of comments raised via the formal Scoping Opinion (**Appendix 1B** (ES Volume II - **Application Document Ref. 6.3**)) and in response to the formal consultation and other pre-application engagement is summarised in Table 12.2.

Table 12.2: Summary of consultation responses that have informed the scope and methodology of the water environment assessment

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
Scoping Stage			
Planning Inspectorate	June 2020 Scoping Opinion	*Study area:* Scoping Report paragraph 6.116 states that all impacts to surface and groundwater bodies in hydraulic connectivity with the Proposed Development Site will be included in the scope of the assessment. However, in paragraph 6.88 a 1km study area surrounding the Proposed Development site is depicted and a 5km area is also used in Figure 3C depicting water sources in relation to the location of the Proposed Development. It is therefore unclear what study area will be applied to the assessment. The ES should clearly set out what study area applied to the assessment; this should be based on the ZOI and effort should be	For the purposes of the water quality assessment, a study area of 1km from the Proposed Development Site has been assessed in order to identify surface water bodies that could reasonably be affected by the Proposed Development. However, since watercourses flow, quality impacts may propagate downstream, and thus where relevant, the assessment also considers a wider study area based on professional judgement. Given the proximity to the River Trent, and the dilution and dispersion that occur in the waterbody, it is not predicted that any effects would propagate beyond 5km.

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		made to agree the study area with the relevant consultation bodies.	Flood risk can impact upstream and downstream, and the assessment therefore considers a wider study area, where relevant. Professional judgement has been applied to identify the extent to which such features are considered. Atmospheric deposition of nitrogen oxides NO_x) and ammonia emitted from the Proposed Power and Carbon Capture (PCC) Site may impact a wider area. Deposition is assessed against critical levels set for different ecosystems as per the requirements of the Environment Act (1995). The study area relating to atmospheric deposition to these sites is reported in **Chapter 8:** Air Quality and **Chapter 11**: Biodiversity and Nature Conservation (ES Volume I -

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
			Application Document Ref. 6.2).
		Baseline methodology: The Scoping Report states that the baseline will be determined through information from previous assessments, supported by an updated desk-based study utilising water quality monitoring data from the EA. No additional surveys are proposed. Effort should be made to agree the approach with the relevant consultation bodies.	The baseline presented herein includes data provided by the Environment Agency with regard to water quality of receptors in the study area, water resources, licensed abstractions and discharge consents, pollution incidents, fisheries and aquatic ecology data and WFD information; alongside data collated from previous planning and consent applications and associated assessments, and publicly available data available online (e.g. Environment Agency Water Quality Archive and Catchment Data Explorer websites, British Geological Survey's Geoindex website). A walkover survey has also been undertaken of potentially

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
			affected waterbodies and is described within this chapter. Technical engagement has been undertaken with the Environment Agency, Canal and River Trust (CRT) and other marine regulators, such as the MMO.
		Climate Change Projections and flood defences: The Strategic Flood Risk Assessment (SFRA) proposed to be used is the North Lincolnshire and North East Lincolnshire SFRA 2011 which will inform the FRA which in turn will inform the ES assessment. Although paragraph 6.120 states that climate change will be taken into account it does not explain how or what projections will be used. Additionally, in paragraph 6.105 the tidal flood defences are stated to provide a 1 in 200 level of protection	Refer to **Appendix 12A:** Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**) which outlines the basis of the FRA and the climate projections, data and assumptions used in the assessment that have been agreed in consultation with the Environment Agency. Information on In-Combination Climate Change Impacts (ICCI) is presented in **Chapter 17**: Climate Change and Sustainability (ES Volume I -

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		but it is unclear as to whether this is based on 2011 data and if it incorporates up to date climate change projections. Therefore, this calls into question whether the defences still, or will continue to, provide the appropriate level of protection. The assessment should apply the most up-to-date UK Climate Change Projections (currently UKCP18) used in The National Planning Policy Guidance (NPPG) on Flood Risk Assessment and Climate Change Allowances to the ES assessment and make effort to agree the approach with the relevant consultation bodies. These projections should be used to inform the future baseline in the assessment and inform mitigation strategies over the lifetime of the Proposed Development; existing and proposed flood defences should be detailed in the ES.	**Application Document Ref. 6.2**).

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		Tidal overtopping/breaching: The site benefits from tidal flood defences as displayed on Figure 3C and explained in paragraph 6.104/5 of the Scoping Report; the ES should include an assessment on breach/overtopping of these defences where significant effects are likely to occur.	Refer to **Appendix 12A:** Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**) which considers breach/ overtopping of defences, with a summary provided within Section 12.6 of this chapter.
		Sensitive receptors: The Scoping Report does not identify any sensitive receptors or explain how they will be identified. The ES should include a list of sensitive receptors identified within the appropriate study area and locate them on a figure.	Whilst other disciplines may consider 'receptor sensitivity', 'receptor importance' is considered in this chapter. This is because when considering the water environment, the availability of dilution means that there can be a difference in the sensitivity and importance of a waterbody. This is explained in more detail later in this chapter. The importance of receptors identified within this chapter is reported in Table 12.17.

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
			The criteria for assessment of importance of receptors is outlined in Table 12.3.
		Drainage Strategy: The Proposed Development will be located in the Isle of Axholme which relies on a complex network of drainage assets; effort should be made to agree the drainage strategy approach with the relevant consultation bodies, including the EA.	Consultation has been undertaken with the relevant stakeholders, including IDB in order to agree details of the surface water drainage strategy. Refer to **Appendix 12A:** Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**).
		Methodology and Significance criteria: The Scoping Report states that standard significance criteria will be used but provides no further explanation and no methodology. The ES should include a methodology and criteria for assessing significance with explanation of how significance is determined and what is considered a 'significant effect'; this should be	The methodology for determining significance of effects is outlined in Section 12.3 of this chapter. The classification and significance of effects has been determined using the principles of the guidance and the criteria set out in DMRB LA 113 (Highways England, 2020) adapted to take account of hydromorphology. Although

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		informed by appropriate guidance which should be referenced.	these assessment criteria were developed for road infrastructure projects, this method is suitable for use on any development project and is considered to provide a robust and well tested method for predicting the significance of environmental effects for EIA.
		Modelling: Any modelling undertaken to inform the ES assessment should be based on relevant guidance and effort should be made to agree the approach with the relevant consultation bodies. Modelling results should be provided with the ES.	Breach modelling has been undertaken. Refer to **Appendix 12A:** Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**) for full details including consultation with the Environment Agency to agree the approach and review the breach model and it's results, prior to submission of the Application. A summary of the flood risk baseline and potential impacts based on this modelling is included within this chapter.

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		CEMP: The Construction Environmental Management Plan (CEMP) should include locations of dust generating construction works and details of preventative measures to limit the risk of pollution entering waterways; effort should be made to agree these measures with the relevant consultation bodies.	Section 12.7 outlines mitigation measures for the construction, operation and decommissioning phases of the Proposed Development. The measures to control effects on the water environment will be detailed in the final CEMP prepared by the appointed contractor, based upon those measures set out in the Framework CEMP (**Application Document Ref. No. 7.1**) which accompanies the DCO Application.
		Site levels: The ES should include existing and proposed site levels including access and egress routes and heights of any existing and proposed flood defences.	**Chapter 3**: The Site and it's Surroundings (ES Volume I – **Application Document Ref. 6.2**) and **Appendix 12A:** Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**) provide information on existing and Proposed Development Site levels,

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
			access/ egress routes and flood mitigation measures.
Anglian Water	Response to PINS Scoping Opinion, June 2020	Reference is made to water abstraction and discharge forming part of the proposals for the main site. It is unclear whether there is a requirement for water services for the site and it is suggested that the ES should include reference to water supply.	**Chapter 4**: The Proposed Development (ES Volume I - **Application Document Ref. 6.2**) outlines that water supply for use on site for all activities. The Applicant notes that there is no existing Anglian Water supply infrastructure in the vicinity of the Proposed Development.
Canal & River Trust	Response to PINS Scoping Opinion, June 2020	The Trust welcome the incorporation of a CEMP and advise that details should include any information on the location of dust generating works, the location of damping down and wheel wash areas and details of protective measures to be incorporated to limit risk of materials being blown into the canal. If proposed biodiversity enhancement measures next to the canal are installed before the compound is	A Framework CEMP (**Application Document Ref. No. 7.1**) supports the DCO Application and outlines measures to limit the potential for dispersal and accidental releases of potential contaminants, soil derived dusts and uncontrolled runoff to occur during construction.

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		brought into use, it could provide a barrier to trap wind blown dust.	
North Lincolnshire Council (NLC)	Response to PINS Scoping Opinion, June 2020	NLC state that the scoping report provided indicates an acceptable level of surface water drainage and flood risk information that is required to be provided as part of DCO.	Further detail relating to surface water drainage and flood risk is provided in this chapter and in **Appendix 12A**: Flood Risk Assessment (including Section 5 – Conceptual Drainage Strategy (ES Volume II - **Application Document Ref. 6.3**).
Environment Agency	Response to PINS Scoping Opinion, June 2020	The ES should include a comprehensive drainage strategy, which considers both potential impact on flood risk and also potential hydrological impacts on receiving watercourses, including alterations in flow around discharge outlets and the impacts they may have on local water quality.	A Drainage Strategy has been produced, provided in **Appendix 12A**: Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**). Further consultation with the Environment Agency, the LLFA, and IDB has been undertaken in order to agree the proposed approach to drainage.
		The EA advises that where the proposed preliminary Water	**Appendix 12B:** Water Framework Directive

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		Framework Directive (WFD) assessment identifies specific components of the development with the potential to impact WFD status/potential or prevent improvement of local watercourses, such components should be subject to comprehensive assessment with potential mitigation strategies identified.	Assessment Report (ES Volume II - **Application Document Ref. 6.3**) assesses potential impacts upon WFD status and objectives, and outlines mitigation where necessary
		The EA advises that the application needs to be supported by a FRA containing plans to identify rivers, waterbodies (including existing culverts/drains on site), other geographical features and the floor plans of the Proposed Development highlighting uses. A topographical survey should be provided, including proposed site levels and the heights of existing flood defences should be included. Flood risk should be assessed from all sources and consider breach, overtopping and climate change.	**Appendix 12A:** Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**) identifies rivers, waterbodies and other geographical features, these are shown on the supporting figures. **Appendix 12A** also details the heights of existing flood defences, no additional flood defences are proposed. **Appendix 12A** assesses flood risk from all sources and outlines mitigation measures to

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		Current and future flood management measures should be considered. It must be demonstrated that flood risk will not increase. If found to increase it may be required to implement floodplain compensation. The development is located on the Isle of Axholme for which a critical flood level of 4.1m AOD has been established, it is advised that all new developments are set with 300 mm freeboard above this level.	ensure the risk does not increase.
Marine Management Organisation	Response to PINS Scoping Opinion, June 2020	The MMO advised that the ES should include details on construction methodology and associated impacts arising from the installation and operation of the cooling water intake for water abstraction and the operation of the outfall pipe for the discharge of treated effluent.	The Applicant's has provided relevant details on likely construction methods in **Chapter 5**: Construction Programme and Management (ES Volume I - **Application Document Ref. 6.2**). Indicative layout and construction details are also provided on **Application Document Ref. 4.9**.

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		The MMO encouraged further engagement in relation to a deemed marine licence ("dML").	Engagement with the MMO to agree the approach and wording of the draft dML has taken place prior to submission of the Application. The dML is contained within the draft DCO (**Application Document Ref 2.1**). Engagement will continue after submission of the Application.
		The MMO requested that the ES provide details, for example, or whether any piling or dredging is required to facilitate the installation of the intake and outfall pipes, or whether the impacts of impingement and entrainment of fish, and their eggs and larvae, taken in via the cooling water intake pipe, are likely.	No piling or dredging is proposed at the outfall location. The assumptions in relation to the piling for the cofferdam and resultant impacts and effects on migratory fish are presented in Section 11.6 of **Chapter 11**: Biodiversity and Nature Conservation (ES Volume I – **Application Document Ref. 6.2**), and in accompanying **Appendix 11H**: (ES Volume II –

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		Provided commentary in relation to migratory fish between the Humber Estuary and headwaters such as European Eel. MMO expect to see species specific assessment for such species and including River and sea lamprey and for the Applicant to engage with Natural England and the Environment Agency on these matters. Considers that the impacts of underwater noise and vibration on fish receptors in relation to activities such as piling which may impede fish migration be considered and further consideration of potential receptors is required in relation to underwater noise. Advised using the Popper et al. (2014) criteria for assessing the potential effects of noise on fish. Noted that in relation to any piling to be carried out within the aquatic environment including intertidal areas, a description of the	**Application Document Ref. 6.3**). A summary of relevant fish species and their ecology is provided in **Appendix 11G**: Aquatic Ecology Survey Report (ES Volume II - **Application Document Ref. 6.3**). Engagement with Natural England and the Environment Agency is noted in this table. The basis for the required assessment of underwater sound and vibration, including use of Popper et al. (2014) is provided in **Appendix 11H**: Underwater Sound Effects on Fish (ES Volume II – **Application Document Ref. 6.3**). This identifies the assumptions used in relation to piling and also identifies relevant ameliorating factors

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		proposed piling techniques should be provided, along with information on pile sizes, number of piles to be used, expected duration for installation of piles, and the timing of in-river piling work.	related to restrictions on construction timings, methods (particularly 'soft start'), and the duration of and restrictions on the progression of piling.
		Requested confirmation of whether any effects thermal/ chemical releases will be assessed specifically against fish Receptors.	Effects of thermal/ chemical releases on fish are presented in Section 11.6 of **Chapter 11**: Biodiversity and Nature Conservation (ES Volume I – **Application Document Ref. 6.2**).
		Requested that a summary of any relevant in combination climate change impact (ICCI) results should	Noted and an ICCI assessment is provided in Section 17.6 of **Chapter 17**: Climate Change and Sustainability (ES Volume I – **Application Document Ref. 6.2**).

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		be included in the proposed Climate Change Chapter. Provided commentary on clarification and justification for study areas which should cover the zone of worst case impacts.	The rationale for determining study areas is set out in Section 12.3 of this chapter.
Althorpe Parish Council	Response to PINS Scoping Opinion, June 2020	Althorpe Parish Council has expressed concern that abstraction of water could cause levels of water to be artificially high to allow abstraction and therefore make flood management on the Isle of Axholme more difficult. The Council is concerned about the effects on wildlife and water quality from abstraction water being returned to watercourses.	**Chapter 12:** Water Resources and Flood Risk (ES Volume I - **Application Document Ref. 6.2**), along with **Appendix 12A:** Flood Risk Assessment and **Appendix 12B:** WFD Assessment Report (ES Volume II - **Application Document Ref. 6.3**) provide details on water abstraction and potential impacts on flood risk and water quality. Paragraphs 7.1.15 – 7.1.19 of **Appendix 12A:** Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**) provide an assessment of

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
			the flood risk in relation to the canal water abstraction option.
Environment Agency	January 2021 (Stage II Consultation / Preliminary Environmental Information (PEI) Report)	**Water Quality comments:** The EA notes that providing relevant requirements from the Environmental Permitting Regulations 2016 and Water Industry Act 1991 are adhered to, the proposal is acceptable. **Flood Risk comments:** The EA provided detailed comments relating to the FRA (refer to Table 2 of **Appendix 12A:** Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**)	The comments on water quality are noted, and relevant legislative requirements are outlined in this chapter of the ES. An H1 screening assessment will be undertaken during the process of obtaining an Environmental Permit, once the CCP licensor and their exact solvent composition is known. Comments on flood risk relating to critical flood levels, site-specific breach assessment, climate- change and flood risk, proposed finished floor levels and mitigation measures have all been accounted for in the final FRA, which is included in **Appendix 12A:** Flood Risk

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		noting that further clarification and updates are required in order to: • take into account the Critical Flood Level for North Lincolnshire, as described in the North Lincolnshire SFRA; • provide details of the site-specific breach assessment which is being used for the site to assess the risk of the Trent defences breaching adjacent to the site during a severe flood event; • provide details of how the provided climate change flood levels for the Trent have been calculated and applied; and • propose finished floor levels for the development in metres above Ordnance Datum (mAOD).	Assessment (ES Volume II - **Application Document Ref. 6.3**). The North Lincs SFRA allows the option for a developer to undertake detailed hydraulic modelling to demonstrate a flood level that differs from the CFL, as long as that modelling includes breach. The approach to raising development on the Proposed Development Site, is sequential, risk based and raised critical operational infrastructure will be well above the modelled breach levels. A new breach model has now been undertaken for the Proposed Development and site specific results are presented in Section 4 of the **Appendix 12A**: Flood Risk Assessment (ES

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		Further information/advice: The EA reiterated advising that the Humber Strategy Team are contacted to discuss the Proposed Development further. **Flood Risk Permits** Several parts of the proposed development are close to Environment Agency main rivers and flood defences, including the Stainforth and Keadby Canal, the Three Rivers and the River Trent. Development in these areas will require Flood Risk Activity Permits.	Volume II - **Application Document Ref. 6.3**). Critical infrastructure associated with the CCGT will be raised to a minimum of 3.6m AOD and where reasonably practicable up to 4.4m AOD. A safe refuge will be installed at a height of 4.4m AOD. Areas of the Proposed PCC Site below the 4.4m AOD level will be designed to safely flood should flooding occur and remain operational, and refuge areas are provided. The Humber Strategy team has been consulted and were supportive of the approach taken. The comments on Flood Risk Activity Permits (FRAP) are

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
			noted, and the need for these is acknowledged within this FRA and within **Application Document Ref. 5.4** - Schedule of Other Consents and Licences that accompanies the Application.
Environment Agency	March 2021 (Stage II Consultation	The Environment Agency are of the view, that essential infrastructure should be designed to remain operational and safe during times of flood, and this should include consideration of the residual risk to the development. Provide details of the site-specific breach assessment which is being used for the site to assess the risk of the Trent defences breaching adjacent to the site during a severe flood event: The Environment Agency acknowledge the site is within a	The breach model completed for the Proposed Development Site demonstrates that the worst-case residual risk (highest level) from a breach of the Trent defences is associated with a 0.5% tidal event with climate change. The maximum breach level is 2.2 mAOD. Full details of the breach model are provided in Annex C of **Appendix 12A**: Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**).

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		tidally dominant location along the River Trent. However, an assessment of the breach during the fluvial 1% AEP plus 30% climate change allowance and the tidal 0.5% AEP plus climate change allowance should be undertaken. The breach assessment should use the data from the Tidal Trent detailed hydraulic model (Mott Macdonald 2014), as this is still considered the latest available information. Assessment should also include a scenario using the extreme Humber water levels as a sensitivity test. To meet current planning requirements the proposed development will need to be safe for its designed lifetime, this means it will need to implement appropriate flood mitigation measures up to 4.1m AOD plus 300mm freeboard.	This area of the Trent is tidally dominated. Breach model runs have been completed for fluvial events, however the water levels from a breach are highest in a tidal event. A Flood Management Strategy for the Proposed Development Site, which includes raising critical operational infrastructure for the CCGT to a minimum of 3.6 mAOD and up to 4.4m AOD where reasonably practicable, is set out in **Appendix 12A**: Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**).

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		Flood Risk Permits: The Environment Agency welcome the acknowledgement of the permitting requirements for works close to Main Rivers and flood defences. The Environment Agency has reviewed Appendix A (technical note on approach to design of bridges) and would expect the (Mabey) bridge to be set no lower than the existing soffit level.	Comments on FRAP are noted. The design of Mabey Bridge Replacement, shown in **Application Document Ref. 4.16** has taken into account feedback from the Environment Agency regarding the need to maintain clearance equivalent to the existing soffit level, where it is not practical to design to the CFL. The proposed clearance of the replacement Mabey Bridge provides a 15mm higher soffit level than the existing Mabey Bridge soffit level at the span ends (the lowest points). The concept design also incorporates a precamber curve so that the soffit level is increased towards midspan. The final soffit levels will be determined at detailed

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
			design, but will be above no worse than, and a slight improvement on the existing soffit levels, allowing any floating debris to pass freely through the replacement structure, as would have been the case prior to the Proposed Development.
Marine Management Organisation	January 2021 (Stage II Consultation / PEI Report)	MMO note that some elements of the proposed development lie immediately west of the River Trent (water discharge corridor, river water abstraction and waterborne transport offloading area) and the discharge of treated effluent will be assessed, including any potential thermal uplift and chemical alteration […] the ES should also consider whether any existing operational activities (e.g. abstraction of water and discharge of effluent from existing sites) within the study area could result in cumulative or in-combination impacts to fish […]	The discharge of treated effluent and associated thermal/ physico-chemical effects are considered within this chapter. **Appendix 12B:** WFD Assessment Report (ES Volume II - **Application Document Ref. 6.3**) provides further details on water abstraction, discharge and potential impacts on water quality. Section 11.6 of **Chapter 11**: Biodiversity and Nature

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			Conservation (ES Volume I – **Application Document Ref. 6.2**) assesses the impacts and effects on fish.
Canal & River Trust	January 2021 (Stage II Consultation / PEI Report)	The works to install the abstraction point from the Stainforth & Keadby Canal would require the consent of and grant of a licence from the Trust. Contact the Trust for assistance in regard to whether sufficient water resources exist on the canal, and whether the new abstraction can be safely accommodated. The Trust outline that works to install abstraction equipment next to the canal would need to be designed to safeguard navigational safety and that their input would be crucial to ensure that the impact on navigational safety can be fully assessed. The Trust advise that full details of the design of any abstraction equipment and the	Consultation with CRT has been ongoing throughout the design phase, including providing information on proposed abstraction rates to inform pre-application engagement by CRT with the Environment Agency in December 2020 with regard to the potential abstraction and scope of works to determine any potential impact on the wider catchment and water levels. CRT comments in relation to the design of the abstraction equipment and methods are noted and are proposed to be secured by a requirement of the

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		method of construction (including details of any cofferdam) would need to be submitted to and approved by the Trust prior to the commencement of the works on this part of the development. Vibrations from construction processes on site and construction equipment could result in damage to the canal wash wall, or the structure at Keadby Lock, which is a scheduled ancient monument. The Trust note that land to the immediate north of Keadby Lock is proposed to be used for the craning of goods from the River Trent. The Trust would welcome full confirmation that no additional piling works will occur at this part of the development site, which would reduce the risk to Keadby Lock.	draft DCO (**Application Document Ref. 2.1**), including where relevant, protective provisions . Refer to **Chapter 8**: Noise and Vibration (ES Volume I - **Application Document Ref. 6.2**) regarding the impact of piling on Keadby Lock and other sensitive receptors. No piling is proposed at the Waterborne Transport Offloading Area in the vicinity of Keadby Lock, which will be used for the delivery of abnormal indivisible loads (AIL) for the Proposed Development. Refer to paragraph 5.4.63 in **Chapter 5**: Construction Programme and Management

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		The latest documents include a new construction laydown area to the south of the Stainforth and Keadby Canal. Loading from plant and equipment here could impact upon the stability of land next to the waterway, and the Trust therefore request that appropriate information is submitted to allow them to ascertain whether there would be a risk towards the waterway possibly reserved as part of a CEMP. There is potential that dust and waste generated from the construction compound and turnaround areas could reach the canal unless appropriate precautions are undertaken.	(ES Volume I – **Application Document Ref. 6.2**). Construction laydown Area 2C (refer to **Figure 5.1** in ES Volume III – **Application Document Ref. 6.4**) is intended to be utilised for parking and equipment storage during construction. No loading from plant and equipment is proposed that could impact upon the stability of land next to the canal. Risk of pollution to waterways including the Stainforth and Keadby Canal are assessed in this chapter (Section 12.6), including risks during the construction phase. The measures to control effects on the water environment including

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		The proximity of the proposed offloading area to the access point for the Stainforth & Keadby canal at Keadby Lock could result in an obstruction to the entrance point of the canal due to the size of vessels likely required. The Trust request further information from the applicant on this matter. The Trust state that they understand that materials will be transported long distance, it may be difficult to organise set closure times for the canal and believe that measures to allow for night time off-loading could be considered to give the applicant more flexibility to allow for offloading during night hours when the canal is not in heavy use.	measures to control dust and waste generated by the construction compound will be detailed in the final CEMP prepared by the appointed contractor, based upon those measures set out in the Framework CEMP (**Application Document Ref. No. 7.1**). The Navigational Risk Assessment provided in **Appendix 12C** (ES Volume II - **Application Document Ref. 6.3**) considers obstruction risk to the canal. The CRT were consulted on the scope and approach to the NRA in February 2021. Comments regarding night-time offloading are noted and considered in **Appendix 12C** (ES Volume II - **Application Document Ref. 6.3**) which

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
			notes that night-time unloading is unlikely to be viable for a range of health, safety and practical reasons.
Internal Drainage Board (IDB) and Isle of Axholme and North Nottinghamshire Water Level Management Boards	January 2021 (Stage II Consultation / PEI Report)	Glew Drain, an open watercourse, exists on the northern boundary of the site. IDB Byelaws and the Land Drainage Act 1991 apply to this watercourse. IDB consent is required for any works that increase the flow or volume of water to any IDB watercourse or culvert (other than directly to a main river where consent of the Environment Agency is required). IDB consent is also required: 1. to erect any building or structure (including walls and fences), whether temporary or permanent, or plant any tree, shrub, willow or other similar growth within 9 metres of the top edge of any IDB	The need for IDB and Environment Agency consents is noted in the Schedule of Other Consents and Licences (**Application Document Ref. 5.4**) that accompanies the Application. Comments regarding the IDB Byelaws, and activities requiring consent have been noted, and have been taken account of within the chapter and in development of the Proposed Development design, where relevant.

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		watercourse or the edge of any IDB maintained culvert; 2. for any works, temporary or permanent, in, over or under, any IDB maintained watercourse or culvert (including the construction of an emergency access bridge); and 3. erection or alteration of any mill dam, weir or other like obstruction to the flow, or of any culvert, whether temporary or permanent, within the channel of a riparian watercourse. The Board's consent will only be granted where proposals are not detrimental to the flow or stability of the watercourse/ culvert or the Board's machinery access to the watercourse/ culvert which is required for annual maintenance,	The Landscape and Biodiversity Management and Enhancement Plan (**Application Document Ref. 5.10**) including planting proposals (**Application Document Ref. 4.15**) have been developed with cognisance of relevant IDB bylaws.

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		periodic improvement and emergency works. Any planting undertaken at the site must be carried out in such a way to ensure that the planting does not encroach within nine metres of any Board maintained watercourse when fully matured. The proposed surface water discharge from the site is in excess of that usually permitted by the Board (agricultural runoff rate 1.4 l/s/ha) with a potential impact upon the receiving watercourse. In considering the applicant's proposals, the capacity at Bewcarrs and Paupers Pumping Stations will require consideration. Further discussions will be required to determine the acceptability of the proposal and agree any mitigation measures or financial contributions that may be deemed necessary to	The consent of the IDB would be sought for the proposed surface water discharge and engagement on this matter is described in Section 5 of **Appendix 12A**: Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**) including in respect of agreeing runoff rates.

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		accommodate the additional flows both within the receiving watercourse and at the above mentioned pumping stations.	
North Lincolnshire Council - LLFA	January 2021 (Stage II Consultation / PEI Report)	Any application will require a full Flood Risk Assessment, Drainage Strategy and SUDS Guidance Document. References should be made to the Consultation Document. When developing the detailed surface water drainage scheme reference should be made to North Lincolnshire Council's SuDS and Flood Risk Guidance Document, which is available on the Council's website.	Please refer to **Appendix 12A:** Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**). The latter includes the SuDS strategy for the Proposed Development, taking into account North Lincolnshire Council's SuDS and Flood Risk Guidance Document
Natural England	January 2021 (Stage II Consultation / PEI Report)	Natural England welcomes the measures outlined at 12.5 and 12.6 Chapter 12 Water Environment of the PEI Report, which are to be included within a Construction Environmental Management Plan (CEMP) and outlined a number of risks to the Humber Estuary SSSI/	The comments provided by Natural England on the PEI Report have been noted and taken into account within this chapter.

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		SAC/ Ramsar that the CEMP should also consider including 'urban diffuse pollutants' along with suitable treatment measures if required. Noted that potential impacts that may occur when discharging the water from the cooling system into the River Trent. Measures to avoid or prevent these impacts should be detailed, if required. This may include an assessment of the potential risks from a change of temperature to the watercourse.	The discharge of treated effluent and associated thermal / chemical effects are considered within this chapter. **Appendix 12B:** WFD Assessment Report (ES Volume II - **Application Document Ref. 6.3**) provides further assessment of the thermal effects of cooling water discharge.
Public Health England	January 2021 (Stage II Consultation / PEI Report)	Noted that because plans for Keadby 1 Power Station have not yet been confirmed, a worst-case approach (which includes the continued operation of Keadby 1) is recommended in all water assessments.	As described in **Chapter 2**: EIA Methodology (ES Volume I – **Application Document Ref. 6.2**) the Proposed Development is being designed to re-use elements of Keadby 1 Power Station's infrastructure and so it would not be possible for Keadby 1 Power Station to

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
			operate simultaneously with the Proposed Development.
Maritime and Coastguard Agency (MCA)	January 2021 (Stage II Consultation / PEI Report)	The MCA would expect all works in the marine environment which may impact navigation on the River Trent, and its local canals within the subject area to be considered under the Marine Licensing requirements of the Marine and Coastal Access Act 2009, and the MCA consulted as part of that process. It is likely that any concerns could be addressed by suitably worded conditions of consent. For works within the marine environment, the MCA would expect to see consideration of potential impact on safe navigation of vessels transiting the area, and safety of other marine users. The MCA would like to see further information and detail provided to determine the significance of these predictions.	A draft DML has been subject to MMO review and is provided with the Draft Development Consent Order (**Application Document Ref. 2.1**). Technical engagement has been carried out with relevant navigational authorities, including the MCA and ABP Humber – the appropriate navigational authority. Further details are provided within a Navigational Risk Assessment (**Appendix 12C** (ES Volume II - **Application Document Ref. 6.3**).

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		Where possible, the developer should also seek to consult other local marine stakeholders, including both commercial shipping and recreational vessel groups.	
Anglian Water	January 2021 (Stage II Consultation / PEI Report)	Cooling water abstraction: reference is made to a potential option which would involve water abstraction from the River Trent. Anglian Water abstracts water from the River Trent at Newton to provide potable (clean) water to our customers. Anglian Water would welcome further information being provided in relation to surface water abstraction on the River Trent to understand whether there are any significant impacts anticipated downstream of the proposed development site. Most of the proposed development site appears to be located outside of Anglian Water's water supply	Abstraction by Anglian Water at Newton, some 50km upstream of the Proposed Development Site is noted. Details and assessment of the proposed surface water abstraction option from the River Trent are provided within this chapter (refer to Section 12.6) Comments regarding the supply boundary and statutory sewage area and consultation with the relevant undertakers are noted and consultation undertaken with these providers prior to submission of the Application is

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		boundary. It is recommended that SSE Generation Ltd consults Yorkshire Water for the proposed activities which require a water supply. The site is located outside of Anglian Water's statutory sewerage area. As such they would expect Severn Trent Water to be consulted further in relation to any requirements for foul connection(s) to the public sewerage network. Anglian Water would welcome discussion relating to the protective provisions be included in the wording of the Draft DCO.	summarised in the Consultation Report (**Application Document Ref. 5.1**).
Keadby with Althorpe Parish Council	January 2021 (Stage II Consultation / PEI Report)	Regarding the two possibilities for Water Abstraction, (Trent and Canal), the Council have been informed that the environmental impacts of both options are being looked at to make sure that they are acceptable; the Council question who this is acceptable to. Concerns	Consultation with CRT, who (as is the case for Keadby 2 Power Station cooling water abstraction) would be the licence holder/ applicant for any water abstraction licence from the Environment Agency, is ongoing. The scope of works

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		that the canal water level will have to be kept artificially high to meet the water volume requirements are noted. The Council notes that the Flood Risk Assessment shows that neither option would increase the flood risk and questions whether the Risk Assessments have been ratified by an independent 3rd party. The Parish Council would once again like to make the point that the preferred option is Abstraction from the Trent and not from the Canal.	required to determine the feasibility of any future abstraction are subject to ongoing pre-applications between CRT and the Environment Agency. Potential impacts on the wider catchment would be considered as part of the feasibility works for any water abstraction. Any abstraction would be subject to the conditions of an abstraction license granted by the Environment Agency. The Flood Risk Assessment has been reviewed by the Environment Agency at formal consultation stage and their comments, and the Applicant's responses, are provided in this table and in **Appendix 12A** (ES Volume II - **Application Document Ref. 6.3**). A final draft Flood Risk Assessment,

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
			including breach model has been reviewed by the Environment Agency prior to submission of the Application.
Canal and River Trust	Additional Consultation (April 2021)	It will clearly be a priority to the Trust to ensure that there is no adverse impact on the waterway or towpath users.	Noted. Impacts on the canal are assessed in Section 12.6 of this chapter and supporting appendices, including **Appendix 12C**: Navigational Risk Assessment (ES Volume II – **Application Document Ref. 6.3**).
Environment Agency	Additional Consultation (April 2021)	In relation to the proposed additional oversail area in the River Trent which will protrude by 5m and cover an area of 400m$^{2:}$ if this results in the loss of floodplain on the wet side of the flood defence, the applicant should provide floodplain compensation up to the 1 in 100 year fluvial flood event plus 30% climate change allowance flood event.	Work No. 10B in Schedule 1 of the draft DCO (**Application Document Ref. 2.1**) is consistent with the use of Railway Wharf for the recent Keadby 2 Power Station abnormal indivisible load (AIL) deliveries and will not involve any new construction or alteration of the existing facilities. Rather, works would comprise the maintenance of the existing jetty and temporary

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		The applicant will also need to demonstrate that the proposed addition will not impede flood flows and increase the flood risk to others (includes tidal). The applicant will require an environmental permit for the proposed activity and associated activities due to working within or over a main river (also within 16m of the top of a tidal Main River and flood defence). The proposed extension is within close proximity of the Environment Agency flood defence asset (flood wall). The applicant will also need to demonstrate how the flood defence asset will not be impacted by the proposed development.	placement of mobile crane(s) including the temporary oversailing of crane arms. As described in paragraph 6.2.4 of **Appendix 12A**: Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**), due to the residual risk to construction personnel and equipment resulting from a breach of defences on the River Trent, construction works would not take place during times of high flow when there is a Flood Alert. Any crane will not operate in the oversail area during times of high water and there is therefore no impact on flood storage or flow paths.
Associated British Ports	Additional Consultation (April 2021)	The refinement of the oversail areas will not impact operations on the River Trent. Use of Keadby Rail Wharf for the transport of abnormal loads must align with the parameters set out and used in the Keadby 2	Noted **Appendix 12C**: Navigational Risk Assessment (ES Volume II - **Application Document Ref. 6.3**) presents the assessment of

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
		Project. In relation to the River Water Abstraction Option, as details of the final permanent structure are not available, a detailed assessment with regards to navigational risk and impact on river users is required. Concerns are noted in relation to the temporary cofferdam in the River Trent which appears to extend 30m from MLWS into the river and have the potential to cause disruption and be a navigational hazard to commercial vessels navigating on that part of the river, with potential unforeseen effects on the riverbed including the natural shoaling process of the river that could lead to a further limiting of the depths within the navigational channel which is immediately adjacent. Any construction required in this area should not encroach any more into the river than existing infrastructure, to limit the risk of any unforeseen consequences.	risk in relation to the cofferdam including mitigation measures to reduce the risk to as low as reasonably practicable (ALARP). The cofferdam area would only be required in the River Trent in the event that the preferred Canal Water Abstraction Option is not feasible. In that event, any works within the River Trent to the existing infrastructure would be enclosed by a temporary cofferdam. The method and duration of installation of the cofferdam will be controlled via the deemed marine licence (DML) which has been shared as a draft with ABP and additional conditions incorporated (Part 3, Condition 10, 11 and 27) to provide assurances to ABP in relation to their concerns. The maximum extent of the cofferdam for the

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
			River Water Abstraction Option has been refined down to 22m.
Marine Management Organisation	May 2021 (Technical Engagement)	Noted the Applicant's assessment of underwater sound effects on fish including low hearing sensitivity and nocturnal migratory habit of lamprey, agreeing with the conclusion that adverse effects on lamprey are likely to be negligible as piling will not be undertaken at night and that to protect upstream migration of adult salmon, the Applicant is proposing to restrict piling activity between September to November. Noted that the MMO support this impact avoidance measure. Recommend details of local hydrodynamics (e.g. tidal range/currents and river flow) be included with the sediment details of the Coastal Processes section of the notes.	Technical engagement with MMO and Centre for Fisheries, Environment and Aquaculture Science (Cefas) has been undertaken to discuss matters raised. The Applicant has committed to a seasonal restriction for piling within the River Trent (refer to **Chapter 5**: Construction Programme and Management and Section 11.5 of **Chapter 11**: Biodiversity and Nature Conservation (ES Volume I – **Application Document Ref. 6.2**). This has also been included as a draft condition on the DML provided as part of the draft DCO (**Application Document Ref. 2.1**).

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
			No seasonal restrictions are proposed in relation to installation or removal of the cofferdam within the Stainforth and Keadby Canal given that the only migratory fish species likely to use the canal is European eel. **Chapter 11**: Biodiversity and Nature Conservation (ES Volume I – **Application Document Ref. 6.2**) concludes that seasonal restrictions are not required for this species. Further details, including those related to tidal range, currents and flows, are considered within Section 12.6 of this Chapter including an appraisal of the potential for localised changes to coastal processes, increases in SSC/ turbidity and the need for any specific mitigation. In order to validate the

Consultee or organisation approached	Date and Nature of Consultation	Comments Raised	Response Provided in this chapter
			assessment conclusions, pre and post-works bathymetry conditions have been included within the draft DML (**Application Document Ref. 2.1**), which has been subject to MMO review.

Summary of Key Changes to Chapter 12 since Publication of the Preliminary Environmental Information (PEI) Report and PEI Report Addendum

12.3.2 The PEI Report was published for statutory consultation in November 2020, allowing consultees the opportunity to provide informed comment on the Proposed Development, the assessment process and preliminary findings through a consultation process, prior to the finalisation of this ES. A PEI Report Addendum was subsequently published in March 2021 following minor changes that were made to the indicative Order Limits since the formal Stage 2 consultation.

12.3.3 The key changes relevant to this chapter since the PEI Report and PEI Report Addendum were published are summarised in Table 12.3 below.

Table 12.3: Summary of key changes to chapter since publication of the PEI Report and addendum

Summary of change since PEI Report and addendum	Reason for change	Summary of change to chapter text in the ES
Update to Section 12.3: Consultation	Section 42 consultation responses have been received in response to the PEI Report. Consultation has taken place with various stakeholders as designs for the Proposed Development have progressed.	Table 12.2 has been updated to reflect the latest consultation comments (both formal consultation and technical engagement following Stage 2 consultation) and how these have been addressed.
Update to Section 12.3: Rochdale Envelope and General Assumptions	The Proposed Development design has progressed and so assumptions have changed in some instances since the PEI Report.	Paragraphs 12.3.32 to 12.3.53 have been updated with the revised assumptions for the Water Environment impact assessment
Updates to Section 12.4: Baseline	The Proposed Development boundary has been refined since the PEI Report.	Section 12.4 'baseline' has been updated to take into account the study area for the final Proposed Development Site.

Summary of change since PEI Report and addendum	Reason for change	Summary of change to chapter text in the ES
References to effects on navigation/ other mariners	A navigation risk assessment has been completed since the PEI Report was published.	Relevant details on the navigational use of the River Trent and Stainforth and Keadby Canal have been added to this chapter, and cross references to **Appendix 12C**: Navigational Risk Assessment (ES Volume II – **Application Document Ref. 6.3**) added throughout.
Updates to Section 12.5: Development Design and Impact Avoidance	Evolution of Proposed Development design/ detail has developed requiring update of the section.	Addition of details of Mabey Bridge replacement, A18 widening and an emergency access bridge. Additional details on the abstraction points and cofferdam sizing. Inclusion of updated conceptual drainage strategy details.
Updates to Section 12.6: Likely Impacts and Effects	The assessment has been updated where necessary to reflect the latest Proposed Development design.	The assessment of significant effects has been updated to reflect the final design details prior to submission of the Application including the revised conceptual drainage strategy and updated Flood Risk Assessment **(Appendix 12A** (ES Volume II - **Application Document Ref. 6.3**)). An assessment of impacts on navigation during construction are also included.
Updates to Section 12.7: Mitigation, Monitoring and Enhancement Measures	Enhancements for the water environment have been proposed since the PEI Report.	Habitat enhancements described in the Landscape and Biodiversity Management and Enhancement Plan (LBMEP) (**Application Document Ref. 5.10**) and

Summary of change since PEI Report and addendum	Reason for change	Summary of change to chapter text in the ES
		illustrated on **Application Document Ref. 4.15** are proposed, including enhancement of ditches within the Proposed PCC Site. These habitat enhancements, as well as proposed use of SuDS, are reflected in this chapter.

Baseline Data Collection

Desk based sources

12.3.4 The following sources of information that define the Proposed Development have been reviewed and form the basis of this assessment:

- **Chapter 4:** The Proposed Development (ES Volume I - **Application Document Ref. 6.2**);
- **Chapter 5:** Construction and Management (ES Volume I - **Application Document Ref. 6.2**);
- **Appendix 12A:** Flood Risk Assessment (ES Volume II) including Section 5 - Conceptual Drainage Strategy (ES Volume II - **Application Document Ref. 6.3**); and
- **Appendix 12B**: WFD Assessment Report (ES Volume II) including Annex C - Water Quality Data (ES Volume II - **Application Document Ref. 6.3**).

12.3.5 Figures presented in ES Volume III (**Application Document Ref. 6.4**) that define the Proposed Development and that have been reviewed include:

- **Figure 1.1**: Site Location Plan;
- **Figure 3.1:** The Order Limits;
- **Figure 3.3:** Indicative Work Areas Referred to in the Environmental Statement; and
- **Figure 5.1**: Construction Laydown Areas.

Study Area

12.3.6 For the purposes of the water quality assessment, a study area of approximately 1km from the Proposed Development Site has been considered in order to identify surface waterbodies that could reasonably be affected by the Proposed Development. However, since watercourses flow and water quality impacts may propagate downstream, where relevant the assessment also considers a wider study area based on professional judgement. Professional judgement has been applied to identify the extent to which such features are considered. In this instance, the Proposed Development lies adjacent to the tidal River Trent. Given the size and length of the River Trent, it is unlikely that any further waterbodies downstream would be affected and thus the River Trent is considered the final receiving waterbody that could conceivably be affected.

12.3.7 As flood risk impact can also influence waterbodies upstream and downstream, the Flood Risk Assessment (**Appendix 12A** (ES Volume II - **Application Document Ref. 6.3**)) considers a wider study area, where relevant. Professional judgement has been applied to identify the extent to which such features are considered. Additional indirect effects may also occur to other water environment receptors distant from the study area through increased demand on water supplies and/ or foul water treatment.

12.3.8 The study area for the air quality assessment which has been used to inform the WFD Assessment (**Appendix 12B** (ES Volume II – **Application Document Ref. 6.3**)) covers a wider area including the ponds at Crowle Borrow Pits Site of Special Scientific Interest (SSSI) and Hatfield Chase Ditch SSSI. This is reported in **Chapter 8:** Air Quality (ES Volume I - **Application Document Ref. 6.2**).

Desk Study

12.3.9 Desk based research has been undertaken to identify the waterbodies within and adjacent to the Proposed Development Site, and to gather and critically evaluate relevant data and information on their condition and attributes.

12.3.10 In summary, the key background reports, websites and data used include the following:

- British Geological Survey's Geological Mapping Viewer, 'Geoindex' (BGS, 2020);
- Environment Agency's Catchment Data Explorer (Environment Agency, 2020a);
- Environment Agency's Water Quality Archive (Environment Agency, 2020b);

- Environment Agency's Guidance on discharges to surface water and groundwater: environmental permits (Environment Agency, 2016);
- Environment Agency's Flood Risk Maps (Environment Agency, 2020c);
- Centre for Ecology and Hydrology (CEH)'s National River Flow Archive (CEH, 2020);
- Cranfield University's 'Soilscapes' (Cranfield University, 2020)
- Meteorological Office's Climate averages data (Met Office, 2020);
- DEFRA's Multi-Agency Geographic Information for the Countryside (MAGIC) website (DEFRA, 2020);
- Ordnance Survey (OS) maps and aerial photography (Bing, 2020);
- data requested from the Environment Agency with regard to water quality of receptors in the study area, water resources (licensed abstractions and discharge consents), pollution incidents, fisheries and aquatic ecology data and WFD information and data;
- information available through previous applications for Marine Consent associated with the operation and maintenance of the Keadby 1 Power Station intake and outfall; and
- information available in previous Section 36 Consent (including associated Environmental Statement (ERM, 2016) and planning applications relating to Keadby 2 Power Station.

Site Surveys

12.3.11 A site walkover was undertaken on 31 July 2020 by surface water quality specialists in warm, dry and sunny conditions following a week of dry weather. The walkover focused on surface waterbodies in the study area, observing their current character and condition, the presence of existing risks and any potential pathways for construction and operational impacts from the Proposed Development. The walkover survey by water quality specialists provided an opportunity to review and ground truth the Phase 1 walkover survey completed in April 2020 by ecologists of relevant watercourses (refer to **Appendix 11C**: Preliminary Ecological Appraisal (PEA) (Annex D) (ES Volume II – **Application Document Ref. 6.3**)).

Source-Pathway-Receptor Approach

12.3.12 The impact assessment is based on a source-pathway-receptor approach. For an impact on the water environment to exist the following is required:

- an impact source (such as the release of polluting chemicals, particulate matter, or biological materials that cause harm or discomfort to humans or other living organisms, or the loss or damage to all or part of a waterbody);

- a receptor that is sensitive to that impact (i.e. waterbodies and the services they support); and
- a pathway or pathways by which the two are linked.

12.3.13 The first stage in applying the source-pathway-receptor model is to identify the potential causes or 'sources' of impact from a development. The sources have been identified through a review of the details of the Proposed Development, including the size and nature of the development, potential construction methodologies and timescales. The next step in the model is to undertake a review of the potential receptors, that is, the water environment receptors that have the potential to be affected. Waterbodies including their attributes have been identified through desk study and site surveys. The last stage of the model is to determine if there is a viable exposure pathway or a 'mechanism' linking the source to the receptor. This has been undertaken in the context of local conditions relative to the water receptors within the study area, such as topography, geology, climatic conditions and the nature of the impact (e.g. the mobility of a liquid pollutant or the proximity to works that may physically impact a waterbody).

12.3.14 The assessment of the likely significant effects is qualitative, and considers construction, operational and decommissioning phases, as well as cumulative effects with other developments. This assessment has considered the risk of pollution to surface waterbodies directly and indirectly from construction activities, particularly in relation to those water features which are within or close to the Proposed Development Site. The risk of pollution from urban runoff and the increased demand on water resources has also been considered so that appropriate measures (e.g. SuDS, proprietary treatment devices, and water conservation measures) can be incorporated into the design of the Proposed Development.

12.3.15 Some specific assessments have been undertaken to support this impact assessment process. These are described in more detail in the following sections.

Assessment of Surface Water Runoff for the Operational Phase

12.3.16 During operation, surface water runoff from the Proposed Development may contain pollutants derived from urban surfaces (e.g. inert particulates, litter, hydrocarbons, metals, nutrients and de-icing salts). This mixture of pollutants is collectively known as 'urban diffuse pollutants,' and although each pollutant may itself not be present in harmful concentrations, the combined effects over the long term can cause chronic adverse impacts. Changes in impermeable surfaced area within the Proposed Development Site may lead to increases in the rate and quantities of these pollutants from the Proposed Development Site to receiving watercourses. An assessment is therefore needed to

determine the potential risk to the receiving watercourses and to inform the development of suitable treatment measures.

12.3.17 The appropriateness of the surface water drainage measures in terms of providing adequate treatment of diffuse pollutants has been assessed with reference to the Simple Index Assessment method described in the SuDS Manual (CIRIA, 2015a). The Simple Index Approach follows three steps:

- Step 1 – Determine suitable pollution hazard indices for the land use(s);
- Step 2 – Select SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index (for three key types of pollutants - total suspended solids, heavy metals and hydrocarbons). Only 50% efficiency should be applied to second, third etc. treatment train components; and
- Step 3 – If the discharge is to a waterbody protected for drinking water, consider a more precautionary approach.

12.3.18 The SuDS Manual only provides a limited number of land use types, so these have been chosen as the most suitable for the components of the Proposed Development. Where more than one pollution hazard category applies to a component of the Proposed Development, the worst pollution hazard has been selected. For areas where there is a greater risk of a chemical spillage, a process specific risk assessment may be required, for example, to inform the Environmental Permit application.

Water Framework Directive Assessment

12.3.19 A qualitative assessment of the compliance of the Proposed Development against the WFD objectives for those WFD waterbodies that could be affected has been undertaken. This includes the assessment of the potential construction/ decommissioning (where they are of sufficient scale and duration that they may affect status) and operational phase impacts of the Proposed Development on hydromorphological, biological and physico-chemical parameters with respect to the WFD objectives of no deterioration and failure to prevent improvement. For the purposes of the assessment, decommissioning phase impacts are considered to be likely to be similar to construction phase impacts and therefore are not considered separately. The assessment takes into account proposed mitigation measures where the waterbody is not at Good Ecological Status/Potential or better, the objectives of relevant Protected Area designated under other EU Directives, and adjacent WFD waterbodies. Refer to **Appendix 12B:** WFD Assessment (ES Volume II - **Application Document Ref. 6.3**) for further details.

Flood Risk Assessment

12.3.20 A Site-wide FRA is provided in **Appendix 12A:** Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**) which assesses the current and

future risk of flooding from all sources including tidal, fluvial, surface water, groundwater, artificial sources and drainage infrastructure. The FRA includes a full description of the flood risk baseline, which is also summarised in Section 12.4 of this chapter.

Cooling Water System Discharge Assessment

12.3.21 The Proposed PCC Site will require a source of cooling water for heat rejection purposes. A number of options are technically feasible to achieve the required cooling including options for direct/ hybrid cooling of the CCGT and/ or the CCP. Technical assessments have been undertaken in order to identify preferred cooling options for the Proposed Development and two water sources are under consideration; the Stainforth and Keadby Canal (Canal Water Abstraction Option) or the River Trent (River Water Abstraction Option - see **Figure 3.2** (ES Volume III - **Application Document Ref. 6.4**)).

12.3.22 The Applicant is proposing to re-use existing assets and pipework for Keadby 1 Power Station for the discharge of treated effluent to the River Trent. A **Water Discharge Corridor** is included in the Proposed Development Site, comprising the existing easement of the existing cooling water corridor north-east from Keadby 1 Power Station connecting with the River Trent. Interconnecting pipework would extend from the Proposed PCC Site to connect to this infrastructure.

12.3.23 Given the proposed low volumes of cooling water discharge and the minimal anticipated thermal uplift, a qualitative appraisal of the CWS discharge to the estuarine River Trent has been undertaken, giving consideration to both potential thermal impacts and chemical pollutants. Alongside this assessment, the choice of cooling technique and the associated water source has been selected in accordance with an appraisal of BAT, considering the BAT hierarchy and evaluating the efficiency benefits and environmental effects of a range of available options. The BAT assessment for Cooling Technology will be provided in the Environmental Permit Application for the Proposed Development which will be submitted shortly after the DCO Application It is anticipated that a H1 risk assessment will be undertaken for the Environmental Permit, once the CCP licensor and their exact solvent composition is known following due process and the approach of the Keadby 2 Power Station.

Classification of Effect and Significance Criteria for EIA Assessment

12.3.24 There is no standard guidance in place for the assessment of the likely significant effects on the water environment from developments of this type. Based on professional judgement and experience of other similar schemes, a qualitative assessment of the likely significant effects on surface water quality and water resources has been undertaken.

12.3.25 The classification and significance of effects has been determined using the principles of the guidance and the criteria set out in DMRB LA113 (Highways England, 2020) adapted to take account of hydromorphology and navigation. Although these assessment criteria were primarily developed for road infrastructure projects, they are suitable for any development project and provide a robust and well tested method for assessing the likely significance of effects. The methodology also considers advice set out in Department for Transport (DfT) TAG Unit A3, Environmental Impact Appraisal (DfT, 2019).

12.3.26 Approaches to mitigating potential significant effects during construction and operational phases have been described with reference to good practice guidance and design.

12.3.27 Following the DMRB LA 113 (Highways England, 2020) guidance, the importance of the receptor (Table 12.4) and the magnitude of impact (The magnitude of impact will be determined based on the criteria in Table 12.5 taking into account the likelihood of the impact occurring. The likelihood of an impact occurring is based on a scale of certain, likely or unlikely. Likelihood has been considered in the case of water resources only, as likelihood is inherently included within the flood risk assessment.

12.3.28 Table 12.5) are determined and then used to determine the overall classification of effects (see Table 12.6). Where significant adverse effects are predicted, options for mitigation have been considered and proposed where reasonably practicable. The residual effects of the Proposed Development with identified mitigation in place have then been assessed.

12.3.29 Whilst other disciplines may consider 'receptor sensitivity', 'receptor importance' is considered here. This is because when considering the water environment, the availability of dilution means that there can be a difference in the sensitivity and importance of a waterbody. For example, a small drainage ditch of low conservation value and biodiversity with limited other socio-economic attributes, is very sensitive to impacts, whereas an important regional scale watercourse, that may have conservation interest of international and national significance and support a wider range of important socio-economic uses, is less sensitive by virtue of its ability to assimilate discharges and physical effects. Irrespective of importance, all controlled waters in England are protected by law from being polluted.

Table 12.4: Evaluating the Importance for Surface Water, Flood Risk, and Water Resources

Importance	Surface Water[1]	Morphology[2]	Flood Risk	Navigation
Very High	Watercourse having a WFD classification shown in a RBMP and Q95≥1.0m^3/s. European sites and sites protected/ designated under UK legislation (SAC, SPA, SSSI, Ramsar, salmonid water) / Species protected by relevant European Ecology and Nature Conservation legislation.	Unmodified, near to or pristine conditions, with well-developed and diverse geomorphic forms and processes characteristic of river type.	Essential infrastructure or highly vulnerable development	Corridor is a navigation route of principal importance (high volume of domestic and commercial traffic, all year round, and close proximity to ports, marinas and moorings.
High	Watercourse having a WFD classification shown in a RBMP and Q95<1.0m^3/s. Species protected under relevant European or UK Ecology and Nature Conservation legislation.	Conforms closely to natural, unaltered state and would often exhibit well-developed and diverse geomorphic forms and processes characteristic of river type, with abundant bank side vegetation. Deviates from natural conditions due to direct and/or indirect channel, floodplain, and/or catchment development pressures.	More vulnerable development	Corridor is a navigation route of high importance (high volume of domestic and commercial traffic, but not all year round and lower proximity to ports, marinas and moorings).
Medium	Watercourses not having a WFD classification shown in	Shows signs of previous alteration and / or minor flow regulation but still retains some	Less vulnerable development	Corridor is a navigation route of medium importance

Importance	Surface Water[1]	Morphology[2]	Flood Risk	Navigation
	a RBMP and Q95 >0.001m^3/s.	natural features or may be recovering towards conditions indicative of the higher category.		(e.g. intermittently used by a small number of domestic craft)
Low	Watercourses not having a WFD classification shown in a RBMP and Q95 <0.001m^3/s.	Substantially modified by past land use, previous engineering works or flow regulation and likely to possess an artificial cross-section (e.g. trapezoidal) and would probably be deficient in bedforms and bankside vegetation. Could be realigned or channelised with hard bank protection, or culverted and enclosed. May be significantly impounded or abstracted for water resources use. Could be impacted by navigation, with associated high degree of flow regulation and bank protection, and probable strategic need for maintenance dredging. Artificial and minor drains and ditches would fall into this category.	Water compatible development	Corridor is rarely used for navigation or is non-navigable

Note 1: Professional judgement is applied when assigning an importance category to all water features.

All controlled waters are protected from pollution under the Environmental Permitting (England and Wales) Regulations 2016 and the Water Resources Act 1991 (as amended), and future WFD targets also need to be considered.

Importance	Surface Water[1]	Morphology[2]	Flood Risk	Navigation
Note 2: Based on the waterbody 'Reach Conservation Status' presently being adopted for the High Speed 2 project (developed originally by Atkins) and developed from EA conservation status guidance (Environment Agency 1998a, 1998b) as DMRB guidance does not currently provide any importance criteria for morphology.				

12.3.30 The magnitude of impact will be determined based on the criteria in Table 12.5 taking into account the likelihood of the impact occurring. The likelihood of an impact occurring is based on a scale of certain, likely or unlikely. Likelihood has been considered in the case of water resources only, as likelihood is inherently included within the flood risk assessment.

Table 12.5: Evaluating Magnitude for Surface Water, Flood Risk, and Water Resources

Impact	Criteria	Description and Examples
Major Adverse	Results in a loss of attribute and/ or quality and integrity of the attribute	Loss or extensive change to a fishery. Loss of regionally important public water supply. Loss or extensive change to a designated Nature Conservation Site. Reduction in waterbody WFD classification Increase in peak flood level (>100mm)[5] Major disruptions to navigation or risks posed to navigable craft
Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute	Partial loss in productivity of a fishery. Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies. Contribution to reduction in waterbody WFD classification. Increase in peak flood level (>50mm). Delays to navigation as a result of a reduction in navigable channel extent
Minor Adverse	Results in some measurable change in attribute's quality or vulnerability	Minor effects of water supplies. Increase in peak flood level (>10mm). Minor reductions to wetted width of the channel and at the edge of what is navigable

[5] All references to peak flood level in this table are for a 1% annual probability event, including climate change. Note: adapted from DMRB LA113 (Highways England, 2020).

Impact	Criteria	Description and Examples
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity	No risk identified to surface water quality or hydromorphology or navigation Negligible change in peak flood level (≤+/- 10mm).
Minor Beneficial	Results in some beneficial impact on attribute or a reduced risk of negative effect occurring	Contribution to minor improvement in water quality, but insufficient to raise WFD classification. Creation of flood storage and decrease in peak flood level (>10mm). Removal of an in channel structure at edge of or outwith of the navigable channel, which may lead to small improvements to travel times.
Moderate beneficial	Results in moderate improvement of attribute quality	Contribution to improvement in waterbody WFD classification. Creation of flood storage and decrease in peak flood level (>50mm). Removal of in channel structure increasing width of navigable channel leading to a reduction of travel times.
Major beneficial	Results in major improvement of attribute quality	Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in waterbody WFD classiciation. Creation of flood storage and decrease in peak flood level (>100mm). Removal of an in channel structure leading to a significant reduction in collision risk to vessels.

Classification and Significance of Effect

12.3.31 Once the magnitude of impact and the receptor importance have been defined, the classification and significance of the potential effect can be derived by combining both assessments in a simple matrix as shown in Table 12.6. Effects classed as moderate or greater are considered significant in EIA terms (i.e. shaded cells). Where there is a range of effects (e.g. large/

very large) professional judgement has been used to determine the residual effect.

Table 12.6: Classification and Significance of Effect

Magnitude of Impact	Importance of Attribute			
	Very High	**High**	**Medium**	**Low**
Major	Very Large	Large / Very Large	Moderate / Large	Slight / Moderate
Moderate	Large / Very Large	Moderate / Large	Moderate	Slight
Minor	Moderate / Large	Slight / Moderate	Slight	Neutral / Slight
Negligible	Slight	Slight	Neutral / Slight	Neutral / Slight
No change	Neutral	Neutral	Neutral	Neutral
Note: adapted from DMRB LA104 (Highways England, 2020)				

Rochdale Envelope and Basis of Assessment

12.3.32 The assessment makes use of the 'Rochdale Envelope' approach under the Planning Act (2008) (HMSO, 2008). The approach is employed where the nature of the Proposed Development means that some details of the whole project have not been confirmed when the application is submitted, and flexibility is sought to address the uncertainty.

12.3.33 Key principles in the context of the DCO application process are given in the PINS Advice Note Nine: Using the Rochdale Envelope (PINS, 2018). This includes the need to outline timescales associated with the flexibility sought, and that the assessment should establish those parameters likely to result in the maximum adverse effect (the reasonable worst-case scenario) and be undertaken accordingly to determine significant effects from the Proposed Development and to allow for the identification of necessary mitigation.

12.3.34 The reasonable worst-case scenario assumptions (maximum parameters) and general assumptions for the purposes of the Water Environment assessment include:

- It is assumed that during construction the Contractor will as a minimum conform to all permit/consent/licence requirements and best practice measures to avoid, reduce and minimise the risk of water pollution or unacceptable physical impacts (without mitigation) on waterbodies. Details of this mitigation and best practice standards are described in Section 12.5 of this report and would be secured via the final CEMP; a

framework CEMP is submitted with the application (**Application Document Ref. 7.1**).

- As a worst-case scenario, the assessment considers both options to abstract from the River Trent or from Stainforth and Keadby Canal, described in **Chapter 4**: The Proposed Development (ES Volume I - **Application Document Ref. 6.2**). The corridors within which the water supply connections are shown on the Water Connection Plans (**Application Document Ref. 4.9**).
- If the preferred Canal Water Abstraction Option is selected:
  - It is assumed that a similar canal intake structure and layout as currently being constructed for the Keadby 2 Power Station intake will be used for the Proposed Development. It is assumed that the overall dimensions of the new inlet will be no larger[6] than the Keadby 2 Power Station installation. Consultation is ongoing with the Environment Agency and CRT to define the parameters of any canal water abstraction, including the volume of water that could be abstracted per annum, and frequency/ rate.
  - The maximum extent of the cofferdam would extend approximately 10m from the canal bank.
- If the alternative River Water Abstraction Option is chosen:
  - It is anticipated that the existing Keady 1 Power Station infrastructure including existing gravity intake is in a suitable condition for re-use with some refurbishment and additions (e.g. new pumps).
  - The existing River Trent water intake would be subject to modification either (involving a new gravity or pumped intake system) to address silt issues and to comply with the Eels (England and Wales) Regulations 2009 (HMSO, 2009) ('Eels Regulations') including accommodating new 2mm eel screens. The cooling water intake will be designed with the aim of reduced fish entrainment/ compliance with BAT.
  - A cofferdam at the existing River Trent abstraction point on the western bank of the Trent would extend to a maximum of 22m into the watercourse to ensure a safe and dry working area beyond the existing intake infrastructure.
- Whichever abstraction option is selected the following assumption apply and form the basis of the assessment in this chapter:
  - The timing of piling works associated with cofferdam installation/ removal would avoid the main migratory periods of noise and vibration

[6] The existing Keadby 2 Power Station screen installation is designed for 442 litres per second (L/s) and the maximum estimated hybrid cooling water demand for the Proposed Development is approximately 348 L/s[6],

sensitive fish species in the River Trent (which is September to November), as described in **Chapter 11**: Biodiversity and Nature Conservation (ES Volume I - **Application Document Ref. 6.2**).
  - Water would be pumped out after any necessary fish rescue and at a suitable rate and way as to avoid any significant disturbance or scour of the river bed.
  - No dredging would be required.
  - A pipeline would be constructed from the intake into the Proposed PCC Site; as a worst case, it has been assumed that open-cut methods will be required for installation of any pipework across minor watercourses within the Proposed PCC Site. Where this is required, it is assumed that flow would be temporarily over-pumped, diverted around or flumed through the working area and the watercourse fully reinstated on completion of works, in keeping with standard construction practice and taking into account relevant IDB byelaws.
  - All other pipework crossings in sensitive areas would use trenchless technologies, and at a sufficient depth below the bed to ensure that there is no risk of exposure.

- Water supply for use on site for all activities with the exception of cooling water and process water (i.e. make-up to the steam/water cycle of the Proposed PCC Site) will be supplied by the relevant statutory undertaker.
- At this stage in the design process, preliminary water supply and wastewater discharge assessments have outlined what process waste waters may be generated by the Proposed Development and how these may be treated with the application of BAT. These assessments indicate that wastewater contaminants will be generated from the following activities:
  - cooling tower blowdown - blowdown from the power plant and carbon capture cooling towers are likely to contain total dissolved solids (TDS), with some suspended solids plus trace chemical and organics resulting from water treatment chemical addition. The composition of the cooling tower blowdown will be limited by the number of cycles of concentration that the water undergoes. It is proposed that this will be discharged via a dedicated pipeline connection to the existing infrastructure used by Keadby 1 Power Station to the River Trent. All discharges would be in accordance with an Environmental Permit required for the operation of the Proposed Development.
  - Direct Contact Cooler (DCC) Blowdown - DCC blowdown wastewater will be treated within the power island and CCP plant area. A number of Treatment processes are under consideration to enable the treated water to be recovered for cooling water make-up or discharged to the River Trent.
  - Demineralisation Plant and Condensate Polishing Plant Regeneration - The wastewater from the demineralisation plant and possible steam

condensate polishing plant will be treated prior to discharge to the River Trent.
  - Heat Recovery Steam Generator (HRSG) Boiler Blowdown - The HRSG boiler blowdown is likely to be treated prior to recovery for cooling water make-up or otherwise discharged to the River Trent following treatment.
  - Water Treatment Works (WTW) Residuals - The quantity and quality of the wastewater discharge from the WTW is highly dependent upon the salinity of the source and the required level of desalination, and so will vary depending on the chosen abstraction option.

- The assessment assumes that prior to discharge to the River Trent, effluent treatment facilities will be provided on site for treatment of contaminants in the cooling tower blowdown, direct contact cooler (DCC) blowdown, demineralisation plant and condensate polishing plant regeneration wastewater, Heat Recovery Steam Generator (HRSG) boiler blowdown and reject water (brine) from the desalination process.
- It is assumed that wastewater from the cooling process will be discharged to the River Trent following treatment at a rate compliant with the discharge limits set by the Environment Agency within the Environmental Permit.
- It is anticipated that the rate of discharge from the Proposed Development will be less than 1m^3/s and be discharged intermittently, in combination with the 0.016 m^3/s proposed to be discharged from Keadby 2 Power Station. The existing Keadby 1 Power Station permit (EPR/YP3133LL) allows a maximum daily discharge of 15m^3/s (average over a 24-hour period). Keadby 1 Power Station will not operate at the same time as the Proposed Development, as explained in **Chapter 2**: Assessment Methodology (ES Volume I – **Application Document Ref. 6.2**). Consequently, it is considered that the Proposed Development will be operating well within the existing consented parameters of Keadby 1 Power Station.
- The Environmental Permit will specify the release points and emission limit values required to maintain the status of the receiving waters. Cooling water will be monitored prior to discharge in compliance with the conditions of this permit. It is noted that the Keadby 2 Power Station Permit Variation specifies that the emission limit values (and associated monitoring points) apply at the point of discharge within the Keadby 1 Power Station cooling water culvert, not at the River Trent outfall point. The control points and parameters for the Proposed Development will be agreed by the Environment Agency.
- Due to the proposed low volumes associated with the cooling water discharge and the minimal anticipated thermal uplift, a qualitative assessment of potential impacts to the River Trent has been undertaken. This takes into account the previous cooling water assessments

undertaken for Keadby 1 Power Station and Keadby 2 Power Station operating simultaneously. As there is not a scenario whereby the Proposed Development and Keadby 1 Power Station and Keadby 2 Power Station would be operational together, (the Proposed Development is being designed to re-use some of Keadby 1 Power Station's infrastructure) the findings from the combined assessment for Keadby 1 Power Station and Keadby 2 Power Station have helped to inform this qualitative assessment.

- As noted above, a draft H1 screening assessment for discharges to water is being undertaken and will be finalised during the process of obtaining an Environmental Permit, once the CCP licensor and their exact solvent composition is known; this will include an appraisal of the treated effluent against relevant Equivalent Quality Standard (EQS) values for the constituent parts of the treated effluent.
- For the purposes of this assessment it has been assumed that all foul water from welfare facilities will be directed via the existing foul water sewer for Keadby 2 Power Station to the Severn Trent Water pumping station on Chapel Lane, and from there to the nearest wastewater treatment works (WwTW), subject to suitability of the infrastructure and agreement with the local sewerage undertaker, Severn Trent Water.. If the pipeline condition is not suitable for continued use, foul sewerage would instead be treated on site in a package treatment plant with the treated water directed to the River Trent via the water discharge connection.
- Surface water drainage from the Proposed Development will be discharged to Keadby Common Drain subject to agreement from the IDB. The IDB has noted that they do not normally accept discharges higher than agricultural runoff rate (1.4l/s/ha) but is considering the Applicant's proposals including any mitigation measures that may be required in order for such a discharge to be accepted. An alternative discharge route is also proposed, should this be required i.e. if the IDB is only able to accept surface water runoff at the agricultural run-off rate. In this event excess surface water up to the greenfield runoff rate would be discharged via the Keadby 2 Power Station site cooling tower ponds and Water Discharge Corridor and into the River Trent as shown on **Application Document Ref 4.13** and explained in **Appendix 12A**: Flood Risk Assessment (ES Volume II – **Application Document Ref. 6.3**). SuDS are to be provided in the form of ditches, swales and an attenuation pond.
- Water would be stored in an appropriately sized attenuation pond (refer to **Application Document Ref 4.13**) to accommodate the 1% Annual Exceedance Probability (AEP) event with 40% allowance for climate change.
- Bypass oil water separators will be provided for surface water runoff to the attenuation retention pond situated upstream of the main outfall from the Proposed Development Site.

- The final drainage strategy secured by a requirement of the draft DCO (**Application Document Ref. 2.1**) will incorporate the pollution prevention measures described in the conceptual drainage strategy (Section 5 of **Appendix 12A** (ES Volume II - **Application Document Ref. 6.3**)) and will therefore include:
  - oil interceptors;
  - separation of process water from surface water drainage; and
  - use of bunds in areas where spillages are likely to occur.
- A primary objective of the site drainage system is to protect the local environment and waterbodies from accidental discharges of oil or other chemicals (e.g. fire-fighting foam). The conceptual drainage strategy allows for inclusion of isolation/ sluice valves in the drainage network to allow any unplanned chemical spills or firewater from chemical fires to be safely removed for treatment. At detailed design stage, a surface water drainage strategy would be developed which will include fire water drainage, using relevant British Standards and realistic worst-case antecedent conditions such that in the event of an incident occurring, contaminated fire water would not enter the surface water drainage system or process water system, but rather be retained on-Site for a period and be disposed of safely. Provision of a surface water drainage strategy, following consultation with the LLFA is secured by requirement (Detailed Design) of the draft DCO (**Application Document Ref. 2.1**).
- The expected treatment performance of different SuDS options is based on advice reported in CIRIA C753 - The SuDS Manual (CIRIA, 2015a) using the Simple Index Approach. Professional judgement has been used when deciding the example land use used, and what treatment a particular option may provide, taking into account the design of the SuDS feature and whether it is considered to be 'optimum' or 'sub-optimum' for the Proposed Development.
- Any crossings of watercourses to facilitate either construction access (e.g. to temporary laydown areas) or permanent access, including emergency egress for the Proposed Development will seek to minimise the length of bank affected and impacts to these watercourses. Where upgrades to existing pipework are required, trenchless excavation methods ('sliplining') could be applied. This technique involves the existing pipeline remaining in-situ and acting as a host pipe for a new smaller diameter carrier pipe. The space between the two pipes ('annulus') would then be grouted and the ends sealed.
- The assessment has been based on understanding of flow pathways as observed during the site walkover. Assumptions have been made regarding flow pathways for culverted sections of watercourses, based on Ordnance Survey mapping. Understanding of flow pathways is described for each watercourse in the baseline (Section 12.4).

- Assumptions relating to flood risk are outlined in **Appendix 12A:** Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**) and relevant design and impact avoidance measures are described in Section 12.5.

12.4 Baseline Conditions

12.4.1 The relevant baseline physical characteristics of the study area and the water features present are described in this section and with reference to **Figure 12-1:** Surface Waterbodies and their attributes (ES Volume III - **Application Document Ref. 6.4**).

Land Use, Topography and Rainfall

12.4.2 The Proposed Development Site and a 1km study area surrounding this lies within the extensive floodplain of the River Trent within the Isle of Axholme. Land is generally low lying at elevations below 10m Above Ordnance Datum (mAOD) and with very shallow gradients. Beyond the area associated with the current (operational) Keadby 1 Power Station, land use is almost entirely arable farming, used mainly to grow wheat and sugar beets. The land is particularly fertile due to its history of annual flooding from the Trent and peat soil.

12.4.3 The Water Connection Corridors extend eastwards and north eastwards from the Proposed Development Site towards the village of Keadby, and the Proposed Development Site construction and operational access route extends to the south west, crossing numerous watercourses including Hatfield Waste Drain, the Sheffield and South Yorkshire Navigation – Stainforth and Keadby Canal (herein referred to as 'the Stainforth and Keadby Canal'), North Soak Drain and South Soak Drain.

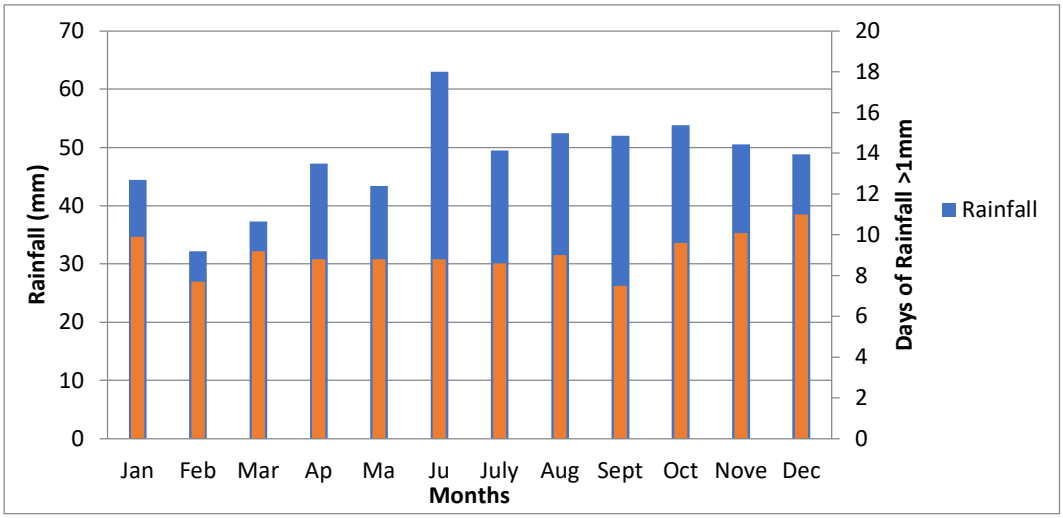
12.4.4 In the vicinity of the Proposed Development Site, the River Trent is tidal, therefore parts of the Proposed Development Site are within the UK marine area. No harbour works are proposed.

12.4.5 The study area has a complex surface water hydrology and a long history of land drainage. The Proposed Development Site and land north of the Stainforth and Keadby Canal is within the IoAaNNWLMB area indicated on **Figure 12.6** (ES Volume III – **Application Document Ref. 6.4**).

12.4.6 The nearest weather station on the Met Office website with historical data is located at Robin Hood Doncaster Sheffield Airport, approximately 21km south west of the Proposed Development Site, at NGR SK 65933 98500. Based on the average climate data (for the period 1981 to 2010) for this weather station, the study area experiences an average of 574mm of rainfall per year, with it raining more than 1mm on around 109 days per year. This is a relatively low level of rainfall when compared to the average for England.

12.4.7 Plate 12.1 illustrates this data to show how the average rainfall varies throughout the year, with the wettest period being in the mid to late summer to autumn, and driest in late winter to early spring. Average monthly rainfall is generally less than 60mm throughout the year, except in July when it rises to 63mm. February is the driest month with an average of approximately 32mm between 1981 and 2010.

Plate 12.1: Robin Hood Doncaster Sheffield Airport Weather Station - Average rainfall per month (1981-2010) and average days per month with >1mm of rainfall (1981-2010)



Groundwater, Geological Features and Soils

12.4.8 **Chapter 13:** Geology, Hydrogeology and Land Contamination (ES Volume I - **Application Document Ref. 6.2**) describes the geology and groundwater at the Proposed Development Site, summarised here.

12.4.9 The British Geological Society (BGS) Geoindex viewer (BGS, 2020) indicates that the entire study area is underlain by bedrock of the Mercia Mudstone Group. Above this, superficial deposits consist mainly of Warp (sand and silt) with Alluvium (clay, sand, silt, and gravel) along the course and immediate margins of the River Trent. Warp is artificially induced alluvium that was created when agricultural warping[7] was practiced.

12.4.10 According to the MAGIC online map (DEFRA, 2020) the bedrock beneath the Proposed Development Site is classed as a Secondary B aquifer ('predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin

[7] Warping is the process of allowing turbid river water to flood agricultural land to deposit a layer of sediment to improve fertility before the water was allowed to drain away.

permeable horizons and weathering. These are generally the water-bearing parts of former non-aquifers') whilst the superficial deposits across the Proposed Development Site are classed as a Secondary A aquifer ('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').

12.4.11 Levels within the historical borehole records (BGS, 2020) indicate generally shallow groundwater levels within the superficial geology of between 0.9m and 3.0m below ground level (bgl). Occasionally, deeper groundwater strikes were recorded between 5.4m and 6.9m bgl. There is insufficient information to conclude at this stage whether these levels are representative of true groundwater levels across the wider area.

12.4.12 According to the Environment Agency's online Catchment Data Explorer website (Environment Agency, 2020a) groundwater beneath the Proposed Development Site and north of the Stainforth and Keadby Canal is designated under the WFD as waterbody GB40402G990300 (Lower Trent Erewash - Secondary Combined) of the Humber RBMP. This groundwater body has a surface area of approximately 1924km^2 and is currently at Good Overall Status. To the south of the Stainforth and Keadby Canal, the WFD groundwater body is the 'Idle Torne - Secondary Mudrocks' (GB40402G992200). This waterbody has a surface area of approximately 321km^2 and is at Good overall status.

12.4.13 Information obtained from Cranfield Soil and AgriFood Institute (CSAI) Soilscapes website (CSAI, 2020) describes the soils on the Proposed Development Site to be loamy and clayey soils of coastal flats with naturally high groundwater[8]. Land within this soil type is described as generally draining to local groundwater and mostly drained. Shallow groundwater and marginal ditches to most fields mean that the water resource is vulnerable to pollution from nutrients, pesticides and wastes that may be applied to the land.

12.4.14 According to the Landmark Information Group Envirocheck report (Landmark, 2020), Natural England reports the Agricultural Land Classification (ALC) to be Grade 2 for the majority of the Proposed Development Site. This is classed as soil of 'very good quality'. This land is further described as having only minor limitations which affect crop yield, cultivations or harvesting. It can support a wide range of agricultural and horticultural crops but there can be some reduced flexibility on land within the grade, which causes difficulty in the production of more demanding crops e.g. winter harvested vegetables and arable root crops. In areas of the Proposed Development Site south of the Stainforth and Keadby Canal, some parts are classified as Grade 1

[8] Soilscape identification description number 21

(excellent quality). Further information is provided in **Chapter 3**: The Site and its Surroundings (ES Volume I - **Application Document Ref. 6.2**).

Water Features

12.4.15 A Site Walkover was undertaken on 31 July 2020 in sunny, dry conditions. Using observations taken on this visit, data from OS mapping and the Environment Agency Catchment Data Explorer website (Environment Agency, 2020a) the surface waterbodies listed in Table 12.7.7 were identified within the study area. **Figure 12-1** (ES Volume III - **Application Document Ref. 6.4**) illustrates the location and WFD status of these waterbodies.

Table 12.7: Summary of Waterbodies in the Study Area including WFD status

Waterbody	Type of Waterbody	WFD designation or associated WFD Waterbody (where applicable)
River Trent	Transitional Waterbody (main river)	Humber Upper (GB530402609203)
Paupers Drain (includes Warping Drain and Eastoft Moors Drain)	Watercourse (ordinary) – maintained by IoAaNNWLMB	Paupers Drain Catchment (trib of Trent) (GB104028064300)
North Soak Drain (and South Soak Drain)	Watercourse (main river)	North Soak Drain Catchment (trib of Torne/Three Rivers) (GB104028064350)
Hatfield Waste Drain (includes North Engine Drain)	Watercourse (main river)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers) (GB104028064330)
Torne/Three Rivers (includes South Engine Drain and Folly Drain)	Watercourse (main river)	Torne/Three Rivers from Mother Drain to Trent (GB104028064340)
Eastoft Moors Drain	Watercourse (ordinary) – maintained by IoAaNNWLMB	Tributary of Humber Upper (GB530402609203)
Sewer Drain	Watercourse (ordinary) -	Tributary of Humber Upper (GB530402609203)

Waterbody	Type of Waterbody	WFD designation or associated WFD Waterbody (where applicable)
	maintained by IoAaNNWLMB	
Keadby Boundary Drain	Watercourse (ordinary) - maintained by IoAaNNWLMB	Tributary of Paupers Drain Catchment (trib of Trent) (GB104028064300)
South Moors Drain	Watercourse (ordinary) - maintained by IoAaNNWLMB	Tributary of Paupers Drain Catchment (trib of Trent) (GB104028064300)
North and South Cross Moors Road Drain	Watercourse (ordinary) - maintained by IoAaNNWLMB	Tributary of Paupers Drain Catchment (trib of Trent) (GB104028064300)
Sheffield and South Yorkshire Navigation – Stainforth and Keadby Canal	Watercourse (Canal)	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) (GB70410281)
Keadby Common Drain	Watercourse (ordinary) - maintained by IoAaNNWLMB	Paupers Drain Catchment (trib of Trent) (GB104028064300)
Kelsey Drain	Watercourse (ordinary)	Paupers Drain Catchment (trib of Trent) (GB104028064300)
Pumping Drain	Watercourse (ordinary) - maintained by IoAaNNWLMB	Paupers Drain Catchment (trib of Trent) (GB104028064300)
Glew Drain / Drain D1 (as named in **Appendix 11C**: PEA Report (ES Volume II - **Application Document Ref. 6.3**))	Watercourse (ordinary) - maintained by IoAaNNWLMB	Paupers Drain Catchment (trib of Trent) (GB104028064300)
Ubiquitous unnamed drainage ditches (including those	Watercourse (ordinary) – generally	Tributaries of the various WFD waterbodies listed above

Waterbody	Type of Waterbody	WFD designation or associated WFD Waterbody (where applicable)
named in **Appendix 11C**: PEA Report (ES Volume II - **Application Document Ref. 6.3**) as drains D2-D6)	maintained by private landowners	
Five small ponds west of the River Trent (four immediately east of Keadby Boundary Drain, one south of Boskeydyke Farm)	Stillwater	Situated within the Paupers Drain Catchment (trib of Trent) (GB104028064300)
One small pond east of the River Trent within the study area, off Neap House Road	Stillwater	Situated within the Humber Upper (GB530402609203) catchment
Idle Torne – Secondary Mudrocks	Groundwater	WFD designation (GB40402G992200)
Lower Trent Erewash – Secondary Combined	Groundwater	WFD designation (GB40402G990300)

Surface Waterbodies

12.4.16 The Environment Agency's Catchment Data Explorer website (Environment Agency, 2020a) confirms that the transitional waterbodies in the study area (i.e. River Trent) are contained within the:

- the Humber River Basin District;
- Humber Transitional and Coastal (TraC) Management Catchment; and
- Humber Estuary TraC Operational Catchment.

12.4.17 The fluvial waterbodies are contained within:

- the Humber River Basin District;
- Trent Lower and Erewash, and Idle and Torne Management Catchments; and
- Trent and Trib, and Isle of Axholme Operational Catchments.

12.4.18 There are six WFD designated surface water bodies within the study area, described briefly in Table 12.8. Although these are the WFD reporting reaches, WFD principles and objectives apply to all tributaries of these watercourses. The WFD waterbodies include one transitional waterbody (Humber Upper transitional waterbody), four rivers (Paupers Drain Catchment (trib of Trent), North Soak Drain Catchment (trib of Torne/Three Rivers), Hatfield Waste Drain Catchment (trib of Torne/ Three Rivers) and Torne/ Three Rivers from Mother Drain to Trent) and one canal (Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)). **Figure 12-1** (ES Volume III - **Application Document Ref. 6.4**) illustrates these waterbodies.

Table 12.8: WFD Surface Waterbodies in the Study Area

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
Humber Upper (GB530402609203) – Transitional Waterbody	Moderate Ecological Potential	Fail	Moderate (2015)	Heavily Modified	This section of the River Trent is designated from Owston Ferry to the south (approximately 13km upstream of Keadby) to its confluence with the River Ouse approximately 14.5km downstream of Keadby.
Site Observations: The Humber Upper waterbody (River Trent) was observed during the site visit from the western bank adjacent to Keadby Power Station, where it flows from the south to the north. Embankments line the river here for flood protection. At this point the waterbody is tidal and has a width of approximately 140m. The river is used for navigation with a wharf at Keadby and the nearest jetty approximately 600m upstream on the east bank near Gunners Wharf. Further details regarding hydrodynamics, tides and sediments are provided later in the baseline. Adjacent to Keadby village, there are two existing discharge points into the River Trent from Keadby Power Station (SE 83536 11647 and SE 83655 12226), with trash screens and bollards to prevent collision from passing boats. The tide was low enough during the site visit to expose intertidal muddy sediments at the channel margins surrounded by vegetation that appeared typical of a salt marsh. The river adjacent to Keadby is situated in the Humber Estuary SSSI, Humber Estuary SAC and Humber Estuary Ramsar Site.					
Paupers Drain Catchment (trib of Trent) (GB104028064300)	Moderate Ecological Potential	Fail	Moderate (2015)	Artificial	Unusually, this waterbody consists of two separate designated watercourses, Warping Drain and Paupers

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
					Drain which both flow west to east between Crowle and the River Trent, totalling approximately 13km length and draining an area of around 32.0km^2.
Site Observations: Warping drain was observed from the B1392 at SE 83592 12125 where it crosses beneath the road. The watercourse is single thread and approximately 7m wide here and perfectly straight. There was no flow observed due to the tidal lock upstream of the River Trent. The watercourse was extremely turbid and so depth could not be ascertained. There was an algal bloom upstream of the tidal lock indicative of nutrient enrichment. The channel is incised with banks rising relatively steeply away from the channel bed. The banks and riparian zone was densely vegetated as would be expected in summer and provided a buffer strip to the arable fields beyond. The drain is a designated local wildlife site (LWS) as it supports a population of whorled water-milfoil (*Myriophyllum verticillatum*). The site is also designated for its wet reed beds with a large population of common reed (*Phragmites australis*).					
North Soak Drain Catchment (trib of Torne/Three Rivers) (GB104028064350)	Moderate Ecological Potential	Fail	Moderate (2015)	Artificial	This artificial drain is designated between Thorne and Keadby, where it meets Torne/ Three Rivers shortly upstream of the River Trent. It is 26.4km in length and drains a catchment area of 55.6km^2
Site Observations: North and South Soak Drains were observed during the site visit at SE 82505 11545 and SE 82487 11450, respectively. Both were approximately 8m wide and are straight, artificial drainage channels with steep banks, and are located					

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
either side of the Stainforth and Keadby Canal. Both were extremely turbid with phytoplankton such that depth could not be ascertained although is expected to a be several metres. There were clumps of algae on the surface and they appeared nutrient enriched. Fine sediment accumulations were apparent at channel margins in some locations. South Soak Drain is located approximately 3m lower in elevation than the adjacent canal, and the drain supports rich aquatic, emergent and marginal flora. The drain is a designated LWS for its swamp habitat which is dominated by common reed.					
Hatfield Waste Drain Catchment (trib of Torne/Three Rivers) (GB104028064330)	Poor Ecological Potential	Fail	Good (2027)	Artificial	The designated reach consists of two branches, one rising at Old Cantley and the other near Tunnel Pits Farm. The two arms meet near the A18 at Bolton Grange and flow east to meet the Torne/ Three Rivers at Pilfrey Bridge. The designated watercourse is 36.4km in length and drains a catchment of 120.2km^2.
Site Observations: This watercourse was not visited as part of the Water Environment walkover. **Appendix 11C**: Preliminary Ecological Appraisal Report (ES Volume I - **Application Document Ref. 6.3**) indicates that this is a designated LWS for a rich aquatic, emergent and marginal flora with a surrounding mosaic of neutral grassland and common reed swamp.					
Torne/ Three Rivers from Mother Drain to Trent (GB104028064340)	Moderate Ecological Potential	Fail	Good (2027)	Artificial	This watercourse includes the River Torne, South Engine Drain and Folly Drain. In total, it is

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
					designated from the north-east of Rossington and flows generally north west to meet the River Trent at Keadby. In places the drains move apart and flow parallel to each other. Their combined total length is 50.6km, and they drain a catchment of 85.3km^2.
Site Observations: Torne/ Three Rivers from Mother Drain to Trent was not visited during the Water Environment walkover due to being upstream of the Proposed Development, and so should not be impacted. Three Rivers is a LWS designated for its three parallel canalised watercourses which support a rich aquatic, emergent and marginal flora. Similarly, the River Torne LWS is designated for supporting a rich aquatic, emergent and marginal flora. It is also designated for its surrounding neutral grassland, purple moor grass and rush pasture and marsh.					
Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) (GB70410281)	Moderate Ecological Potential	Fail	Good (2015)	Artificial	The designated reach is 43.8km in length, extending from an offtake from the River Don in the centre of Doncaster to the south west, to the River Trent immediately south-east of the Keadby 1 Power Station.

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
Site Observations: This watercourse was visited between the road crossing at SE 82494 11484 and the lock gates between the canal and River Trent at SE 83444 11423. The canal by its nature is artificial and so very straight. At this point it is a wide waterbody at approximately 30m width. There are four sets of lock gates separating the canal from the River Trent, managed by CRT. The canal appeared to be around 1.5m deep with the water being very clear at the time of the site visit. There was an abundance of submerged, floating and emergent macrophytes, and numerous fish were seen in the channel. The canal is used for navigation and water sports, and the towpath is popular for recreation. There is an existing abstraction point from the canal for Keadby 1 Power Station at SE 82997 11468, and a new abstraction point for Keadby 2 Power Station was being constructed behind a cofferdam during the site visit at SE 82769 11499. The Stainforth and Keadby Corridor LWS is designated for a rich aquatic flora throughout its length. The canal is also designated for its mosaic of associated bankside habitats.					

12.4.19 Within the catchments of the WFD waterbodies outlined in Table 12.8, there are also a number of named watercourses shown on Ordnance Survey mapping, and these are described in Table 12.9 based on the Proposed Development Site visit and walkover details also described in **Appendix 11C:** PEA Report (ES Volume II - **Application Document Ref. 6.3**).

Table 12.9: Other named watercourses in the study area that are not defined WFD waterbodies

Waterbody	Tributary of	Watercourse Description	Site Observations
Sewer Drain	River Trent	This drain flows as two connected parallel channels which are also parallel to the Warping Drain, approximately 30m and 330m to the north of Warping Drain between Keadby windfarm and the River Trent. Further upstream of the windfarm it is known as Old Sewer. Its approximate combined length is 3.5km.	This watercourse was not visited during the site visit as it is upstream of the Proposed Development and will not be impacted.
Keadby Boundary Drain/ Drain D3 as described in **Appendix 11C**: PEA Report (ES Volume II - **Application Document Ref. 6.3**).	Warping Drain	This drain is orientated north south between North Pilfrey Farm to the south (adjacent to Stainforth and Keadby Canal) and north to Warping Drain. Its approximate length is 1.4km.	Field drain approximately 1m wide with spring water depth approximately 20cm deep. The channel was dominated by silt. Banks support semi-improved grassland and dense scrub. Common reed was the dominant plant species within the channel. Connected to the rest of the

Waterbody	Tributary of	Watercourse Description	Site Observations
			drains associated with Keadby Common.
South Moors Drain	Warping Drain	This drain is orientated north south between the Stainforth and Keadby Canal between Ealand Warpings and North Pilfrey Farm to the south, extending north to Bonnyhale Moor Road. It is approximately 1.1km in length.	This watercourse was not visited during the site visit as it is upstream of the Proposed Development and will not be impacted.
North and South Cross Moors Road Drain	Warping Drain	This drain is orientated north south between the Stainforth and Keadby Canal between Ealand Warpings to the south, extending north to Bonnyhale Moor Road. It is approximately 1.2km in length.	This watercourse was not visited during the site visit as it is upstream of the Proposed Development and will not be impacted.
Keadby Common Drain	Unnamed drainage ditch upstream of River Trent	This drain is orientated east-west between the residential properties to the north of Chapel Lane and Glew Drain. It is approximately 565m in length	The drain has been over-deepened, has steep banks, with bare earth in places. Elsewhere the banks are vegetated by rough grasses. The water is less than 0.5m deep, and channel width is less than 2m. The channel supports a limited diversity of aquatic and wetland

Waterbody	Tributary of	Watercourse Description	Site Observations
			plants typical of small drains. There is no shading from trees. The drain and its banks have clearly been affected by regular vegetation clearance works.
Kelsey Drain	Keadby Common Drain	This watercourse is orientated north south between Chapel Lane and Trent Road, adjacent to the site entrance to Keadby 1 Power Station. It is approximately 180m in length.	Over-deepened watercourse with steep banks, which are bare earth in places. Artificially straight watercourse of approximately 2m width. There are deciduous trees around the southern extent of the watercourse which provide a degree of shading.
Pumping Drain	Unnamed drainage ditch upstream of River Trent	This watercourse is orientated north south between Warping Drain and Chapel Lane, immediately north of Kelsey Drain. It is approximately 200m long.	Over-deepened watercourse with steep banks, which are bare earth in places. Artificially straight watercourse of approximately 2m width. The riparian zone to the west has several deciduous trees which provide a degree of shading.
Glew Drain / D1 as described in **Appendix 11C**: PEA Report (ES	Unnamed drainage ditch upstream of River Trent	This drain flows along the northern boundary of Keadby Common between Keadby Boundary Drain and Keadby 1	Field drain which is designated as a LWS. The drain is over-deepened and is subject to periodic dredging. The

Waterbody	Tributary of	Watercourse Description	Site Observations
Volume II - **Application Document Ref. 6.3**)		Power Station. It has a ninety degree change in course to the north-east of the substation and flows north to Warping Drain. It is approximately 1.7km in length.	channel width is approximately 2m. Water depth is variable, but the average is around 50cm. The substrate within the drain is equal part clay to silt. Supports a moderately diverse flora.
Drain D2 as described in **Appendix 11C**: PEA Report (ES Volume II - **Application Document Ref. 6.3**)	Unnamed drainage ditch upstream of River Trent	This drain runs along the southern boundary to Keadby Common adjacent to the laydown area for Keadby 2 Power Station. It is approximately 900m in length.	Field drain approximately 2m wide and 50cm deep at time of spring survey for the PEA. The channel was dominated by silt and the water surface was dominated by algae. Banks support semi-improved grassland and dense scrub. Common reed was dominant in the channel by July, except where overhung by scrub. Connected to other drains associated with Keadby Common.
Drain D4 as described in **Appendix 11C**: PEA Report (ES Volume II - **Application Document Ref. 6.3**)	Unnamed drainage ditch upstream of River Trent	This drain runs through the centre of Keadby Common and is approximately 380m long.	Field drain with water approximately 10cm deep and approximately 1m wide. The channel was dominated by silt. Banks support improved grassland. Common reed, reed

Waterbody	Tributary of	Watercourse Description	Site Observations
			canary-grass and reed sweet-grass are all abundant. Connected to the rest of the drains associated with Keadby Common.
Drain D5 as **Appendix 11C**: PEA Report (ES Volume II - **Application Document Ref. 6.3**)	Unnamed drainage ditch upstream of River Trent	This drain runs along the eastern boundary to Keadby Common adjacent to the existing 400kV National Grid substation.	Field drain with water depth in spring of approximately 10cm. Channel 1m wide. The channel was dominated by silt. Banks support improved grassland. Reed canary-grass dominates the channel Connected to the rest of the drains associated with Keadby Common.
Drain D6 as described in **Appendix 11C**: PEA Report (ES Volume II - **Application Document Ref. 6.3**)	River Trent	This drain runs along the eastern side of the field south of Trent Road. It is therefore within the Proposed Development Site but distant from the land required for construction of the Proposed Development.	Field drain with water depth approximately 50cm and 2m wide. Banks supported rank semi improved grassland and a hedgerow. Common reed present.
Drain D7a, b, c, as described in **Appendix 11C**: PEA Report (ES Volume II - **Application**	Unnamed drainage ditch upstream of River Trent	Three arable field drains which are culverted under the existing access road.	Incised, straight watercourses of approximately 1m width.

Waterbody	Tributary of	Watercourse Description	Site Observations
Document Ref. 6.3)			
Drain parallel to access road from the A18	Unnamed drainage ditch between Hatfield Waste Drain and South Soak Drain	This drain flows from immediately west of Mabey Bridge in a northerly direction to South Soak Drain, alongside the existing access road for Keadby 2 Power Station.	Incised, straight watercourse of approximately 2m width. Beyond the road it is surrounding by arable fields on both sides, with a few trees in the riparian margin towards its northern extent.

12.4.20 In addition to the watercourses described in Table 12.8 and Table 12.9, there are numerous small drains and ditches across the wider 1km study area. These are predominantly related to drainage of agricultural land. In general, they are artificial, straight, embanked watercourses that are likely to be nutrient enriched due to runoff of fertilisers and other farming products. They are generally expected to have minimal biodiversity value with many likely to be ephemeral (i.e. flowing for only part of the year or only after storms), with few geomorphic bedforms (e.g. riffles and pools).

12.4.21 There are five small ponds west of the River Trent in the study area. The largest is south of Boskeydyke Farm (SE 83703 12940) and is approximately 2.0km^2. There are four immediately east of Keadby Boundary Drain, at SE 81311 12482, SE 81199 12003, SE 81373 11953 and SE 81275 12021. These are offline ponds, not obviously connected to other watercourses in the study area. There is also a small pond to the east of the River Trent at SE 84410 12362, but this is not considered further as it is upstream of the Proposed Development and on the opposite bank to the Proposed Development.

River Trent – Tidal Cycle

12.4.22 Preliminary Water Supply and Discharge assessment undertaken by the Applicant for the Proposed Development indicates that the estuary of the River Trent is characterised by a semi-diurnal tide (i.e. a cycle which has two high and two low tides a day). There is approximately 24 hours 50 minutes between two tidal crests (for example, high– low –high–low–high) and so one tidal cycle (that is, high–low–high) has a period of approximately 12 hours 25 minutes. In this regime, the two high tide levels are commonly unequal.

12.4.23 A complete tidal cycle from high tide to low tide to high tide comprises two distinct elements – the flood tide (the incoming tide when water levels are rising) and the ebb tide (the outgoing tide when water levels are falling).

12.4.24 There are two key variations in tides which occur over a 29-day cycle (i.e. spring and neap tides), with two spring and two neap tides occurring over this period. During neap tides, the tidal range is significantly reduced compared with that experienced during spring tides (that is, high tide levels are lower and low tide levels are higher). The maximum spring and neap tides occur approximately 1.5 days after new/ full Moon or first/ last quarter. These two variations have a significant influence on the range of impact on water quality and suspended sediment.

12.4.25 The tides experienced in the River Trent estuary have very pronounced spring and neap tides. In addition, the tidal cycle seen in the River Trent estuary is not perfectly symmetrical (i.e. flood and ebb portions of the cycle are of unequal lengths). This is due to frictional resistance between oncoming and reflected tidal waves within the irregular coastline of the Humber estuary. In the River Trent, the time between ebb slack and flood slack is approximately three hours, while the difference between flood slack and ebb slack is approximately nine hours. This gives rise to a very rapid rise in tide level followed by a slow decline in the tide level. These times are subject to natural variation, particularly due to weather and flow within the River Trent itself.

12.4.26 Adjacent to the operational Keadby 1 Power Station, the typical mean tidal range is 4.7m (i.e. -0.4 mAOD to +4.3 mAOD) with a maximum astronomical tide range of 7.62m (i.e. - 0.81 mAOD to +5.81 mAOD).

12.4.27 The tidal limit of the River Trent is 70km upstream of the Proposed Development area at Cromwell Weir, shortly downstream of Newark-on-Trent.

River Trent - Hydrology

12.4.1 The area draining to the River Trent at Keadby comprises almost the whole of the Trent basin. The River Trent channel is entrained between primary flood defences at Keadby, with land on both sides of the river being very low-lying marsh at approximately 2mAOD. Over the last 170 years, the artificial component of total freshwater flows has increased due to the import of water for public supply from the Severn basin with subsequent discharge to the Trent catchment. At low flows, it is reported that the artificial component can make up half of the total flow (National Rivers Authority (now Environment Agency), 1994).

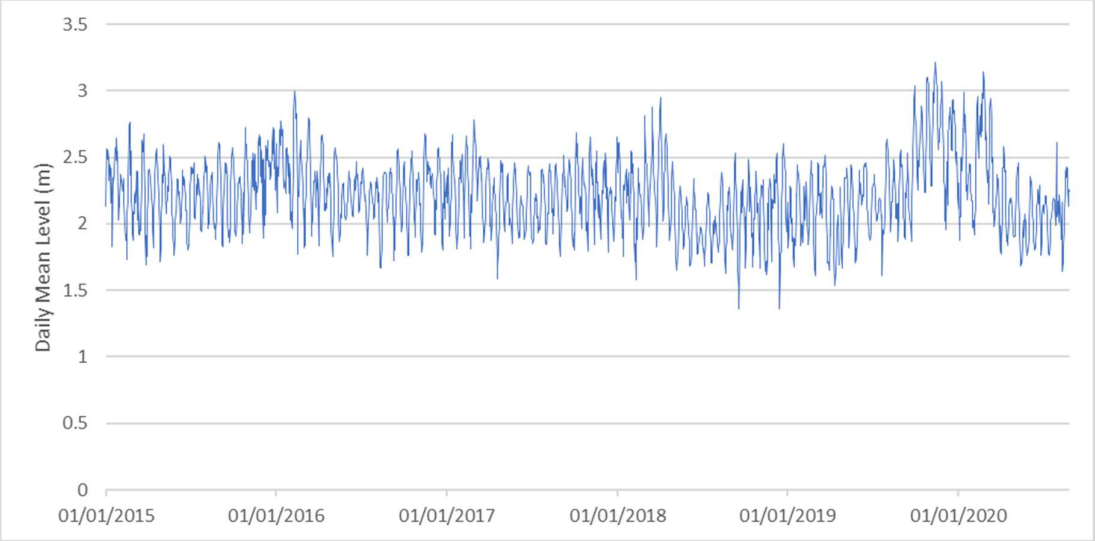
12.4.2 The long-term average mean daily flow from the Trent to the Humber Estuary was 7,590 megalitres per day (Ml/d) for the period 1969-92, mean summer flow (April-September) was 5,290Ml/d and mean winter flow was 9,910Ml/d.

The flow which is exceeded for 95% of the time (Q95) was 2,340Ml/d for the same period (National Rivers Authority (now Environment Agency) 1994).

12.4.3 The Environment Agency has provided mean daily level data for the Keadby gauge at SE 08354 01131. The data for 2015-2020 is shown in Plate 12.2. This indicates that highest levels (and hence flows) in this period have been recorded in the winter and spring of 2019-2020, peaking at a mean daily level of 3.2m on 14/11/19.

12.4.4 The UK Government's river levels website indicates that at the same Keadby gauging station, the typical water level range is 0.61m to 6.60m. The highest level on record was 7.23m recorded on 5/12/2013.

Plate 12.2: Mean Daily Level (m) for the River Trent at the Environment Agency's Keadby gauge.



12.4.5 No other river levels are available for watercourses in the study area on the National River Flow Archive website (CEH, 2020) or the UK Government river levels website. The Environment Agency also provided no further level of flow data for watercourses in the study area.

River Trent – Sedimentology

12.4.6 A review of available sampling analysis for neighbouring Marine Licence applications (MLA), as advocated by the International Maritime Organisation (IMO) sampling guidelines (IMO, 2005), has been undertaken.

12.4.7 The sediment characteristics of The River Trent adjacent to the Proposed Development Site have been considered as part of preliminary water supply and wastewater discharge feasibility assessments for the Proposed Development. Initial findings suggest that the suspended solid concentration

and particle size distribution varies considerably from hour to hour, from season to season, and climatically as a result of tidal conditions, floodwater, degree of saline mixing, turbulence due to river traffic and dredging activities.

12.4.8 The results of particle size analysis undertaken at the Keadby 1 Power Station cooling water intake (John Brown Engineering Ltd, 1996) are shown in Table 12.10 below:

Table 12.10: River Trent Water Particle Size (<10µm)

Particle Size	Minimum Concentration (%)	Maximum Concentration (%)	Mean Concentration (%)
<10 µm	42	90	59

12.4.9 Analysis of the dredged material removed annually from between the Keadby 1 Power Station intake and outfall locations identified the dredged material as silty clay (i.e. 31.3 - 62.5 µm particle size) with a specific gravity of 2.7 (CEFAS, 2017a). Analysis of the dredged material was undertaken in 2017 for trace metals, organotins (tributyltin, dibutyltin) and polyaromatic hydrocarbons (PAH) (CEFAS, 2017b). Trace metal results show slightly elevated levels of determinands cadmium, chromium, nickel, lead and zinc. These determinands were found to be above Cefas Action Level 1[9] however, in the context of the River Trent, they are not unusual (noting that sample results were reported to be 'within the expected range for the River Trent and Humber Estuary and therefore are not a cause for concern' (Cefas/ MMO, 2017).

12.4.10 The results for organotins showed that the levels were below limits of detection. However, the PAH results did show elevated levels for a number of determinands above Cefas Action Level 1. Cefas and the MMO noted that whilst PAH levels above Action Level 1 required further investigation, it was noted that levels had dropped since previous sampling in 2014.

12.4.11 Limited sample analysis of the River Trent at a point approximately 3.8km upstream of the intake was carried out in 1996 and 1997. The results from the two sets of sample analysis identified that the mean particle size varied from

[9] Cefas action levels are non-statutory, but provide a method used to help determine the suitability of material prior to disposal to sea. Whilst it is focused on informing a decision on licensing of disposal activities, Action Levels can also be used to help inform wider considerations of potential environmental (marine) risk. Generally, material at/ below Action Level 1 is suitable for disposal to sea; material at/ above Action Level 2 may not be suitable for disposal to sea without prior treatment.

between 10 µm - 50 µm, indicating the variability of particle size distribution and the large quantity of fines in the sediment bed and wash load.

River Trent - Navigation

12.4.12 A Navigational Risk Assessment (**Appendix 12C** (ES Volume II - **Application Document Ref. 6.3**)) has been prepared to accompany the application for the Proposed Development and describes the navigation baseline for the River Trent and contains the figures referred to in this section.

12.4.13 Automatic Identification System (AIS) data provides information on the average vessel density in the area surrounding the Proposed Development Site. AIS data can represented visually as density grids 'or heat maps'. Publicly available AIS data from the MMO has been obtained for both 2015 and 2017 and is presented as a heat map (Figure 12C-1) and as anonymised vessel transects (Figure 12C-2). In addition, more recent AIS data from 2019 has been procured; this is reported as anonymised vessel points (Figure 12C-7).

12.4.14 The figures show that the Humber Estuary and its approaches contain a far higher vessel density than the River Trent; this is largely attributable to the nature of the Humber Estuary as a major shipping hub.

12.4.15 The Proposed Development Site is within the direct vicinity of Keadby, a port which is owned and operated by PD Ports. PD Ports operate a selection of individual facilities under the Keadby umbrella:

- Keadby (approximately 20m to the south of the Proposed Development Site);
- Grove Wharf/ Groveport (approximately 1.5km to the north-east of the Proposed Development Site); and
- Port of Howden (approximately 16.5km to the north-west of the Proposed Development Site).

12.4.16 RMS Trent Ports operates a number of additional port facilities within the vicinity of the Proposed Development Site:

- Gunness (approximately 700m to the south-east of the Proposed Development Site on the opposite bank of the River Trent);
- Flixborough (approximately 3km to the north-east of the Proposed Development Site); and
- Althorpe Wharf (approximately 1km to the south of the Proposed Development Site).

12.4.17 ABP Humber operates a smaller (single) port facility – Neap House – which is approximately 1.5km to the north east of the Proposed Development Site (and is affiliated to Grove Wharf/ Groveport).

12.4.18 In terms of recreational use, the Proposed Development Site is not within a 'General Boating, 'Cruising' or 'Racing' area; the closest Royal Yacht Association (RYA) boating area ('General Boating') is at the mouth of the River Trent, approximately 11km to the north of the Proposed Development Site).

12.4.19 There are several waterside marinas to the south of the Proposed Development Site, beyond the tidal reaches of the River Trent, at Newark. This includes Kings Marina, Newark Marina and Farndon Marina which provide a range of day, short trip, residential and wintering moorings.

12.4.20 It is understood that commercial fishing activity in the vicinity of the Proposed Development Site is extremely limited owing to the lack of commercially-targeted species and distance from primary fleet fishing ground outside of the Humber Estuary.

Surface Water Quality

12.4.21 The Humber Upper Transitional waterbody, Paupers Drain Catchment, Torne/Three Rivers from Mother Drain to Trent, Hatfield Waste Drain Catchment and Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) are all at Fail Chemical Status under the WFD Cycle 2 classifications (2019).

River Trent Water Quality at Keadby

12.4.22 Preliminary water supply and wastewater discharge assessments summarise water quality collected close to the study area. This is considered further in **Appendix 12B:** Water Framework Directive Assessment (Annex C): Baseline Surface Water Quality Data (ES Volume II - **Application Document Ref. 6.3**) summarises available data on water quality within and close to the study area. The data indicates that the River Trent at Keadby is circum-neutral with high electrical conductivity as would be expected for a transitional water. It is a very turbid river with an average total suspended particulate matter of >300mg/L based on values of 406mg/L, 1,875mg/L and 3,347mg/L during three sampling programmes for this determinand. Based on the data in **Appendix 12B (Annex C)** (ES Volume II - **Application Document Ref. 6.3**), dissolved oxygen (mg/L) falls within the WFD Good classification based on 5th percentile and High classification based on the mean.

12.4.23 Pollutants including Biochemical Oxygen Demand (BOD) and ammonia are present at low concentrations, likely due to the significant dilution provided due to the scale of the River Trent. Nitrate concentrations are high (mean

35mg/L) likely reflecting the agricultural land use of the surrounding catchment, with use of fertilisers which run off to watercourses draining to the River Trent. Certain metals such as copper and zinc are elevated and may exceed WFD EQS. Such metals may be derived from road runoff to watercourses across the catchment, including the Stainforth and Keadby Canal, which is then directed towards the River Trent.

Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby Canal) – Water Quality

12.4.24 Preliminary water supply and wastewater discharge study assessments undertaken CEFAS, 2017 summarise water quality monitoring data for the Stainforth and Keadby Canal undertaken by the Applicant and it's appointed contractor for the construction of Keadby 2Power Station). This is presented in **Appendix 12B (Annex C):** Baseline Surface Water Quality Data (ES Volume II - **Application Document Ref. 6.3**).

12.4.25 The data indicates that pH is weakly alkaline, and the watercourse has moderate electrical conductivity. Turbidity is low, reflecting conditions noted on the site visit where the water was very clear. Nitrate and orthophosphate concentrations are very high as would be expected given the surrounding agricultural land uses. Several metals are elevated (e.g. dissolved copper), which may be driven from runoff from the road and railway crossings noted above.

Keadby Warping Drain – Water Quality

12.4.26 Water quality data has been obtained from the Environment Agency's Water Quality Archive (Environment Agency, 2020, Environment Agency, 2020b) for Keadby Warping Drain. Ten samples were taken between 2016 and 2018 and data is summarised in **Appendix 12B (Annex C):** Baseline Surface Water Quality Data (ES Volume II – **Application Document Ref. 6.3**) which indicates slightly alkaline conditions, with an average pH of 7.9, falling within the WFD High classification based on the ten samples.

12.4.27 A 10th percentile dissolved oxygen saturation of 20.2% falls within Poor classification (<45%). Available data suggests that the waterbody is extremely vulnerable to large fluctuations of dissolved oxygen which may be the result of nutrient rich water with an abundance of macrophytes. Ammonia levels are classified as Good which suggests pollution from organics such as a sewage materials are unlikely to be having a detrimental impact on the waterbody. Nitrate and orthophosphate values are somewhat elevated and indicate potential pressure from the surrounding agricultural land uses through use of fertilisers and other products which may runoff to the watercourse.

Keadby Pumping Station Drain – Water Quality

12.4.28 Water quality data has been obtained from the Environment Agency's Water Quality Archive (Environment Agency, 2020b) for Keadby Pumping Station Drain. Fourteen samples were taken between 2018 and 2020 and data is summarised in **Appendix 12B (Annex C):** Baseline Surface Water Quality Data (ES Volume II - **Application Document Ref. 6.3**). The data indicates the Keadby Pumping Station Drain is very slightly alkaline in nature with an average pH of 7.8 and falls within the WFD High classification based on the 14 samples considered.

12.4.29 A 10th percentile dissolved oxygen saturation of 48.5% falls within Moderate classification, with available data suggesting that the waterbody is vulnerable to large fluctuations of dissolved oxygen and may be the result of nutrient rich water with an abundance of macrophytes.

12.4.30 Ammonia levels are classified as Moderate (<1.1mg/L) which suggests pollution from organics could be having a detrimental impact on the waterbody. However, BOD, falls within the Good WFD classification, suggesting the slightly elevated ammonia levels are not from sewage materials. Nitrate and orthophosphate values are somewhat elevated and potentially indicate pressure from surrounding agricultural land uses through use of fertilisers and other products which may runoff to the watercourse.

Ecology Overview

12.4.31 Details regarding aquatic ecology within the study area are provided in **Chapter 11:** Biodiversity and Nature (ES Volume I - **Application Document Ref. 6.2**). The chapter is supported by **Appendix 11C:** Preliminary Ecological Appraisal, including **Annex 11D:** Descriptions of Relevant Watercourses and Assessment of their Suitability for Riparian Mammals, Fish and Aquatic Invertebrates and **Appendix 11G**: Aquatic Ecology Report (ES Volume II - **Application Document Ref. 6.3**).

12.4.32 Together, these includes details on:

- fish surveys;
- macroinvertebrate surveys;
- macrophyte surveys;
- sites of ecological importance;
- other ecologically designated sites;
- LWS within 1km of the Proposed Development Site; and
- other designations.

12.4.33 This is also supported by **Appendix 11C:** Preliminary Ecological Appraisal, including **Annex 11D:** Descriptions of Relevant Watercourses and Assessment of their Suitability for Riparian Mammals, Fish and Aquatic Invertebrates and **Appendix 11G**: Aquatic Ecology Report (ES Volume II - **Application Document Ref. 6.3**).

Water Resources

12.4.34 The Environment Agency and the Landmark Information Group Envirocheck report (Landmark, 2020) have provided information on water availability, water activity permits (i.e. discharges), water abstractions and past pollution incidents, summarised below.

Water Availability

12.4.35 Keady Power Station is on the boundary of two of the Environment Agency's Catchment Abstraction Management Strategy (CAMS) areas: the Lower Trent & Erewash (LT&E) CAMS; and the Idle & Torne (I&T) CAMS. The LT&E CAMS covers 174km of the River Trent (and tributaries) from its confluence with the River Dove until its confluence with the River Humber at Trent Falls (this includes the section passing the Keadby Power Station). I&T CAMS includes the Stainforth and Keadby Canal and the Torne which join the River Trent at Keadby.

12.4.36 The Environment Agency has undertaken a water resource assessment of the two catchment areas. The approach is illustrated in the CAMS documents (Environment Agency, 2013; SSE Engineering Centre). The assessment indicates that the Environment Agency considers the area around Keadby Power Station (within the LT&E CAMS) as having water available for licensing at all but the lowest flows (i.e. Q95) where it is 'Restricted for Licensing'. This restriction does not necessarily mean that an abstraction licence will not be issued but it is likely that any new abstraction licence would be subject to a Hands Off Flow (HOF) condition at which abstraction is prohibited (Environment Agency, 2013).

12.4.37 With regards to the I&T CAMS assessment, this has identified that there is no water available for abstraction at any flowrate in the vicinity of Keadby Power Station. As both CAMS were published in 2013 and as there are no Environment Agency assessment points close to Keadby Power Station on the River Trent, this may not represent the current situation.

12.4.38 Preliminary Water Supply and Wastewater Discharge Study assessments undertaken to inform the design of the Proposed Development indicate that the Environment Agency has assessed water reliability and expect that the water resources (in the LT&E CAMS) in the region of the Keadby Power Station will be available at least 70% of the time. But from the I&T CAMS the availability is expected to be less than 30%.

12.4.39 The Canal and River Trust's Code of Practice (CRT, 2020) states that applications will be considered for the purchase of untreated water which is surplus to the Trust's navigational requirements. This includes for cooling and/ or heating of waterside developments but would be subject to water availability and with no guarantee on either the quality of water or the continuity of supply. Additionally, where maintenance of the canal is required, abstraction may have to cease for the duration of the works.

12.4.40 Abstractions from the canal taking greater than 20m³ per day of water will also be subject to an abstraction licence from the Environment Agency. This would be applied for, and usually held, by the CRT.

Water Activity Permits

12.4.41 There are 13 active water permits (i.e. formerly discharge consents) within 1km of the Proposed Development. These are listed in Table 12.11 and shown in **Figure 12-1** (ES Volume III - **Application Document Ref. 6.4**).

Table 12.11: Water Activity Permits within the Study Area

Label on Fig 12.1	Licence	NGR	Issued Date	Discharge Type	Receiving Water
Environment Agency Data:					
D1	T/83/21614/O (Woodcarr Avenue Storm Overflow)	SE 83370 11090	22/06/1992	Storm Tank/ combined sewer overflow (CSO) on Sewerage Network (water company)	Three Rivers
D2	WQ/72/137 (Canal Side, Keadby)	SE 83200 11300	21/08/1975	Undefined or Other	Three Rivers
D3	EPRLB3392RP (Keadby Power Station)	SE 82607 11512 and SE 82334 11595	17/05/2019	Sub-station/ Electricity/ Gas/ Air Conditioning Supply	North Soak Drain
D4	3/28/83/0806 (Keadby 400kv substation)	SE 82300 11800	22/01/1968	Undefined or Other	North Soak Drain

Label on Fig 12.1	Licence	NGR	Issued Date	Discharge Type	Receiving Water
D5	WQ/72/1350 (Keadby Sanitary Station)	SE 83100 12100	23/08/1977	Undefined or Other	Warping Drain
D6	T/84/45997/T (Keadby substation)	SE 82340 12160	12/09/2004	Sub-station/ Electricity/ Gas/ Air Conditioning Supply	Keadby Boundary Drain
D7 / D8	T749 (Vazon Swing Bridge House)	SE 82500 11400	12/10/1960	WwTW (not water co) (not STP at a private premises)	South Soak Drain
Landmark Envirocheck Data:					
D9	Am6773 (Keadby Power Station)	SE 83661 12227, SE 82764 11755, SE 83001 11477, SE 82978 11592, SE 83017 11721 and SE 82596 11766	09/10/1995	Sub-station/ Electricity/ Gas/ Air Conditioning Supply, Trade Effluent Discharge – Site Drainage	River Trent, Unnamed Drainage Ditch, Stainforth and Keadby Canal
D10	T/84/45990/R (Gunness STW)	SE 83924 12359	11/08/2004	WwTW/ Sewage Treatment Works (Water Company)	River Trent
D11	WQ/72/1296/1 (Chemical Vessel Services Ltd)	SE 83397 11286	14/07/1977	Sewage Effluent	Groundwater

Label on Fig 12.1	Licence	NGR	Issued Date	Discharge Type	Receiving Water
D12	T83/45559/R (Althorpe Sewage Treatment Works)	SE 83564 11268	24/09/2009	Sewage Discharges – Final/ Treated Effluent	River Trent
D13	T/83/21614/O	SE 83564 11268	22/06/1992	Public Sewage: Storm Sewage Overflow	Three Rivers

12.4.42 The consented discharges are for a range of uses including combined sewer overflows (CSO) on the sewerage network, final/ treated sewage effluent discharges, and discharges from Keadby Power Station including process water and runoff.

Abstractions

12.4.43 Data provided by the Environment Agency and derived from the Envirocheck report indicates that there are 16 licensed water abstractions within the circa 1km study area surrounding the Proposed Development Site, which are presented in Table 12.12 and **Figure 12.1** (ES Volume III - **Application Document Ref. 6.4**).

Table 12.12: Abstraction Licenses within the Study Area

Fig 12.1 Ref	Licence Holder	Abstraction Licence	Use	Source Description	National Grid Reference
Environment Agency:					
A1	Canal and River Trust	03/28/83/0171 (Surface Water - Canal)	Boiler Feed	Production Of Energy - Electricity	SE 8279 1149
A2	R Smith & Son	03/28/83/0245 (Surface Water - River)	Spray Irrigation - Direct	Agriculture - General Agriculture	SE 8190 1040
A3	R Smith & Son	03/28/83/0245 (Surface Water – River)	Spray Irrigation - Direct	Agriculture - General Agriculture	SE 8256 1004
A4	M & J Agriculture	03/28/83/0246 (Surface Water – River)	Spray Irrigation - Direct	Agriculture - General Agriculture	SE 8190 1040

Fig 12.1 Ref	Licence Holder	Abstraction Licence	Use	Source Description	National Grid Reference
A5	Keadby Generation Ltd	03/28/85/0007 (Tidal Waters)	Non-Evaporative Cooling	Production of Energy - Electricity	SE 8354 1164
A6	Keadby Generation Ltd	03/28/85/0007 (Tidal Waters)	Boiler Feed	Production of Energy - Electricity	SE 8354 1164
A7	Canal and River Trust	MD/028/0083/014 (Surface Water – Canal)	Evaporative Cooling	Production of Energy - Mechanical Non Electrical	SE 82790 11478
A8	Siemens Public Limited Company	MD/028/0083/040 (Groundwater)	Dewatering	Industrial, Commercial and Public Services - Other Industrial/ Commercial/ Public Services	SE 82653 11642
A9	Siemens Public Limited Company	MD/028/0083/040 (Groundwater)	Dewatering	Industrial, Commercial and Public Services - Other Industrial/ Commercial/ Public Services	SE 82619 11656
A10	Siemens Public Limited Company	MD/028/0083/040 (Groundwater)	Dewatering	Industrial, Commercial and Public Services - Other Industrial/ Commercial/ Public Services	SE 82420 11710
A11	ER Woodhouse	MD/028/0084/002/R01 (Surface Water – River)	Spray Irrigation - Direct	Agriculture - General Agriculture	SE 82260 12480
A12	RJ & AE Godfrey	MD/028/0084/005 (Surface Water – River)	Spray Irrigation - Direct	Agriculture - General Agriculture	SE 83171 12204

Landmark Envirocheck Data					
Fig 12.1 Ref	**Licence Holder**	**Abstraction Licence**	**Use**	**Source Description**	**National Grid Reference**
A13	Mr W Foster-Thornton	03/28/85/0007 (Surface Water - River)	General agriculture: spray irrigation - direct	Agriculture - General Agriculture	SE 81780 12230
A14	J A Chapman Farms	03/28/83/0094 (Surface Water - River)	General agriculture: spray irrigation - direct	Agriculture - General Agriculture	SE 81800 11400
A15	Holly Hall Farms Ltd	03/28/85/0006/1 (Tidal Waters)	Spray irrigation	Agriculture - General Agriculture	SE 83700 11795
A16	T F Belton Limited	03/28/85/0010 (Tidal Water)	General agriculture: spray irrigation - direct	Agriculture - General Agriculture	SE 83700 11795

12.4.44 Three of the abstractions are from groundwater, and these are all for dewatering relating to the Keadby 2 Power Station (under construction). There are four abstractions from tidal waters, both for use in the operational Keadby 1 Power Station to the west of the River Trent, and for agricultural spray irrigation to the east of the River Trent. There are two abstractions from the Stainforth and Keadby Canal for process water relating to the operational Keadby 1 Power Station and (under construction) Keadby 2 Power Station. The remaining seven licenses are from rivers and are for agricultural use (direct spray irrigation).

12.4.45 NLC has confirmed that there are no records of any private water supplies in the study area.

Water Pollution Incidents

12.4.46 In response to the submitted data request, the Environment Agency has stated that there have been no Category 3 or above pollution incidents in the area of interest within the last 5 years.

Flood Risk

12.4.47 **Appendix 12A:** Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**) provides information relating to existing flood risk in the study area from all sources.

12.4.48 The Environment Agency's 'Flood Map for Planning' (Environment Agency, 2020c) identifies areas subject to fluvial/ tidal flood risk. The Flood Zone definitions for the flood zones used on the Flood Map for Planning, are defined in Table 12.13 below. These have been illustrated on **Figure 12-3**: Flood Zones (ES Volume III, **Document Ref. 6.4**) and should be referred to throughout.

Table 12.13: Flood Zone Definitions (source Table 1 of the PPG Ref 12-4)

Flood Zone	Definition	Probability of Flooding
Flood Zone 1	Land that has a low probability of flooding (less than 1 in 1,000 annual probability of river or sea flooding (<0.1%))	Low
Flood Zone 2	Land that has a medium probability of flooding (between 1 in 100 and 1 in 1,000 annual probability of river flooding (0.1-1%), or between 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.1-0.5%)	Medium
Flood Zone 3a	Land that has a high probability of flooding (1 in 100 year or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%)	High
Flood Zone 3b (Functional Floodplain)	Land where water has to flow or be stored in times of flood based on flood modelling of a 5% AEP event (1 in 20 chance of flooding in any one year) or greater, or land purposely designed to be flooded in an extreme flood event (0.1% AEP).	Very High

Tidal Sources

12.4.49 The River Trent is considered tidal from the Humber Estuary to Cromwell Lock, with the normal tidal limit approximately 70km upstream of the Proposed Development Site at SK 80932 61242. The Environment Agency's 'Flood Map for Planning' (Environment Agency, 2020c) identifies that the majority of the Proposed Development Site and surrounding environs are

located within Flood Zone 3, with the exception of a small section of the Proposed Development Site within the New Permanent Access from A18, which is in Flood Zone 2. Flood Zone 3 is land assessed as having a 1 in 200 or greater annual probability of flooding from the sea (>0.5% Annual Exceedance Probability or AEP). The River Trent is tidal adjacent to the site and tidal food risk (flooding from the sea) is the dominant source of flooding. The North Lincolnshire Strategic Flood Risk Assessment (SFRA) (North Lincolnshire Council, 2011) defines the Proposed Development Site as in the Tidal Flood Zone 3a. It is not defined as in Zone 3b; land where water has to flow or be stored in times of flood, as the Proposed Development Site does not act as a functional floodplain as it benefits from the existing Environment Agency maintained flood defences (embankments) along the River Trent which prevent natural flooding from occurring.

Tidal Flood Defences

12.4.50 In accordance with the NPPF (MHCLG, 2019), the requirements are to ensure any proposed developments are built to withstand tidal flooding up to a 0.5% AEP (1 in 200 chance) event taking into account the potential impacts of climate change.

12.4.51 As noted in paragraph 12.4.49, there are existing tidal flood defences located approximately adjacent along the banks of the River Trent, and specifically, within the Water Connection Corridor for the Proposed Development Site (Environment Agency, 2021). The Environment Agency Asset Management Dataset demonstrates that the tidal defences are 6.2m to 6.3m AOD and have been built to provide a 1 in 200-year level of protection. According to the additional information provided by the Environment Agency, the tidal defences protecting the area around the Proposed Development Site consist of concrete floodwalls and are in 'poor' to 'fair' condition' - further details are provided in **Appendix 12A:** Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**). The Environment Agency inspect these defences routinely to ensure potential defects are identified. The residual risk of flooding in the event of a defence breach scenario has specifically been considered in relation to the Proposed Development Site and the results presented in **Appendix 12A:** Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**). Section 12.6 summarises the breach scenario results).

Tidal Flooding – Summary

12.4.52 The Proposed Development Site is at a 'low' risk of flooding from tidal sources with the defences in place and the available flood and defence levels suggest there would not be overtopping of the defences during events that exceed a 0.5% AEP (1 in 200 year chance) of flooding. If the defences were to fail and breach during the 0.5% AEP event, the hazard to the Proposed Development Site would be 'high' as flood waters would enter the area. However, the

probability of a breach occurring is 'low', meaning that the residual risk remains 'low'.

12.4.53 During a future scenario resulting from climate change up to the year 2068, the Proposed Development Site is potentially at a 'high' residual risk of flooding as a result of overtopping during events that exceed a 0.5% AEP (1 in 200 chance) of flooding on the River Trent where defences are 6.2 to 6.3m AOD. This assumes there is no future raising of the defences which is considered a highly conservative assumption[10].

12.4.54 The Proposed Development Site is at a 'low' residual risk of tidal flooding originating from the North and South Soak Drains where defences are 1.3m AOD.

Fluvial Flooding

12.4.55 The Flood Map for Planning (Environment Agency, 2020c) illustrates that the Proposed Development Site is wholly located within Flood Zone 3 (high risk) defined as land having a >1% AEP (greater than a 1 in 100 chance in any year) of river flooding. However, this map does not differentiate between the tidal/ fluvial sources of risk and the tidal defences are not taken into account.

12.4.56 Data provided by the Environment Agency on fluvial flooding is provided in **Annex A** of **Appendix 12A:** Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**) (Environment Agency, 2020c).

12.4.57 Based on the information provided by the Environment Agency, it has been determined that the Proposed Development Site is at a 'low' risk of flooding from fluvial sources with the defences in place or resulting from overtopping of the defences during events that exceed a 0.5% AEP (1 in 200 chance) and 0.1% AEP (1 in 1000 chance). There is a residual risk associated with breach of the defences on the River Trent, however, as fluvial water levels are lower than tidal water levels the assessed tidal risk is the worst-case with regards to overtopping and breach on the Trent as previously described.

Groundwater Flood Risk

12.4.58 Groundwater flooding can occur when groundwater levels rise above ground surface levels. The underlying geology has a major influence on where this

[10] The risk of overtopping in the future and as a result of climate change driven sea level rise assumes that in the intervening period up to 2068, no raising of the Trent tidal defences occurs. This is a highly conservative assumption and given the areas of land and property at risk across the wider area, it is reasonable to assume that future defence raising, and upgrades may continue to protect the Proposed Development Site, mitigating the overtopping risk.

type of flooding takes place; it is most likely to occur in low-lying areas underlain by permeable rocks (aquifers).

12.4.59 Historical data indicates that the Proposed Development Site is not at risk from reservoir flooding and groundwater flooding based on the geological setting of the wider area encompassed by Keadby 1 and Keadby 2 Power Stations (Mott MacDonald, 1991). Based on the previous assessment undertaken as part of the Keadby 2 Power Station ES (ERM, 2016), groundwater flooding is understood to be effectively managed via the extensive drainage system serving Keadby 1 and Keadby 2 Power Stations.

12.4.60 The 'Areas Susceptible to Groundwater Flooding' (AStGWF) dataset provided by the Environment Agency to inform the NLC SFRA can be used to identify areas where geological conditions could enable groundwater flooding to occur and where groundwater may come close to the ground surface. This information is shown as a proportion of 1km grid squares in which a percentage is given for what proportion of the 1 km^2 where there is potential for groundwater emergence. The data does not show where flooding is likely to occur, but instead is appropriate for reference at a strategic level to indicate areas for further investigation.

12.4.61 The areas around the Proposed Development Site are artificially drained by various land drains and pumping stations, which help to maintain the groundwater level. These are assumed to remain operational through the lifetime of the Proposed Development, contributing to a low risk of groundwater emergence at the Proposed Development Site.

12.4.62 In addition, a significant proportion of the Proposed Development Site is covered in impermeable hardstanding surface, reducing natural infiltration potential as part of the Proposed Development. As a result, due to hardstanding ground intercepting groundwater and preventing it from reaching the surface, the likelihood of localised groundwater reaching the surface and causing flooding is reduced.

12.4.63 Based on the information provided in **Appendix 12A:** Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**), the Proposed Development Site is considered to be at low risk of flooding from groundwater sources.

Overland Flow of Rainfall Runoff

12.4.64 Overland flow results from rainfall that fails to infiltrate the surface and travels over the ground surface; this is exacerbated where the permeability of the ground is low due to the soil (e.g. clayey soils) and geology or urban development with more impermeable surfaces.

12.4.65 The Environment Agency 'Risk of Flooding from Surface Water' maps (Environment Agency, 2020d) indicate areas at risk from surface water flooding when rainwater does not drain away through the normal drainage

systems or soak into the ground, but instead lies on or flows over the ground. The mapping indicates that the Proposed Development Site is generally not at risk from surface water flooding, classifying the majority of the land to be at 'very low' risk of flooding from surface water. The Environment Agency define 'very low risk' as an area that has a less than a 1 in 1000 (0.1%) probability of flooding in any given year. Mapping shows that there are isolated areas at low and medium risk along existing roads and paths on the Proposed Development Site, and one small area of high risk along East Road within the existing (operational) Keadby 1 Power Station site.

Existing Drainage Infrastructure – Flood Risk

12.4.66 Extensive site drainage systems exists at the Proposed Development Site within Keadby 1 Power Station and Keadby 2 Power Station area. Information supplied by the Environment Agency confirms that the Keadby 2 Power Station drainage system compromises three subsystems:

- surface water system;
- oily-waste system; and
- condensate polishing plant wastewater system.

12.4.67 Construction of these drainage systems as part of Keadby 2 Power Station is currently ongoing.

12.4.68 Further data is provided in **Appendix 12A**: Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**).

12.4.69 Based on available data presented in **Appendix 12A**: Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**), the risk to the Proposed Development Site from overland flow of surface water generated adjacent to, or from waterbodies located within, is considered to be 'low' to 'very low'.

Artificial Waterbodies – Flood Risk

12.4.70 The Proposed Development Site is not considered at risk from reservoir flooding (Environment Agency, 2020d). The Stainforth and Keadby Canal is directly adjacent to the Proposed Development Site, but given the flat, shallow gradients and that it drains into the River Trent by a sluice, the risk of flooding is also considered likely to be low from this source.

12.4.71 If any overtopping of the canal were to occur, this would drain into the North and South Soak drains located at a lower elevation on either side of the canal and drain away. However, the canal levels are monitored and maintained by the Canal & River Trust. As a result, overtopping is unlikely and so the site is at low risk of flooding from the canal.

12.4.72 The risk of flooding to the Proposed Development Site from all artificial waterbodies is therefore considered to be low.

Future Baseline

Construction (2022)

12.4.73 The future baseline has been determined qualitatively by considering the likelihood of changes in the attributes that are considered when deciding the importance of waterbodies in the study area.

12.4.74 Generally, there is an improving trend in water quality and the environmental health of waterways in the UK since the commencement of significant investment in sewage treatment in the 1990s, the adoption of the WFD from 2003, and the application of ever more stringent planning policies.

12.4.75 It is reasonable to assume that improvements in the biological quality of the River Trent may occur over time due to the WFD, which requires all waterbodies to achieve 'good ecological status' by 2027 (which is defined with reference to quantifiable parameters relating to ecological, hydromorphological, physico-chemical and chemical condition) and to experience no deterioration in status. Good ecological status by 2027 is therefore to be assumed.

12.4.76 Under the WFD, relevant waterbodies have the following future objectives:

- the Humber Upper waterbody has an objective of achieving Moderate Ecological Potential by 2015;
- Paupers Drain Catchment has an objective of Moderate Ecological Potential by 2015;
- North Soak Drain Catchment has a target of Moderate Ecological Potential by 2015;
- Hatfield Waste Drain Catchment has a target of Good Ecological Potential by 2027;
- Torne/ Three Rivers has a target of Good Ecological Potential by 2027;
- Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) has a target of Good Ecological Potential by 2015;
- The Lower Trent Erewash - Secondary Combined groundwater body has an objective of Good by 2027; and
- The Idle Torne - Secondary Mudrocks groundwater body has an objective of Good by 2015.

12.4.77 Where waterbodies are currently at this overall status, there must be no deterioration from this, and there are also objectives for individual elements

of the WFD classification that are to be achieved (e.g. biological quality elements, physico-chemical parameters). It is assumed that these objectives would be achieved.

12.4.78 There are additional significant challenges such as adapting to a changing climate (i.e. in general drier summers, wetter winters, and an increased frequency of significant storms are forecast for the UK) and the pressures of population/ economic growth that could have a retarding effect on the water environment if it is not managed carefully through the design of projects, mitigation, and the maintenance of those mitigating solutions. However, again it is difficult to forecast these changes with any certainty.

12.4.79 The assessment of the importance of waterbodies takes into account a large range of attributes and does not focus solely on water quality. This assessment takes into account other attributes such as scale, nature conservation designations, fish habitat type, the presence of protected species, social and economic uses. For some of these attributes, it is unlikely that they will change in the future (e.g. waterbody size, whether a river is likely to support cyprinid or salmonid fish populations, the presence of a designated nature conservation site or bathing water).

Operation (2026)

12.4.80 The same future baseline conditions expected during construction will apply to the operation phase (i.e. all WFD targets are met, improving water quality, no change in the presence and status of designated sites).

Importance of Receptors

12.4.81 The importance of the local water resource receptors within the study area is described in Table 12.14. Importance is based on the criteria outlined above in Table 12.4.

Table 12.14: Importance of Identified Receptors

Watercourse	Importance Descriptions
River Trent (Humber Upper WFD waterbody)	The River Trent is considered a **Very High importance** receptor for **water quality** on the basis of its scale, being WFD designated and supporting and range of internationally, nationally and locally protected nature conservation sites (e.g. Humber Estuary SSSI, Humber Estuary SAC and Humber Estuary Ramsar). It is also important for the dilution and dispersion of treated/ untreated sewerage/ trade/ process wastewater, which at the same time influence water quality and present a risk of chemical spillages.

Watercourse	Importance Descriptions
	The **morphology** is considered **Low importance** due to the heavily modified nature of the channel, particularly along the banks. The channel is considered **High importance** for **navigation**.
Paupers Drain Catchment (trib of Trent) WFD waterbody	Paupers Drain (including Warping Drain) is considered a **High importance** receptor for **water quality** on the basis of being WFD designated and an estimated Q95 flow rate of <1 m^3/s. It also supports locally protected nature conservation sites (LWS). The **morphology** of the waterbody is considered **Low importance** as an artificial, heavily modified waterbody, with flow controlled by a tidal lock.
North Soak Drain Catchment (trib of Torne/Three Rivers) WFD waterbody	North Soak Drain Catchment (including South Soak Drain) is considered a **High importance** receptor for **water quality** on the basis of being WFD designated and an estimated Q95 flow rate of <1 m^3/s. It also supports locally protected nature conservation sites (LWS). The **morphology** of the waterbody is considered **Low importance** as an artificial, heavily modified waterbody.
Hatfield Waste Drain Catchment (trib of Torne/Three Rivers) WFD waterbody (including North Engine Drain)	Hatfield Waste Drain is considered a **High importance** receptor for **water quality** on the basis of being WFD designated and an estimated Q95 flow rate of <1m^3/s. It also supports locally protected nature conservation sites (LWS). The **morphology** of the waterbody is considered **Low importance** as an artificial, heavily modified waterbody.
Torne/Three Rivers from Mother Drain to Trent WFD waterbody	Torne/Three Rivers is considered a **High importance** receptor for **water quality** on the basis of being WFD designated and an estimated Q95 flow rate of <1m^3/s. It also supports locally protected nature conservation sites (LWS). The **morphology** of the waterbody is considered **Low importance** as an artificial, heavily modified waterbody.
Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) WFD waterbody	Sheffield and South Yorkshire Navigation is considered a **High importance** receptor for **water quality** on the basis of its scale, being WFD designated and supporting a locally protected nature conservation site. It is also important for water supply with current abstractions to Keadby 1 Power Station, and another under construction to Keadby 2 Power Station.

Watercourse	Importance Descriptions
	The **morphology** is considered **Low importance** due to being an artificial channel. The watercourse is considered **High importance** for **navigation**.
Sewer Drain	Sewer Drain is considered a **Medium importance** receptor for **water quality** on the basis of not having a WFD classification but is estimated to have a Q95 >0.001m^3/s. It is likely to be suffering from nutrient enrichment given the surrounding agricultural land use. It is considered a **Low importance** receptor for **morphology** on the basis of being an artificial watercourse (i.e. straight ditch with steep banks) with deficiency of bedforms.
Keadby Boundary Drain / Drain D3	Keadby Boundary Drain is considered a **Medium importance** receptor for **water quality** on the basis of not having a WFD classification but is estimated to have a Q95 >0.001m^3/s. It is likely to be suffering from nutrient enrichment given the surrounding agricultural land use. It is considered a **Low importance** receptor for **morphology** on the basis of being an artificial watercourse (i.e. straight ditch with steep banks) with deficiency of bedforms.
South Moors Drain	South Moors Drain is considered a **Medium importance** receptor for **water quality** on the basis of not having a WFD classification but is estimated to have a Q95 >0.001m^3/s. It is likely to be suffering from nutrient enrichment given the surrounding agricultural land use. It is considered a **Low importance** receptor for **morphology** on the basis of being an artificial watercourse (i.e. straight ditch with steep banks) with deficiency of bedforms.
North and South Cross Moors Road Drain	North and South Cross Moors Road Drain is considered a **Medium importance** receptor for **water quality** on the basis of not having a WFD classification but is estimated to have a Q95 >0.001m^3/s. It is likely to be suffering from nutrient enrichment given the surrounding agricultural land use. It is considered a **Low importance** receptor for **morphology** on the basis of being an artificial watercourse (i.e. straight ditch with steep banks) with deficiency of bedforms.

Watercourse	Importance Descriptions
Keadby Common Drain	Keadby Common Drain is considered a **Medium importance** receptor for **water quality** on the basis of not having a WFD classification but is estimated to have a Q95 >0.001m^3/s. It is likely to be suffering from nutrient enrichment given the surrounding agricultural land use. It is considered a **Low importance** receptor for **morphology** on the basis of being an artificial watercourse (i.e. straight ditch with steep banks) with deficiency of bedforms.
Kelsey Drain	Kelsey Drain is considered a **Low importance** receptor for **water quality** on the basis of not having a WFD classification and an estimated Q95 <0.001 m^3/s. It is likely to be suffering from nutrient enrichment given the surrounding agricultural land use. The drain is considered a **Low importance** receptors for **morphology** on the basis of being an artificial watercourse (i.e. straight ditch with steep banks) with deficiency of bedforms.
Pumping Drain	Pumping Drain is considered a **Medium importance** receptor for **water quality** on the basis of not having a WFD classification but is estimated to have a Q95 >0.001m^3/s. It is likely to be suffering from nutrient enrichment given the surrounding agricultural land use. It is considered a **Low importance** receptor for **morphology** on the basis of being an artificial watercourse (i.e. straight ditch with steep banks) with deficiency of bedforms.
Drain D1/ Drain D2 /Drain D6	Drain D1, Drain D2 and Drain D6 are considered **Medium importance** receptors for **water quality** on the basis of not having a WFD classification but being estimated to have a Q95 >0.001m^3/s. These drains are likely to be suffering from nutrient enrichment given the surrounding agricultural land use. These drains are considered **Low importance** receptors for **morphology** on the basis of being artificial watercourses (i.e. straight ditches with steep banks) with deficiency of bedforms.
Drain D4/ Drain 5/ Drain D7 a and b	Drain D4, Drain 5 and Drains 7a, b, and c are considered **Low importance** receptors for **water quality** on the basis of not having a WFD classification and an estimated Q95 <0.001 m^3/s. These drains are

Watercourse	Importance Descriptions
	likely to be suffering from nutrient enrichment given the surrounding agricultural land use. The drains are considered **Low importance** receptors for **morphology** on the basis of being artificial watercourses (i.e. straight ditches with steep banks) with deficiency of bedforms.
Other unnamed drains	Other unnamed drains are small in scale and artificially straight and incised. They are not WFD designated and considered likely ephemeral, and so are considered **Low importance** receptors for **water quality**, and **Low importance** receptors for **morphology**.
Small Ponds near Boskeydyke Farm and Keadby Common	**Low importance** for **water quality and morphology** as they are not designated and have minimal social or economic use.

Floodplain Sensitivity for Impact Assessment

12.4.82 For the construction assessment, the key receptor in terms of all forms of flood risk relates to construction workers present at the Proposed Development Site, who are considered to be of Very High sensitivity.

12.4.83 For the operational assessment, the importance is based on understanding of the receptors present within areas at risk of flooding (i.e. the Proposed Development and other infrastructure) and the existing risk of flooding from all sources. This can include both operatives at the Proposed Development Site, or members of the public (where relevant) who are also classified as being of Very High sensitivity.

12.4.84 As noted previously, the Proposed Development Site is potentially at a 'high' residual risk of flooding as a result of overtopping during events that exceed a 0.5% AEP (1 in 200 chance) of flooding, or in the event that the defences were to breach during either the 0.5% or 0.1% AEP (1 in 1000 chance) events. Given this, the sensitivity of the floodplain for impact assessment purposes is considered 'Very High'.

12.4.85 In terms of fluvial flood risk, the entire Proposed Development Site is within Flood Zone 3. However, the flood defences are sufficient to prevent overtopping during events with a 0.5% annual probability, the overall sensitivity to fluvial flooding is therefore considered 'Low'.

12.4.86 The criteria described in Table 12.4 do not provide examples of sensitivity for other forms of flood risk and so the sensitivity is based on the existing baseline risk described earlier in this chapter. For the purpose of this impact assessment the sensitivity of non-fluvial forms of flood risk is as follows:

- flooding from surface water – mainly Very Low to Low Sensitivity, with localised areas of Medium and High Sensitivity ;
- flooding from artificial sources – Low Sensitivity;
- flooding from groundwater – Low Sensitivity; and
- flooding from existing drainage infrastructure – Low to Very Low Sensitivity.

12.5 Development Design and Impact Avoidance

12.5.1 Measures to deliver compliance with industry good practice and environmental protection legislation during both construction and operation (e.g. in relation to prevention of surface and groundwater pollution) can be assumed in accordance with NPS EN-1 paragraph 4.10.3. It must be assumed that all measures available to regulators to secure such requirements will be properly applied and enforced by the relevant regulators. Most of the measures required are already committed and are set out in the Framework Construction Environmental Management Plan (CEMP) which accompanies the DCO Application (**Application Document Ref. No. 7.1**).

12.5.2 The following impact avoidance measures have either been incorporated into the design (i.e. embedded mitigation) or are standard construction or operational practices (i.e. essential mitigation). These measures have, therefore, been taken into account during the impact assessment and will be secured within the draft DCO (**Application Document Ref. 2.1**). The construction mitigation measures will be secured through the Framework CEMP (**Application Document Ref. 7.1**) and the operational measures through the Commitments Register (**Appendix 20A** (ES Volume II, **Application Document Ref. 6.3**)).

Construction

Surface Water

12.5.3 During construction, water pollution may occur directly from spillages of polluting substances into waterbodies, or indirectly by being conveyed in runoff from hardstanding, other sealed surfaces or from construction machinery. Fine sediment may also be disturbed in waterbodies directly or also wash off working areas and hardstanding (including approach roads) into waterbodies indirectly via existing drainage systems or overland. This sediment may potentially contain contaminants that could be harmful to the

aquatic environment. Due to past industrial activity, this sediment may not be inert and may potentially contain contamination that could be harmful to the aquatic environment. However, potential impacts to the water environment during the construction phase would tend to be temporary and short term.

12.5.4 Prior to construction starting on-site, a Final CEMP will be prepared by the Contractor(s) and would outline the measures necessary to avoid, prevent and reduce adverse effects where possible on the local surface water and groundwater environment. This will be detailed within a Water Management Plan (WMP) that will form a technical appendix to the Final CEMP. A Framework CEMP accompanies the DCO Application (**Application Document Ref. No. 7.1**).

12.5.5 The final CEMP will be reviewed, revised and updated as the project progresses towards construction to ensure all relevant potential impacts and residual effects are considered and addressed as far as reasonably practicable, in keeping with available good practice at that point in time. The principles of the mitigation measures set out below are the minimum standards that the Contractor will implement. However, it is acknowledged that for some issues, there are multiple ways in which they may be addressed. In addition, the methods of dealing with pollutant risk will need to be continually reviewed on-site and adapted as construction works progress in response to different types of work, weather conditions, and locations of work.

12.5.6 The final CEMP will be supported by a WMP that would be included as a technical appendix. The WMP will provide greater detail regarding the mitigation to be implemented to protect the water environment from adverse effects during construction.

12.5.7 The potential for adverse effects would be avoided, minimised and reduced by the adoption of the general mitigation measures which are outlined in the following sections, and which will be described in the WMP in the final CEMP.

Good Practice Guidance

12.5.8 The following relevant Guidance for Pollution Prevention (GPP) have been released to date on the NetRegs website (Northern Ireland Environment Agency and Scottish Environment Protection Agency, 2020; NetRegs, 2020). While these are not regulatory guidance in England where the UK government website outlines regulatory requirements, it remains a useful resource for best practice:

- GPP 1: Understanding your environmental responsibilities – good environmental practices (October, 2020);
- GPP 2: Above ground oil storage tanks (January, 2018);

- GPP 3: Use and design of oil separators in surface water drainage systems;
- GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul sewer (November, 2017);
- GPP 5: Works and maintenance in or near water (February, 2018);
- GPP 8: Safe storage and disposal of used oils (July, 2017);
- GPP 13: Vehicle washing and cleaning (April, 2017);
- GPP 19: Vehicles: Service and Repair (June, 2017);
- GPP 20: Dewatering underground ducts and chambers (January, 2018);
- GPP 21: Pollution Incident Response Planning (July, 2017);
- GPP22: Dealing with spills (October, 2018); and
- GPP26: Safe storage – drums and intermediate bulk containers (February, 2019).

12.5.9 Where new GPP are yet to be published, previous Environment Agency Pollution Prevention Guidance (PPG) documents (Environment Agency, 2001) continue to provide useful advice on the management of construction to avoid, minimise and reduce environmental impacts, although they should not be relied upon to provide accurate details of the current legal and regulatory requirements and processes. Construction phase operations would be carried out in accordance with guidance contained within the following PPG (also available at NetRegs), including:

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

12.5.10 Additional good practice guidance for mitigation to protect the water environment can be found in a range of CIRIA documents and British Standards Institute documents described in Section 12.3. A full list is provided in the Framework CEMP which accompanies the DCO Application (**Application Document Ref. No. 7.1**).

Management of Construction Site Runoff

12.5.11 The measures to manage fine sediment in surface water runoff as a result of construction activities are included in the Framework CEMP (**Application Document Ref. 7.1**) and will be developed with further detail in the WMP (to accompany the final CEMP). There are a wide range of measures that can be adopted by the Contractor(s) to reduce the risk of excessive fine sediment in runoff (timing of works, minimising earthworks and seeding or covering them),

to intercept runoff to prevent uncontrolled runoff from the Proposed Development Site (e.g. by using cut off drains, fabric silt fences, bunds and straw bales, designated areas for cleaning plant and equipment, wheel washes and road sweepers), and to treat runoff to remove excessive levels of fine sediment (e.g. settlement lagoons, sumps, spraying on to land or even proprietary measures such as lamella clarifiers). Other measures to protect waterbodies from fine sediment runoff include storage of topsoil/ subsoil a minimum of 20m from watercourses on flat lying land (and further where any ground is sloping). It will be for the Contractor(s) to continually monitor the need for measures depending on the nature of the works being undertaken the weather conditions, and the performance of sustainable drainage systems installed.

Management of Construction Spillage Risk

12.5.12 Measures will be implemented to manage the risk of accidental spillages and potential conveyance to nearby waterbodies via surface runoff or land drains. The measures relating to the control of spillages and leaks are summarised in the Framework CEMP (**Application Document Ref. 7.1**) and will be included in the WMP in the final CEMP and adopted during the construction works. Measures will be in accordance with prevailing pollution prevention legislation and following best practice guidance summarised earlier. They will include details of how fuel and other chemicals (including cement) will be stored, used on site, and equipment and plant cleaned, as well as how leaks and spillages will be prevented or remediated if needed. This will also include the implementation of a Pollution Prevention Plan and an Emergency Response Plan.

12.5.13 In addition, site welfare facilities will be appropriately managed, and all foul waste disposed of either to the existing Keadby 2 Power Station foul connection, or for the laydown areas south of the Stainforth and Keadby Canal, via a licensed waste contractor to a suitably permitted facility.

Use of Cofferdam at the Abstraction Point

12.5.14 As described in **Chapter 5**: Construction Management and Programme (ES Volume I - **Application Document Ref. 6.2**), the Proposed Development will require use of a cofferdam in close proximity to the chosen intake structure which may either be the preferred intake structure in the Stainforth and Keadby Canal or in the River Trent. Use of a cofferdam is necessary in order to create a dry working environment which is safe for contractors to operate within. Assumptions in respect of either cofferdam are explained in **Chapter 5**: Construction Management and Programme (ES Volume I – **Application Document Ref. 6.2**) and in Section 12.3 of this chapter.

12.5.15 Installation of any cofferdam in the Stainforth and Keadby Canal would require permission from the Environment Agency and CRT. Any cofferdam within the

River Trent would require a Marine Licence from the MMO; a draft 'Deemed' Marine Licence has been subject to MMO review and is provided with the Draft Development Consent Order (**Application Document Ref. 2.1**). Maintaining a dry working area for any in-channel working using a cofferdam will reduce the overall channel disturbance and potential for mobilising fine sediment (and any contamination) into the water column and estuary /canal.

12.5.16 Any works would be undertaken in compliance with the Eels (England and Wales) Regulations 2009 (HMSO, 2009), which may require installation of an eel screen. A fish rescue would be required from the cofferdam before pumping out of water. All works would be undertaken in accordance with a Fish Management Plan, as described in **Chapter 11**: Biodiversity and Nature Conservation (ES Volume I - **Application Document Ref. 6.2**), secured by the final CEMP.

12.5.17 Any cofferdam would be designed to minimise changes to the estuary or canal bed and bank erosion and toe scour by extending the minimum distance required into the channel. Silt curtains would be used to minimise impacts on water quality. During higher flow events, there is potential for increased scour if the river abstraction option was taken forward due to the constriction of the channel, most likely along the front of the cofferdam, which will be minimised using scour protection rock bags, where necessary. Given the minimal flow in the Stainforth & Keadby Canal, scour risk here is not deemed to require additional protection.

12.5.18 Dewatering within the cofferdam area will be undertaken once any fine sediment has settled out such that it is consistent with the turbidity of the waterbody (River Trent or Stainforth & Keadby Canal) and following any necessary fish rescue. The rate and location of the discharge will be controlled and carefully chosen to avoid further erosion of any nearby soft sediments.

12.5.19 Whilst in-situ, the cofferdam will be regularly inspected and maintenance undertaken, where required, and any water entering the cofferdam area via seepage will be disposed of appropriately (i.e. by pumping back into the waterbody).

Water Connection Corridors

12.5.20 Measures to reduce impacts and potential adverse effects within the Water Connection Corridors would include:

- implementation of a temporary site drainage system;
- completing a pre-works survey on affected land drains to record waterbody form and condition prior to works commencing;

- any required pump intakes would be appropriately screened to prevent fish being drawn into the pipe/ pump (noting that fish are unlikely to be present in land drains);
- no plant would track through any channel where works are to be undertaken but all work would be undertaken from the banks;
- crossings would be perpendicular to the channel where reasonably practicable; and
- measures to control effects relating to bed substrate would also be developed including careful storage of sediment layers to enable typical pre-construction habitats and hydromorphological processes to quickly re-establish following the works.

12.5.21 In addition to cooling water connections, a connection would also be made within the Proposed PCC Site to provide a towns water connection including works to the existing towns water pipelines and connections to fire and raw water storage tank (refer to **Application Document Ref. 4.10**).

Water Discharge Corridors

12.5.22 It is proposed to re-use existing assets including the outfall and pipework for Keadby 1 Power Station for the discharge of cooling tower blowdown and treated effluent to the River Trent. A Water Discharge Corridor is included in the Proposed Development Site comprising the easement of the existing cooling water outfall corridor north east from Keadby 1 Power Station, connecting with the River Trent. Interconnecting pipework would extend from Proposed PCC Site to connect to this infrastructure.

12.5.23 As part of refurbishment and/ or replacement works within the Water Discharge Corridor, various ancillary works may be required. It is not envisaged that upgrades to the existing Keadby 1 Power Station easement pipework will be necessary, however, if minor upgrades are required, trenchless excavation methods ('sliplining') would be applied to the existing pipeline. There will be no open cut pipeline replacement along the existing pipeline easement.

12.5.24 It is anticipated that it will be possible to re-use the existing outfall and that any maintenance activities are likely to be minor and limited to inspection and hand-based maintenance. This may be either shore-led or supported by small specialist workboats, comparable to those which are periodically used for Keadby Power Station operation and maintenance activities.

Mabey Bridge Replacement and Emergency Access Bridge over Drain 1

12.5.25 Early works will include the widening of the A18 and the replacement of Mabey Bridge over the Hatfield Waste Drain to provide the permanent access into the Proposed Development Site. The works to the A18 are immediately

parallel to the Hatfield Waste Drain to the north and North Engine Drain to the south, and the best practice mitigation measures outlined above and within the Framework CEMP (**Application Document Ref. No. 7.1**) will be implemented to prevent adverse impacts to these watercourses during construction. Further details related to this activity are provided in **Chapter 5:** Construction Programme and Management (ES Volume I, **Application Document Ref. 6.2**) and the general arrangement, drainage details and construction sequence for works in this area are provided in **Application Document Ref. 4.6** and **Application Document Ref. 4.16**.

12.5.26 An emergency access bridge is also proposed over Drain 1 (Glew Drain) to the north of Keadby Common and the Proposed PCC Site. The general arrangement is provided as **Application Document Ref. 4.17**. Initial site clearance will be undertaken including vegetation clearance. The channel beneath the proposed bridge crossing is likely to require lining to accord with IDB bylaws which seek to prevent vegetation growth, as this area will no longer be accessible to IDB machinery for maintenance. Piling works, if required, would then take place before the main structure of the bridge is constructed. Further details related to this activity are provided in **Chapter 5:** Construction Programme and Management (ES Volume I, **Application Document Ref. 6.2**).

12.5.27 There may be a requirement for minor works to watercourse crossings relating to the temporary access roads for strengthening, maintenance or minor improvements. This could potentially impact Drain 6, Drain 7a and Drain 7b in relation to the temporary construction laydown areas in the agricultural fields south of the Stainforth and Keadby Canal. Any such work would be subject to discussions with the relevant landowner.

Land Drainage

12.5.28 Appropriate measures to minimise short-term impacts on land drainage will be agreed with the relevant landowner for those works affecting Drain 6, Drain 7a and Drain 7b within the temporary construction and laydown areas (refer to **Chapter 5:** Construction Programme and Management (ES Volume I, **Application Document Ref 6.2**). Where land drains are under the control of the IDB, as shown on **Figure 12.6** (ES Volume III – **Application Document Ref. 6.4)**, relevant bylaws will be adhered to or consent obtained for works affecting/ crossing these drains within the Electrical Connection to the 132kV Northern Powergrid Substation , Water Discharge Corridor and emergency vehicle access route shown on **Figure 3.3** (ES Volume III – **Application Document Ref. 6.4**). These measures will be secured in the Final CEMP, noting that a Framework CEMP is included as **Application Document Ref. 7.1.**

Management of Flood Risk

12.5.29 The final CEMP would incorporate measures aimed at preventing an increase in flood risk during construction works, as far as reasonably practicable. The Framework CEMP (**Application Document Ref. 7.1**) incorporates measures to prevent an increase in flood risk during the construction works. Examples of such measures include:

- adequate containment of storage areas, to ensure that material does not wash away and cause pollution and damage to infrastructure;
- the construction laydown area site office and supervisor will be notified of any potential flood occurring by use of the 'Floodline Warnings Direct' service; and
- the Contractor will be required to produce a Flood Risk Management Action Plan/ Method Statement which will provide details of the response to an impending flood and include:
  - a 24 hour availability and ability to mobilise staff in the event of a flood warning;
  - the removal of all plant, machinery and material capable of being mobilised in a flood for the duration of any holiday close down period;
  - details of the evacuation and site closedown procedures; and
  - arrangements for removing any potentially hazardous material and anything capable of becoming entrained in floodwaters, from the temporary works area.

12.5.30 Due to the residual risk to construction personnel and equipment resulting from a breach of defences on the River Trent, construction works would not take place during times of high flow when there is a Flood Alert.

12.5.31 If water is encountered during below ground construction, suitable de-watering methods will be used. Any significant groundwater dewatering required will be undertaken in line with the requirements of the Environment Agency (under Water Resources Act 1991 as amended and Environmental Permitting Regulations (HMSO, 2016).

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

Management of Navigational Risk

12.5.33 **Appendix 12C**: Navigational Risk Assessment (ES Volume II **- Application Document Ref. 6.3**) identifies measures to mitigate against navigational risks associated with the canal and river abstraction options.

12.5.34 With the application of mitigation, it is considered that all risks can be managed to a level which is As Low as is Reasonably Practical (ALARP).

Operation

12.5.35 A number of embedded mitigation features would be incorporated into the design of the Proposed Development design in order to avoid, minimise and reduce potential impacts and adverse effects on water features, water resources and flood risk, and these are described in the following sections.

Surface Water Drainage

12.5.36 A new surface water drainage network and management system will be provided for the Proposed PCC Site that will provide adequate interception, conveyance, treatment, and attenuation of surface water runoff from buildings and hard standing. The proposed concept drainage strategy is provided in Section 5 of **Appendix 12A:** Flood Risk Assessment (**ES Volume II - Application Document Ref. 6.3)** and an indicative layout for the surface water drainage system is provided in **Application Document Ref. 4.13**. This will be further defined in consultation with the Environment Agency, the LLFA (NLC) and the IDB as the project progresses, taking into account suitable water quality assessment to define treatment requirements.

12.5.37 The proposed surface water drainage system is to include the use of sustainable drainage systems (SuDS) to provide treatment of runoff from urban areas where there is a low risk of contamination by any chemicals used by the energy generation processes to ensure potential adverse effects on water quality and habitat of receiving water bodies are avoided. The drainage system will be designed to be inherently safe and protect the local environment from urban diffuse pollutants that may be present. Clean surface water runoff will be segregated from contaminated/ potentially contaminated water, which will be directed to the on-site treatment plant or in the case of amine contaminated water for off-site disposal. Gravity drainage is also used wherever practicable.

12.5.38 The proposed drainage system is to include the use of bypass oil water separators and SuDS in the form of swales and an attenuation pond, to attenuate surface water flows due to increases in the impermeable area as a result of the Proposed Development. SuDS would also provide treatment of runoff to ensure potential adverse effects on water quality are avoided/ minimised, as far as reasonably practicable. SuDS and the treatment train have been selected and assessed with reference to the SuDS Manual (CIRIA, 2015a) and the Simple Index Approach contained therein.

12.5.39 The maintenance required for SuDS and drainage networks will be based on standard guidance and practice. Requirements for maintenance and management of vegetated drainage systems (e.g. ponds) are described in

The SuDS Manual (CIRIA, 2015a) and DMRB CG 532 (Highways England, 2020a).

12.5.40 Furthermore, as the Proposed Development will be an active industrial site controlled by an Environmental Permit and regulated by the Environment Agency, pollution control measures will be required to demonstrate Best Available Techniques (BAT) in order to prevent accidental discharge of pollutants such as hydrocarbons to surface water systems. An Assessment of BAT has been completed in support of the Environmental Permit Application for the Proposed Development. Pollution prevention measures considered would include (but would not be limited to):

- silt / oil alarms will be fitted on all interceptors and attenuation storage facilities to alert operators when they require emptying;
- foul flows and effluent arising from the Proposed Development operation will be kept separate from the surface drainage network; and
- areas which are expected to be sources of frequent pollutant spills to be isolated through the use of bunds.

Process Water Treatment

12.5.41 Following treatment, process water that is to be directed to the outfall would flow via the existing Keadby 1 Power Station cooling water culvert. As per the Environmental Permit for Keadby 2 Power Station, it is assumed that the emission limits would apply to the discharge point into the cooling water culvert rather than the eventual outfall in the River Trent. It is anticipated that the wastewater environmental regulatory emission limit values (ELV) that apply within the Environmental Permit shall be in-line with the target BAT Associated Emission Levels (BAT-AEL) from wastewater treatment plants treating effluent from chemicals sites, or processes as identified within the BAT Reference Document for Common Waste Water and Waste Gas Treatment / Management Systems in the Chemical Sector (European Commission, 2016) and its associated BAT Conclusions document. If the project Environmental Risk Assessment (to be developed post-consent) shows that a significant impact could occur with the plant discharging at the BAT-AEL concentrations, tighter emission limits could subsequently be applied.

River Trent Outfall

12.5.42 Cooling water will be discharged at a rate and with a chemical water quality compliant with the discharge limits set by the Environment Agency within the Environmental Permit, considering Best Available Techniques (BAT) for those discharges. This will include consideration of the requirements of the Eels Regulations.

Management of Hazardous Substances on Site

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

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

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

- HS(G)191 Emergency planning for major accidents. Control of Major Accident Hazards Regulations 1999 (Health and Safety Executive, 1999);
- HS(G)71 Chemical warehousing: the storage of packaged dangerous substances (Health and Safety Executive, 1992); and
- BS 5908: Fire and explosion precautions at premises handling flammable gases, liquids and dusts. Code of practice for precautions against fire and explosion in chemical plants, chemical storage and similar premises (British Standards Institute, 1990).

Flood Risk during Operation

12.5.46 Mitigation measures are required to protect the Proposed Development from the residual risk of flooding in the event that the existing tidal defences fail in the vicinity of the Proposed Development Site, or in the event of heavy rainfall that could result in surface water flooding at the Proposed Development Site if the design capacity of the drainage network is exceeded.

12.5.47 A number of flood resistance/ resilience measures are included in **Appendix 12A**: Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**) for consideration at the detailed design stage of the Proposed Development.

12.5.48 In order to protect against the residual risk of breach and the future risk from defence overtopping, the critical operational equipment and infrastructure will be raised above the modelled breach level during the 0.5% AEP plus climate change tidal event. Wholesale land raising of the Proposed Development Site is not proposed.

12.5.49 The development platform of the Main Site would be raised to the breach level (2.2m AOD) +400mm freeboard i.e. 2.6m AOD, aligned with the consented levels of the Keadby 2 Power Station development platform. Within this area critical operational infrastructure associated with the CCGT (defined in paragraph 6.3.11 of **Appendix 12A**: Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**)) will have a further clearance of 1.0m, therefore providing a level of resilience of no less than 3.6m AOD which is also the approach that has been adopted for the Keadby 2 Power Station. This is a minimum level that will be achieved for critical operational infrastructure, but further clearance will be provided up to 4.4m AOD (i.e. the CFL + 300mm freeboard) where reasonably practicable to do so. These levels (respectively the "Minimum Critical Operational Infrastructure Design Level" and the "Critical Operational Infrastructure Design Level") are proposed to be secured via a requirement of the Draft DCO (**Application Document Ref. 2.1**) and are reported as parameters in **Chapter 4:** The Proposed Development (ES Volume I – **Application Document Ref. 6.2**).

12.5.50 It is proposed that a room above ground floor level of the Proposed Development would be allocated and adapted to provide adequate facilities to provide a place of safe refuge including welfare facilities for employees occupying the Proposed PCC Site in the extremely rare and unlikely event that the Trent tidal defences were to breach. The internal finished floor level of this refuge area will be a minimum level of 4.4m AOD (the CFL + 300mm freeboard) and will be set within a building with a minimum ground floor level of 2.6m AOD (the 0.5% AEP + CC breach level plus 400mm freeboard).

12.5.51 Further detail on additional resilience and mitigation measures is provided in Section 6 of **Appendix 12A**: Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**).

Decommissioning

12.5.52 At the end of its design life, decommissioning of the Proposed Development will see the removal of all above ground equipment down to ground level. It is assumed that all underground infrastructure will remain in-situ; however, all connection and access points will be sealed or grouted to ensure disconnection. At this stage it is assumed that decommissioning impacts are expected to be limited and will be the same/similar to the construction impacts, as discussed above.

12.5.53 The Proposed Development would be subject to decommissioning under the conditions of the Environmental Permit including conditions relating to chemical/ polluting material handling, storage and use and emergency procedures in line with BAT. A Decommissioning Environmental Management Plan (DEMP) would be prepared and agreed with the Environment Agency to identify required measures to prevent pollution during this phase of the Proposed Development, as part of the Environmental

Permitting and site surrender process at the appropriate time and is separate to the DCO application.

12.5.54 The DEMP will consider in detail all potential environmental risks and contain guidance on how risks can be removed, mitigated or managed. This will include details of how surface water drainage should be managed on the Proposed PCC Site during decommissioning and demolition.

12.6 Likely Impacts and Effects

12.6.1 The Proposed Development has the potential to cause adverse effects to the water environment during construction, operation and decommissioning phases. Water resources described in Section 12.4 have therefore been assessed for the likelihood of actual effects occurring as a result of these phases of the Proposed Development (taking into account the mitigation measures as detailed in **Section 12.5**).

Construction Phase

Surface Water Quality – Suspended Fine Sediments

12.6.2 Taking into consideration the source-pathway-receptor approach, construction of the cofferdam required in either the Stainforth and Keadby Canal or River Trent) (the receptors) for the cooling water abstraction intake would cause some mobilisation of fine sediments during installation and removal, and this may mobilise some fine sediment into the water column (the pathway). However, the volume of sediment will be relatively small and localised. In the case of the River Trent, background data shows that concentrations of TSS are often quite high. Once any cofferdam has been installed, any fine sediment that has been mobilised will quickly dissipate through settling or dispersion and is unlikely to create a plume that may propagate into the wider waterbody. Historical environmental assessment and consenting evidence, including that associated with the Keadby Power Station Operation and Maintenance Marine Licence, indicates that even far greater volumes of material being disturbed within the River Trent are environmentally inconsequential for this environment where existing turbidity is high (MMO; MLA/2017/00312, 2017). The purpose of the cofferdam is to allow a dry working area to be created, which in itself is a measure designed partly to reduce adverse impacts on water quality.

12.6.3 The cofferdam will be designed to minimise changes in riverbed and bank erosion and toe scour through keeping it to the minimum dimensions necessary to undertake the works and thereby reducing any constriction of the channel. Furthermore, this would reduce the extent of sediment mobilisation. The structures would not protrude significantly into the channel (i.e. up to circa 10m for the Stainforth and Keadby Canal or up to circa 22m

for the Trent), taking into account similar works within these watercourses for the purposes of Keadby Power Station.

12.6.4 There is a wealth of sedimentological data from both the Keadby power Station intake and outfall which has been obtained in order to fulfil the Marine Licence Application 'MLA/2014/00183/2' and associated mid-point sample returns. Notwithstanding, it is anticipated that sedimentology and potential risk of contaminant disturbance would be considered through the method statement required through the DML. A draft DML has been subject to MMO review and is provided with the Draft Development Consent Order (**Application Document Ref. 2.1**).

12.6.5 Any requirement for pre-construction sampling within the Stainforth and Keadby canal prior to works required for the Canal Water Abstraction Option cofferdam would be agreed with the relevant regulators.

12.6.6 With reference to Table 12.5 and the embedded mitigation measures (described in Section 12.5) in place, it is considered that there would be negligible magnitude of impact to the River Trent from any cofferdam installation at the potential abstraction point and minor maintenance at the discharge outfall, given the scale of the watercourse and that preparatory dredging is not proposed. The tidal nature of the estuary here would quickly disperse any mobilised sediments. Given that the River Trent is a very high importance receptor (Table 12.4), considering the classification of effects matrix in Table 12.6, this negligible impact would result in a slight adverse effect (**not significant**).

12.6.7 Construction of the abstraction point behind a cofferdam in the Stainforth and Keadby Canal would have a minor adverse magnitude impact given that there is less ability to quickly disperse any sediment in this waterbody given the low flow. This minor adverse impact would be very localised and temporary in nature. It will be necessary to consider appropriate cofferdam installation in order to ensure no impact to the canal liner at the abstraction point, and this may include bolstering the liner with clay. Given appropriate cofferdam design, the overall impact is considered to be minor adverse on the high importance Stainforth and Keadby Canal. This would result in a slight adverse effect (**not significant**).

12.6.8 Assuming as a worst-case an open-cut crossing of drain D2 (medium importance) to accommodate the water supply connection corridor (from either abstraction option) within the Proposed PCC Site, , the works to the channel could mobilise sediments (source) and be directly mobilised (pathway) into the watercourse (receptor) which could then also propagate further downstream. Given the very localised and temporary nature of the works for any open-cut crossings of this ephemeral drain, as well as restoration required, the magnitude of impact is considered minor, and largely mitigated through the measures outlined in Section 12.5. This would result in

a slight adverse effect (**not significant**). Given the embedded mitigation measures, no adverse effect is anticipated to downstream waterbodies.

12.6.9 The construction of a replacement clear span bridge (Mabey Bridge) over Hatfield Waste Drain and a new clear-span emergency access bridge over Drain D1 (Glew Drain) will require works in the riparian margins and over these two watercourses, with potential piling and use of other plant leading to mobilisation of sediment that could be conveyed into the watercourses given the immediate proximity of the works. Widening of the A18 would also require construction works in the immediate riparian margin of North Engine Drain and Hatfield Waste Drain.

12.6.10 These works would be carried out in accordance with the final CEMP and the best practice measures outlined in Section 12.5. Given that no work would be required within the channels themselves, other than works to the line the channel of Drain 1 to comply with IDB bylaws, and that the foundations will be set back from the watercourses, any adverse impacts would be negligible. For the high importance Hatfield Waste Drain and North Engine Drain this would give a slight adverse effect (**not significant**). For the medium importance Drain D1 (Glew Drain) this would also give a slight adverse effect (**not significant**).

12.6.11 There is likely to be strengthening, maintenance or minor improvement works to existing watercourse crossings relating to the temporary access roads during construction. This may impact existing crossings of Drain D6, Drain D7a and Drain D7b. At this stage it is not clear the extent of any works required; however, they are assumed to be no more than minor alterations to the existing structures. As any improvement works would be immediately adjacent to, and/ or over these drains, there is potential for mobilisation and conveyance of fine sediments to the channels. Given implementation of the best practice mitigation measures outlined in the CEMP, this impact would be minor and temporary. For the medium importance Drain D6 this would give a slight adverse effect (**not significant**), while for the low importance Drains D7a and D7b this would give a neutral effect (**not significant**).

12.6.12 There are also existing access route crossings via North Pilfrey Bridge of the North and South Soak Drain (high importance) and Stainforth and Keadby Canal (high importance), which will be used. No works are proposed to North Pilfrey Bridge. However, there will be construction work in laydown area 2c and in areas 3a and 3b in close proximity to South Soak Drain and North Soak Drain which could result in runoff of fine sediment towards them. There will also be works in close proximity to the unnamed drainage ditch alongside the access road from Mabey Bridge (low importance). Given the embedded mitigation measures described in Section 12.5 including standoff distances included in relation to laydown areas (minimum 20m from high importance receptors), any adverse impact is expected to be negligible, resulting in a slight adverse (**not significant**) effect to North and South Soak Drain and the

Stainforth and Keadby Canal, and a neutral (**not significant**) effect to the unnamed drain. No adverse effects on downstream waterbodies are anticipated from this source i.e. the Torne/Three Rivers waterbody or the River Trent.

Surface Water Quality – Chemical Spillages

12.6.13 Leaks and spillages of polluting substances during construction could potentially pollute nearby surface watercourses if their use or removal is not carefully controlled (source) and spillages enter existing flow pathways or waterbodies directly (pathway). Like excessive fine sediment in construction site runoff, the risk is greatest where works occur close to and within waterbodies (the receptor). However, to ensure legislative compliance, storage, handling and disposal of such substances will need to be in place prior to and during construction via the CEMP.

12.6.14 As described above, minor maintenance and improvement works are proposed to be undertaken directly within the River Trent at the water discharge outfall and potentially more substantial works at the river water abstraction point, should this option be selected. Given the scale of the waterbody with significant dilution potential and given the majority of the more significant works at the abstraction point (if required) would be undertaken behind a cofferdam with embedded mitigation measures implemented (described in Section 12.5), including water quality monitoring, there would be a negligible impact on the very high importance River Trent. This would give a short-term slight adverse effect (**not significant**).

12.6.15 Within the Stainforth and Keadby Canal (high importance waterbody)any impact relating to chemical spillages during installation of the potential Canal Water Abstraction Option would be negligible given the implementation of best practice measures (see Section 12.5) and the use of a cofferdam to isolate the majority of the works, causing a slight adverse effect (**not significant**).

12.6.16 For the works in close proximity to, and over (but not directly within), the high importance Hatfield Waste Drain for the replacement clear span bridge off the A18. Works would also be undertaken close to the high importance North Soak Drain which crosses into the Proposed Development boundary adjacent to the potential canal abstraction point, and adjacent to the high importance North Engine Drain for widening of the A18, given the implementation of mitigation measures within the final CEMP, any impact from chemical spillages to these watercourses is anticipated to be negligible, giving a slight adverse effect (**not significant**) for the high importance Hatfield Waste Drain, North Engine Drain and North Soak Drain, and neutral effect (**not significant**) for the medium importance drain D1.

12.6.17 The medium importance drain D2 is expected to be directly worked on for an open-cut crossing in the Proposed PCC Site. Given that open-cut works carry a greater risk of chemical spillages directly into the channel, this would be a temporary minor adverse impact, giving a slight adverse effect (**not significant**).

12.6.18 Strengthening, maintenance or minor improvements of existing crossings of medium importance drain D6 and low importance drains D7a and D7b pose a risk of chemical spillage given works would occur immediately adjacent to the channel and may impinge on the channel itself where structures need improvement within the channel. There may also be works close to the unnamed drainage ditch (including regular vehicular movements) adjacent to the access road from Mabey Bridge. There is therefore potential to receive spillages during construction, but given the mitigation measures described above, this would result in a temporary minor adverse impact to these drains, giving a slight adverse effect (**not significant**) for D6 and neutral effect (**not significant**) for drain D7a and D7b and the unnamed ditch alongside the access road.

12.6.19 Given the embedded mitigation to deal with chemical spillages there is expected to be no impact to any other waterbody or downstream waterbodies (e.g. River Torne/Three Rivers), or the isolated ponds within the Proposed Development Site boundary which are not directly impacted.

Morphological Effects to Waterbodies relating to the use of a Cofferdam

12.6.20 The installation of a cofferdam will result in the localised loss of habitat on the bed of the River Trent or Stainforth and Keadby Canal beneath its footprint and in relation to the Trent, has the potential to cause some localised scour. However, any cofferdam will be designed to minimise changes in riverbed and bank erosion and will be designed to provide the minimum dimensions necessary to safely undertake the required works, thereby reducing any constriction of the channel as far as reasonably practicable. Scour would not be expected to be significant given the large size of the River Trent and its dynamic nature. However, scour protection (such as rock bags, gabion baskets or similar) may be deployed around the base of any cofferdam in the (higher energy) River Trent. The construction detail and any required scour protection measures for would be agreed following detailed design through the method statement return on the DML (**Application Document Ref. 2.1**) if the River Water Abstraction Option is selected.

12.6.21 Overall, taking into account the temporary nature of the works, the mitigation measures proposed and the dynamic nature of the River Trent which contains significant TSS concentrations, any impact on the estuary bed would be short-lived and would be expected to infill rapidly following removal of the cofferdam. This conclusion is consistent with historical licensing advice locally which indicates that (substantially greater) disturbance of up to

2,500m^3 per annum is environmentally acceptable and will not have a significant effect on the marine environment. Against this context, the Proposed Development includes the potential for small scale temporary loss of mudflat and also very small increases in TSS; this is deemed to be inconsequential when considered against the background levels of turbidity within the River Trent. In order to validate these predictions and determine the as-installed effect of the cofferdam, if this is required within the River Trent for the River Water Abstraction Option, pre and post-works bathymetry would be completed if this is required; this would be detailed and agreed within the method statement returns process for the DML (**Application Document Ref. 2.1**), as necessary.

12.6.22 Scour impacts of the nature described above are not anticipated in the Stainforth & Keadby canal given the low flow within the watercourse. However, the less dynamic nature of the watercourse means that any minor impact that may occur would likely require a longer recovery time.

12.6.23 Using the source-pathway-receptor approach, impacts on morphology would be negligible for the River Trent due to the localised and temporary nature of the impact in a dynamic environment. The area affected is negligible in the context of the size of the Humber Estuary. As such, there is expected to be a neutral effect (**not significant**) on an asset of low importance (for morphology) with regard to the cofferdam use within the River Trent.

12.6.24 The impact on the Stainforth and Keadby Canal would be minor adverse given the slower probable recovery of the bed to any disturbance, giving a slight adverse effect (**not significant**) on this low importance (for morphology) receptor.

Morphological Effects to Waterbodies: New Bridges and Crossings for the Connection Corridors and Access

12.6.25 The replacement bridge over the Hatfield Waste Drain and new bridge over drain D1 are anticipated to have negligible on the morphology of the bed itself as they are of a clear span design with set back foundations and so would not impact the channel itself. However, there would be localised impact to riparian habitats on the banks and potential increase in channel shading (see **Chapter 11**: Biodiversity and Nature Conservation (ES Volume I – **Application Document Ref. 6.2**)). Both Hatfield Waste Drain and drain D1 are of low importance for morphology, and so the negligible impact on their morphology would give a neutral effect (**not significant**).

12.6.26 Any minor improvement works required to the existing crossings of low importance (for morphology) drains D6, D7a and D7b are not expected to significantly alter the footprint of the structures, and any impact on morphology would again be negligible, giving a neutral effect (**not significant**).

12.6.27 Drain D2 is of low importance for morphology, due to being artificially straight, lacking significant geomorphic and bedform features. For open-cut crossings, any pipes/ cables will be buried at sufficient depth to prevent exposure and the flow over-pumped or flumed during the works to minimise the risk of water pollution being carried downstream. However, there will unavoidably be short term, temporary adverse impacts on the watercourse and riparian habitats, and the hydrological and sediment regimes during construction. These impacts would be very localised and short in duration, with the channels reinstated. Overall, physical works to drain D2 would give a localised, temporary minor adverse impact against hydromorphological status, resulting in a neutral effect (**not significant**) due to the short-term nature of the work which would have limited impact at the scale of the wider waterbody.

Navigation

12.6.28 A Navigational Risk Assessment has been undertaken and is provided in **Appendix 12C** (ES Volume II - **Application Document Ref. 6.3**). A number of risks were identified as described below.

12.6.29 Both the Stainforth and Keadby Canal and River Trent water abstraction options would involve the construction and eventual removal of a cofferdam which may involve the use of a barge or large workboat. The presence of work boat(s) and presence of the cofferdam itself may constrain vessel passage along the watercourses, and it may also act as distraction to mariners. In the River Trent it may disturb third party operations.

12.6.30 For the River Trent water discharge outfall, only minor primarily hand-based maintenance activities would be undertaken. This may be either shore-led or supported by small specialist workboats, comparable to those which are periodically used for Keadby Power Station O&M activities. Hazards are predicted to be minimal and associated with the presence of a workboat in the River Trent.

12.6.31 With regard to Abnormal Indivisible Load (AIL) movements, on final approaches to Railway Wharf, the presence of a large vessel (i.e. of up to 82m in length and 12m in beam) may present a hazard to other mariners through collision. This may include another vessel or a fixed object, such as a mooring, wharf or other vessels using the River Trent. The operation of a large vessel may distract other mariners.

12.6.32 During the final approach and docking itself, the manoeuvring of a large vessel and support craft (i.e. tug) within the River Trent may constrain the passage of other mariners. During the use of the NAABSA (not always afloat but safely aground) berth, depending on the condition of the riverbed, the vessel may not achieve a stable unloading position. Listing into the Trent may cause a hazard to other mariners. The docking and unloading of a large

vessel may also distract other mariners, including through the use of wharf/vessel illumination during hours of darkness.

12.6.33 Whilst docked, vessel mooring or docking failure(s) may pose a hazard to both other mariners using the River Trent and neighbouring fixed objects; and whilst docked, the presence of a vessel may pose a risk to users of the Stainforth and Keadby Canal.

12.6.34 A 'Worst Credible Scenarios' approach has been used within the **Appendix 12C:** Navigational Risk Assessment (ES Volume II - **Application Document Ref. 6.3**) to understand the location and nature of any navigational risks; a variety of mariners have been considered ranging from small unpowered "vessels" and recreational craft to very large commercial vessels known to use the port approaches.

12.6.35 In all instances, the identified risks are 'low' or in some instances, 'medium' (in relation to workboats in the River Trent, presence of a cofferdam (if required) in the River Trent and AIL movements at the Waterborne Transport Offloading Area. With the application of the proposed mitigation, it is considered that all risks can be reduced to ALARP and can be suitably managed by risk control protocols to reduce them to an acceptable level. The primary risk reduction measures proposed in **Appendix 12C**: Navigation Risk Assessment (ES Volume II - **Application Document Ref. 6.3**) are:

- engagement and collaboration with ABP Humber and CRT to inform the final approach to marine works such that they have a minimal risk of disruption to the mariner;
- a suite of DML conditions, such as CEMP and method statement returns, to ensure that ABP Humber and other relevant stakeholders are informed on final proposals;
- additional DML conditions to ensure mariners are made fully aware of works such that they can plan safe passage; and
- 'standard-set' DML marking, lighting and warning conditions to ensure any mariners are aware of the marine works.

12.6.36 Further detail of the Navigational Risk Assessment is provided in **Appendix 12C** (ES Volume II **- Application Document Ref. 6.3**) In EIA terms, the overall magnitude of impact is considered minor for the River Trent and the Stainforth and Keadby Canal. Both are high importance receptors for navigation, resulting in a slight adverse effect (**not significant**) in relation to navigational risk at both watercourses.

Potential Flood Risk – Tidal and Fluvial Sources During Construction

12.6.37 Taking into account implementation of standard construction methods and mitigation as described in the Section 12.5, which would be included in the

CEMP, flood risk during construction would be effectively managed. A Flood Management Action Plan/ Method Statement will provide details of the response to an impending flood and will ensure that flood warnings are received from the Environment Agency's 'Floodline Warnings Direct' service to inform if there is a risk of flooding from a tidal storm surge type event which could result in overtopping or breach of defences. As described in Section 12.5, construction works would not take place during times of high flow when there is a Flood Alert.

12.6.38 Given these measures, the magnitude of flooding from these sources on very high importance construction workers, on site and further downstream, is considered to be negligible resulting in a slight adverse effect (**not significant**).

Potential Flood Risk – Surface Water Sources During Construction

12.6.39 The Proposed Development Site would in general be at very low to low risk from surface water flooding, although in some areas associated with watercourses there are areas of medium to high risk as outlined in the baseline and **Appendix 12A:** Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**). During the works, existing surface flow paths may be disrupted and altered due to site clearance, earthworks, and excavation work. The exposure and compaction of bare ground and the construction of new embankments and impermeable surfaces may increase the rates and volume of runoff and increase the risk from surface water flooding. However, with the implementation of standard construction methods and mitigation measures (see Section 12.5), this risk can be effectively managed. As such, the magnitude of flooding from these sources on very high importance construction workers is considered to be negligible resulting in a slight effect (**not significant**).

Potential Flood Risk – Groundwater Sources During Construction

12.6.40 The Proposed Development Site is considered to be at low risk of flooding from groundwater sources. Excavation of any cuttings has the potential to liberate groundwater in some areas, and open excavations in some locations may also be more prone to becoming inundated by groundwater. With the implementation of the measures outlined in the CEMP and WMP (presented in Section 12.5), a negligible magnitude of impact is predicted resulting in a slight effect (**not significant**) on very high importance construction workers.

Potential Flood Risk – Drainage Infrastructure and Artificial Sources During Construction

12.6.41 The Proposed Development is at low to very low risk of flooding from existing drainage infrastructure. With the implementation of the measures outlined in the CEMP and other flood risk mitigation as outlined in Section 12.5, flooding

from these sources is considered to be negligible given the implementation of standard good practice construction techniques resulting in a slight effect (**not significant**).

12.6.42 Environment Agency mapping and the FRA (**Appendix 12A** in ES Volume II – **Application Document Ref. 6.3**) indicates that the Proposed Development Site is not at risk of flooding from reservoirs (no effect), and at low risk from artificial waterbodies given proximity to the Stainforth and Keadby Canal. As such, the risk of flooding from artificial sources (canal) is considered to have a slight effect (**not significant**) on very high importance construction workers.

Operation Phase

Potential Pollution of Surface Watercourses: Surface Water Routine Runoff and Accidental Spillages

12.6.43 Throughout its lifetime, the Proposed Development would be regulated by the Environment Agency through an Environmental Permit and potentially also by the HSE through a COMAH Licence, if required, which would control the handling, storage and use of hazardous materials, including emergency procedures in line with the use of BAT. These measures would be in place to prevent pollution during plant operation in accordance with the consents.

12.6.44 The Conceptual Drainage Strategy (**Appendix 12A: Flood Risk Assessment** (including Section 5: Conceptual Drainage Strategy (ES Volume II - **Application Document Ref. 6.3)**) proposes to include SuDS in line with North Lincolnshire Council's SuDS and Flood Risk Guidance Document (North Lincolnshire Council, 2017). This will enable attenuation of surface water flows due to increases in the impermeable area as a result of the Proposed Development. SuDS would also provide treatment of runoff to ensure potential adverse effects on water quality are avoided.

12.6.45 Using the source-pathway-receptor approach, the source of pollution would be potential contaminants on impermeable surfaces (e.g. metal from vehicles on roads) which are transferred by the pathway of surface water runoff to Keadby Common Drain (the receptor) using the same outfall as the Keadby 2 Power Station, subject to consent from the IDB. The alternative discharge (should IDB consent not be granted for discharge at the greenfield runoff rate) would be to the River Trent via the existing Keady 1 Power Station outfall and drainage infrastructure.

12.6.46 The Conceptual Drainage Strategy (**Appendix 12A:** Flood Risk Assessment (including Section 5 - Conceptual Drainage Strategy (ES Volume II - **Application Document Ref. 6.3)** indicates that SuDS attenuation for surface water runoff will be provided in the form of swales discharging into an attenuation pond prior to discharge to a watercourse (pond indicated on **Figure 4.1** (ES Volume III - **Application Document Ref. 6.4**)). In-line oil

separators will also be installed, the locations of which are to be determined during detailed design. All surface water discharge leaving the Proposed PCC Site is to pass through an oil separator (with collected oil intermittently removed and disposed of off-site).

12.6.47 The SuDS Manual's Simple Index Approach (CIRIA, 2015a) has been applied to assess the suitability of an assumed attenuation pond for surface water runoff and spillages (from non-process areas). The High Pollution Hazard Index has been adopted to assess runoff from the Proposed Development, as this is described in the SuDS Manual as, *"Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites, trunk roads and motorways"*. It is thus deemed the most appropriate hazard index available for the Proposed Development.

12.6.48 Table 12.15 shows the pollutant hazard index score for different pollutants for the High Pollution Hazard Level, as outlined in the SuDS Manual (CIRIA, 2015a).

12.6.49 Table 12.15 also shows the treatment potential of a swale and pond when compared against the pollution hazard index. To achieve a pass, the total mitigation index of the treatment train must meet or surpass the pollution hazard index. Under the Simple Index Approach the effectivity of the second treatment component (i.e. attenuation pond in this instance) is considered to be 50% compared to the first treatment component (i.e. the swale).

12.6.50 On this basis of the proposed SuDS alone, the mitigation index fails to meet the pollution hazard index for hydrocarbons but passes the assessment for TSS and metals. However, additional treatment is proposed to be provided using oil interceptors, as detailed in Section 12.5. Proprietary treatment systems such as these are not considered within the Simple Index Assessment as the performance varies between available products. The majority of available oil interceptors would provide sufficient treatment for hydrocarbons to ensure that the treatment train passes the assessment, however, the appropriateness of the chosen product for providing the additional treatment required for runoff will be confirmed through consultation with the relevant regulators including the Environment Agency, the LLFA and IDB.

Table 12.15: Pollution Hazard Indices and the Total Pollutant Index for each Pollutant

Proposed Development Land Use	Suds	Mitigation		
		Total Suspended Solids	Metals	Hydrocarbons
Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites, trunk roads and motorways	Swale	0.5	0.6	0.6
	Pond (at 50% efficiency)	0.35	0.35	0.25
	Pollution Hazard Index	0.8	0.8	0.9
	Mitigation Index	**0.85**	**0.95**	**0.85**
	Final Mitigation Index	With integration of an appropriate oil interceptor all elements would **pass** the assessment		

12.6.51 The Drainage Strategy developed at the detailed design stage will ensure that suitable treatment is provided prior to discharge to any watercourse in order to not adversely impact water quality of receiving waterbodies.

12.6.52 As described in **Chapter 4**: The Proposed Development (ES Volume I – **Application Document Ref. 6.2**), an inventory of hazardous substances used on the Proposed Development Site will be developed through the detailed design process. In each case, the product will have a Material Safety Data Sheet providing guidance on safe disposal of waste chemicals. It is assumed that during operation of the facility, the disposal of product

containers and chemical waste will adhere to this guidance, and the impact avoidance measures above and discussed in Section 12.5.

12.6.53 The Drainage Philosophy will require provisions for dealing with chemical spillages and firewater. Spillages within the Proposed Development Site will be treated as per the pollution prevention measures described within the impact avoidance measures (Section 12.5), and spilt substances collected and disposed of as per their individual requirements. Areas where pollutants are stored and spillages are likely will be bunded, and oil interceptors will be fitted with alarms. Penstocks will be provided to isolate any spills or contaminated water/ firewater in the surface water drainage system and prevent its discharge to the environment. An Emergency Response Plan would also be prepared and implemented as part of the Proposed Development Site's EMS. Should any spillage occur, the Environment Agency would immediately be informed, or Severn Trent Water should it impact the foul water system.

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

12.6.55 Given that the Drainage Strategy will have to meet standards required by the environmental permit and the expected local policy requirements, and that measures will be in places for dealing with spillages and firewater then a negligible impact is predicted to Keadby Common Drain from surface water drainage. Given that this is a medium importance receptor, this would result in a neutral effect (**not significant**).

12.6.56 Should IDB consent not be granted to discharge to Keadby Common Drain, then the outfall to the River Trent would instead be used, subject to Environment Agency consent, the controls of an Environmental Permit and any associated monitoring requirements. There would be a negligible impact to the River Trent given the mitigation measures and large dilution capacity of the watercourse, resulting a slight adverse effect (**not significant**) due to it being a high importance receptor.

Potential Impacts on water quality of the River Trent from Operational discharges

12.6.57 Cooling water from the Proposed Development Site (the source in the source-pathway-receptor approach) will discharge (the pathway) to the River Trent (the receptor) under an environmental permit. It is anticipated that the rate of discharge from the Proposed Development will be less than 1m^3/s and be

discharged intermittently, in combination with the 0.016 m^3/s proposed to be discharged from Keadby 2 Power Station (AECOM, 2020). The existing Keadby 1 Power Station permit (EPR/YP3133LL) allows a maximum daily discharge of $15m^3/s$ (average over a 24-hour period). Consequently, it is considered that the Proposed Development will be operating well within the existing consented parameters of Keadby 1 Power Station.

12.6.58 Discharge of cooling water will require a permit from the Environment Agency, which will specify the effluent quality required to maintain the status of the receiving waters. Cooling water will be monitored prior to discharge in compliance with the conditions of this permit (as with Keadby 2 Power Station). It should be noted that as per the Keadby 2 Power Station Permit Variation that the effluent quality limits (and associated monitoring) will apply at the point of discharge within the Keadby 1 Power Station cooling water culvert, not at the River Trent outfall point.

12.6.59 On the basis of available data at this time, it is considered that there will be negligible impact on temperature status of the River Trent, and the discharge would not prevent a barrier to migratory routes for fish. For the very high importance River Trent, this negligible impact would give a slight effect (**not significant**). Engagement with the relevant stakeholders – principally the Environment Agency and MMO – has been undertaken to help inform the EIA process. In addition, the choice of cooling technique and the associated water source has been selected in accordance with an appraisal of BAT considering the BAT hierarchy and evaluating the efficiency benefits and environmental effects of the different techniques available. The BAT assessment for cooling has been completed to support the Environmental Permit application for the Proposed Development An H1-screening assessment will also be undertaken during the process of obtaining an Environmental Permit, once the CCP licensor and their exact solvent composition is known.

12.6.60 There is further potential for physico-chemical water quality impacts at the River Trent outfall, from the discharge of process water The Humber Upper (River Trent) WFD waterbody currently has Good physico-chemical Status and Chemical Status is Failing. The Proposed Development must not lead to deterioration of this status or prevent future improvement. It will need to be demonstrated that the discharged effluent from the Proposed Development meets the required standards for a range of water quality indicators in order to obtain a Water Activity Permit (i.e. a consent from the Environment Agency to discharge).

12.6.61 The key wastewater stream generated at the Proposed Development Site requiring treatment on-site will be from the DCC. This wastewater will comprise primarily water containing dissolved CO_2 from the exhaust gas and up to 165 mg/l of ammonia originating from the SCR system in the HRSG. This stream will require treatment to remove the ammonia and nitrogen prior to discharge to the outfall. Treatment will be undertaken to remove ammonia

and blow-down water and wastewater from the raw water treatment plant will be combined with the treated DCC water prior to discharge to the Water Discharge Corridor.

12.6.62 Water sampling facilities are to be provided for manual sampling of water prior to discharge. The frequency of testing and parameters will be agreed with the Environment Agency.

12.6.63 Given the requirements for the effluent from the Proposed Development to meet conditions of an Environmental Permit, it is considered that there is limited potential for pollution from the outfall, especially given the large capacity for dilution and dispersal offered by the Trent waterbody. As such, a negligible impact is predicted at this stage, with no changes likely to impact on WFD classifications for the larger waterbody. Given that the outfall is to a very high importance receptor, this results in a slight effect (**not significant**).

Surface Water Ponds: Water Quality

12.6.64 There are no ponds within the Proposed Development Site boundary, but five within the wider study area west of the River Trent; the assessment concludes that these will receive no impact.

Physical Effects to Waterbodies: Loss of Drain D4

12.6.65 Construction of the Proposed PCC Site would result in the loss of one minor field drain (Drain D4 – see Figure 12A) which would be infilled and built over. This artificial drain is straight, 400m long, approximately 1m wide and 10cm deep (depths noted at time of the spring survey for the PEA (**Appendix 11C** of ES Volume II - **Application Document Ref. 6.3**). The channel is dominated by silt and largely overgrown with a very limited diversity of aquatic and wetland macrophyte species in the summer. It lacks hydromorphic bedform features (e.g. riffles, pools, localised meanders) and is not known to be of any significant biodiversity, social, or economic value.

12.6.66 Given the limited existing morphological or biodiversity value of this drain, it is considered that the impact arising from habitat loss can be readily compensated through sensitive design of the surface water attenuation infrastructure required by the Proposed Development, which includes a series of swales.. Furthermore, there will be habitat enhancement works to ditches surrounding Keadby Common (discussed further in Section 12.7). A surface water attenuation pond (and associated design) will be secured as a requirement of the draft DCO (**Application Document Ref. 2.1)**; it is considered that this pond will likely accrue a minor biodiversity value as explained in the Landscape and Biodiversity Management and Enhancement Plan (LBMEP) (**Application Document Ref. 5.10**).

12.6.67 Consent would need to be obtained through consultation with the IoAaNNWLMB given hydrological links to IDB maintained watercourses (i.e. Drain 1), and consultation will therefore be continued to agree any relevant mitigation measures required.

12.6.68 Given the low quality of the D4 drain habitat and potential new habitat creation, the magnitude of the impact is considered moderate adverse. As drain D4 is a low importance receptor for morphology (with an estimated Q95 below 0.001m^3/s), this results in a slight adverse effect (**not significant**).

Demand for Water

12.6.69 Keadby Power Station currently holds two abstraction licences, a license to abstract from the Stainforth and Keadby Canal for Keadby 2 Power Station and a licence for abstraction from the River Trent for Keadby 1 Power Station. It is anticipated that the Proposed Development would potentially be able to adopt an existing licence for water abstraction, although this is subject to ongoing engagement with the Canal and River Trust. If existing licences are not sufficient to provide the cooling water needs, then a new licence would be required, or the water requirement may be achieved through licence trading. This would follow the same approach as applying for a new licence.

12.6.70 Given that there is sufficient water supply available from the River Trent and also potentially from the Stainforth and Keadby Canal (through suitable trading arrangements or conditions), and that any abstraction would be licensed by the Environment Agency, a negligible impact is predicted on water availability from these sources. This gives a slight adverse effect (**not significant**) on the River Trent due to it being a very high importance receptor, and a neutral effect (**not significant**) on the Stainforth and Keadby Canal as a high importance receptor.

Foul Water Discharge

12.6.71 All foul water from welfare facilities from the Proposed Development is intended to be directed via the existing foul water sewer for Keadby 2 Power Station to the Severn Trent Water pumping station on Chapel Lane, and from there to the nearest wastewater treatment works (WwTW). It has been assumed that given the relatively small volumes involved, that Severn Trent Water will have adequate capacity to provide treatment within current permit standards. This will be confirmed through ongoing consultation with Severn Trent Water. If the pipeline condition is not suitable for continued use, foul sewage would instead be treated on site in a package treatment plant with the treated water directed to the River Trent via the water discharge connection under the conditions of an Environmental Permit.

12.6.72 For the purposes of this assessment, it has been assumed that the Severn Trent Water WwTW or the on-site package treatment plant will treat foul water

prior to discharge to any waterbodies in accordance with requirements to not cause deterioration or prevent improvement under the WFD. On this basis, the impact of foul water discharges on the River Trent is considered to be a neutral (**not significant**) effect.

Flooding from Tidal Sources during Operation

12.6.73 It has been determined in the FRA (**Appendix 12A** of ES Volume II - **Application Document Ref. 6.3**) that the Proposed Development Site is at a 'low' risk of flooding from tidal sources with the defences in place or resulting from overtopping of the defences during events that exceed a 0.5% AEP (1 in 200 chance) of flooding.

12.6.74 During a future scenario resulting from climate change up to 2068 the Proposed Development Site is potentially at a 'high' residual risk of flooding as a result of overtopping during events that exceed a 0.5% AEP (1 in 200 chance) of flooding on the River Trent where defences are 6.2 to 6.3m AOD. The Proposed Development Site is however at 'low' residual risk of tidal flooding originating from the North and South Soak Drains where defences are 1.3m AOD.

12.6.75 In the event that the defences were to breach during the 0.5% AEP event, the hazard to the Proposed Development Site would be 'high' as flood waters would enter the area. The flood levels resulting from a breach event are higher than those that would be expected from overtopping of the defences and therefore represent a conservative flood level on the Proposed Development Site. However, the probability of a breach occurring is 'low', meaning that the residual risk remains 'low'.

12.6.76 As described in Section 12.5 and the FRA (**Appendix 12A** of ES Volume II - **Application Document Ref. 6.3**), a range of mitigation measures are proposed to mitigate flood risk so that the occupiers of the Proposed Development Site are safe and critical operational infrastructure associated with the CCGT can continue to function at the Proposed Development Site in the event of such inundation. This would include a Flood Emergency Response Plan, and allocation of a place of safe refuge. Furthermore, finished floor levels across the Proposed PCC Site are to be raised to to the breach level (2.2m AOD) +400mm freeboard i.e. 2.6m AOD; critical operational infrastructure will have a further clearance of 1.0m, therefore providing a level of resilience ofno less than 3.6m AOD which is also the approach that has been adopted for the Keadby 2 Power Station. Further clearance will be provided up to 4.4m AOD (i.e. the Critical Flood Level + 300mm freeboard) where reasonably practicable to do so.

12.6.77 All surface water runoff from the Proposed Development Site is to discharge to the Keadby Common Drain or River Trent following SuDS attenuation and this discharge would be restricted to the greenfield runoff rate. As such, the

risk of tidal flooding should not be exacerbated by the Proposed Development.

12.6.78 Tidal flooding is considered of Very High Importance due to the nature of the development as essential infrastructure. Given that the Proposed Development is expected to have negligible impact on flood levels on or off site through implementation of a Drainage Strategy and the flood resistance and resilience measures, then a slight effect (**not significant**) is anticipated on tidal flooding (based on the classification approach in Table 12.4). While there is a high residual risk of flooding to the Proposed Development Site, appropriate mitigation measures have been outlined to manage this risk.

Flooding from Fluvial Sources during Operation

12.6.79 The FRA (**Appendix 12A** of ES Volume II - **Application Document Ref. 6.3**) indicates that the Proposed Development Site is at a 'low' risk of flooding from fluvial sources with the flood defences in place or resulting from overtopping of the defences during events that exceed a 0.5% AEP (1 in 200 chance) and 0.1% AEP.

12.6.80 As described above (with regard to tidal flooding) all runoff from the Proposed Development Site is to discharge to Keadby Common Drain or the River Trent following SuDS attenuation and this discharge would be restricted to the greenfield runoff rate. As such, the risk of fluvial flooding should not be exacerbated by the Proposed Development. Given the low risk of fluvial flooding and implementation of the proposed drainage strategy (**Appendix 12A** of ES Volume II - **Application Document Ref. 6.3**), it is considered that the Proposed Development would result in a negligible impact on fluvial flooding on and off site during operation, resulting in a long-term neutral effect (**not significant**) on fluvial flooding.

Flooding from Surface Water Sources during Operation

12.6.81 The risk of surface water flooding within the Proposed Development Site from elsewhere or generated within the Proposed Development Site is considered to be 'low to very low', with some small and isolated patches of medium and high risk. Extensive drainage infrastructure already exists across the Proposed Development Site due to the Keadby 1 Power Station and Keadby 2 Power Station and the Proposed Development drainage would be kept separate from this.

12.6.82 Given the implementation of the proposed drainage strategy, surface water from the Proposed Development will be carefully managed, treated and directed to Keadby Common Drain or the River Trent outfall at controlled greenfield runoff rates. It is therefore considered that the Proposed Development would have a negligible impact on surface water flood risk on or off site, resulting in a neutral effect (**not significant**).

Flooding from Ground Water Sources during Operation

12.6.83 The risk of groundwater flooding within the study area is considered to be 'low' within the FRA (**Appendix 12A** of ES Volume II - **Application Document Ref. 6.3**).

12.6.84 Should the Proposed Development comprise below ground development within strata where groundwater is recorded as present, mitigation measures, including those outlined in British Standard 8102 Code of Practice for Protection of Below Ground Structures Against Water From the Ground (BSI, 2009) will be required to reduce the risk of groundwater flooding to underground structures as is best practice. Assuming this to be the case, the magnitude of impact from groundwater flooding during operation is considered negligible, with a resultant neutral (**not significant**) effect.

Flooding from Artificial Sources during Operation

12.6.85 The Proposed Development Site is not considered at risk from reservoir flooding. The Stainforth and Keadby Canal is adjacent to the Proposed Development Site, but given the shallow gradients, and that it drains into the River Trent by a sluice, the risk of flooding is also likely to be low (see **Appendix 12A** (ES Volume II **- Application Document Ref. 6.3**)). If any overtopping of the canal were to occur, this would drain into the North and South Soak drains located at a lower elevation on either side of the canal and drain away. However, the canal levels are monitored and maintained by the CRT. As a result, overtopping is unlikely and so the Proposed Development Site is at low risk of flooding from the canal. As such, the risk of flooding from these sources is considered negligible in EIA terms, giving a neutral (**not significant**) effect.

12.6.86 Following the completion of the Proposed Development, an additional residual risk relates to maintenance of the on-site drainage infrastructure. Failure, blockage and capacity exceedance above that of the design events for the drainage system are a potential risk to the Proposed Development Site and the surrounding area. In order to reduce the risks, an inspection and maintenance programme would be put in place for the drainage infrastructure to prevent/ minimise the residual risk of flooding from this source, should it occur.

12.6.87 CIRIA C6352 9 (CIRIA, 2006) provides guidance on measures that can be incorporated into the detailed design of developments to steer surface water that has exceeded the capacity of the drainage system away from buildings and route it towards the intended point of attenuation and discharge (for example along swales and roads using raised kerbing and through parking areas). The proposed drainage infrastructure design will be agreed with the LLFA before construction to ensure that the risks of flooding from drainage infrastructure are not increased due to the Proposed Development.

12.6.88 With regard to flooding from drainage infrastructure, given appropriate design measures previously described, the magnitude of impact is considered to be minor adverse, and a slight effect (**not significant**) is anticipated as a worst-case scenario.

Decommissioning Phase

12.6.89 At the end of its operating life, all above-ground equipment associated with the Proposed Development would be decommissioned and removed from the Proposed Development Site. It is assumed that all underground infrastructure will remain in-situ, however, all connection and access points will be sealed or grouted to ensure disconnection.

12.6.90 On this basis, decommissioning impacts are expected to be limited to waterbodies in close proximity to the Proposed Development Site (i.e. River Trent, Stainforth and Keadby Canal, Keadby Common Drain, North Soak Drain and Drains D1, D2, D5 and D6), and will be similar to the impacts reported for the construction phase, but with fewer earthworks, excavations and tunnel arisings to manage.

12.6.91 A detailed Decommissioning Environmental Management Plan will be prepared to identify required measures to prevent pollution during this phase of the development, based on the detailed decommissioning plan.

12.6.92 There may be marginal improvements to the water quality of the River Trent, Stainforth and Keadby Canal or Keadby Common Drain waterbodies following decommissioning of the Proposed Development given that the proposed abstraction/ discharges will be ceasing. However, any such change will be negligible given that no significant adverse effects have been identified. For the very high importance River Trent this negligible impact is a slight beneficial effect (**not significant**). For the high importance Stainforth and Keadby Canal and medium importance Keadby Common Drain this also gives a slight beneficial effect (**not significant**).

12.7 Mitigation, Monitoring and Enhancement Measures

Mitigation Measures

12.7.1 Mitigation of adverse impacts on the water environment during the construction phase will be achieved principally through embedded measures identified in Section 12.5, notably the adoption of a CEMP and WMP.

Monitoring Measures

12.7.2 A water quality monitoring programme will be set out in the CEMP. This will need to be further developed by the Principal Contractor in consultation with the Environment Agency (due to works potentially impacting flow in a main river and WFD waterbodies), the LLFA and/ or IDB (due to works potentially

impacting flow in ordinary watercourses), and the MMO (due to works impacting the tidal River Trent) during the process of obtaining Environmental Permits/ Consents/ Licences for works affecting, or for temporary discharges to, waterbodies during the construction period.

12.7.3 The programme will be assumed to include a combination of daily observations and monitoring using a calibrated, handheld water quality probe through the upstream and downstream reaches of water features hydrologically-connected to the Proposed Development Site. It is expected that water quality sampling will be undertaken on a periodic as well as ad-hoc basis, dependent upon circumstances / activities on-site. Monitoring and sampling will be undertaken prior to the commencement of construction as to allow a sufficient baseline data.

12.7.4 It is assumed that the need for long term water quality monitoring will be set out and agreed with the Environment Agency through the environmental permitting process and thus no details of what this may involve are described here.

12.7.5 A number of additional mitigation strategies will be considered during the design process for the Proposed Development to ensure the operation of the Proposed Development Site is maintained in the event of an extreme flood should the existing tidal defences fail in the vicinity of the Proposed Development Site, or in the event of heavy rainfall that could result in surface water flooding at the Proposed Development Site, should the design capacity of the drainage network be exceeded. These strategies include:

- providing flood resistance and resilience measures including raising of critical operational infrastructure;
- flood emergency response plans;
- flood warnings and alerts;
- emergency access and egress;
- place of safe refuge; and
- design capacity exceedance.

Enhancement Measures

Attenuation Pond:

12.7.6 It is proposed that the design of the surface water management system including attenuation pond will be agreed through a requirement of the draft DCO (**Application Document Ref. 2.1**). The pond will be designed so that it is also suitable for freshwater and/or wetland flora and fauna. It will therefore complement the main habitat enhancement approach described in

the Landscape and Biodiversity Management and Enhancement Plan (LBMEP) provided as **Application Document Ref. 5.10**.

12.7.7 To achieve biodiversity enhancement the attenuation pond will be designed to:

- avoid linkages to foul water drainage and requirements for importation of topsoil, as these sources may result in additions of nutrients to the pond;
- provide (subject to confirmation of sufficient water availability) a variable water depth with shallow and gradual marginal areas and a deeper area (of up to 1m maximum depth); and
- retain permanent standing water in most years while not preventing seasonal drawdown (pond drying) given this is ecologically beneficial.

Drains within Keadby Common:

12.7.8 The final LBMEP, to be secured through requirement of the draft DCO (**Application Document Ref. 2.1**) will include details of a programme of field drain enhancement works to re-instate areas with open water more suitable to support a greater range of aquatic biodiversity, including water vole. The target drains are those on the southern, eastern and western boundaries of Keadby Common (800m total length/ 0.08ha).

12.7.9 Further detail on these enhancements is provided in Section 8.0 of **Appendix 12B**: Water Framework Directive Assessment (**Application Document Ref. 6.3**).

Limitations or Difficulties

12.7.10 This assessment has been undertaken using available data and Proposed Development design details. However, at this concept design stage, details of the Proposed Development remain uncertain or under development, e.g. final location of the abstraction and the detailed design of drainage arrangements. For this reason, as described in Section 12.3, reasonable worst-case assumptions have been used following the Rochdale Envelope approach.

12.8 Limitations and Difficulties

12.8.1 No water quality monitoring has been undertaken specifically to inform this assessment. This is not considered a limitation as background water quality data has been determined from the nearest data available of the Environment Agency's Water Quality Archive website (Environment Agency, 2020b) and other assessments produced to inform the design of the Proposed Development (including preliminary water supply and wastewater discharge feasibility assessments).

12.8.2 This assessment has been undertaken using available data and Proposed Development design details at the time of writing in April 2021. However, at this stage many details of the Proposed Development remain uncertain or under development, such as the final water abstraction. The assumptions used are listed in Section 12.3 and have followed the Rochdale Envelope approach. As such, the assessment is a worst-case scenario.

12.9 Summary of Likely Residual Effects

12.9.1 A summary of residual effects on water resources and flood risk and their significance is provided in Table 12.17.

Table 12.16: Summary of Residual Impacts and Effects

Description of Effect	Importance of Receptor (sensitivity for Flood Risk)	Magnitude of Impact	Initial Classification of Effect (with embedded mitigation)	Additional Mitigation and Monitoring	Residual Effect Significance
Construction					
Surface Water Quality – suspended fine sediments	River Trent – Very High; Stainforth and Keadby Canal – High; North and South Soak Drain – High; Hatfield Waste Drain (and North Engine Drain) – High; Drain D1, D2, D6 – Medium; Drains D7a, D7band unnamed drain adjacent to access road – Low.	River Trent – Negligible; Stainforth and Keadby Canal – Minor Adverse; North and South Soak Drain – Minor Adverse; Hatfield Waste Drain (and North Engine Drain) - Negligible Drains D1, D2, D5, D6, D7a, D7b– Minor Adverse.	Slight Adverse (**not significant**) effects predicted for: River Trent Stainforth and Keadby Canal North and South Soak Drain Hatfield Waste Drain (and North Engine Drain) Drain D1, D2, D6 Neutral (**not significant**) effect for Drains D7a, D7b and unnamed	Further to the implementation of the CEMP and WMP (embedded mitigation), water quality monitoring pre-construction and during construction will be undertaken. Careful management of any required drilling techniques for pipeline installation across watercourses as far as reasonably practicable.	Slight Adverse (**not significant**) effects for: River Trent Stainforth and Keadby Canal North and South Soak Drain Hatfield Waste Drain (and North Engine Drain) Drain D1, D2, D6 Neutral (**not significant**) effects for

Description of Effect	Importance of Receptor (sensitivity for Flood Risk)	Magnitude of Impact	Initial Classification of Effect (with embedded mitigation)	Additional Mitigation and Monitoring	Residual Effect Significance
			drain adjacent to access road		Drains D5, D7a, D7band unnamed drains
Surface Water Quality – chemical spillages	River Trent – Very High; Stainforth and Keadby Canal – High; North and South Soak Drain – High; Hatfield Waste Drain (and North Engine Drain) – High; Drain D1, D2, D6 – Medium; Drains D7a, D7band unnamed drain adjacent to access road – Low.	River Trent – Negligible; Stainforth and Keadby Canal – Negligible; North and South Soak Drain – Negligible; Hatfield Waste Drain (and North Engine Drain) – Negligible Drain D1 - Negligible Drains D2, D6, D7a, D7band unnamed drain adjacent to	Slight Adverse (**not significant**) effects predicted for: River Trent Stainforth and Keadby Canal North and South Soak Drain Hatfield Waste Drain (and North Engine Drain) Drain D2 & D6 Neutral (**not significant**) effects for: Drains D1, D7a, D7band	Further to the implementation of the CEMP and WMP (embedded mitigation), water quality monitoring pre-construction and during construction will be undertaken.	Slight Adverse (**not significant**) effects for: River Trent Stainforth and Keadby Canal North and South Soak Drain Hatfield Waste Drain (and North Engine Drain) Drain D2 & D6 Neutral (**not significant**) effects for:

Description of Effect	**Importance of Receptor (sensitivity for Flood Risk)**	**Magnitude of Impact**	**Initial Classification of Effect (with embedded mitigation)**	**Additional Mitigation and Monitoring**	**Residual Effect Significance**
		access road – Minor adverse.	unnamed drain adjacent to access road		Drains D1, D7a, D7b and unnamed drain adjacent to access road.
Morphological effects relating to installation of a cofferdam at the abstraction point	River Trent – Low (for morphology); Stainforth and Keadby Canal – Low (for morphology).	River Trent – Negligible; Stainforth and Keadby Canal – Minor adverse.	Neutral (**not significant**) effects for: River Trent Slight Adverse (**not significant**) effects for: Stainforth and Keadby Canal	Monitoring, as required, during cofferdam works.	Neutral (**not significant**) effects for: River Trent Slight Adverse (**not significant**) effects for: Stainforth and Keadby Canal
Morphological Effects to Waterbodies: New Bridges and Crossings for the Connection	Hatfield Waste Drain - Low Drains D1, D2, D6, D7a, D7b – Low (for morphology).	Hatfield Waste Drain – Negligible ; D1 – Negligible;	Neutral (**not significant**) effects for: Hatfield Waste Drain, Drains D1,	Further to the implementation of the CEMP and WMP (embedded mitigation), including, water should be over-pumped through the works; works should be undertaken in drier periods of the year, as far	Neutral (**not significant**) effects for: Hatfield Waste Drain, Drains

Description of Effect	**Importance of Receptor (sensitivity for Flood Risk)**	**Magnitude of Impact**	**Initial Classification of Effect (with embedded mitigation)**	**Additional Mitigation and Monitoring**	**Residual Effect Significance**
Corridors and Access		Drain D2 – Minor adverse; Drains D6, D7a, D7b- Negligible.	D2, D6, D7a and D7b	as reasonably practicable; pump intakes should be appropriately screened to prevent fish being drawn into the pipe/ pump; and drainage and planting to be reinstated following completion of works.	D1, D2, D6, D7a and D7b
Navigation impacts during construction	River Trent – High (for navigation) Stainforth & Keadby Canal – High (for navigation)	River Trent – minor adverse; Stainforth & Keadby Canal – minor adverse.	Slight adverse (**not significant**) effects for: River Trent and Stainforth & Keadby Canal	Ongoing pre-application engagement with ABP Humber to inform the final approach to marine works such that they have a minimal risk of disruption to the mariner; Ongoing engagement with the Canal and Rivers Trust to help refine measures to ensure awareness of works among mariners.	Slight adverse (**not significant**) effects for: River Trent and Stainforth & Keadby Canal
Flooding from tidal and fluvial sources during construction	Flood Risk - High (construction workers)	Negligible	Slight adverse (**not significant**)	Implementation of temporary site drainage system as described in CEMP and WMP (embedded mitigation); Flood	Slight adverse (**not significant**)

Description of Effect	Importance of Receptor (sensitivity for Flood Risk)	Magnitude of Impact	Initial Classification of Effect (with embedded mitigation)	Additional Mitigation and Monitoring	Residual Effect Significance
				Emergency Response Plan; Safe access and egress routes	
Flooding from surface water sources during construction	Flood Risk - High (construction workers)	Negligible	Slight adverse (**not significant**)	Implementation of temporary site drainage system as described in CEMP and WMP (embedded mitigation).	Slight adverse (**not significant**)
Flooding from groundwater sources during construction	Flood Risk - High (construction workers)	Negligible	Slight adverse (**not significant**)	Implementation of temporary site drainage system as described in CEMP and WMP (embedded mitigation).	Slight adverse (**not significant**)
Flooding from drainage artificial sources and drainage infrastructure during construction	Flood Risk - High (construction workers)	Negligible	Slight adverse (**not significant**)	None proposed.	Slight adverse (**not significant**)
Operation					
Potential Pollution of Surface Watercourses: Routine Runoff and	Keadby Common Drain - Medium Or	Keadby Common Drain – Negligible Or	Keadby Common Drain - Neutral (**not significant**) Or	Implementation of Drainage Strategy during detailed design (embedded mitigation).	Keadby Common Drain - Neutral (**not significant**)

Description of Effect	**Importance of Receptor (sensitivity for Flood Risk)**	**Magnitude of Impact**	**Initial Classification of Effect (with embedded mitigation)**	**Additional Mitigation and Monitoring**	**Residual Effect Significance**
Accidental Spillages	River Trent – Very High	River Trent - Negligible	River Trent – Slight adverse (**not significant**)		Or River Trent – Slight adverse (**not significant**)
Potential Impacts on water quality of the River Trent from operational discharges	River Trent - Very High	River Trent - Negligible	River Trent - Slight adverse (**not significant**)	Implementation of Drainage Strategy during detailed design (embedded mitigation).	River Trent - Slight adverse (**not significant**)
Surface Water Ponds: Water Quality	Ponds - Low	Ponds - No change	Ponds - Neutral	Refer to **Chapter 8**: Air Quality (ES Volume I - **Application Document Ref. 6.2**) for effects relating to atmospheric deposition.	Ponds – Neutral (**not significant**)
Physical Effects to Waterbodies: Loss of Drain D4	Drain D4 – Low	Drain D4 – Moderate Adverse	Drain D4 – Slight Adverse (**not significant**)	New compensatory habitat to be created including swales and an attenuation pond, plus enhancements made to Keadby Common ditches.	Drain D4 – Slight Adverse (**not significant**).

Description of Effect	**Importance of Receptor (sensitivity for Flood Risk)**	**Magnitude of Impact**	**Initial Classification of Effect (with embedded mitigation)**	**Additional Mitigation and Monitoring**	**Residual Effect Significance**
Demand for Water Abstraction	River Trent - Very High; Stainforth and Keadby Canal - High	River Trent: Negligible; Stainforth and Keadby Canal: Negligible.	River Trent – Slight Adverse (**not significant**); Stainforth and Keadby Canal – Neutral (**not significant**).	Further engagement to be undertaken with Environment Agency and CRT on abstraction options, including licensing and trading.	River Trent – Slight Adverse (**not significant**); Stainforth and Keadby Canal – Neutral (**not significant**).
Demand for Foul Water	Unknown waterbody (depends on treatment works used)	Minor adverse	Neutral (**not significant**)	Consultation to be undertaken with Severn Trent Water.	Neutral (**not significant**)
Flooding from tidal sources during operation	Flood Risk: Very High	Negligible	Slight Adverse (**not significant**)	Implementation of the drainage strategy (embedded mitigation)	Slight Adverse (**not significant**)
Flooding from fluvial sources during operation	Flood Risk: Low	Negligible	Neutral (**not significant**)	Implementation of the drainage strategy (embedded mitigation)	Neutral (**not significant**)
Flooding from surface water	Flood Risk: Low to Very Low,	Negligible	Neutral (**not significant**)	Implementation of the drainage strategy (embedded mitigation)	Neutral (**not significant**)

Description of Effect	**Importance of Receptor (sensitivity for Flood Risk)**	**Magnitude of Impact**	**Initial Classification of Effect (with embedded mitigation)**	**Additional Mitigation and Monitoring**	**Residual Effect Significance**
sources during operation	isolated patches Medium				
Flooding from groundwater sources during operation	Flood Risk: Low	Negligible	Neutral (**not significant**)	Implementation of the drainage strategy (embedded mitigation) Consideration of BS British Standard 8102 Code of Practice for Protection of Below Ground Structures Against Water From the Ground.	Neutral (**not significant**)
Flooding from drainage infrastructure and artificial waterbodies during operation	Flood Risk: Low	Minor	Slight (**not significant**)	Implementation of the drainage strategy (embedded mitigation)	Slight (**not significant**)

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