KEADBY
NEXT GENERATION
POWER STATION
Hydrogen-enabled flexible power

A collaboration between SSE Thermal and Equinor

The Keadby Next Generation Power Station Project

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The Keadby Next Generation Power Station Development Consent Order [year]

Environmental Statement (ES)

Volume II – Appendix 12B Water Environment (Water Framework Directive) Regulations Assessment

The Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure Regulations 2009 – Regulation 5(2)(l) The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

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Glossary

Abbreviation/	Description
AQAL	Air Quality Assessment Level
AEP	Annual Exceedance Probability
AEL	Associated Emission Level
BAT	Best Available Technique
BGL	Below Ground Level
BOD	Biochemical Oxygen Demand
BSI	British Standards Institute
Ca	Calcium
$CaCO_3$	Calcium Carbonate
CCGT	Combined Cycle Gas Turbine
CJEU	Court of Justice of the European Union
COMAH	Control of major Accident Hazards Regulations 2015
COSHH	Control of Substances Hazardous to Health Regulations
DDT	Dichlorodiphenyltrichloroethan
DEFRA	Department for Environment, Food and Rural Affairs
DEMP	Decommissioning Environmental Management Plan
DOC	Dissolved Organic Carbon
DrWPA	Drinking Water Protected Areas
ELV	Emission Limit Value
EQS	Environmental Quality Standard

Abbreviation/	Description
GWDTE	Groundwater Dependent Terrestrial Ecosystem
HSE	Health and Safety Executive
HMWB	Heavily Modified Water Body
HRA	Habitat Regulations Assessment
IDB	Internal Drainage Board
INNS	Invasive Non-Native Species
IoAaNNWLMB	Isle of Axholme and North Nottinghamshire Water Level Management Board
LBMEP	Landscape and Biodiversity Management and Enhancement Plan
LLFA	Lead Local Flood Authority
LWS	Local Wildlife Site
NH_3	Ammoniacal Nitrogen
NH_4	Ammonium Ion
NO_3	Nitrate
O_2	Oxygen
PBDE	Polybrominated diphenyl ethers
PFOS	Perfluorooctane sulphonate
RBD	River Basin District
RBMP	River Basin Management Plan
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TON	Total Organic Nitrogen
WFD	Water Framework Directive
WwTW	Wastewater Treatment Works
ZoI	Zone of Influence

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12B. Introduction

12B.1. Overview

12B.1.1. This Technical Appendix provides a Water Environment (Water Framework Directive) Regulations (WER) Assessment for the Keadby Next Generation Power Station Project (herein referred to as the 'Proposed Development') and supports **ES Volume I Chapter 12:** Water Resources and Flood Risk **(Application Document Ref. 6.2)**

12B.1.2. New developments that have the potential to impact the current or targeted WER status of a water body are required to assess their compliance against the WER objectives of the potentially affected waterbodies. In accordance with the Planning Inspectorate's (PINS) Advice Note on the Water Framework Directive (PINS, 2024) and the Environment Agency guidance for competing WER assessments for coastal and transitional waters (Environment Agency, 2023), a three-stage approach may be adopted:

- Stage 1: WER Screening (Baseline);
- Stage 2: WER Scoping (Preliminary); and
- Stage 3: WER Impact Assessment.

12B.1.3. This report presents the findings of Stages 1-2, Screening and Scoping, which have been undertaken in relation to the Proposed Development. The Stage 3 assessment requires detailed design information and will therefore be undertaken at the detailed design stage (post DCO).

Relevant aspects of the Proposed Development for the water environment

12B.1.4. Information regarding the scheme components for the Proposed Development is set out in Section 4.3 of **ES Volume I Chapter 4**: The Proposed Development (**Application Document Ref. 6.2)**.

12B.1.5. The information provided below is extracted from **ES Volume I Chapter 4**: The Proposed Development (**Application Document Ref. 6.2)** and sets out the components of the Proposed Development that are most relevant to the water environment.

Cooling Water and Effluent Connection Works

- The Main Site will require a source of cooling water for heat rejection purposes. Process water will also be required in order to provide make-up to the steam/ water cycle of the Proposed Development. There will also be a requirement for water for domestic and sanitary use.

- The preferred cooling method, for reasons of operational functionality and performance, is hybrid cooling of the CCGT using water abstracted from the Stainforth and Keadby Canal. An intake structure would be constructed within the canal with equipment to comply with the Eels (England and Wales) Regulations 2009 (HMSO, 2009) ('the Eels Regulations'). The Applicant understands from consultation with the Environment Agency that in order to achieve Best Available Eel Protection, the canal water abstraction infrastructure will require a 2mm mesh screen and an intake velocity < 0.1m/s to protect glass eel and elver. This should negate the need for a fish recovery and return system, however as the Keadby 2 Power Station canal water abstraction includes a fish recovery and return system, the EIA has assessed the potential need for a fish recovery and return system as a worst case. For the purposes of assessment, it is assumed the fish return system would comprise a Multidisc screen with 2 mm diameter mesh size to prevent debris and fish entering the cooling water system. The multidisc screens would include specially designed fish buckets attached to the screen panels that retain water during the upwards travel, therefore capturing any fish to minimise the rate of injury / mortality, and transferring fish to a fish return system (similar to that approved by the Environment Agency and that has been constructed for Keadby 2 Power Station). Pumps with varying pressure would be used to clear debris from the screens, including 6 bar and separate low-pressure pump for handling / returning the fish (1.2 bar). The cooling method would also require intake pipework, a wet well pumping station and chlorination plant.
- Treatment of cooling water is to be achieved through direct dosing of acid, hardness stabiliser and biocide. The cooling tower system requires a balance of abstraction and discharge to match the losses through evaporative cooling, whilst maintaining dissolved solids at an acceptable level. The remaining raw water will be directed to the demineralised water treatment plant where it will be processed to produce demineralised water suitable for the steam/water cycle and other consumers of high purity water such as gas turbine wash-water.
- The Applicant is proposing to re-use existing assets and pipework for Keadby 1 and Keadby 2 Power Stations for the discharge of treated effluent to the River Trent. The route of the existing water discharge connection from Keadby 1 and Keadby 2 Power Stations north-east to the River Trent (and associated easement) is included within the Site.

Interconnecting pipework would extend from the Main Site to connect to this infrastructure.

- A number of potential sources of effluent may arise from the Proposed Development including (but not limited to):
  - Cooling tower discharge (sometimes also referred to as blowdown, separate to boiler blowdown within the CCGT);
  - Neutralised (where necessary) effluent streams from the demineralised water treatment plant;
  - Blowdown from the CCGT steam/water cycle; and
  - Uncontaminated surface water.
- Effluent discharges will be regulated by the Environment Agency through the Environmental Permit that will be required for the operation of the Proposed Development; this would be discharged to the River Trent via the existing Keadby Power Station outfall. Surface water will be appropriately segregated, treated and attenuated prior to discharge. The preferred option is to discharge surface water to a drain managed by the Internal Drainage Board (IDB). An alternative discharge route (following segregation, treatment and attenuation) is also proposed, should this be required, via the existing Keadby 1 Power Station cooling water outfall.

Domestic and Sanitary Effluent

- Foul drainage from permanent welfare facilities would be directed to the local sewerage system, subject to agreement with the local sewerage undertaker. The existing foul sewer connection within the wider Keadby Power Station Site would be utilised if it is found to be fit for purpose for life of development. If this is not the case, a package treatment plant will be used which will discharge into the cooling water outfall.

Public Water Connection

- A new public water connection will be required from the Yorkshire Water main situated along Chapel Lane, including works to the existing public water pipelines within the Keadby Power Station site.

Chemical Storage

- A number of chemicals will be required to be transported to, stored and used on the Main Site. The Main Site will therefore contain chemical storage facilities including road tanker unloading area.
- Where any substance could pose a risk to the environment through its uncontrolled release (e.g. surface water drains), the substance will be

stored within appropriate containment facilities including impermeable concrete surfaces and appropriately designed and sized bunds.

- The inventory of materials to be stored on the Main Site will be developed through the detailed design. However, where storage of hazardous materials, individually or in-combination exceeds the relevant thresholds, separate permissions will be sought from the Health and Safety Executive (HSE) and local planning authority as appropriate for their storage, under the Planning (Hazardous Substances) Regulations 2015 (HMSO, 2015a) and Control of Major Accident Hazards Regulations 2015 (COMAH) (HMSO, 2015b) regimes. An Environmental Permit will be required for the operation of the Proposed Development which will include conditions on the storage of all chemicals with the potential to cause pollution.

Landscaping and Biodiversity

- The Proposed Development would include the provision of landscaping, planting and biodiversity enhancement works.

12B.1.6. An **Outline Landscape and Biodiversity Management and Enhancement Plan (LBMEP) Report** (**Application Document Ref. 5.10)** has been prepared. The document sets out the principles of habitat creation, management and enhancement and of landscape design that will be adopted in the detailed design process and the areas of the Site allocated for this purpose, as well as the existing areas of planting to be retained, protected and managed. Implementation of the proposed measures is secured by a Requirement of the **Draft DCO** (**Application Document Ref. 3.1**).

Structure of the Report

12B.1.7. The remainder of this report is set out as follows:

- Section 2 provides an overview of the WER;
- Section 3 describes the assessment methodology;
- Section 4 describes the general approach and assumptions to the assessment;
- Section 5 details the screening assessment;
- Section 6 details the Preliminary scoping assessment;
- Section 7 presents enhancement opportunities; and
- Section 8 presents the conclusions of the assessment.

12B.1.8. In addition, this assessment is supported by the following technical annexes:

- Annex 1 WER Water Body Status Classifications Cycle 3;
- Annex 2 Baseline Conditions;
- Annex 3 Baseline Surface Water Quality data for WER waterbodies;
- Annex 4 Aquatic Ecology Baseline; and
- Annex 5 Water Resources Baseline.

12B.2. Overview of the Water Environment Regulations Assessment

Legislative Context

12B.2.1. The Water Framework Directive (WFD) aims to protect and enhance the quality of the water environment and is transposed into legislation in England by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (WER). It takes a holistic approach to the sustainable management of water by considering the interactions between surface water (including transitional and coastal waters, rivers, streams and lakes), groundwater and water-dependent ecosystems.

12B.2.2. Under the WER, 'waterbodies' are the basic management units, defined as all or part of a river system or aquifer. Waterbodies form part of a larger 'river basin district' (RBD), for which 'River Basin Management Plans' (RBMP) are used to summarise baseline conditions and set broad improvement objectives.

12B.2.3. In England, the Environment Agency is the competent authority for implementing the WER, although many objectives will be delivered in partnership with other relevant public bodies and private organisations (for example, local planning authorities, water companies, River Trusts, large private landowners and developers). As part of its regulatory role and statutory consultee on planning applications and environmental permitting (under the Environmental Permitting Regulations (England and Wales) 2016 (as amended), the Environment Agency must consider whether proposals for new developments have the potential to:

- cause a deterioration of a waterbody from its current status or potential; and/ or
- prevent future attainment of good status or potential where not already achieved.

12B.2.4. In determining whether a development is compliant or non-compliant with the WER objectives for a water body, the Environment Agency must also

consider the conservation objectives of any Protected Areas (i.e. European sites or water dependent Sites of Special Scientific Interest (SSSI)) and adjacent WER waterbodies, where relevant.

Surface Water Body Status

12B.2.5. Under the WER, surface water body status is classified on the basis of chemical and ecological status or potential. Ecological status is assigned to surface waterbodies that are natural and considered by the Environment Agency not to have been significantly modified for anthropogenic purposes. The overall objective for natural surface waterbodies is to achieve Good Ecological Status and Good Chemical Status. Good Ecological Status represents only a small degree of departure from pristine conditions, which are otherwise known as High Ecological Status. All five status class definitions are provided in **Table 12B.1**.

Table 12B.1: Definition of status in the Water Framework Directive (Environment Agency, 2015)

Status	Definition
High	Near natural conditions. No restriction on the beneficial uses of the water body. No impacts on amenity, wildlife or fisheries.
Good	Slight change from natural conditions as a result of human activity. No restriction on the beneficial uses of the water body. No impact on amenity or fisheries. Protects all but the most sensitive wildlife.
Moderate	Moderate change from natural conditions as a result of human activity. Some restriction on the beneficial uses of the water body. No impact on amenity. Some impact on wildlife and fisheries.
Poor	Major change from natural conditions as a result of human activity. Some restrictions on the beneficial uses of the water body. Some impact on amenity. Moderate impact on wildlife and fisheries.
Bad	Severe change from natural conditions as a result of human activity. Significant restriction on the beneficial uses of the water body. Major impact on amenity. Major impact on wildlife and fisheries with many species not present.

12B.2.6. Ecological potential is assigned to artificial and man-made waterbodies (such as canals), or natural waterbodies that have undergone significant modification; these are termed Heavily Modified Water Bodies (HMWB). The term ‘ecological potential’ is used as it may be impossible to achieve good ecological status because of modification for a specific use, such as navigation or flood protection. The ecological potential represents the degree to which the quality of the water body approaches the maximum it could achieve and depends on the classification of WER parameters, and

the implementation of mitigation measures identified by the Environment Agency.

12B.2.7. Ecological status of waterbodies is classified according to relevant biological, physico-chemical, and hydromorphological parameters on a five-point scale as either High, Good, Moderate, Poor or Bad Ecological Status. The classification system is based on a worst-case 'one-out all-out' system, meaning that the overall ecological status is based on the lowest individual parameter score. This general system is summarised below in **Plate 12B.1.**

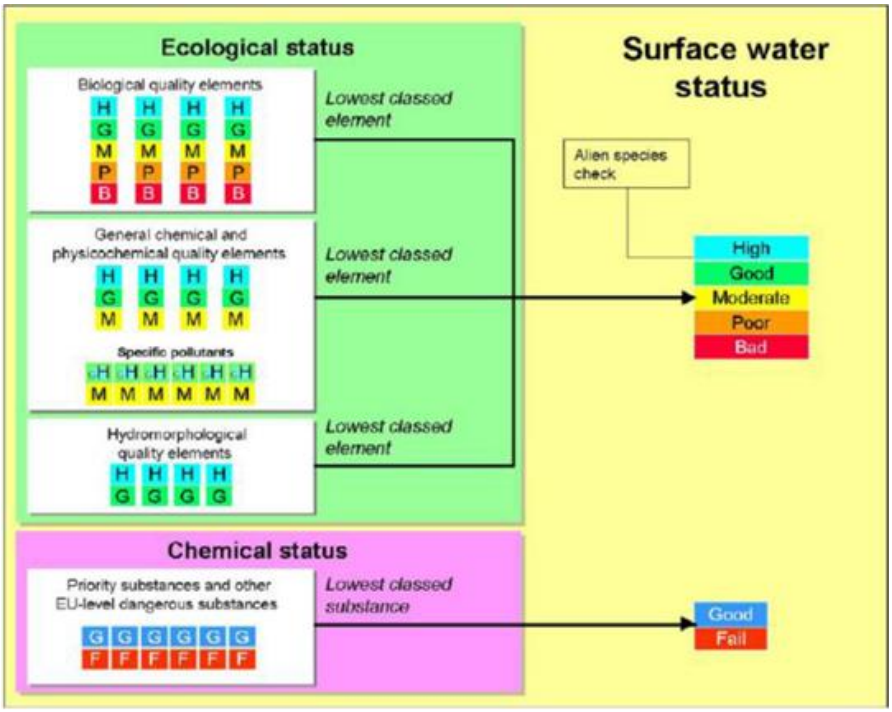

Plate 12B.1: WER classification elements for surface waterbody status (Environment Agency, 2022)

Chemical Status

12B.2.8. Chemical status is defined by compliance with environmental standards for chemicals that are priority substances and/or priority hazardous substances, in accordance with the WER and the Environmental Permitting (England and Wales) (Amendment) Regulations 2016. Chemical status is assigned on a scale of good or fail. Surface waterbodies are only monitored for priority substances where there are

known discharges of these pollutants; otherwise surface waterbodies are reported as being at good chemical status.

Ecological Status or Potential

12B.2.9. Ecological status or potential is defined by the overall health or condition of the watercourse. This is assigned on a scale of High, Good, Moderate, Poor or Bad, and on the basis of four classification elements or 'tests' (Environment Agency, 2022), as follows:

- **Biological:** This test is designed to assess the status indicated by a biological quality element such as the abundance of fish, invertebrates or algae and by the presence of invasive species. The biological quality elements can influence an overall water body status from Bad through to High.
- **Physico-chemical**: This test is designed to assess compliance with environmental standards for supporting physico-chemical conditions, such as dissolved oxygen, phosphorus and ammonia. The physico-chemical elements can only influence an overall water body status from Moderate through to High.
- **Specific pollutants:** This test is designed to assess compliance with environmental standards for concentrations of specific pollutants, such as zinc, cypermethrin or arsenic. As with the physico-chemical test, the specific pollutant assessment can only influence an overall water body status from Moderate through to High.
- **Hydromorphology:** For natural, non-HMWBs, this test is undertaken when the biological and physico-chemical tests indicate that a water body may be of High status. It specifically assesses elements such as water flow, sediment composition and movement, continuity, and structure of the habitat against reference or 'largely undisturbed' conditions. If the hydromorphological elements do not support High status, then the status of the water body is limited to Good overall status. For artificial or HMWBs, hydromorphological elements are assessed initially to determine which of the biological and physico-chemical elements should be used in the classification of ecological potential. In all cases, assessment of baseline hydromorphological conditions are an important factor in determining possible reasons for classifying biological and physico-chemical elements of a water body as less than Good, and hence in determining what mitigation measures may be required to address these failing waterbodies.

Groundwater Body Status

12B.2.10. Under the WER, groundwater body status is classified on the basis of quantitative and chemical status. Status is assessed primarily using data collected from the Environment Agency monitoring network; therefore, the scale of assessment means that groundwater status is mainly influenced by larger scale effects such as significant abstraction or widespread/ diffuse pollution. The worst-case classification is assigned as the overall groundwater body status, in a 'one-out all-out' system. This system is summarised in **Plate 12B.2**.

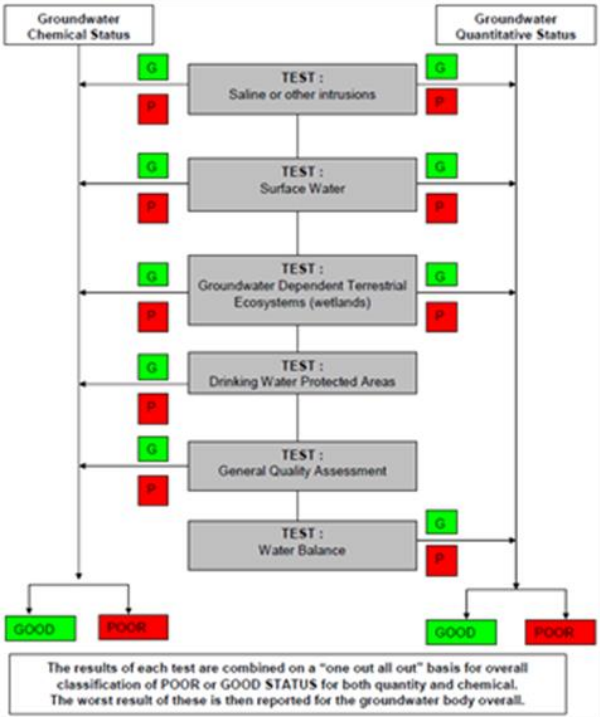

Plate 12B.2 WER Classification Elements for Groundwater Body Status (Environment Agency, 2022b)

Quantitative Status

12B.2.11. Quantitative status is defined by the quantity of groundwater available as baseflow to watercourses and water-dependent ecosystems, and as 'resource' available for use as drinking water and other consumptive purposes. This is assigned on a scale of Good or Poor, and on the basis of four classification elements or 'tests' as follows:

- **Saline or other intrusions**: This test is designed to identify groundwater bodies where the intrusion of poor quality water, such as saline water or water of different chemical composition, as a result of groundwater abstraction, is leading to sustained upward trends in

pollutant concentrations or significant impact on one or more groundwater abstractions.

- **Surface water**: This test is designed to identify groundwater bodies where groundwater abstraction is leading to a significant diminution of the ecological status of associated surface waterbodies.
- **Groundwater Dependent Terrestrial Ecosystems (GWDTE)**: This test is designed to identify groundwater bodies where groundwater abstraction is leading to "significant damage" to associated GWDTE (with respect to water quantity).
- **Water balance**: This test is designed to identify groundwater bodies where groundwater abstraction exceeds the 'available groundwater resource', defined as the rate of overall recharge to the groundwater body itself, as well as the rate of flow required to meet the ecological needs of associated surface waterbodies and GWDTE.

Chemical Status

12B.2.12. Chemical status is defined by the concentrations of a range of key pollutants, by the quality of groundwater feeding into watercourses and water-dependent ecosystems and by the quality of groundwater available for drinking water purposes. This is assigned on a scale of Good or Poor, and on the basis of five classification elements or 'tests' as follows:

- **Saline or other intrusions**: This test is designed to identify groundwater bodies where the intrusion of poor quality water, such as saline water or water of different chemical composition, as a result of groundwater abstraction is leading to sustained upward trends in pollutant concentrations or significant impact on one or more groundwater abstractions.
- **Surface water**: This test is designed to identify groundwater bodies where groundwater abstraction is leading to a significant diminution of the chemical status of associated surface water bodies.
- **GWDTE**: This test is designed to identify groundwater bodies where groundwater abstraction is leading to "significant damage" to associated GWDTE (with respect to water quality).
- **Drinking Water Protected Areas (DrWPA)**: This test is designed to identify groundwater bodies failing to meet the DrWPA objectives defined in Article 7 of the WER or at risk of failing in the future.
- **General quality assessment:** This test is designed to identify groundwater bodies where widespread deterioration in quality has or will compromise the strategic use of groundwater.

12B.3. Assessment Methodology

Overview

12B.3.1. The PINS Advice Note on the Water Framework Directive (PINS, 2024) and the Environment Agency guidance for completing WER assessments for coastal and transitional waters (Environment Agency, 2023) suggest that a three-stage approach can be adopted:

- **Stage 1: WER Screening** - Identification of the proposed work activities that are to be assessed and determination of which WER waterbodies could potentially be affected through identification of a Zone of Influence (ZoI). This step also provides a rationale for any waterbodies screened out of the assessment.
- **Stage 2: WER Scoping** - For each water body identified in Stage 1, an assessment is carried out to identify the effects and potential risks to quality elements from all activities. The assessment is made taking into consideration embedded mitigation (measures that can reasonably be incorporated into the design of the proposed works) and good practice mitigation (measures that would occur with or without input from the WER assessment process).
- **Stage 3: WER Impact Assessment** - A detailed assessment of the waterbodies and activities carried forward from the WER screening and scoping stages. It involves:
  - the baseline conditions of the concerned waterbodies;
  - an assessment of the risk of deterioration (either in isolation or cumulatively);
  - a description of any additional mitigation that is required (if applicable) and how it will be implemented; and,
  - an explanation of any positive contributions to the RBMP objectives proposed, and how they will be delivered.

12B.3.2. This report covers Stage 1 and Stage 2 of the above assessment process.

Defining no deterioration

12B.3.3. No deterioration was defined by the Environment Agency in its Position Paper (Environment Agency, 2020). Steps are required to prevent deterioration of the ecological status, ecological potential and chemical

status of surface water and the qualitative status and quantitative status of groundwater.

12B.3.4. Originally deterioration was defined by the Environment Agency as deterioration from one status class to a lower one, however following a ruling by the Court of Justice of the European Union (CJEU) in July 2015 (Case C-461/13 on the 1st July 2016 (Bund für Umwelt und Naturschutz Deutschland eV v Bundesrepublik Deutschland) (Court of Justice of the European Union, 2015)), this has been redefined. The CJEU ruling clarified that:

- 'deterioration of the status' of the relevant water body includes a fall by one class of any element of the 'quality elements' even if the fall does not result in a change in the classification of the water body as a whole;
- 'any deterioration' in quality elements in the lowest class constitutes deterioration; and
- certainty regarding a project's compliance with the Directive is required at the planning consent stage; hence, where deterioration 'may' be caused, derogations under Regulation 19 of the WER are required at this stage.

12B.3.5. Whilst deterioration within a status class does not contravene the requirements of the WER, (except for Water Supply (Water Quality) (Amendment) Regulations 2017 parameters in drinking water protected areas), the WER requires that action should be taken to limit within-class deterioration as far as practicable. For groundwater quality, measures must also be taken to reverse any environmentally significant deteriorating trend, whether or not it affects status or potential.

12B.3.6. The no deterioration requirements are applied independently to each of the elements coming together to form the water body classification as required by Appendix V of the Water Framework Directive and Article 4 of the Groundwater Daughter Directive. This is transposed into UK legislation by the Groundwater (England and Wales) Regulations 2009 (HMSO, 2009a).

12B.3.7. For surface waters, to manage the risk of deterioration of the biological elements of surface waters, the no deterioration requirements are applied to the environmental standards for the physico-chemical elements, including those for the Moderate/Poor and Poor/Bad boundaries.

12B.3.8. For groundwater, the no deterioration requirements are applied to each of the four component tests for quantitative status and the five component tests for chemical status. The no deterioration requirement may not apply

to elements at High status and elements at High status may be permitted to deteriorate to Good status, provided that:

- the waterbody's overall status is not High;
- the RBMP has not set an objective for the water body of High status;
- the objectives and requirements of other domestic or European Community legislation are complied with; and
- action is taken to limit deterioration within High or Good status or potential classes as far as practicable.

12B.3.9. The no deterioration baseline for each water body is the status that is reported in **Annex 1**.

Surface Water Assessment

12B.3.10. Table 12B.2 presents the matrix used to assess the effect of a project on surface water status or potential class. It ranges from a major beneficial effect, a positive change in overall WER status, through no effect, and down to deterioration in overall status class. The assessment considers all waterbodies that may be directly or indirectly affected (adjacent waterbodies). It has also considered any Protected Areas as defined by other European Directives such as Special Areas of Conservation (SAC) and Special Protection Areas (SPA), and water dependent SSSIs. Where more stringent (than WER) standards apply (such as conservation objectives) these have also been considered.

Table 12B.2: Surface Water Assessment Matrix

Effect	Description / Criteria	Outcome
Major beneficial	Impacts that taken on their own or in combination with others have the potential to lead to the improvement in the ecological status or potential of a WER quality element for the entire waterbody	Increase in status of one or more WER element giving rise to a predicted rise in status class for that waterbody.
Minor / localised beneficial	Impacts when taken on their own or in combination with others have the potential to lead to a minor localised or temporary improvement that does not affect the overall WER status of the waterbody or any quality elements	Localised improvement, no change in status of WER element
Green (no impact)	No measurable change to any quality elements.	No change

Effect	Description / Criteria	Outcome
Yellow - Localised/ temporary adverse effect	Impacts when taken on their own or in combination with others have the potential to lead to a minor localised or temporary deterioration that does not affect the overall WER status of the waterbody or any quality elements or prevent improvement. Consideration will be given to mitigation measures such as habitat creation or enhancement measures.	Localised deterioration, no change in status of WER element when balanced against mitigation measures embedded in the scheme.
Orange - Adverse effect on class of WER element	Impacts when taken on their own or in combination with others have the potential to lead to the deterioration in the WER status class of one or more biological quality elements, but not in the overall status of the waterbody. Consideration will be given to mitigation measures such as habitat creation or enhancement measures.	Decrease in status of WER element when balanced against positive measures embedded in the scheme.
Red – Adverse effect on overall WER class of waterbody	Impacts when taken on their own or in combination with others have the potential to lead to the deterioration in the ecological status or potential of a WER quality element, which then lead to a deterioration of status/potential of waterbody.	Decrease in status of overall WER waterbody status when balanced against positive measures embedded in the scheme.

Groundwater Assessment

12B.3.11. Table 12B.3 presents the matrix used to assess the effect of a project on groundwater status class. It ranges from a beneficial effect, through no effect, and down to deterioration in overall status class. The assessment considers potential impacts to the groundwater body(ies) through either direct or indirect construction activities and scheme components. This includes consideration of Protected Areas.

Table 12B.3: Groundwater assessment matrix

Magnitude of Impact of Scheme Element on WER Element i.e. in individual cells	Effect on WER Element within the assessment boundary i.e. at end of row	Effect on Status of WER element at the Groundwater Body Scale
Impacts lead to beneficial effect	Combined impacts have the potential to have a beneficial effect on the WER element.	Improvement but no change to status of WER element
No measurable change to groundwater levels or quality.	No measurable change to WER elements.	No change and no deterioration in status of WER element
Impacts when taken on their own have the potential to lead to a minor localised or temporary effect	Combined impacts have the potential to lead to a minor localised or temporary adverse effect on the WER element.	Combined impacts have the potential to lead to a minor localised or temporary effect on the WER element. No change to status of WER element and no significant deterioration at groundwater body scale.
Impacts when taken on their own have the potential to lead to a widespread or prolonged effect.	Combined impacts have the potential to have an adverse effect on the WER element.	Combined impacts have the potential to have an adverse effect on the WER element, resulting in significant deterioration but no change in status class at groundwater body scale.

Magnitude of Impact of Scheme Element on WER Element i.e. in individual cells	Effect on WER Element within the assessment boundary i.e. at end of row	Effect on Status of WER element at the Groundwater Body Scale
Impacts when taken on their own have the potential to lead to a significant effect.	Combined impacts in combination with others have the potential to have a significant adverse effect on the WER element.	Combined impacts in combination with others have the potential to have an adverse effect on the WER element AND change its status at the groundwater body scale

Future Status Objectives

12B.3.12. RBMP are used to outline water body pressures and the actions that are required to address them. The future status objective assessment considers the ecological potential of a surface water body and the mitigation measures that defined the ecological potential. Assessments undertaken for the Proposed Development should consider the mitigation measures defined in the 2022 RBMP. Information on WER measures available from the Environment Agency Catchment Data Explorer website (accessed August 2025) has also been reviewed. The assessment considers whether a project has the potential to prevent the implementation or impact the effectiveness of the defined measures.

Regulation 19 tests

12B.3.13. Regulation 19 of the WFD states that the appropriate agency will not be in breach of the Directive when failure to meet its environmental objectives is the result of either new modifications to the physical characteristics of a water body or as a result of new human sustainable development, on the proviso that the modifications or new development proposed are compliant with the four key conditions listed below. In doing so, Regulation 19 provides a means whereby a derogation for a proposed modification or sustainable development may be granted where it meets these four conditions:

1. all practicable steps have been taken to mitigate the adverse impact on the status of the water body;
2. the reasons for the modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of

achieving the objectives are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development;

3. the beneficial objectives served by the modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option; and
4. the reasons for the modifications or alterations are clearly identified to the Environment Agency, so that they can be specifically set out and explained in the relevant RBMP, and the environmental objectives must be reviewed every six years.

Environment Agency's Clearing the Waters for All guidance

12B.3.14. Within the PINS Advice Note on the Water Framework Directive (PINS, 2024), PINS advise following the approach given in the Environment Agency's Clearing the Waters for All guidance (Environment Agency, 2023). While developed for estuarine and coastal waters, PINS consider the staged approach equally suitable for rivers, lakes and groundwater projects in England and Wales.

12B.3.15. The Environment Agency's guidance on WER assessment (Environment Agency, 2022) lists the following activities which can be screened out of assessment due to being of low risk:

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

Flood Risk Activity Permit Exemptions

12B.3.16. Certain activities on or near waterbodies are exempt from the requirement for Environmental Permits for Flood Risk Activities, and hence would be

unlikely to require WER assessments, as summarised in **Table 12B.4**, below.

Table 12B.4: Flood Risk Activity Exemptions

Activity	Type of Modification
Low impact maintenance activities (encourage removal of obstructions to fish/eel passage)	Re-pointing (block work structures)
	Void filling ('solid' structures)
	Re-positioning (rock or rubble or block work structures)
	Replacing elements (not whole structure)
	Re-facing
	Skimming/ covering/ grit blasting
	Cleaning and/or painting of a structure
Temporary works	Temporary scaffolding to enable bridge re-pointing
	Temporary clear span bridge with abutments set-back from bank top
	Temporary cofferdam(s) (if eel/ fish passage not impeded)
	Temporary flow diversion (if fish/ eel passage not impeded) such as flumes and porta-dams
	Repair works to bridge or culvert which do not extend the structure, reduce the cross-section of the river or affect the banks or bed of the river, or reduce conveyance
	Excavation of trial pits of boreholes in byelaw margin
	Structural investigation works of a bridge/ culvert/ flood defence such as intrusive tests, non-intrusive surveys
Footbridges	Footbridge over a main river not more than 8 m wide from bank to bank
	Bridge deck/ parapet replacement/ repair works
Service crossing	Service crossing below the river bed, installed by directional drilling or micro tunnelling if more than 1.5 m below the natural bed line of the river
	Service crossing over a river. This includes those attached to the parapets of a bridge or encapsulated within the bridge's footpath or road

Activity	Type of Modification
	Replacement, installation or dismantling of service crossing/ high voltage cable over a river
Other structures	Fishing platforms
	Fish/ eel pass on existing structure (where <2% water body length is impacted)
	Cattle drinks
	Mink rafts
	Fencing (if open panel/ chicken wire) in byelaw margin
	Outfall to a river ≤300 mm diameter

12B.3.17. If the project or components of the project meet the above criteria, they may be screened out of any further assessment although agreement should also be sought from the Environment Agency.

12B.4. General Approach and Assumptions

12B.4.1. The following provides a description of the scope of works. The assessment is mainly qualitative and based on readily available data and information, including a site survey. It appraises the potential for non-compliance with the core WER objectives of no deterioration or failure to improve, taking into account Protected Areas and adjacent waterbodies.

12B.4.2. Data and information upon which this assessment is based is summarised below; for further details, please refer to **ES Volume I Chapter 12:** Water Environment and Flood Risk (**Application Document 6.2**).

Desk Study

12B.4.3. A desk study has been undertaken to review:

- online aerial, historic and Ordnance Survey maps to review historical land uses, channel planform, notable morphological features and any changes to the channel;
- WER classifications, Environment Agency investigation reports, and any mitigation measures proposed to meet Good Ecological Potential; and
- background water quality and biological data from online sources and provided directly by the Environment Agency, as well as water quality data collected to inform the baseline for the Proposed Development.

12B.4.4. The desk study and site survey has been used as the basis for a qualitative review of the Proposed Development and to identify components requiring assessment of WER compliance, or where mitigation or further investigation and assessment will be required. Full details of the desk study are provided in **ES Volume I Chapter 12:** Water Environment and Flood Risk (**Application Document 6.2**).

12B.4.5. A site walkover has previously been undertaken to allow water receptors in the area to be assessed in terms of their character and morphology, and their connectivity to the Proposed Development to be considered in terms of the surrounding topography and adjacent receptors (e.g. nearby sites of ecological importance).

Source-Pathway-Receptor Approach

12B.4.6. The impact assessment is based on a source-pathway-receptor model. 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 water body);
- a receptor that is sensitive to that impact (i.e. waterbodies and the services they support); and
- a pathway by which the two are linked.

12B.4.7. The first stage in applying the Source-Pathway-Receptor model is to identify the causes or 'sources' of potential 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 themselves 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, therefore, 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 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).

12B.4.8. The assessment of the likely significant effects is qualitative, and considers both construction and operation 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. The risk of pollution from road runoff has also been considered such that appropriate measures (SuDS, proprietary treatment devices) could be incorporated into the design of the Proposed Development.

Rochdale Envelope Assumptions

12B.4.9. The assessment contained herein 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.

12B.4.10. Key principles in the context of the DCO application process are given in the PINS Advice Note Nine: 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.

12B.4.11. The following are the reasonable worst-case scenario assumptions (maximum parameters) for the purposes of the WER screening assessment as outlined in **ES Volume I Chapter 12:** Water Environment and Flood Risk (**Application Document 6.2**):

- 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 are set out in the **Outline CEMP** (**Application Document Ref. 7.4)** which accompanies the Application.
- cooling water will be required for heat rejection from the CCGT. The preferred cooling method, for reasons of operational functionality and performance, is hybrid cooling of the CCGT using water abstracted from the Stainforth and Keadby Canal. An intake structure would be constructed within the canal with equipment to comply with the Eels (England and Wales) Regulations 2009 (HMSO, 2009) ('the Eels Regulations') which may comprise 2mm eel screens, baffles and fish return system (similar to that approved by the Environment Agency and that has been constructed for Keadby 2 Power Station) together with intake pipework, a wet well pumping station and chlorination plant. A pipeline would be constructed from this inlet into the Main Site initially

broadly following the route consented for Keadby 2 Power Station. As mentioned in paragraph 12B.1.5, The Applicant understands that in order to achieve Best Available Eel Protection, the canal water abstraction infrastructure will require a 2mm mesh screen and an intake velocity < 0.1m/s which should negate the need for a fish recovery and return system. However, as the Keadby 2 Power Station canal water abstraction includes a fish recovery and return system, the potential need for a fish recovery and return system has been assessed as worst-case scenario for the purposes of the EIA.

- 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 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 (which, in this case, is the Isle of Axholme and North Nottinghamshire Water Level Management Board (IoAaNNWLMB)) byelaws. All other pipework crossings would use trenchless technologies, and at a sufficient depth below the bed to ensure that there is no risk of exposure.

General Assumptions and Limitations

12B.4.12. The assessment has been undertaken using available data and Proposed Development design details at the time of writing in August 2025. It is also based on available information from previous assessment work undertaken in 2021, including information from site walkovers[1]. Assumptions have been made regarding flow pathways for culverted sections of watercourses, based on Ordnance Survey mapping.

12B.4.13. For the purposes of the assessment, it is assumed that a similar canal intake structure and layout as constructed for the Keadby 2 Power Station intake will be used for the Proposed Development. It is expected that the overall dimensions of the new inlet will be no larger than the Keadby 2 Power Station installation. Consultation is ongoing with the CRT in regard to the abstraction.

12B.4.14. It is assumed that treated effluent from the Proposed Development will be discharged to the River Trent following treatment at a rate compliant with

[1] AECOM (on behalf of SSE Thermal) 2021. Document Ref. 6.3 Environmental Statement – Volume II. Appendix 12B: Water Framework Directive Assessment Report.

the discharge limits and environmental quality standards set by the Environment Agency within the Environmental Permit.

12B.4.15. It is assumed that installation works will require use of a cofferdam in close proximity to the intake structure in the Stainforth and Keadby Canal. The cofferdam and associated working area is anticipated to extend approximately 20m into the channel. 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 or canal bed. It is assumed that no dredging would be required.

12B.4.16. Water supply for use on site for all activities with the exception of cooling water, fire water and process water will be supplied by the relevant undertaker. The EA approved a variation to the Canal and River Trust's licence to abstract water into Stainforth and Keadby Canal from the River Don for the purposes of evaporative cooling, boiler feed, make-up or top-up water and process water in April 2023. The licence will be updated if required to allow canal water to also be used for firewater top-up (with no change to abstraction volumes). Abstraction licence for SSE to abstract water from the Canal for use in Keadby Power Stations is also already agreed, as noted in the **Schedule of Other Consents and Licences (Application Document Ref. 5.4)**.

12B.4.17. 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), and that given the relatively small volumes involved, that they will have adequate capacity to do so 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 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, under an appropriate Environmental Permit.

12B.4.18. The assessment assumes that prior to discharge to the River Trent, effluent treatment facilities will be provided on site for treatment of contaminants from the effluent streams.

12B.4.19. The preferred option for discharge of surface water is to a drain managed by the IDB (following attenuation and treatment). An alternative discharge route is also proposed, should this be required, via the existing Keadby 1 Power Station cooling water outfall. SuDS are to be provided, likely in the form of ditches, swales and an attenuation pond, as outlined in the indicative drainage strategy (included as Annex 3 to **ES Volume II Appendix 12A**: Flood Risk Assessment (**Application Document Ref.**

6.3). High risk areas will be bunded and stormwater from these areas will be managed separately. The drainage design will be developed in consultation with the Environment Agency and Lead Local Flood Authority (LLFA).

12B.4.20. In the event of an incident, fire waters will be managed in a manner which is consistent with the proposed drainage strategy across the Site.

12B.4.21. 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.

12B.4.22. Due to the proposed low volumes associated with the treated effluent 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 (see also APEM, 2011). There is potential for Keadby 1 Power Station to continue to operate at the same time as the Proposed Development (although it is likely to cease operating at some point during the operational life of the Proposed Development). For the purpose of this assessment, the worst-case scenario has been assumed whereby the Keadby 1 and 2 Power Stations and the Proposed Development are operational at the same time. It is expected that the Proposed Installation discharge would achieve the same (or more stringent) discharge conditions as the Keadby 1 and 2 Power Stations. Additional conditions have been assumed for water quality on any discharge from the Proposed Installation and these are set out in the Best Available Techniques (BAT) assessment for cooling technology which will accompany the Application for an Environmental Permit, to be submitted following the DCO Application for consideration by the Environment Agency.

12B.4.23. As a contractor has not yet been appointed, construction method statements are not available at this time, and therefore reasonable assumptions have been made that all works will take place using best practice. Such measures are set out in the **Outline CEMP** (**Application Document Ref. 7.4)** which accompanies the Application.

12B.4.24. No water quality monitoring has been undertaken specifically to inform this assessment. Background water quality has been determined from the nearest data available of the Environment Agency's Water Quality Archive website (Environment Agency, 2020a) and other assessments produced

to inform the design of the Proposed Development (including preliminary water supply and effluent discharge feasibility assessments).

12B.4.25. For the canal water abstraction, a cofferdam would be expected in the Stainforth and Keadby Canal to extend approximately 20 m from the canal bank. Cofferdam installation or removal would be timed to minimise ecological impacts from the structure (e.g. relating to fish migration in the River Trent), as described in **ES Volume I Chapter 11**: Biodiversity and Nature Conservation **(Application Document Ref. 6.2).**

12B.4.26. The expected treatment performance of different SuDS options will be based on advice reported in CIRIA C753 - The SuDS Manual (CIRIA, 2016) using the Simple Index Approach. Professional judgement will be 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.

12B.5. Screening Assessment

Overview

12B.5.1. The waterbodies screened into the assessment have been selected based on the following criteria:

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

12B.5.2. Reference has been made to **ES Volume I Chapter 4:** The Proposed Development (**Application Document Ref. 6.2**). All potential pathways to an effect and ZoI have been identified from this understanding of the Proposed Development. A description of the baseline WER status for those waterbodies which are screened into the assessment via the ZoI approach is presented in Section 5. In accordance with Regulation 14 of the WER, potential for effects on protected areas has also been considered with those WER protected areas within 2 km of the proposed works screened in for further consideration.

12B.5.3. The proposed works are located within the catchment of the Humber RBMP (DEFRA, 2024). The first RBMPs were published in 2009, with the second cycle of RBMPs published in 2015. Under the WER, the third cycle

of RBMPs was published in 2022, covering six years from 2021-2027. The Humber RBMP published as part of the 2021 RBMP cycle has been considered in the summary baseline classification information which is presented in **Annex 1** of this Appendix.

Relevant WER waterbodies

12B.5.4. Table 12B.5 provides a summary of the baseline status/ potential of the various WER waterbodies that have been identified within 1 km of the Proposed Development boundary. Full WER status classifications under Cycle 3 (2022) are shown in **Annex 1** within this Appendix. Full baseline conditions for the study site are outline in **Annex 2 – Annex 5**.

12B.5.5. Table 12B.6 summarises other waterbodies that have been identified within a 1 km study area surrounding the Proposed Development and indicates how they are related to the WER waterbodies outlined in Table 12B.5.

Table 12B.5: WER surface waterbodies in the study area

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
Humber Upper (GB530402609203)	Moderate Ecological Potential	Fail	Good (2027)	Heavily Modified	This section of the River Trent is designated from Owston Ferry to the south (around 13 km upstream of Keadby) to its confluence with the River Ouse around 14.5 km downstream of Keadby.
Site Observations from 2021 assessment: 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 140 m. The river is used for navigation with a wharf at Keadby and the nearest jetty approximately 600 m upstream on the east bank near Gunness 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. **Protected Areas related to WER Waterbody**: The river adjacent to Keadby is situated in the Humber Estuary SSSI, Humber Estuary SAC and Humber Estuary Ramsar Site. Nitrates Directive areas S653, S298, S281, S352. Habitats and Species Directive UK0030170 (SAC), Conservation of Wild Birds Directive area UK9006111 (SPA) and Urban Wastewater Treatment Directive area UKENRI130.					
Paupers Drain Catchment (trib of River Trent)	Moderate Ecological Potential	Fail	Good (2027)	Artificial	Unusually, this waterbody consists of two separate designated

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
(GB10402 8064300)					watercourses, Warping Drain and Paupers Drain which both flow west to east between Crowle and the River Trent, totalling around 13 km length and draining an area of around 32.04 km^2.
Site Observations from 2021 assessment: Warping drain was observed from the B1392 at SE 83592 12125 where it crosses beneath the road. The watercourse is single thread and approximately 7 m 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 provides something of a buffer strip to the arable fields beyond. **Protected Areas related to WER Waterbody**: 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*). Nitrates Directive areas S653, S281, S349, S352 and S350. Habitats and Species Directive area UK0030170 (SAC).					
North Soak Drain Catchment (trib of Torne/Three Rivers) (GB10402 8064350)	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

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
					the River Trent. It is 26.4 km in length and drains a catchment area of 55.641 km^2
Site Observations from 2021 assessment: North and South Soak Drains were observed during the site visit at SE 82505 11545 and SE 82487 11450, respectively. Both were approximately 8 m wide and are straight, artificial drainage channels with steep banks, and are located 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 appear nutrient enriched. Fine sediment accumulations were apparent at channel margins in some locations. South Soak Drain is located approximately 3 m lower in elevation than the adjacent canal, and the drain supports rich aquatic, emergent and marginal flora. **Protected Areas related to WER Waterbody**: The site is a designated LWS for its swamp habitat which is dominated by common reed. Nitrates Directive area S351, S298, S281, S349, S342; Habitats and Species Directive area UK0012915 Thorne Moor.					
Hatfield Waste Drain Catchment (trib of Torne/Three Rivers) (GB104028064330)	Moderate Ecological Potential	Fail	Moderate (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

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
					designated watercourse is 36.4 km in length and drains a catchment of 120.2 km^2.
Site Observations from 2021 assessment: This watercourse was not visited as part of the Water Environment walkover. **Protected Areas related to WER Waterbody**: The watercourse is a designated LWS for a rich aquatic, emergent and marginal flora with a surrounding mosaic of neutral grassland and common reed swamp. Nitrate Directive areas S351, S298 and S352. Habitats and Species Directive UK0030166 (SAC).					
Torne/ Three Rivers from Mother Drain to Trent (GB10402 8064340)	Moderate Ecological Potential	Fail	Good (2027)	Artificial	This watercourse includes the River Torne, South Engine Drain and Folly Drain. In total, it is 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 50.6 km, and they drain a catchment of 85.3 km^2.

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
Site Observations: Torne/Three Rivers from Mother Drain to Trent was not visited during the Water Environment walkover. **Protected Areas related to WER Waterbody**: 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. Nitrates Directive areas S335, S653, S351, S352, S337. Urban Wastewater Treatment Directive area UKENRI99 and Habitats and Species Directive area UK30030166 (SAC).					
Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) (GB70410281)	Good Ecological Potential	Fail	Good (2015)	Artificial	The designated reach is 43.8 km 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.
Site Observations from 2021 assessment: 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 30 m width. There are four sets of lock gates separating the canal from the River Trent, managed by the Canal and River Trust. The canal appeared to be around 1.5 m 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 construction of Keadby 2 Power Station began in August 2018 and it entered commercial operation in 2023.					

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
Protected Areas related to WER Waterbody: 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. Nitrates Directive Area S653.					
Lower Trent Erewash - Secondary Combined WER Groundwater Body (GB40402G990300)	Good Quantitative Status	Good Chemical Status	Good (2021)	Not applicable	In relation to the Proposed Development, this waterbody spans the study area to the north of Keadby Common. The overall waterbody is large (1,924 km^2) and extends from Ashby-de-la-Zouch to the south to the Humber Estuary to the north.
Protected Areas related to WER Waterbody: Nitrate Directive areas Lincolnshire Limestone (G69), Nottinghamshire (G40), Burton (G34); Lower Trent Erewash – Secondary Combined Drinking Water Protected Area (UKGB40402G990300).					
Idle Torne - Secondary Mudrocks WER Groundwater Body (GB40402G992200)	Good Quantitative Status	Good Chemical Status	Good (2015)	Not applicable	In relation to the Proposed Development, this waterbody spans the study area to the south of Keadby Common. The overall waterbody is large

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
					(320 km^2) and extends from Bilsthorpe to the south to the Swinefleet to the north.
Protected Areas related to WER Waterbody: Nitrates Directive area Nottinghamshire (G40); Idle Torn – Secondary Mudrocks Drinking Water Protected Area (UKGB40402G992200)					

Table 12B.6: Other named watercourses in the study area that are not defined WER 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 30 m and 330 m 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 3.5 km.	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 **ES Volume II Appendix 11C**: PEA **(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 1.4 km.	Field drain approximately 1 m wide with spring water depth approximately 20 cm deep. The channel was dominated by silt. Banks support semi-improved grassland and dense scrub. Common reed was the dominant

Waterbody	Tributary of	Watercourse Description	Site Observations
			plant species within the channel. Connected to the rest of the 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 1.1 km 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 1.2 km 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 565 m 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 0.5 m deep, and channel width is less than 2 m. 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 180 m in length.	Over-deepened watercourse with steep banks, which are bare earth in places. Artificially straight watercourse of approximately 2 m 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 200 m long.	Over-deepened watercourse with steep banks, which are bare earth in places. Artificially straight watercourse of approximately 2 m width. The riparian zone to the west has several deciduous trees which provide a degree of shading.
Glew Drain / D1 as described in **ES Volume II Appendix 11C:**	Unnamed drainage ditch upstream of	This drain flows along the northern boundary of Keadby Common between Keadby Boundary Drain	Field drain which is designated as a LWS. The drain is over-deepened and is

Waterbody	Tributary of	Watercourse Description	Site Observations
PEA **(Application Document Ref. 6.3).**	River Trent	and Keadby 1 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 1.7 km in length.	subject to periodic dredging. The channel width is approximately 2 m. Water depth is variable, but the average is around 50 cm. The substrate within the drain is equal part clay to silt. Supports a moderately diverse flora.
Drain D2 as described in **ES Volume II Appendix 11C:** PEA **(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 900 m in length.	Field drain approximately 2 m wide and 50 cm 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 **ES Volume II Appendix 11C:** PEA **(Application Document Ref. 6.3).**	Unnamed drainage ditch upstream of River Trent	This drain runs through the centre of Keadby Common and is approximately 380 m long.	Field drain with water approximately 10 cm deep and approximately 1 m wide. The channel was dominated by silt. Banks support improved grassland. Common reed, reed canary-grass and reed sweet-grass

Waterbody	Tributary of	Watercourse Description	Site Observations
			are all abundant. Connected to the rest of the drains associated with Keadby Common.
Drain D5 as **ES Volume II Appendix 11C:** PEA **(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 10 cm. Channel 1 m 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 **ES Volume II Appendix 11C:** PEA **(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 Site but distant from the land required for construction of the Proposed Development.	Field drain with water depth approximately 50 cm and 2 m wide. Banks supported rank semi improved grassland and a hedgerow. Common reed present.
Drain D7a, b, c, as described in **ES Volume II Appendix 11C:** PEA **(Application Document Ref. 6.3).**	Unnamed drainage ditch upstream of River Trent	Three arable field drains which are culverted under the existing access road.	Incised, straight watercourses of approximately 1 m width.
Drain parallel to access road from the A18	Unnamed drainage ditch between Hatfield	This drain flows from immediately west of Mabey Bridge in a northerly direction to South Soak Drain	Incised, straight watercourse of approximately 2 m width. Beyond the road it is surrounding by

Waterbody	Tributary of	Watercourse Description	Site Observations
	Waste Drain and South Soak Drain	alongside the existing access road for Keadby 2 Power Station.	arable fields on both sides, with a few trees in the riparian margin towards its northern extent.
Drain A	Unnamed drainage ditch south of Drain 2	East-west drain not shown on Ordnance Survey mapping.	Previously dry ditch approximately 1.0m wide, with 0.2m depth of water.

Zone of Influence

12B.5.6. WER waterbodies have been screened into this assessment using a ZoI approach and on the basis of whether they are:

- a designated WER water body within the ZoI; and
- a designated WER water body indirectly affected by the ZoI.

12B.5.7. **Table 12B.7** sets out the pathways to an effect, the extent of the ZoI and the waterbodies that are directly within the ZoI.

Table 12B.7: ZOI and relevant WER waterbodies

Potential pathway	ZoI and basis for determination	Relevant waterbodies	Adjacent waterbodies
Construction works within, along the banks and across watercourses can be a direct source of fine sediment mobilisation, and this sediment could contain contaminants given the past industrial activities adjacent to the Site (i.e. Keadby 1 and Keadby 2 Power Stations). Works within watercourses would include any installation of pipe/ service crossings which may use open-cut techniques for the smaller drains (of 1-2 m width).	All watercourses within and immediately adjacent to the Site or boundary could be impacted by runoff containing fine sediment during construction. These are all tributaries of the River Trent (including the Stainforth and Keadby Canal which is connected to the Trent via a series of locks). Given dilution and dispersal potential in the tidal River Trent, a ZoI up to 1 km downstream of the Proposed Development in the River Trent (Humber Upper WER waterbody) is appropriate.	Humber Upper WER waterbody (River Trent) Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) WER waterbody Paupers Drain Catchment (trib of Trent) WER waterbody – this includes Warping Drain North Soak Drain Catchment (trib of Torne/Three Rivers) WER waterbody Torne/ Three Rivers from Mother Drain to Trent WER waterbody Hatfield Waste Drain Catchment (trib of Torne/Three Rivers) WER waterbody A number of unnamed drainage ditches.	The Humber Upper WER waterbody is adjacent to the Humber Middle WER waterbody but is too far downstream to be of relevance. All other watercourses drain to the Humber Upper WER waterbody.
The construction of a cofferdam in the Stainforth and Keadby Canal for works to the abstraction point would cause some	The Stainforth and Keadby Canal is less dynamic, and so any mobilised sediment is likely to settle in closer proximity to the source. A 500 m ZoI is	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) WER waterbody	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) WER waterbody is

Potential pathway	ZoI and basis for determination	Relevant waterbodies	Adjacent waterbodies
mobilisation of fine sediments during its installation and removal, and this may mobilise some fine sediment into the water column.	considered appropriate as a reasonable worst case.		connected to the Humber Upper WER waterbody.
During construction, fuel, hydraulic fluids, solvents, grouts, paints and detergents and other potentially polluting substances will be stored and / or used on Site. Leaks and spillages of these substances could pollute the nearby surface watercourses or groundwater if their use or removal is not carefully controlled and spillages enter existing flow pathways or waterbodies directly.	All watercourses or groundwater within or immediately adjacent to the Site or boundary could be impacted by accidental spillages during construction. These are all tributaries of the River Trent (including the Stainforth and Keadby Canal which is connected to the Trent via a series of locks). Given dilution and dispersal potential in the tidal River Trent, a ZoI up to 1 km downstream of the Proposed Development in the River Trent is appropriate.	Humber Upper WER waterbody (River Trent) Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) WER waterbody Paupers Drain Catchment (trib of Trent) WER waterbody – this includes Warping Drain North Soak Drain Catchment (trib of Torne/Three Rivers) WER waterbody Torne/Three Rivers from Mother Drain to Trent WER waterbody Hatfield Waste Drain Catchment (trib of Torne/Three Rivers) WER waterbody A number of unnamed drainage ditches.	The Humber Upper WER waterbody is adjacent to the Humber Middle WER waterbody but is too far downstream to be of relevance. All other watercourses drain to the Humber Upper WER waterbody

Potential pathway	ZoI and basis for determination	Relevant waterbodies	Adjacent waterbodies
		Lower Trent Erewash - Secondary Combined WER Groundwater Body Idle Torne - Secondary Mudrocks WER Groundwater Body	
Excavations, cuttings or piling required during construction of the Proposed Development have the potential to intercept groundwater and may create a pathway for pollutants to be transferred to groundwater if not mitigated.	Groundwater bodies directly beneath the Site.	Lower Trent Erewash - Secondary Combined WER Groundwater Body Idle Torne - Secondary Mudrocks WER Groundwater Body	Idle Torne - Secondary Mudrocks WER Groundwater Body Lower Trent Erewash - Secondary Combined WER Groundwater Body
Physical modification of watercourse bed due to temporary use of a cofferdam in the Stainforth and Keadby Canal for works to the abstraction or discharge point (including scour, deposition and habitat loss),	The immediate footprint and environs (within which any scour affects would be expected to occur) of the cofferdam in the Stainforth and Keadby Canal.	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) WER waterbody	Not applicable – this impact pathway relates to the affected watercourse only.

Potential pathway	ZoI and basis for determination	Relevant waterbodies	Adjacent waterbodies
There could be morphological impacts to a limited number of drains which may require new crossings relating to connection corridors and access routes. Non-intrusive crossing methodologies will be used wherever reasonably practicable, but it is assumed that open-cut methods will be required in some instances for small watercourses (1-2 m width).	The immediate footprint of pipe / service crossing, plus 20 m upstream and downstream, based on professional judgement.	Unnamed drainage ditches (tributaries of the Humber Upper WER waterbody, North Soak Drain Catchment (trib of Torne/Three Rivers) WER waterbody and Paupers Drain Catchment (trib of Trent) WER waterbody.	Not applicable, this pathway relates to morphology of the directly impacted watercourse only.
Surface water runoff from the Site could contain various diffuse pollutants given the industrial nature of the site. A drainage strategy will be in place to manage the rate and quality of the runoff (including the use of SuDS) prior to discharge	All surface water runoff is to be discharged to the River Trent or Keadby Common Drain, via attenuation for flows and water quality. The ZoI for the River Trent is not expected to be greater than 1 km downstream or upstream of the outfall location as a reasonable worst case, given the dynamic nature of this transitional water.	Humber Upper WER waterbody – (River Trent) Keadby Common Drain (tributary of the Humber Upper WER waterbody)	The Humber Upper WER waterbody is adjacent to the Humber Middle WER waterbody but is too far downstream to be of relevance.

Potential pathway	ZoI and basis for determination	Relevant waterbodies	Adjacent waterbodies
to the River Trent or Keadby Common Drain.			
Process water from the Proposed Development is to be discharged to the River Trent and will include water from: • neutralised effluent streams from the demineralisation plant; • uncontaminated surface water; • surface water incident on process areas, that may be contaminated with oils or amines; • water treatment effluent; or • canal water effluent. Effluent derived from the above processes would be treated following Best Available Techniques	All treated process water runoff is to be discharged to the River Trent. The ZoI in the River Trent is not expected to be greater than 1 km downstream of the outfall location as a worst case, given the dynamic nature of this transitional water.	Humber Upper WER waterbody – (River Trent)	The Humber Upper WER waterbody is adjacent to the Humber Middle WER waterbody but is too far downstream to be of relevance.

Potential pathway	ZoI and basis for determination	Relevant waterbodies	Adjacent waterbodies
(BAT) and regulated by the Environment Agency under an Environmental Permit, with discharge to a retention pond upstream of the River Trent outfall. There is potential for the thermal discharge to impact fish migration, as well as for chemical pollution should any contaminants not be suitably treated.			
Sections of Drain D4 on the Site expected to be lost beneath the footprint of the power station.	The ZoI will be the extent of the drains that are directly lost beneath the Proposed Development.	Drain D4 (tributary of the Humber Upper WER waterbody).	Not applicable, this pathway relates to morphology of the impacted watercourse only.
Abstraction of water will be required for process operations. This will be from the Stainforth and Keadby Canal.	The ZoI is the waterbody scale.	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) WER waterbody	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) WER waterbody is connected to the Humber Upper WER waterbody.

Potential pathway	ZoI and basis for determination	Relevant waterbodies	Adjacent waterbodies
			Don from Mill Dyke to River Ouse WER waterbody
Foul drainage from permanent welfare facilities would be directed to the local sewerage system, subject to the agreement with the local sewerage undertaker. The existing foul sewer connection within the Keadby Site would be utilised if it is found to be fit for purpose for life of development. If this is not the case, a package treatment plant will be used which will discharge into the cooling water outfall.	Given that any treated effluent from a wastewater treatment works would be subject to an Environmental Permit, the ZoI should be small. A reasonable worst-case scenario would be 1 km downstream from the outfall in the receiving waterbody.	Unknown at this stage, as it will depend on the Severn Trent Water treatment works that is utilised (subject to consultation). Alternatively, if foul water is treated on site it would be discharged to the River Trent.	Unknown at this stage, as it will depend on the Severn Trent Water treatment works that is utilised (subject to consultation). Alternatively, if discharged to the River Trent, the adjacent Humber Middle WER waterbody is too far downstream to be of relevance.

Screening Outcome

12B.5.8. The following waterbodies have been identified within the study area and are screened in on the basis of **Table 12B.7** for further consideration at Stage 2 (scoping – for transitional and coastal waterbodies only) and Stage 3 (assessment – all waterbodies):

- Humber Upper (GB530402609203);
- Paupers Drain Catchment (trib of Trent) (GB104028064300);
- North Soak Drain Catchment (trib of Torne/Three Rivers) (GB104028064350);
- Hatfield Waste Drain Catchment (trib of Torne/Three Rivers) (GB104028064330);
- Torne/ Three Rivers from Mother Drain to Trent (GB104028064340);
- Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) (GB70410281);
- Lower Trent Erewash - Secondary Combined WER Groundwater Body (GB40402G990300); and
- Idle Torne - Secondary Mudrocks WER Groundwater Body (GB40402G992200).

12B.5.9. In accordance with Environment Agency Clearing the Water guidance (Environment Agency, 2023), a scoping assessment is not required if the proposed activity meets any one of several criteria that indicate the activity is low risk (refer to Section 3.7). The Proposed Development does not meet any of the criteria assessed in Section 3.7, therefore a scoping assessment is required.

12B.5.10. The Proposed Development can also be screened against the list of Flood Risk Activity exemptions detailed in Section 3.8. The following exemptions are relevant:

- **Service crossing below the riverbed, installed by directional drilling or micro tunnelling if more than 1.5 m below the natural bed line of the river** – this may be relevant to the minor crossings of the Glew Drain for the 400kV connection to the Northern Powergrid Substation option, if required. As an exempt activity this is not assessed further;
- **Service crossing over a river**. This includes those attached to the parapets of a bridge or encapsulated within the bridge's footpath or road – this may be relevant to the minor crossings of the Glew Drain

for the 400kV connection to the Northern Powergrid Substation option, if required and so it is considered appropriate that this exemption is applied where relevant. Low maintenance activities (e*.g. replacing elements of structures but not entire structures)* – this may be relevant to the hand-based repair to the existing; and

- **Low maintenance activities (e.g. replacing elements of structures but not entire structures***)* – this may be relevant to the hand-based repair to the existing Keadby Power Station water discharge outfall to the Trent. However, as this is in the estuarine environment and the extent of the works is not yet clear, this is considered by the assessment as a precautionary approach.

Don from Mill Dyke to River Ouse WER waterbody

12B.5.11. The Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) WER waterbody is fed by waters from the Don from Mill Dyke to River Ouse WER waterbody (GB104027064243). Therefore, abstraction from the Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) for the Proposed Development has the potential to impact on the Don from Mill Dyke to River Ouse WER waterbody.

12B.5.12. An existing agreed abstraction licence is in place for the current Keadby Power Stations. This Application does not propose to increase abstraction from the Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) WER waterbody above the level of the existing agreed abstraction licence (which includes the abstraction required for the consented Keadby 3 CCS Power Station, which the Proposed Development is an alternative to). Therefore, given the level of abstraction for the Proposed Development is not proposed to change from that in the existing abstraction licence, the Don from Mill Dyke to River Ouse WER waterbody is screened out of the WER assessment process.

12B.6. Scoping assessment

Overview

12B.6.1. A scoping assessment is required to determine whether any potential impacts on WER quality elements, or waterbodies as a whole, will arise as a result of the Proposed Development.

12B.6.2. For the coastal and estuarine receptors that may be impacted by the Proposed Development, these receptors are defined in accordance with the Environment Agency Clearing the Waters for All guidance (Environment Agency, 2023) and are based on the waterbody's quality elements; the receptors include:

- hydromorphology;
- water quality;
- biology – habitats;
- biology – fish;
- protected areas; and
- the scoping assessment also considers Invasive Non-Native Species (INNS).

12B.6.3. As the scoping assessment outlined in the Clearing the Waters Guidance is designed for coastal and estuarine waterbodies it is applied here to the Humber Upper waterbody only (Paragraphs 12B.6.6 to 12B.6.30).

12B.6.4. For the screened in fluvial and groundwater bodies each of the activities of the proposed scheme which could potentially impact WER status are assessed against the relevant biological, physico-chemical and hydro-morphological receptors (Paragraphs 12B.6.31 to 12B.6.42).

12B.6.5. Information regarding Mitigation Measures, Programme of Measures, Investigations and any other additional water body information was

requested from the Environment Agency in August 2024, and the data was received in September 2024.

Humber Upper WER Waterbody

12B.6.6. Small areas of the Proposed Development adjacent to the River Trent fall partially within the Humber Upper WER waterbody.

12B.6.7. The Proposed Development does not include proposals within the Humber Upper water body. Existing infrastructure will be utilised for the Proposed Development, including the existing water discharge outfall and Railway Wharf).

12B.6.8. The Humber Upper waterbody is a HMWB that is currently at Moderate Ecological Potential. The water body status is currently being limited by the status for Saltmarsh quality element (Moderate), and Mitigation Measures Assessment not being in place (Moderate or less). The waterbody has an objective of Good Ecological Potential by 2027 (see **Annex 1**).

Hydromorphology

12B.6.9. Hydromorphology refers to the physical characteristics of waterbodies. Hydromorphological quality elements include the size, shape and structure of the waterbody, and the flow and quantity of water and sediment. Impacts on hydromorphology include changes to morphological conditions (for example variation in the structure of the seabed and intertidal zone) and tidal patterns (for example dominant currents, freshwater flow and wave exposure). Hydromorphology is only a WER quality element for high status waterbodies (see Table 12B.1), but significantly influences other elements, particularly biological ones, and thus is an important part of the assessment.

12B.6.10. The scoping assessment of the potential effects to hydromorphology is provided in **Table 12B.8**, below.

Table 12B.8: Scoping assessment of risks to hydromorphology

Risk	Requires Impact Assessment	Impact Assessment Not Required	Hydromorphology risk issue(s)
Could impact on the hydromorphology (e.g. morphology or tidal patterns) of a water body at high status		✓	N/A – waterbody is at Moderate Status overall, and 'Supports Good' for hydromorphology
Could significantly impact the hydromorphology (i.e. bed morphology and substrate) of any waterbody		✓	There are no proposals to install new or modify existing structures on the Humber Upper water body which could affect the morphology of the estuary bed and / or local sediment dynamics.
Activity is in a water body that is heavily modified for the same use as your activity		✓	N/A

Water Quality – Physico-chemical Quality Elements

12B.6.11. Impacts to ecological water quality relates to effects on any of the following: Water clarity, temperature, salinity, oxygen levels, nutrients, microbial patterns for longer than a spring neap tidal cycle (approximately 14 days). In addition to the above, if the water body has

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

12B.6.12. There is potential for chemical spillages and runoff containing contaminants during construction, related to works close to the water body and its upstream tributaries, several of which intersect the Site.

12B.6.13. During operation, changes in water quality could occur from operational discharges of treated process effluent and water from the cooling system although these would be controlled under an Environmental Permit, both in term of water composition and temperature. Similarly, if not mitigated there could be impacts on the Humber Upper waterbody's chemical status from diffuse urban pollutants in surface water runoff, or as a result of accidental chemical spillages, which may be discharged via the outfall to the estuary (although the preferred option is currently to discharge to an IDB drain subject to consent).

12B.6.14. Operational foul drainage from the Site may also be discharged to the waterbody via treatment at the existing Severn Trent Water treatment works on Chapel Lane and if so, would be controlled under Severn Trent Water's existing Environmental Permit conditions. If this is not practicable, foul drainage 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, which could impact physico-chemical quality elements.

12B.6.15. Phytoplankton Status is High for the Humber Upper waterbody. Biological survey data and WER investigation reports were requested from the Environment Agency for the waterbody, and none related to phytoplankton was returned and so it is assumed that there is no monitoring of harmful algae, indicating that this is not a particular risk for this water body. As such, further consideration of phytoplankton and harmful algae has been scoped out from further consideration in the WER impact assessment, summarised in **Table 12B.9**, below. Conditions which could promote future algal blooms are screened in to the assessment (e.g. temperature, water quality).

Table 12B.9: Scoping assessment of risks to physico-chemical quality elements

Risk	Requires Impact Assessment	Impact Assessment Not Required	Water Quality risk issue(s)
Could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)	✓		Impacts from mobilisation of sediments due to vessel movement during construction, surface water runoff containing contaminants (including to tributaries of the water body) or as a result of accidental spillages.
Is in a waterbody with a phytoplankton status of moderate, poor or bad		✓	Phytoplankton is at High Status
Is in a waterbody with a history of harmful algae		✓	There is no known monitoring of harmful algae, which it is assumed to indicate that this is not a particular risk for this water body. As such, further consideration of phytoplankton and harmful algae has been scoped out from further consideration in the WER impact assessment. Conditions which could promote future

Risk	Requires Impact Assessment	Impact Assessment Not Required	Water Quality risk issue(s)
			algal blooms have been screened in and assessed (e.g. temperature, water quality)

Water Quality – Chemical Status

12B.6.16. There is potential for chemical spillages and runoff containing contaminants and from upstream tributaries, which discharge to the waterbody and also intersect the Site.

12B.6.17. As noted in the physico-chemical status above, operational process effluent and foul water is likely to be discharged to the water body following treatment, including cooling water which is to be treated with biocide during operation. Surface water runoff may also be discharged

to the water body if the preferred rate of discharge to the IDB watercourse cannot be accommodated.

12B.6.18. The scoping assessment for chemical status is summarised in **Table 12B.10**, below.

Table 12B.10: Scoping assessment of risks to Chemical Status

Risk	Requires Impact Assessment	Impact Assessment Not Required	Water Quality risk issue(s)
The chemicals are on the Environmental Quality Standards Directive (EQSD) list	✓		Potential for a range of chemicals to be discharged to Humber Upper waterbody from diffuse urban pollutants in surface water runoff or process effluent, or as a result of accidental spillages, or biocide from cooling water.
It disturbs sediment with contaminants above CEFAS Action Level 1	✓		Potential for sediment to contain contaminants above CEFAS Action Level 1

Biology - Habitats

12B.6.19. A number of habitats have been highlighted in the Environment Agency Clearing the Waters guidance (Environment Agency, 2023) as being of higher and lower sensitivity based on their resistance to, and recovery rate, from human pressures. **Table 12B.11** below outlines the higher and lower sensitivity habitats associated with the Humber Upper water body (based on the Environment Agency WER waterbody summary table). These have the potential to be impacted during construction by physical disturbance associated with works in the Trent, if required, or water quality. Furthermore, changes in water quality could occur during

operation through discharges from the outfall causing thermal plumes or chemical changes in water quality and deposition of air pollutants.

Table 12B.11: Higher and Lower Sensitivity Habitats found in the Humber Upper waterbody

Higher Sensitivity Habitats	Area (ha)	Lower Sensitivity Habitats	Area (ha)
Saltmarsh	309.12	Intertidal soft sediment	232.38
		Subtidal soft sediment	231.42

12B.6.20. Habitats should be included as part of the WER impact assessment if the footprint of the activity is any of the following (Environment Agency, 2017), noting that this also includes the footprint of thermal or sediment plumes:

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

12B.6.21. Multi- Agency Geographic Information for the Countryside (MAGIC) Map (DEFRA) has been used to confirm the approximate location of the noted sensitive habitats to the proposed works. The draft Order Limits directly cross Higher Sensitivity Habitat (saltmarsh).

12B.6.22. In accordance with the Environment Agency guidance and as shown in **Table 12B.12**, the habitats outlined in **Table 12B.11** have been scoped into the WER impact assessment on account of a potential sediment plume being produced by vessels during the offloading of materials proposed within the Trent and, as a worst-case scenario, due to being within 500 m of higher sensitivity habitat.

Table 12B.12: Scoping assessment of risks to biological habitat

Footprint is:	Requires Impact Assessment	Impact Assessment Not Required	Biological habitat risk issue(s)
0.5 km^2 or larger	✓		Potential for a temporary sediment plume to be formed from offloading

Footprint is:	Requires Impact Assessment	Impact Assessment Not Required	Biological habitat risk issue(s)
			materials in the Trent. While this is unlikely to exceed 0.5 km^2, this is scoped in as a worst-case scenario
1% or more of the water body's area		✓	Footprint of activity is not expected to be this large, with no new footprint on the water body bed.
Within 500 m of any higher sensitivity habitat	✓		Less than 500 m to nearest higher sensitivity habitat.
1% or more of any lower sensitivity habitat		✓	Footprint of activity would be less than 1% of any lower sensitivity habitat, although there is potential for a sediment plume to spread further downstream in the water body.

Fish

12B.6.23. The Humber Upper waterbody is known to support several nationally and internationally protected migratory fish species (e.g. Atlantic salmon, European eel, river lamprey and sea lamprey). River lamprey and sea lamprey are protected species under Annex II of the Habitats Directive. Accordingly, the populations of these species are of international value. The River Trent at Keadby is of key functional importance for these two lamprey species as it is the route by which they access and leave the wider River Trent catchment.

12B.6.24. Release of pollutants from runoff or spillages during construction could affect fish population health in the short term or longer term (spillages and routine discharges from the Proposed Development). Discharges

could also impact temperature affecting conditions for fish if not controlled. Discharge from outfalls could serve as an attractant flow to fish, potentially resulting in entrainment / entrapment, risk of predation and / or increased estuarine residence time leading to delays in migration, though it should be noted this discharge will be from an existing outfall structure – not a proposed structure. The Site is also within the boundary of the Humber Estuary SAC and therefore any discharges should be controlled so they comply with conditions required for a SAC and a salmonid water. The scoping assessment of risk to fish is provided in **Table 12B.13**, below.

Table 12B.13: Scoping assessment of risks to biological fish

Risk	Requires Impact Assessment	Impact Assessment Not Required	Biological fish risk issue(s)
Is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary	✓		Movement of vessels and use of the Railway Wharf for proposed construction works could cause: - a chemical change in the waterbody through disturbance of fine sediment that may be contaminated, - generation of underwater noise, - change in visual stimuli (such as artificial light) - release of a thermal discharge plume or pollutants in operational

Risk	Requires Impact Assessment	Impact Assessment Not Required	Biological fish risk issue(s)
			surface water runoff or cooling, process and foul water discharge.
Could impact on normal fish behaviour like movement, migration, or spawning (e.g. creating a physical barrier, noise, chemical change or change in depth or flow)	✓		Movement of vessels and use of the Railway Wharf for proposed construction works could cause: - a chemical change in the waterbody through disturbance of fine sediment that may be contaminated, - generation of underwater noise, - changes in visual stimuli (such as artificial light), - release of a thermal discharge plume or pollutants in surface water runoff or discharge of process water effluent to the water body. Discharge to the Humber Upper could serve as an attractant

Risk	Requires Impact Assessment	Impact Assessment Not Required	Biological fish risk issue(s)
			flow to fish, potentially resulting in entrainment / entrapment, risk of predation and / or increased estuarine residence time leading to delays in migration
Could cause entrainment or impingement of fish		✓	No works currently proposed that could cause entrainment or impingement of fish.

WER Protected Areas

12B.6.25. The location of the Proposed Development in relation to the following WER Protected Areas has been considered:

- SAC;
- SPA;
- shellfish waters;
- bathing waters; and
- nutrient sensitive areas.

12B.6.26. The outcome of the scoping assessment for WER protected areas is shown in **Table 12B.14**, below.

Table 12B.14: Scoping assessment of WER Protected Areas

Risk	Requires Impact Assessment	Impact Assessment Not Required	Protected areas risk issue(s)
Activity is within 2 km of any WER protected area	✓		Activity is within 2 km of WER protected areas – i.e. the Site overlaps with Humber Estuary SAC and Ramsar.

Invasive Non-Native Species (INNS)

12B.6.27. INNS harm the environment. They can be small and hard to spot so are easily spread on damp equipment and clothing. If the Proposed Development risks introducing or spreading INNS, this should be included in the WER impact assessment. The risks of introducing or spreading INNS includes marine vessels, marine plant, construction materials or equipment being used that have come from, have been used in or have travelled through other waterbodies and activities that help spread existing INNS either within the immediate water body or to other waterbodies. Indeed, any equipment which has been used in the presence of INNS, regardless of habitat, presents a potential risk.

12B.6.28. The scoping assessment of risks from INNS is summarised in **Table 12B.15** below.

Table 12B.15: Scoping assessment of risks from INNS

Risk	Requires Impact Assessment	Impact Assessment Not Required	INNS issue(s)
Activity may introduce or spread INNS to a water body	✓		Marine plant, vessels and equipment may be required during the construction phase of the project, and so have the potential to introduce INNS to the Site and wider water body.

Scoping summary for the Humber Upper

12B.6.29. A summary of the receptors and relevant WER quality elements that have been scoped into the WER impact assessment for the Humber Upper waterbody is shown in **Table 12B.16**, below.

Table 12B.16: Scoping outcome for the Humber Upper waterbody

Receptor	Relevant WER quality element(s)	Potential risk to receptor
Water Quality	Fish, Physico-chemical and chemical water quality elements	Movement of vessels and use of the Railway Wharf for proposed construction works could mobilise sediments. Diffuse urban pollutants in surface water runoff during construction, diffuse urban pollutants in surface water runoff or process water effluent, or as a result of accidental spillages, or biocides from cooling water which are discharged via the outfall the River Trent.

Receptor	Relevant WER quality element(s)	Potential risk to receptor
Biology: Habitats	Saltmarsh and Hydromorphological Supporting Elements	Potential temporary sediment plume during construction due to the use of vessels and Railway Wharf to offload material, or thermal plume during operation.
Biology: Fish	Fish	Fish behaviour could be affected by changes in visual stimuli (such as artificial light), underwater noise and physical disturbance. Chemical or thermal change in the water body due to the discharge of treated effluent could also affect fish behaviour. Discharge to the Humber Upper from existing outfalls could serve as an attractant flow to fish, potentially resulting in impacts from entrapment, increased residence and / or increased risk of predation.
Protected areas	N/A	Activity is within 2 km of WER protected areas – Humber Estuary SAC, SSSI.

Assessment

12B.6.30. Based on the information presented in Section 12B.6 and **Table 12B.16**, a summary assessment matrix is detailed in **Table 12B.17**. This summary matrix outlines the potential effects of scheme components on relevant quality elements for the Humber Upper water body.

Table 12B.17: Humber Upper scoping assessment – summary matrix

Scheme component / impact type	ECOLOGICAL STATUS				CHEMICAL STATUS	Protected Areas	Additional mitigation required	Residual effect on WER water body
	Fish	Saltmarsh	Hydromorphological supporting elements	Physico-chemical quality elements				
CONSTRUCTION PHASE								
Impacts from mobilisation of sediments and diffuse urban pollutants in surface water runoff during construction	No impact	-	-	No impact	No impact	No impact	Based on the information available and anticipated level of impact, no additional mitigation is anticipated to be required.	None
Potential changes to visual stimuli (such as artificial light), underwater noise and physical disturbance	No impact	-	-	-	-	-	However, the requirement for additional mitigation should be reviewed at detailed design stage and as the design develops further.	None
OPERATION PHASE								
Diffuse urban pollutants in surface water runoff or process water effluent, or as a result of accidental spillages, or biocides from cooling water which are discharged via the outfall the River Trent	No impact	-	-	No impact	No impact	No impact	Based on the information available and anticipated level of impact, provided anticipated control measures are implemented, no additional mitigation is anticipated to be required. However, the requirement for additional mitigation should be reviewed at detailed design stage and as the design develops further.	None
Potential thermal plume during operation	No impact	-	-	No Impact	No impact	No impact		None
Potential for discharges to the Humber Upper from an existing outfall to serve as attractant flow to fish, increase risk of predation and/or contribute to delays in migration	No impact	-	-	-	-	-		None

Surface water bodies

12B.6.31. A summary assessment matrix has been compiled using the results of the screening assessment detailed in Section 12B.5 (Table 12B.18). Each of the activities of the Proposed Development which could potentially result in deterioration of WER status are assessed in turn against the relevant biological, physico-chemical and hydromorphological receptors.

- Paupers Drain Catchment (trib of Trent) (GB104028064300);
- North Soak Drain Catchment (trib of Torne/Three Rivers) (GB104028064350);
- Hatfield Waste Drain Catchment (trib of Torne/Three Rivers) (GB104028064330);
- Torne/Three Rivers from Mother Drain to Trent (GB104028064340);
- Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) (GB70410281);

12B.6.32. Construction details are not yet available at this stage of the Proposed Development. During the **construction** phase, potential WER impacts could occur on sediment dynamics, morphology and water quality through the uncontrolled mobilisation of sediments. Mobilised sediments could contain pollutants that could further impact water quality. Such changes could in turn impact biological quality elements. Appropriate working practices, plans and equipment required to deal with dewatering of groundwater, including discharges to other water bodies, have been included in the **Outline CEMP** (**Application Document Ref. 7.4**) to ensure these potential impacts are mitigated against. Ground investigations have been undertaken to understand the condition and location of contaminated material across the Site, and to inform appropriate mitigation during construction (see **ES Volume I Chapter 13**: Geology, Hydrogeology and Land Contamination **(Application Document Ref. 6.2**).

12B.6.33. Temporary impacts on hydromorphological quality elements could also result from temporary infrastructure placed in the watercourse, banks and floodplain. Temporary mitigations have been included as part of the **Outline CEMP** (**Application Document Ref. 7.4)**, and any modified morphology restored to its original stated (or better) post-construction.

12B.6.34. It is likely that substances that could be damaging to the water environment such as fuels, solvents, detergents etc. will be used during the construction phase in the vicinity of water bodies or pathways

connected to the water bodies. To allow such substances to enter a watercourse could be in breach of the Environmental Permitting (England and Wales) Regulations 2016 (HMSO, 2016) and the Water Resources Act 1991 (as amended) (HMSO, 1991). Therefore, measures to control the storage, handling and disposal of such substances will need to be in place prior to and during construction, and are detailed in the **Outline CEMP** (**Application Document Ref. 7.4)** which accompanies the Application.

12B.6.35. As long as appropriate measures are put in place, it is considered that these risks can be mitigated against to avoid adverse effects to WER quality elements or water body status. This mitigation will need to be defined once more detailed information about the proposals is available (at the detailed design stage).

12B.6.36. During the **operation** phase, impacts on receiving waterbodies could be caused by diffuse urban pollutants in surface water runoff, or as a result of accidental spillages, with potential for subsequent adverse impacts on aquatic ecology. Appropriate surface water management practices and design of site drainage will follow best practice and legal requirements to prevent such impacts, and therefore it is anticipated there will be no impact at the waterbody scale on the status of the Biological quality elements.

12B.6.37. Process effluent could release contaminants into the water environment if not appropriately treated or in case of accidental spills. The design will need to define process effluent treatment in accordance with relevant Environmental Permits required for the operation of the Site. For the purpose of this assessment, it is reasonable to assume that this mitigation is in place and therefore, at the waterbody scale, no impact is expected on the status of Biological, Physico-chemical, Specific Pollutants and Chemical quality elements.

12B.6.38. Accidental spills of chemical products at the Site could lead to adverse impacts to water quality and as a result to biological quality elements. The use of chemical substances must 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) (HMSO, 2002) and Control of Major Accident Hazards (COMAH) Regulations (2015) (HMSO, 2015). A site Emergency Response Plan will be in place for dealing with emergency situations involving loss of containment of hazardous substances and is included within the **Outline CEMP** (**Application Document Ref. 7.4).** The Emergency Response Plan will be further developed in accordance with the final

CEMP to be secured by requirement on the **Draft DCO** (**Application Document Ref. 3.1**). For the purpose of this assessment it is reasonable to assume that this mitigation is in place, and therefore it is anticipated that there will be no impact on the biological quality elements.

12B.6.39. Hybrid cooling using water abstracted from the Stainforth and Keadby Canal is proposed as the preferred cooling method. A new intake structure within the canal is proposed for this purpose. It is understood that a mesh screen of 2mm and an intake velocity <0.1m/s will be required in order to achieve Best Available Eel Protection. However, as the Keadby 2 Power Station canal water abstraction includes a fish recovery and return system, the EIA has assessed the potential need for a fish recovery and return system as a worst-case scenario. In this scenario, it is anticipated that the system would comprise a Multidisc screen with 2 mm diameter mesh size to prevent debris and fish entering the cooling system. The Multidisc screens would include specially designs fish buckets to retain water and capture fish, and then transfer them to a fish return system (similar to that approved by the Environment Agency and that has been constructed for Keadby 2 Power Station). The use of such a structure cannot completely prevent impingement or entrainment of fish. However, these measures should minimise the potential for accidental injury or death of fish due to abstraction from the canal. With this embedded mitigation, at the water body scale it is anticipated that there will be a minor, localised adverse effect to the fish quality element. As noted in Section 12B.5.12, this Application does not propose to change the existing consented abstraction volumes from the Sheffield And South Yorkshire Navigation (New Junction And Stainforth And Keadby) (GB70410281) for the existing Keadby Power Stations and consented Keadby 3 CCS Power Station.

12B.6.40. Surface water discharges and/or other discharges from the Site could impact the hydromorphology of water bodies by impacting the amount of flow and flow dynamics of watercourses. Once more detail is available about specific proposals for all discharges a detailed assessment of potential impacts and potential mitigation requirements will be undertaken. It is anticipated that this will have no impact on the status of the quality element at the waterbody scale.

12B.6.41. No deterioration is expected to surface water bodies provided appropriate design and/or additional mitigation is identified and implemented to prevent or minimise the identified impacts. Once more information is available, a detailed assessment will be undertaken to determine the relevance and magnitude of any potential effects and

define appropriate mitigation accordingly to ensure that the proposals do not lead to deterioration.

12B.6.42. **Table 12B.18** presents a summary matrix of the assessment for the relevant WER surface waterbodies.

Table 12B.18: Surface water body scoping assessment – summary matrix

RELEVANT WER SURFACE WATER BODIES: PAUPERS DRAIN CATCHMENT (TRIB OF TRENT) (GB104028064300); NORTH SOAK DRAIN CATCHMENT (TRIB OF TORNE/THREE RIVERS) (GB104028064350); HATFIELD WASTE DRAIN CATCHMENT (TRIB OF TORNE/THREE RIVERS) (GB104028064330); TORNE/THREE RIVERS FROM MOTHER DRAIN TO TRENT (GB104028064340); SHEFFIELD AND SOUTH YORKSHIRE NAVIGATION (NEW JUNCTION AND STAINFORTH AND KEADBY) (GB70410281)							
Scheme component / impact type	**ECOLOGICAL POTENTIAL**				**CHEMICAL STATUS**	**Additional mitigation required**	**Residual effect on WER waterbody**
	Biological Quality Elements	**Hydromorphological Supporting Elements**	**Physico-chemical Quality Elements**	**Specific Pollutants**			
CONSTRUCTION PHASE							
Construction works, site drainage and traffic movement leading to	No impact	No impact	No impact	No impact	No impact	Based on the information available and anticipated level of impact, no	None

mobilisation of sediments						additional mitigation is anticipated to be required. However, the requirement for additional mitigation should be reviewed at detailed design stage and as the design develops further.	
Temporary infrastructure placed in the watercourse on banks and floodplain (Sheffield And South Yorkshire Navigation (New Junction And Stainforth And Keadby))	-	No impact	-	-	-		None
Use of fuels, solvents, detergents etc. in the vicinity of water bodies or pathways connected to	No impact	-	No impact	No impact	No impact		None

the water bodies							
OPERATION PHASE							
Diffuse urban pollutants entering waterbodies via surface water runoff, or as a result of accidental spillages	No impact	-	-	-	-	Based on the information available and anticipated level of impact, no additional mitigation is anticipated to be required. However, the requirement for additional mitigation should be reviewed at	None
Discharge of process wastewater	No impact	-	No impact	No impact	No impact		None
Accidental spills of chemical products	No impact	-	-	No impact	No impact		None

Surface water discharges and/or other discharges from site impacting on the quantity and dynamics of flow	-	No impact	-	-	-	detailed design stage and as the design develops further.	None
RELEVANT WER SURFACE WATER BODY: SHEFFIELD AND SOUTH YORKSHIRE NAVIGATION (NEW JUNCTION AND STAINFORTH AND KEADBY) (GB70410281)							
OPERATION PHASE							
New water intake structure in canal	Minor, localised adverse effect	No impact	-	-	-	Based on the information available and anticipated level of impact, no additional mitigation is	None

						anticipated to be required. However, the requirement for additional mitigation should be reviewed at detailed design stage and as the design develops further.	

Groundwater bodies

12B.6.43. The Idle Torne - Secondary Mudrocks WER Groundwater Body (GB40402G992200) and the Lower Trent Erewash - Secondary Combined WER Groundwater Body (GB40402G990300) have been screened in to the assessment. An assessment matrix considering the quality elements that could be potentially impacted are discussed below and summarised in **Table 12B.19.**

12B.6.44. The Idle Torne - Secondary Mudrocks Groundwater Body underlies the majority of the Proposed Site, and encompasses the access road off the A18. The Lower Trent Erewash - Secondary Combined Groundwater Body is found located beneath the existing outfall to the River Trent.

12B.6.45. During **construction** works there is the potential for impacts to groundwater through the creation of new pathways, or exacerbation of existing pathways that may open or modify potential pollutant linkages (e.g. from drilling of piling foundations if piling is required). Excavation of cuttings may liberate groundwater in the form of seepages from any areas of permeable ground or superficial deposits (sands, clays, gravels) that are intercepted. This liberated groundwater may not be suitable for discharge without treatment of contaminants. There is also potential for underlying groundwater to be contaminated from spillages associated with vehicles, construction materials and storage of fuels, oils and other chemicals. Impact on groundwater levels during construction, such as from dewatering within the superficial deposits, will be temporary and undertaken in line with the appropriate abstraction and discharge consenting requirements and as such are considered to not have an adverse effect on the groundwater quantity or quality status.

12B.6.46. There will be a requirement to avoid creating flow paths between potentially contaminated soils and/ or groundwater in the underlying aquifer due to the disturbance or mobilisation of existing contaminated materials. Ground investigations have been undertaken to understand the condition and location of contaminated material across the site, and to inform appropriate mitigation during construction (see **ES Volume I Chapter 13**: Geology, Hydrogeology and Land Contamination **(Application Document Ref. 6.2**). Appropriate working practices, plans and equipment required to deal with dewatering of groundwater, including discharges to other water bodies, have been included in the **Outline CEMP** (**Application Document Ref. 7.4**), including pollution control measures (CIRIA, 2001), and relevant licences being obtained and conditions and best practice followed (CIRIA, 2023). Such

measures will be developed further as part of the final CEMP which will be secured by requirement on the **Draft DCO** (**Application Document Ref. 3.1**).

12B.6.47. Based on the reasonable assumption that appropriate measures are implemented during construction, it is considered that these risks can be mitigated against to avoid adverse effects to either Quantitative or Chemical (GW) quality elements, or water body status. This mitigation will need to be defined once more detailed information about the proposals is available.

12B.6.48. During the **operation** phase of the Proposed Development, leaks and spills (e.g. from equipment or stored chemicals) have the potential to impact on the Chemical (GW) status of the underlying Idle Torne - Secondary Mudrocks and Lower Trent Erewash - Secondary Combined groundwater bodies. The **Drainage Strategy** (included as Annex 3 to **ES Volume II Appendix 12A**: Flood Risk Assessment (**Application Document Ref. 6.3**) notes that the area of impermeable ground will increase permanently for operation of the scheme, compared to the baseline. The Drainage Strategy also notes that there will be several bunded areas which will collect surface water and drain it to separate on-site treatment facilities, including high risk areas. Additionally, it is reasonable to assume that mitigation such as management plans will be developed and implemented during operation of the scheme should a spill occur, such as the availability of spill kits, covering drains and use of materials to bund and absorb potentially polluting substances. Impacts on groundwater levels during operation as a result of the Proposed Development are considered to be negligible based on the size of the development relevant to catchment area and current drainage strategy. Given the above, it is determined that risks to Chemical (GW) status from operation of the Proposed Development can be mitigated, and therefore avoid adverse effects to the status of the quality element or water body.

Table 12B.19 Groundwater bodies scoping assessment – summary matrix

RELEVANT WER WATERBODIES: Lower Trent Erewash - Secondary Combined Idle Torne - Secondary Mudrocks			
Scheme component / impact type	**QUANTITATIVE STATUS**	**CHEMICAL (GW)**	
		Chemical Status element	**Supporting elements**
CONSTRUCTION PHASE			
Potential for impacts to groundwater through the creation of new pathways, or exacerbation of existing pathways that may open up or modify potential pollutant linkages	-	No impact	No impact
Excavation of cuttings may liberate groundwater in the form of seepages from any areas of permeable ground or superficial deposits	No impact	-	-
Potential for underlying groundwater to be contaminated from spillages	-	No impact	No impact

Potential for construction activities to affect groundwater levels and local groundwater quality	No impact	No impact	
OPERATION PHASE			
Potential for underlying groundwater to be contaminated from spillages	-	No impact	No impact
Increase in impermeable area has potential to affect groundwater levels	No impact	-	-

12B.7. Enhancement Opportunities

12B.7.1. The Proposed Development should identify opportunities for enhancements of the water environment that can contribute towards:

- Mitigating negative impacts from the Proposed Development on WER status or future objectives, or
- Improve the status of WER quality elements, or towards the achievement of WER objectives for the relevant water bodies.

12B.7.2. An **Outline LBMEP Report** (**Application Document Ref. 5.10**) has been prepared. The document sets out the principles of habitat creation, management and enhancement and of landscape design that will be adopted in the detailed design process and the areas of the Site allocation for this purpose, as well as the existing areas of planting to be retained, protected and managed. Implementation of the proposed

measures is secured by a Requirement of the **Draft DCO (Application Document Ref. 3.1).**

12B.8. Conclusion

12B.8.1. The Screening and Scoping (Preliminary) WER assessment (Stage 2) indicates that, based on the current understanding of the Proposed Development, there are proposed scheme components that could potentially impact on a number of WER water bodies in the ZoI of the Proposed Development. However, it is expected that best practice and design mitigation would mean that no significant adverse impacts to WER relevant waterbodies would occur for:

- Humber Upper (GB530402609203);
- Paupers Drain Catchment (trib of Trent) (GB104028064300);
- North Soak Drain Catchment (trib of Torne/Three Rivers) (GB104028064350);
- Hatfield Waste Drain Catchment (trib of Torne/Three Rivers) (GB104028064330);
- Torne/Three Rivers from Mother Drain to Trent (GB104028064340);
- Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) (GB70410281);
- Lower Trent Erewash - Secondary Combined WER Groundwater Body (GB40402G990300); and
- Idle Torne - Secondary Mudrocks WER Groundwater Body (GB40402G992200).

12B.8.2. A Detailed WER Assessment (Stage 3) will be undertaken at the detailed design stage when more details will be available, including detailed construction information. This will include the assessment of impacts, and/or identification of any specific design mitigation or additional mitigation which may be required to ensure that there is no deterioration of the WER status of the water body, nor any adverse impacts on the ability to achieve the WER objectives for the water body.

12B.8.3. The assessment will be updated as a ‘living document’ at the detailed design stage.

12B.8.4. To mitigate against the identified impacts, best practice mitigation measures to manage all pollution risks, measures to treat surface water runoff and manage the risk of future spillages and pollution incidents occurring should be implemented during construction in accordance

with the outline Water Management Plan (WMP) included in Appendix C of the **Outline CEMP (Application Document Ref. 7.4).** The final CEMP and final WMP will be secured by requirement on the **Draft DCO (Application Document Ref. 3.1).**

12B.8.5. A number of permissions will be required from the Environment Agency, IBD and/ or Canal and River Trust and these will provide an additional check on the proposed works. A list of consents required for the Proposed Development is provided in the **Schedule of Other Consents and Licences (Application Document Ref. 5.4)**. Prior to construction this will include consents related to discharges of any potentially 'unclean' runoff during construction, and for any activity within 8 m of the bank of a main river or culvert on a main river. Works close to ordinary watercourses would need consent from the Lead Local Flood Authority (LLFA) and in some cases the IDB.

12B.8.6. Appropriate licences and permits will be obtained from the Environment Agency (where applicable) with regards to the operational discharges to the River Trent (process effluent and potentially surface water runoff). It is preferred that surface water drainage will be discharged to Keadby Common Drain, subject to agreement with the IDB, with the River Trent as a backup.

12B.8.7. Consultation with Severn Trent Water will be undertaken to confirm the capacity to accept foul water from the Proposed Development.

12B.9. References

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ANNEX 1 WER WATERBODY BASELINE STATUS 2022

12B1. Annex 1

12B.1. WER Waterbody Baseline Status 2022

Table 12B1.1: Surface Water Body Classification Details (2022)

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
RBMP	Humber	Humber	Humber	Humber	Humber	Humber
Waterbody ID	GB530402609203	GB104028064300	GB104028064350	GB104028064330	GB104028064340	GB70410281
Water Body Type	Transitional; Heavily Modified	Artificial	Artificial	Artificial	Artificial	Artificial
Area (km^2)	-	32.041	55.641	120.158	85.295	-
Length (km)	12.332	13.287	26.44	36.482	50.603	43.815
Overall Ecological Potential / Status	**Moderate Ecological Potential**	**Moderate Ecological Potential**	**Moderate Ecological Potential**	**Moderate Ecological Potential**	**Moderate Ecological Potential**	**Good Ecological Potential***
Chemical Status	**Fail**	**Fail**	**Fail**	**Fail**	**Fail**	**Fail***
Mitigation Measures Assessment	**Moderate or Less**	**Good**	**Moderate or Less**	**Moderate or Less**	**Moderate of Less**	**Good***

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Biological Quality Elements	**Moderate**	**Bad**	**Moderate**	**Poor**	**Moderate**	**-**
Angiosperms	Moderate	-	-	-	-	-
Fish	Good	Bad	-	Poor	Moderate	-
Macroalgae	High	-	-	-	-	-
Phytoplankton	High	-	-	-	-	-
Invertebrates	-	Good	Moderate	Good	Good	-
Macrophytes and Phytobenthos combined	-	Good	-	Moderate*	-	-
Hydromorphological Supporting Elements	**Not high**	**Not high**	**Not high**	**Not high**	**Not high**	**-**
Hydrological Regime	Supports Good	Supports Good	Supports Good	Support Good	Supports Good	-

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Physico-Chemical Parameters	**Good**	**Moderate**	**Moderate**	**Moderate**	**Moderate**	-
Acid Neutralising Capacity	-	-	High	-	High	-
Ammonia (phys-chem)	-	Poor	Poor	Moderate	High	-
Biochemical Oxygen Demand (BOD)	-	High	High	High	High	-
Dissolved Oxygen	Good	Bad	Bad	Poor	Poor	-
pH	-	High	High	High	High	-
Phosphate	-	Poor	Moderate	Poor	Moderate	-
Temperature	-	High	High	High	High	-

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Specific Pollutants	High	-	Moderate	-	High	-
Chlorothalonil	High	-	-	-	-	-
Pendimethalin	High	-	-	-	-	-
Triclosan	High	-	-	-	-	-
Manganese	-	-	High	-	-	-
Chromium (VI)	High	-	-	-	-	-
2,4-dichlorophenol	High	-	-	-	-	-
2,4-dichlorophenoxyacetic acid	High	-	-	-	-	-
Arsenic	High	-	-	-	-	-
Copper	High	-	-	-	High	-

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Diazinon	High	-	-	-	-	--
Dimethoate	High	-	-	-	-	-
Iron	High	-	Moderate	-	-	-
Linuron	High	-	-	-	-	-
Mecoprop	High	-	-	-	-	-
Permethrin	High	-	-	-	-	-
Phenol	High	-	-	-	-	-
Toluene	High	-	-	-	-	-
Zinc	High	-	Fail*	-	-	-
Chemical	**Fail***	**Fail***	**Fail**	**Fail***	**Fail***	**Fail***
Priority Substances	**Fail***	**Good***	**Good***	**Good***	**Good***	**Good***

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
1,2-dichloroethane	Good*	-	-	-	-	-
Atrazine	Good*	-	-	-	-	-
Benzene	Good*	-	-	-	-	-
Alachlor	Good*	-	-	-	-	-
Chlorpyrifos	Good*	-	-	-	-	-
Cypermethrin (Priority)	Fail*	Good*	Good*	Good*	Good*	-
Octylphenol	Good*	-	-	-	-	-
Dichlorvos (Priority)	Good*	-	-	-	-	-
Aclonifen	Good*	-	-	-	-	-
Chlorfenvinphos	Good*	-	-	-	-	-

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Cybutryne (Irgarol®)	Good*	-	-	-	-	-
Terbutryn	Good*	-	-	-	-	-
Dichloromethane	Good*	-	-	-	-	-
Diuron	Good*	-	-	-	-	-
Fluoranthene	Good*	Good*	Good*	Good*	Good*	Good*
Isoproturon	Good*	-	-	-	-	-
Lead and Its Compounds	Good*	-	-	-	-	-
Napthalene	Good*	-	-	-	-	-
Nickel and Its Compounds	Good*	-	-	-	Good*	-
Pentachlorophenol	Good*	-	-	-	-	-

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Simazine	Good*	-	-	-	-	-
Trichlorobenzenes	Good*	-	-	-	-	-
Trichlorobenzenes	Good*	-	-	-	-	-
Other Pollutants	**Good***	**Does not require assessment**	**Does not require assessment**	**Does not require assessment**	**Does not require assessment**	**Does not require assessment**
Aldrin, Dieldrin, Endrin & Isodrin	Good*	-	-	-	-	-
Carbon Tetrachloride	Good*	-	-	-	-	-
DDT Total	Good*	-	-	-	-	-
para - para DDT	Good*	-	-	-	-	-
Tetrachloroethylene	Good*	-	-	-	-	-
Trichloroethylene	Good*	-	-	-	-	-

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Priority Hazardous Substances	**Fail***	**Fail***	**Fail***	**Fail***	**Fail***	**Fail***
Anthracene	Good*	-	-	-	-	-
Polybrominated diphenyl ethers (PBDE)	Fail*	Fail*	Fail*	Fail*	Fail*	Fail*
Perfluorooctane sulphonate (PFOS)	Good*	Good*	Good*	Good*	Fail*	Good*
Benzo (b) and (k) fluoranthene	-	-	-	-	-	-
Benzo(a)pyrene	Fail*	Good	Good*	Good*	Good*	Good*
Cadmium and Its Compounds	Good*	-	-	-	Good*	-

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Dioxins and dioxin-like compounds	Good*	Good*	Good*	Good*	Good*	Good*
Benzo(b)fluoranthene	Fail*	-	-	-	-	-
Benzo(g-h-i)perylene	Fail*	-	-	-	-	-
Benzo(k)fluoranthene	Fail*	-	-	-	-	-
Heptachlor and cis-Heptachlor epoxide	Good*	Good*	Good*	Good*	Good*	Good*
Hexabromocyclododecane (HBCDD)	Good*	Good*	Good*	Good*	Good*	Good*
Quinoxyfen	Good*	-	-	-	-	-

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Di(2-ethylhexyl)phthalate (Priority hazardous)	Good*	-	-	-	Good*	-
Endosulfan	Good*	-	-	-	-	-
Hexachlorobenzene	Good*	Good*	Good*	Good*	Good*	Good*
Hexachlorobutadiene	Good*	Good*	Good*	Good*	Good*	Good*
Hexachlorocyclohexane	Good*	-	-	-	-	-
Mercury and Its Compounds	Fail*	Fail*	Fail*	Fail*	Fail*	Fail*
Nonylphenol	Good*	-	-	-	Good*	-
Tributyltin Compounds	Fail*	-	-	-	Good*	-

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Trifluralin (Priority hazardous)	Good*	-	-	-	-	-

*** Latest data from 2019**

Table 12B1.2 : Groundwater Body Classification Details (2019)

RBMP Parameter	Idle Torne - Secondary Mudrocks	Lower Trent Erewash - Secondary Combined
RBMP	Humber	Humber
Waterbody ID	GB40402G992200	GB40402G990300
Water Body Type	Groundwater	Groundwater
Area (km^2)	320.9	1924.4
Overall Status	**Good**	**Good**
Quantitative	**Good**	**Good**
Quantitative Saline Intrusion	Good	Good
Quantitative Water Balance	Good	Good
Quantitative GWDTE test	Good	Good
Quantitative Dependent Surface Water Body Status	Good	Good
Chemical GW	**Good**	**Good**
Chemical Status Element	Good	Good
Chemical Drinking Water Protected Area	Good	Good
General Chemical Test	Good	Good
Chemical GWDTE test	Good	Good
Chemical Dependent Surface Water Body Status	Good	Good
Chemical Saline Intrusion	Good	Good

ANNEX 2 BASELINE CONDITIONS

12B2 Annex 2

12B2.1. Baseline Conditions

12B2.1.1. The relevant baseline physical characteristics of the study area and the water features present are described in this section and with reference to **ES Volume III Figure 12.1:** Surface Waterbodies and their attributes **(Application Document Ref. 6.4).**

Land Use, Topography and Rainfall

12B2.1.2. The Site and a 1 km 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 10 m Above Ordnance Datum (mAOD) and with very shallow gradients (with the exception being the former ash tip, up to 18 m AOD), to the south-west of the Main Site). Beyond the area associated with the current (operational) Keadby 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.

12B2.1.3. The Water Connection Corridors extend eastwards and north-eastwards from the Site towards the village of Keadby, and the Site construction and operational access route extends to the south-west, crossing numerous watercourses including the Sheffield and South Yorkshire Navigation – Stainforth and Keadby Canal (herein referred to as 'the Stainforth and Keadby Canal'), North Soak Drain, South Soak Drain and Hatfield Waste Drain.

12B2.1.4. The study area has a complex surface water hydrology and a long history of land drainage. The Site and land north of the Stainforth and Keadby Canal is within the Isle of Axholme and North Nottinghamshire Water Level Management Board (IoAaNNWLMB) area.

12B2.1.5. The nearest weather station on the Met Office website with historical data is located at Robin Hood Doncaster Sheffield Airport, approximately 21 km south-west of the Site, at NGR SK 65933 98500. Based on the average climate data (for the period 1991 to 2020) for this weather station, the study area experiences an average of 582 mm of rainfall per year, with it raining more than 1 mm on around 114 days per

year. This is a relatively low level of rainfall when compared to the average for England (870 mm per annum).

12B2.1.6. Plate 12B2.1 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 60 mm throughout the year, except in June when it rises to 65 mm. March is the driest month with an average of approximately 32 mm between 1991 and 2020.

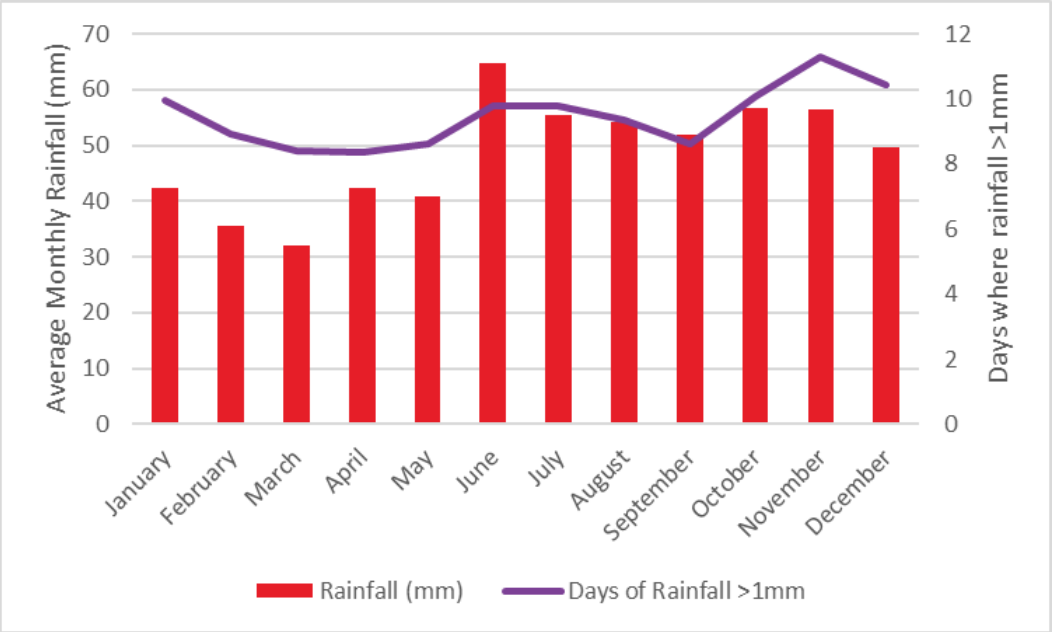

Plate 12B2.1: Robin Hood Doncaster Sheffield Airport Weather Station - Average rainfall per month (1991-2020) and average days per month with >1 mm of rainfall (1991-2020)

Groundwater, Geological Features and Soils

12B2.1.7. **ES Volume I Chapter 13:** Geology, Hydrogeology and Land Contamination (**Application Document Ref. 6.2**) describes the geology and groundwater at the Site, summarised here.

12B2.1.8. The British Geological Society (BGS) Geoindex viewer (BGS, 2024) 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[1] was practiced.

12B2.1.9. According to the MAGIC online map (DEFRA, 2024) the bedrock beneath the 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 permeable horizons and weathering. These are generally the water-bearing parts of former non-aquifers') whilst the superficial deposits across the 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').

12B2.1.10. Levels within the historical borehole records (BGS, 2024) indicate generally shallow groundwater levels within the superficial geology of between 0.9 m and 3.0 m below ground level (bgl). Occasionally, deeper groundwater strikes were recorded between 5.4 m and 6.9 m bgl. There is insufficient information to conclude at this stage whether these levels are representative of true groundwater levels across the wider area.

12B2.1.11. According to the Environment Agency's online Catchment Data Explorer website (Environment Agency, 2024) the Proposed Development lies adjacent to the boundary between two operational groundwater catchments. To the north of the Stainforth and Keadby Canal is the 'Lower Trent Erewash – Secondary Combined' WER water body (GB40402G990300). This groundwater body has a surface area of approximately 1924 km^2 and is currently at Good Overall Status. To the south of the Stainforth and Keadby Canal, the WER groundwater body is the 'Idle Torne - Secondary Mudrocks' (GB40402G992200). This waterbody has a surface area of approximately 321 km^2 and is at Good overall status. The WER groundwater bodies are shown in **ES Volume III Figure 12.2**: Groundwater Bodies and their Attributes **(Application Document Ref. 6.4**).

12B2.1.12. Information obtained from Cranfield Soil and AgriFood Institute (CSAI) Soilscapes website (CSAI, 2024) describes the soils on the Site to be loamy and clayey soils of coastal flats with naturally high groundwater[2]. Land within this soil type is described as generally draining to local groundwater and mostly drained. Shallow groundwater and marginal

[1] 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.

[2] Soilscape identification description number 21

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.

12B2.1.13. According to the Groundsure report (Groundsure, 2024), Natural England reports the Agricultural Land Classification (ALC) to be Grade 2 for the majority of the 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 Site south of the Stainforth and Keadby Canal, some parts are classified as Grade 1 (excellent quality). Further information is provided in **ES Volume I Chapter 3**: The Site and its Surroundings **(Application Document Ref. 6.2).**

Water Features

12B2.1.14. 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, 2024) the surface waterbodies listed in **Table 12B2.1** were identified within the study area. **ES Volume III Figure 12.1 (Application Document Ref. 6.4)** illustrates the location and WER status of these waterbodies.

Table 12B2.1: Summary of waterbodies in the study area including WER status

Waterbody	Type of Waterbody	WER designation or associated WER 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)

Waterbody	Type of Waterbody	WER designation or associated WER waterbody (where applicable)
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) - maintained by IoAaNNWLMB	Tributary of Humber Upper (GB530402609203)
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)

Waterbody	Type of Waterbody	WER designation or associated WER waterbody (where applicable)
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))	Watercourse (ordinary) - maintained by IoAaNNWLMB	Paupers Drain Catchment (trib of Trent) (GB104028064300)
Ubiquitous unnamed drainage ditches (including those named in **Appendix 11C**: PEA Report (ES Volume II) as drains D2-D6)	Watercourse (ordinary) – generally maintained by private landowners	Tributaries of the various WER waterbodies listed above
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	WER designation (GB40402G992200)
Lower Trent Erewash – Secondary Combined	Groundwater	WER designation (GB40402G990300)

Surface Waterbodies

12B2.1.15. The Environment Agency's Catchment Data Explorer website (Environment Agency, 2024) 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.

12B2.1.16. 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.

12B2.1.17. There are six WER designated surface waterbodies within the study area, described in Table 12B.5 of the WER Assessment Report, with full baseline classifications given in **Annex 1**. Although these are the WER reporting reaches, WER principles and objectives apply to all tributaries of these watercourses. The WER 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)). **ES Volume III Figure 12.1** (**Application Document Ref. 6.4**) illustrates these waterbodies.

12B2.1.18. Within the identified WER catchments, there are also a number of named watercourses shown on Ordnance Survey mapping, and these are described in Table 12B.6 of the WER Assessment Report, based on the site visit and walkover details also described in **ES Volume II Appendix 11C:** PEA Report (**Application Document Ref. 6.3**).

12B2.1.19. In addition to the watercourses described in Tables 12B.5 and 12B.6 in the WER Assessment Report, there are numerous small drains and ditches across the wider 1 km 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).

12B2.1.20. 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 2.0 km^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 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.

River Trent – Tidal Cycle

12B2.1.21. Preliminary assessments 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.

12B2.1.22. 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).

12B2.1.23. 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.

12B2.1.24. 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.

12B2.1.25. Adjacent to the operational Keadby 1 Power Station, the typical mean tidal range is 4.7 m (i.e. -0.4 mAOD to +4.3 mAOD) with a maximum astronomical tide range of 7.62 m (i.e. - 0.81 mAOD to +5.81 mAOD).

12B2.1.26. The tidal limit of the River Trent is 70 km upstream of the Proposed Development area at Cromwell Weir, shortly downstream of Newark-on-Trent.

River Trent - Hydrology

12B2.1.27. The area draining to the River Trent at Keadby comprises almost the whole of the Trent basin. The Trent's channel is entrained between primary flood defences at Keadby, with land on both sides of the river being very low-lying marsh at approximately 2m AOD. 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).

12B2.1.28. 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).

12B2.1.29. The daily maximum and minimum level data for the Keadby gauge at SE 08354 01131 have been obtained from the EA’s hydrology data explorer website. The data for 1993-2024 is shown in **Plate 12B2.2**

(note that data past 2022 is unchecked and therefore shows erroneous data spikes).

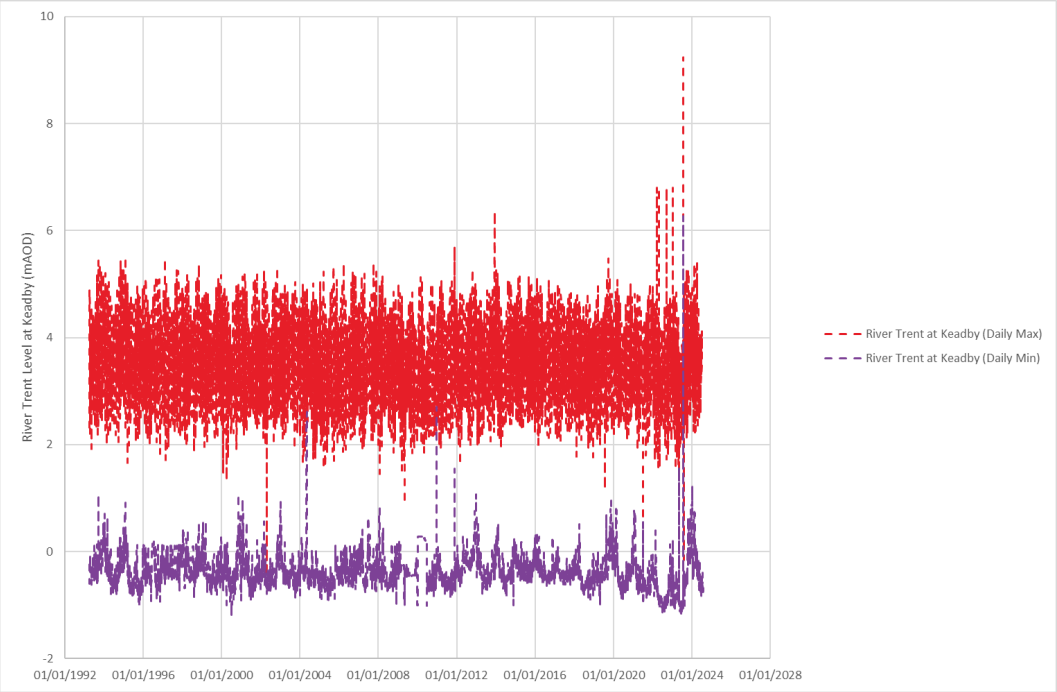

Plate 12B2.2: Daily Maximum and Minimum Levels (m AOD) for the River Trent at the Environment Agency's Keadby gauge

River Trent – Sedimentology

12B2.1.30. A review of available sampling analysis for neighbouring Marine Licence applications (MLA), as advocated by the International Maritime Organisation (IMO) sampling guidelines, has been undertaken.

12B2.1.31. The sediment characteristics of The River Trent adjacent to the Site have been considered as part of preliminary water supply and effluent 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.

12B2.1.32. 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 12B2.2** below.

Table 12B2.2 : River Trent Water Particle Size (<10µm)

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

12B2.1.33. 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 13 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).

12B2.1.34. 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.

12B2.1.35. Limited sample analysis of the River Trent at a point approximately 3.8 km 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 between 10 µm - 50 µm, indicating the

[3] 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.

variability of particle size distribution and the large quantity of fines in the sediment bed and wash load.

References

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ANNEX 3 BASELINE SURFACE WATER QUALITY INFORMATION AND DATA

12B3. Annex 3

12B3.1. Baseline Surface water Quality Information and Data

Surface Water Quality

12B3.1.1. Ahead of the 2019 Cycle assessments, the EA changed the methodology for undertaking the Chemical Status assessment, which resulted in all surface water bodies in England now failing their Chemical Status. These failures generally relate to four groups of global uPBT (ubiquitous, persistent bioaccumulative toxic) pollutants, known as 'forever chemicals', as well as the new inclusion of Cypermethrin within the priority substances assessment. The uPBTs include Mercury, certain Polycyclic aromatic hydrocarbons (PAHs), polybrominated diphenyl ethers (PBEs – a group of brominated flame retardants) and Perfluorooctane sulfonate (PFOS), a group of per- and polyfluoroalkyl substances (PFAS), which are being assessed for the first time.

12B3.1.2. For all water bodies, the chemical status is assessed only once per RBMP cycle (i.e. in 2019), and as such is recorded as 'does not require assessment' in interim Cycle 3 2022 status classifications.

12B3.1.3. The Humber Upper Transitional WER waterbody was at Fail Chemical Status under the 2019 WER Cycle 3 classifications, due to failures for certain priority substances (cypermethrin) and priority hazardous substances (polybrominated diphenyl ethers (PBDE), benzo(b)fluoranthene, benzo(g-h-i)perylene, benzo(k)fluoranthene, mercury and tributylin compounds. All specific pollutants and other pollutants are at Good status or higher.

12B3.1.4. The Paupers Drain Catchment WER waterbody is also at Fail Chemical Status under the WER Cycle 3 classifications (2019) due to failures for certain priority hazardous substances (PBDE and mercury). All priority substances, and other pollutants are at Good status or higher.

12B3.1.5. The North Soak Drain Catchment WER waterbody is at Fail Chemical Status under the WER Cycle 3 classifications (2019) due to failures for certain priority hazardous substances (PBDE and mercury). All priority substances, and other pollutants are at Good status or higher. Of the specific pollutants, iron is at Moderate status and zinc is at Fail status.

12B3.1.6. The Hatfield Waste Drain WER waterbody is at Fail Chemical Status, due to failing priority hazardous substances (PBDE and mercury).

Priority substances and specific pollutants are at Good status while other pollutants do not require assessment.

12B3.1.7. The Torne/Three Rivers from Mother Drain to Trent is at Fail Chemical Status, due to failing priority hazardous substances (PBDE, perfluorooctane sulphonate (PFOS) and mercury). Priority substances and specific pollutants are at Good status while other pollutants do not require assessment.

12B3.1.8. The Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) is at Fail Chemical Status, due to failing priority hazardous substances (PBDE and mercury). Priority substances and specific pollutants are at Good status while other pollutants do not require assessment.

River Trent Water Quality at Keadby

12B3.1.9. Previous studies for Keadby CCS summarise water quality data collected from four locations close to the study area, namely:

- The Keadby 1 Power Station intake (Sampling Programme 1) - SSE site data which is limited to periodic river temperature monitoring over the period 2003-2015 and four spot samples taken over the period Nov 2005-July 2006;
- Keadby Bridge (Sampling Programme 2) - monthly water sampling undertaken by the Environment Agency at a point approximately 1.1 km upstream of the intake over the period February 2004 – February 2015 (SSE, 2020);
- Burringham (Sampling Programme 3) - This sample location is approximately 3.8 km upstream of Keadby 1 Power Station intake. Limited water quality sampling was taken as part of a study into the Particle Size Distribution in an Estuarine Turbidity Maximum Region (Mitchell and West, 2020);
- Burringham Drain (Sampling Programme 4) - approximately 4.1 km upstream of the Keadby 1 Power Station intake. Limited sampling was carried out by the Environment Agency as part of a study into the implications on water quality and sedimentation from the provision of fish access at water-level management structures over a spring and neap tidal cycle in November - December 2011 (Environment Agency, 2020b).

12B3.1.10. The results of the four sampling programmes were combined in the following **Table 12B3.1**.

Table 12B3.1: Summary Water Quality Data for the River Trent at Keadby

Parameter	Units	WER EQS (for pass/good)	Sampling Programme	No. Samples	Min	5%ile	Mean	95%ile	Max
pH	-		2	154	7.1	7.4	7.9	8.3	9.0
			1	4	7.7	7.7	7.9	8.2	8.2
Temperature of Water	°C		2	154	0.1	4.2	12.0	19.5	24.6
Biochemical Oxygen Demand (BOD)	mg/L		2	93	1	1	2	4	8
Ammoniacal Nitrogen (NH_3 as N)	mg/L		2	129	0.01	0.02	0.11	0.25	0.39
Ammonium Ion (NH_4)	mg/L		1	4	0.021	0.021	0.052	0.095	0.101
Total Oxidised Nitrogen (TON) as N	mg/L		2	154	4	6	8	11	12
Ammonia NH_3 as N	mg/L	0.021	2	129	0.0001	0.0003	0.0016	0.0040	0.0060
Nitrate as NO_3	mg/L		1	4	31.9	32	35	38	39
Dissolved Organic Carbon (DOC)	mg/L		2	154	0.2	4	6	8	11

Parameter	Units	WER EQS (for pass/good)	Sampling Programme	No. Samples	Min	5%ile	Mean	95%ile	Max
Total Organic Carbon (TOC)	mg/L		1	4	6	6	7	8	9
Aluminium	µg/l		1	4	5	235	2,454	4,951	5,300
Cadmium	µg/l	0.2	2	130	0.08	0.10	0.24	0.53	1.25
Cadmium, Dissolved	µg/l		2	97	0.04	0.05	0.10	0.15	0.21
Chromium	µg/l		2	154	0.8	1.8	15.8	55.1	73.6
Chromium, Dissolved	µg/l		2	46	0.5	0.6	1.3	3.1	3.6
Lead	µg/l	1.3	2	153	0.8	4.0	34	124	242
Lead, Dissolved	µg/l		2	91	0.1	0.1	0.4	1.0	6.1
Zinc	µg/l	6.8 (plus ambient background)	2	154	8	18	73	220	370
Zinc, Dissolved	µg/l		2	154	5	7	11	16	33
Nickel	µg/l	8.6	2	152	3	3	13	36	55
Nickel, Dissolved	µg/l		2	138	3	3	6	10	13
Iron	µg/l	1.000	2	152	376	860	7,588	24,790	39,800
			1	4	94	914	8,489	16,565	17,600
Iron, Dissolved	µg/l		2	24	32	34	160	586	785

Parameter	Units	WER EQS (for pass/good)	Sampling Programme	No. Samples	Min	5%ile	Mean	95%ile	Max
			1	4	7	10	47	100	110
Copper	µg/l	3.76	2	154	1	4	14	39	57
			1	4	1.2	3	23	39	39
Copper, Dissolved	µg/l		2	154	2	3	5	8	15
			1	4	1.2	2	4	5	5
Calcium	mg/L		1	4	1.1	20	100	143	146
Magnesium	mg/L		1	4	0.3	4	20	29	30
Potassium	mg/L		1	4	0.08	1.3	7	10	10
Orthophosphate as P	µg/l		1	4	323	332	498	705	732
Fluoride	µg/l		1	4	220	240	343	400	400
Sulphate as SO_4	mg/L		1	4	110	118	157	186	190
Sodium	mg/L		1	4	1.2	6	34	55	56
Chloride	mg/L		2	154	29	44	138	286	3,080
			1	4	56	59	143	310	348
			4		303				606
			3		303				4,849
Salinity	ppt		2	158	0.05	0.07	0.23	0.47	5.08

Parameter	Units	WER EQS (for pass/good)	Sampling Programme	No. Samples	Min	5%ile	Mean	95%ile	Max
			4		0.5				1.00
			3		0.5				8.00
			1	4	0.09	0.10	0.24	0.51	0.57
Silica Reactive as SiO_2	mg/L		1	4	0.6	1.3	6.3	9.9	10.1
Solids, Suspended @ 105°C	mg/L		2	154	3	33	406	1,407	2,380
			1	4	264	319	1,875	5,079	5,840
			4	43	400				9,200
			2	106	490	N/D	3,347	10,002	14,562
Total Dissolved Solids @ 180°C	mg/L		1	4	429	458	747	1,201	1,300
Conductivity	µS/cm		1	4	591	633	1,034	1,640	1,770
Turbidity	NTU	>300 = very turbid; 100-300 = turbid; 10 = clear	1	4	>20	>20	>20	>20	>20
			3		200				1,100
Calcium Hardness as $CaCO_3$	mg/L		1	4	2.7	30	189	285	286

Parameter	Units	WER EQS (for pass/good)	Sampling Programme	No. Samples	Min	5%ile	Mean	95%ile	Max
Magnesium Hardness as $CaCO_3$	mg/L		1	4	1.2	10	64	103	105
Total Hardness as $CaCO_3$	mg/L		1	4	3.9	40	253	383	384
Oxygen, Dissolved % Saturation	%		2	154	50	68	87	102	148
Oxygen, Dissolved as O_2	mg/L		2	154	5	6	9	13	15

12B3.1.11. According to the WER Standards and Classification (HMSO, 2017), **Table 12B3.1** 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 >300 mg/L based on values of 406mg/L, 1,875mg/L and 3,347mg/L during the three sampling programmes for this determinand.

12B3.1.12. Based on the data in **Table 12B3.1**, dissolved oxygen (mg/L) falls within the WER Good classification based on 5th percentile and High classification based on the mean. This was calculated using formulae within the WER Standards and Classification document (HMSO, 2017) for transitional waterbodies with a salinity of <35ppt.

12B3.1.13. Sanitary pollutants (e.g. Biochemical Oxygen Demand (BOD) and ammonia) are present at low concentrations and are presumably heavily diluted given the scale of the waterbody. Nitrate concentration is high (mean 35mg/L) and likely reflects the largely agricultural land use of the surrounding catchment, with use of fertilisers which run off to watercourses draining to the River Trent.

12B3.1.14. Certain metals such as copper and zinc are elevated, and may surpass WER EQS, although their bioavailability would need to be determined through further data collection to confirm this. This may be derived from road runoff to watercourses across the catchment which is then directed towards the River Trent.

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

12B3.1.15. The Water Supply and Wastewater Discharge Study (SSE, 2020) summarises water quality monitoring data for the Stainforth & Keadby Canal undertaken by SSE/ Siemens. The following table (**Table 12B3.2**) summarises the water quality data obtained from the sampling programme over the period 20/1/15-18/1/16. The programme was undertaken to identify the Keadby 2 CCGT Power Station water quality specification (Mitchell and West, 2020). No location for the sampling

point has been detailed, but it assumed to be local to the existing Keadby 1 Power Station Demineralisation Plant abstraction point.

Table 12B3.2 : Stainforth & Keadby Canal Water Quality Data

Parameter	Units	No. Samples	Minimum	Mean	Maximum
pH	pH Units	102	6.95	8.02	9.48
Ammoniacal Nitrogen as NH_4	mg/L	102	0.01	0.1	4
Total Organic Nitrogen (TON) as NH_3	mg/L	102	2.94	20.33	59.65
Barium	µg/l	102	10.7	15.62	75.3
Nitrite as NO_2	mg/L	102	0	0.08	0.286
Nitrate as NO_3	mg/L	102	2.82	19.87	59.58
Total Organic Carbon (TOC)	mg/L	102	1.8	5.57	7.2
Aluminium	µg/l	102	9.16	40.15	136
Iron	µg/l	102	31.2	107.2	357.8
Iron, Dissolved	µg/l	102	21.3	46.04	127
Copper	µg/l	102	5.07	7.5	37.25
Copper, Dissolved	µg/l	102	5.07	6.41	13.8
Strontium	mg/L	102	0.1	0.13	0.18
Magnesium	mg/L	102	7.69	19.48	24.6
Potassium	mg/L	102	2.28	8.34	11.2
Orthophosphate as P	mg/L	102	0.16	0.5	1.25
Fluoride	µg/l	102	261	650.5	11,800
Sulphate as SO_4	mg/L	102	70.8	122.14	160
Sodium	mg/L	102	15.4	70.3	96.2
Chloride	mg/L	102	47.97	88.21	152.3

Parameter	Units	No. Samples	Minimum	Mean	Maximum
Salinity (Calculated)	ppt	102	0.08	0.15	0.25
Silica Reactive as SiO_2	mg/L	102	0.16	2.76	7.7
Solids, Suspended @ 105°C	mg/L	102	2	5.87	20*
Total Dissolved Solids @ 180°C	mg/L	102	280	436	630
Conductivity	µS/cm	102	482	678	835
Turbidity	NTU	102	0.32	1.83	10.2
Total Hardness as Ca	mg/L	102	63.36	84.79	102.76

12B3.1.16. **Table 12B3.2** is assumed to be representative of the water quality at the abstraction point for the Proposed Development which is currently assumed to be located locally to the Keadby 2 Power Station abstraction point.

12B3.1.17. 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 maybe driven from runoff from the road and railway crossings.

Keadby Warping Drain – Water Quality

12B3.1.18. Water quality data has been obtained from the Environment Agency's Water Quality Archive (Environment Agency, 2024) for Keadby Warping Drain. Data was reviewed in August 2024 prior to updating this assessment for the Preliminary Environment Information (PEI) Report

stage. The twenty most recent samples (as of August 2024, samples taken between 2013 and 2018) are summarised in **Table 12B3.3.**

Table 12B3.3: Summary of water quality data for Keadby Warping Drain 2013-2018 (Environment Agency)

Parameter	Units	WER Standards	Mean	Max	Min	90th %ile	10th %ile
Alkalinity to pH 4.5 as $CaCO_3$	mg/L	-	288.35	377	189	355.3	232.6
Ammonia un-ionised as N	mg/L	-	0.0027	0.0177	0.0004	0.0058	0.0005
Ammoniacal Nitrogen as N	mg/L	High <0.3 Good <0.6 (90th%ile)	0.271	2.09	0.039	0.4308	0.0506
Conductivity at 25 ºC	µS/cm	-	1289.2	1770	587	1592	1062.9
Nitrate as N	mg/L	-	2.8637	12.8	0.186	7.628	0.1914
Nitrite as N	mg/L	-	0.029	0.0695	0.0051	0.0553	0.0062
Nitrogen, Total Oxidised as N	mg/L	-	3.96	12.8	0.45	9.38	0.654
Orthophosphate, reactive as P	mg/L	-	0.2274	1.36	0.053	0.3905	0.0629
Oxygen, Dissolved as O_2	mg/L	-	8.219	13.8	1.6	12.81	3.834
Oxygen, Dissolved, % Saturation	% sat.	High >70 Good >60 (10^{th}%ile)	73.4	114.2	15.9	108.37	38.9
pH	pH Units	High & Good >=6 to <=9	7.8625	8.4	7.3	8.307	7.539

Parameter	Units	WER Standards	Mean	Max	Min	90th %ile	10th %ile
Temperature of Water	ºC	High <20 Good <23 (98th%ile)	11.115	17.4	4.3	6.59	5.09

12B3.1.19. **Table 12B3.3** indicates the Keadby Warping Drain is slightly alkaline in nature with an average pH of 7.8625 and falls within the WER High classification based on the twenty samples considered here.

12B3.1.20. A 10th percentile dissolved oxygen saturation of 38.9% falls within Poor classification (<45%). In combination with supersaturated recordings this suggests the waterbody is extremely vulnerable to large fluctuations of dissolved oxygen and may be the result of nutrient rich water with an abundance of macrophytes.

12B3.1.21. Nitrate and orthophosphate values are somewhat elevated and indicate probable pressure from the surrounding agricultural land uses through use of fertilisers and other products which may runoff to the watercourse. It is noted that Nitrate values have worsened and Orthophosphate values have improved in more recent samples (mean Orthosphate value of 0.101 mg/l when only considering 10 most recent samples of which 5 were less than 0.01; mean Nitrate value of 3.31 mg/l when only considering 10 most recent samples)

Keadby Pumping Station Drain – Water Quality

12B3.1.22. Water quality data has been obtained from the Environment Agency's Water Quality Archive (Environment Agency, 2024) for Keadby Pumping Station Drain. Data was reviewed in August 2024 prior to updating this assessment for the Preliminary Environment Information (PEI) Report stage. The twenty most recent samples (as of August 2024, samples taken between 2019 and 2021) are summarised in **Table 12B.4.**

Table 12B.4: Summary of water quality data for Keadby Pumping Station Drain 2019-2021 (Environment Agency)

Parameter	Units	WER Standards	Mean	Max	Min	90th %ile	10th %ile
Alkalinity to pH 4.5 as $CaCO_3$	mg/L	-	185.9	210	160	202.8	169

Parameter	Units	WER Standards	Mean	Max	Min	90th %ile	10th %ile
Ammonia un-ionised as N	mg/L	-	0.002	0.005	0.0005	0.003	0.001
Ammoniacal Nitrogen as N	mg/L	High <0.3 Good <0.6 (90th%ile)	0.234	0.636	0.039	0.544	0.067
Biological Oxygen Demand (BOD)	mg/L	High <4 Good <5 (90th%ile)	1.775	4.84	1	2.576	1.04
Nitrate as N	mg/L	-	6.389	10.3	1.58	9.306	3.128
Nitrite as N	mg/L	-	0.071	0.19	0.018	0.113	0.039
Nitrogen, Total Oxidised as N	mg/L	-	6.459	10.4	1.6	9.37	3.168
Orthophosphate, reactive as P	mg/L	-	0.169	0.3	0.1	0.244	0.1
Oxygen, Dissolved as O_2	mg/L	-	8.563	13.6	2.9+9	10.75	5.836
Oxygen, Dissolved, % Saturation	% sat.	High >70 Good >60 (10th%ile)	81.88	145.6	33.8	100.9	61.33
pH	pH Units	High & Good >=6 to <=9	7.796	8.64	7.22	8.154	7.513
Solids, Suspended @ 105°C	mg/L	-	15.13	86	4	24.33	4.63
Temperature of Water	ºC	High 20 Good 23 (98th%ile)	13.59	22.9	3.1	21.22	4.29

12B3.1.23. **Table 12B.4** indicates the Keadby Pumping Station Drain is very slightly alkaline in nature with an average pH of 7.796 and falls within the WER High classification based on the twenty samples considered here.

12B3.1.24. A 10th percentile dissolved oxygen saturation of 61.33% falls within Good classification, with moderate being less than 60% and poor being less than 45%. In combination with supersaturated recordings this suggests the waterbody is vulnerable to large fluctuations of dissolved

oxygen and may be the result of nutrient rich water with an abundance of macrophytes.

12B3.1.25. Nitrate and orthophosphate values are somewhat elevated and indicate probably pressure from the surrounding agricultural land uses through use of fertilisers and other products which may runoff to the watercourse.

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ANNEX 4 AQUATIC ECOLOGY BASELINE

12B4. Annex 4

12B4.1. Aquatic Ecology Baseline

12B4.1.1. Full details regarding aquatic ecology and riparian mammals within the study area are provided in **ES Volume II Appendix 11E:** Riparian Mammal Survey Report (**Application Document Ref. 6.3)** and **ES Volume II Appendix 11F:** Aquatic Ecology Survey Report **(Application Document Ref. 6.3)** and summarised in **ES Volume I Chapter 11:** Biodiversity and Nature Conservation **(Application Document Ref. 6.2).** A brief summary is provided below.

Protected and Notable Species

Water Vole

12B4.1.2. Riparian mammal surveys were undertaken in May 2023, July 2023 and August 2024. The results of these surveys are summarized below for information, though are presented in **ES Volume II Appendix 11E**: Riparian Mammal Report (**Application Document Ref. 6.3**) and in **ES Volume I Chapter 11**: Biodiversity and Nature Conservation (**Application Document Ref. 6.2**).

12B4.1.3. Surveys were undertaken of the Main Site (Drains 1, 2, 3, 4, 5 and A) and Hatfield Waste Drain (at Mabey Bridge). Given that all these surveyed waterbodies are located in close proximity to each other and are connected, they have been evaluated together. Survey locations did not include the Keadby and Stainforth Canal.

12B4.1.4. Across the wider Site, Drain B (which is located east of the National Grid Substation and adjacent to the emergency access route) and Drain C (located adjacent to Chapel Lane which is associated with the emergency access route) also supported higher populations of water vole (assessed to be of medium and high densities respectively). These drains are also assessed to be of district nature conservation value for water vole.

12B4.1.5. Fields signs were found in only discrete locations in the other drains, indicating that there is only a small and perhaps transitory population of water voles associated with the other drains within the Site (likely to be less than 14 territories and individuals). It is possible that the sub-optimal drains of the Main Site only support animals displaced from

more optimal waterbodies elsewhere, and that there is a high turnover of water voles within the Main Site drains year to year.

12B4.1.6. The results for the other drains therefore suggest that numbers peak in these drains after breeding, when water voles born that year disperse to find unoccupied territories. The small numbers, and potentially transitory occurrences, of water vole associated with the sub-optimal waterbodies (small drains lacking sufficient water and prone to drying) are likely to make a minor contribution to the wider population, especially given the habitat conditions present indicate that the territories on the Main Site may not be sustainable over the long-term.

12B4.1.7. Given the above it is considered that the remaining drains within the Site that would be affected by the Proposed Development support a water vole population of local value.

Otter

12B4.1.8. The surveys found no evidence of otter associated with the Site.

12B4.1.9. It is assumed that otters are moving and foraging along the River Trent and the Stainforth and Keadby Canal habitat corridor, and potentially the other waterbodies associated with the Site. However, there is no evidence that habitats within the Site are of specific importance for otter and there is no evidence that otter currently uses the habitats associated the Site for breeding or resting.

12B4.1.10. Otter is not considered to be a constraint to the Proposed Development, so further assessment is not required. However, top-up surveys are likely to be required in future years to reconfirm the status of the species and the suitability of the habitats present.

Great Crested Newt

12B4.1.11. Based on desk studies and AECOM surveys in 2010 and 2017, no Great Crested Newts have been identified within the study area. In addition, surveys undertaken in 2012 and 2015, by SKM and Jacobs respectively, waterbodies within the adjacent Keadby Wind Farm were surveyed, and GCNs were not found. They have been scoped out of the Biodiversity assessment.

White Clawed Crayfish

12B4.1.12. There are no records of white-clawed crayfish in the desk study area and it is not expected to encounter these species within any of the watercourses associated with the Proposed Development. They are not

present in this part of Lincolnshire and so were scoped out of the Biodiversity assessment.

Fish Surveys

12B4.1.13. A fish environmental DNA (eDNA) survey of the Stainforth and Keadby Canal was undertaken in August 2024 at the location of the proposed cooling water abstraction point. The results of this survey are presented in detail in **ES Volume II Appendix 11F**: Aquatic Ecology Survey Report **(Application Document Ref. 6.3)** and are summarised here for information. The survey recorded eDNA of 14 species of fish. The fish community was dominated by roach and perch. The only notable species recorded were European eel and spined loach (*Cobitis taenia*), both of which are indicated to represent a minor component of the fish community. Zander (*Sander lucioperca*) is an INNS species listed on Schedule 9 of the WCA. This species appears to be only a minor component of the fish community. The results of the eDNA survey are presented in **Table 12B4.1**

Table 12B4.1: The mean percentage of the fish community detected via eDNA analysis

Common name	Latin name	Mean percentage recorded
European eel	*Anguilla anguilla*	1.1%
Spined loach	*Cobitis taenia*	0.4%
Common bream	*Abramis brama*	3.4%
Common bleak	*Alburnus alburnus*	0.0%
Silver bream	*Blicca bjoerkna*	5.4%
Dace/ ide	*Leuciscus sp.*	0.7%
Roach	*Rutilus rutilus*	35.3%
Common rudd	*Scardinius erythrophthalmus*	1.8%
Tench	*Tinca tinca*	3.8%
Cyprinidae sp.	Unidentified Cyprinidae	0.1%
Northern pike	*Esox lucius*	2.3%
Ruffe	*Gymnocephalus cernua*	0.5%
Perch	*Perca fluviatilis*	44.7%

Zander	*Sander lucioperca*	0.3%

12B4.1.14. Significant fish species known to be present include river lamprey (Lampetra fluviatilis) and sea lamprey (Petromyzon marinus) which migrate through the estuary to breed in the rivers of the Humber catchment. River lamprey and sea lamprey are protected species under Annex II of the Habitats Directive. Accordingly, the populations of these species are of international value. The River Trent at Keadby is of key functional importance for these two lamprey species as it is the route by which they access and leave the wider River Trent catchment.

12B4.1.15. The populations of Atlantic salmon (Salmo salar) and European eel (Anguilla Anguilla) associated with the River Trent are considered to be of regional value, given this is the main river catchment within the region.

12B4.1.16. All of the other fish species recorded make use of the River Trent either as part of the wider habitat resource of the Humber Estuary, or incidentally e.g. occasional use by species more typically associated with freshwater habitats located upstream of the tidal limit at Keadby. All of these species widespread and relatively common, and accordingly each species is considered to be of local nature conservation value.

12B4.1.17. According to the Environment Agency's Ecology and Fish Data Explorer website a fish sample was taken on the River Trent at Burringham approximately 3.5 km upstream of the Site in May 2016 (NGR: SE 83281 08649). Here, five species were recorded during a single catch sample. This was predominantly roach, but with 3-spined stickleback (Gasterosteus aculeatus), European eel (Anguilla anguilla), chub (Leuciscus cephalus) and perch (Perca fluviatilis) also recorded. None of the surveyed species fall within Annex II of the Habitats Directive.

12B4.1.18. The Environment Agency provided details of a fish survey on the Three Rivers watercourse at Pilfrey Bridge (NGR: SE 80540 09928) in 2004. Five species were recorded, dominated by common bream (Abramis brama) and roach (Rutilus rutilus). None of the surveyed species fall within Annex II of the Habitats Directive.

Macroinvertebrates

12B4.1.19. Details on the aquatic macroinvertebrate desk top study and field surveys can be found in **ES Volume I Appendix 11F:** Aquatic Ecology Survey Report (**Application Document Ref. 6.3**). Surveys have

previously been undertaken of Drain 1-5, the Stainforth and Keadby Canal and Keadby Boundary Drain to inform the Proposed Development baseline:

Drain 1

12B4.1.20. A moderate/ high diversity of aquatic macroinvertebrates was recorded (45 taxa, 26 identified to species) and the community is considered fairly typical for the conditions present i.e. a small, heavily modified, slow flowing drain. The assemblage was dominated by a range of snail, crustacean, beetle and truefly taxa, and the drain is of fairly high conservation value. The majority of the species present are of occasional to very common status. The exceptions to this were:

12B4.1.21. white-lipped ramshorn snail (*Anisus leucostoma*). This is classified as being of local status. More recent information on the status of this snail establishes that it remains widespread within its native range and it is not currently considered threatened.

12B4.1.22. the water beetle (*Rhantus suturalis*). This is classified as notable. However, it is of favourable status and appears to be increasing in range.

12B4.1.23. the diving beetle (*Rhantus exsoletus*). This is classified as being of local status.

12B4.1.24. Two non-native species were recorded. The amphipod (*Crangonyx pseudogracilis/ floridanus*) and the New Zealand mud snail (Potamopyrgus antipodarum). The New Zealand mud snail was first introduced to the UK in 1852 and is now naturalised, widespread and common in many areas.

12B4.1.25. All of the aquatic macroinvertebrate species present are tolerant of fine sediments (PSI: 1.6), as would be expected for a slow flowing drain of the type sampled. The biological quality of the drain is moderate (Biological Monitoring Working Party (BMWP): 97.3, ASPT: 4.2). Only a single pollution-sensitive taxon was recorded (the beetle Gyrinus substriatus), with the drain supporting a range of taxa defined as having a moderate tolerance to pollution.

Drain 2

12B4.1.26. A moderate diversity of aquatic macroinvertebrates was recorded (37 taxa, 14 identified to species) and the community is considered fairly typical of a small, heavily shaded, slow flowing drains. The assemblage was dominated by a range of snail, crustacean, beetle and truefly taxa,

and the drain is of moderate conservation status. All of the species present are of common to very common conservation value. The only exception to this was the white-lipped ramshorn snail which, as highlighted above for Drain 1, remains widespread within its native range and it is not currently considered threatened.

12B4.1.27. The New Zealand mud snail was the only non-native species recorded.

12B4.1.28. All of the aquatic macroinvertebrate species present are tolerant of fine sediments (PSI: 0), as would be expected for a slow flowing drain of the type sampled. The biological quality of the drain is moderate (BMWP: 76.1, ASPT: 4). No pollution-sensitive taxa were recorded but the drain supported a range of taxa defined as having a moderate tolerance to pollution.

Drain 3

12B4.1.29. A low/ moderate diversity of aquatic macroinvertebrates was recorded (22 taxa, nine identified to species) and the community is considered fairly typical of a small, slow flowing drain. The assemblage was dominated by a range of snail, beetle and truefly taxa, and the drain is of moderate conservation value. All of the species present are of frequent to very common status. The only exception to this was the white-lipped ramshorn snail, which as highlighted above for Drain 1, remains widespread within its native range and it is not currently considered threatened. No non-native species were recorded.

12B4.1.30. All of the aquatic macroinvertebrate species present are tolerant of fine sediments (PSI: 0), as would be expected for a slow flowing drain of the type sampled. The biological quality of the drain is moderate (BMWP: 49.3, ASPT: 4.1). No pollution-sensitive taxa were recorded, but the drain supported a range of taxa defined as having a moderate tolerance to pollution.

Drain 4

12B4.1.31. A low diversity of aquatic macroinvertebrates was recorded (19 taxa, six identified to species) and the community is considered fairly typical of a small, slow flowing field drain. The assemblage was dominated by a range of snail, crustacean, caddisfly, beetle and truefly taxa, and the drain is of moderate conservation value. All of the species present are of very common status. The only exception to this was the white-lipped ramshorn snail, which as highlighted above for Drain 1, remains

widespread within its native range and it is not currently considered threatened. No non-native species were recorded.

12B4.1.32. All of the aquatic macroinvertebrate species present are tolerant of fine sediments (PSI: 0), as would be expected for a slow flowing drain of the type sampled. The biological quality of the drain is moderate (BMWP: 37.2, ASPT: 4.1). No pollution-sensitive taxa were recorded but the drain supported a range of taxa defined as having a moderate tolerance to pollution.

Stainforth and Keadby Canal

12B4.1.33. The site sort identified that the canal supported a typical assemblage of aquatic macroinvertebrate found within canals including snails (Viviparidae, Lymnaeidae, Planorbidae), caddisflies (Limnephilidae) and mayflies (Baetidae).

12B4.1.34. The following INNS species were identified. None of these species recorded are listed on Schedule 9 of the WCA.

- zebra mussel (*Dreissena polymorpha*). Although this species is not listed on Schedule 9 of the WCA, it is highly invasive. It is unlike all other native mussel species in that it colonises and grows on hard substrates which can lead to a number of potential impacts including the clogging of water intake pipework and screens. The survey confirms this species to be well established within the canal. Large numbers of live animals were found during sampling, and there were also large numbers of old shells visible on the canal bed;
- demon shrimp (*Dikerogammarus haemobaphes*). This species was first recorded in the UK in 2012 and has spread rapidly. It is a highly efficient predator altering the diversity and abundance of other aquatic macroinvertebrates species;
- caspian mud shrimp (*Corophium curvispinum*). This species was first recorded in Britain in 1935 and now widespread in the south-east and midlands of England; and
- new Zealand mud snail.

Keadby Boundary Drain

12B4.1.35. A moderate diversity of aquatic macroinvertebrates was recorded (30 taxa, 17 identified to species) and the community is considered fairly typical of a small, heavily modified, slow flowing drain. The assemblage was dominated by a range of snail and beetle species, and the drain is

of fairly high conservation value. The majority of the species present are of frequent to very common status. The exceptions to this were:

- the water beetle (*Anacaena bipustulata*). This is classified as regionally notable within the Community Conservation Index (CCI). However, it is of favourable status (see Table 3 in **ES Volume II Appendix 11G**: Aquatic Ecology Report (**Application Document Ref. 6.3**), therefore while it requires due regard, it is not as notable as implied by the CCI;
- white-lipped ramshorn snail. This is classified as being of local status within the CCI. More recent information on the status of this snail establishes that it remains widespread within its native range and it is not currently considered threatened (Seddon et al., 2014); and
- two non-native species were recorded the amphipod *Crangonyx pseudogracilis/ floridanus* and the New Zealand mud snail.

12B4.1.36. All of the aquatic macroinvertebrate species present are tolerant of fine sediments (PSI: 0), as would be expected for a slow flowing drain of the type sampled. The biological quality of the drain is moderate (WHPT: 70, ASPT: 3.7). No pollution-sensitive taxa were recorded but the drain supported a range of taxa defined as having a moderate tolerance to pollution.

Macrophytes (Aquatic Plants)

12B4.1.37. Surveys undertaken for the Proposed Development in April and July 2020 did not identify aquatic plant species within the channel of the River Trent, with the exception of a few fronds of greater duckweed (*Spirodela polyrhiza*). No other in-channel higher plant species would reasonably be expected given this is a tidal reach of a very large river.

12B4.1.38. Along the margins of the River Trent (both banks), above the typical high tide water level there are narrow strips of transitional vegetation dominated by common reed (Phragmites australis). These strips are very species-poor and comprised of common plant species, thus have a negligible nature conservation value. In addition, this vegetation is not considered an example of transitional saltmarsh, as it is not present in

association with any other saltmarsh communities. Below the low tide water level only bare mud was visible.

12B4.1.39. Surveys have been undertaken previously of Drain 1-5, the Stainforth and Keadby Canal and Keadby Boundary Drain to inform the Proposed Development baseline:

Drain 1

12B4.1.40. Drain 1 supported 23 aquatic plant species (excluding algae) which included a range of submerged, floating and emergent species. No rare or notable species were present, and the assemblage is considered fairly diverse for the habitat conditions present.

12B4.1.41. A single non-native plant species was recorded, Nuttall's waterweed (Elodea nuttallii) which was abundant along the length of the drain. This is a controlled weed species listed under Schedule 9 of the WCA, as such it is an offence to cause it to spread in the wild.

Drain 2

12B4.1.42. Drain 2 supported six aquatic plant species. Species diversity was limited by the combination of heavy shading from trees and the dominance of common reed (*Phragmites australis*). Where this species was dominant, it excluded other flora and occurred as mono-specific stands. No rare or notable species were recorded, and the assemblage present is considered typical of the habitat conditions. No non-native plant species were recorded.

Drain 3

12B4.1.43. Drain 3 supported nine aquatic plant species. Species diversity was limited by the shading of the channel by trees and the dominance of common reed. Where common reed was dominant, it excluded other flora and occurred as mono-specific stands. No rare or notable species were recorded, and the assemblage present is considered typical of the habitat conditions. No non-native plant species were present.

Drain 4

12B4.1.44. Drain 4 supported four aquatic plant species. The only species recorded were tall emergent species which dominated the channel. This in combination with the shallow water depth limited the species diversity present. No rare or notable species were recorded, and the assemblage

present is considered typical of an arable field drain. No non-native plant species were recorded.

Stainforth and Keadby Canal

12B4.1.45. Eighteen aquatic plant species were present. The dominant submerged plant species was Nuttall's waterweed, which formed dense beds over most of the visible channel. Nuttall's waterweed is a controlled weed species listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended). Other species were mostly either limited to the margins of the canal and/ or were present at low cover.

12B4.1.46. Filamentous green algae was also present at a relatively high cover within the canal. The presence of such algae may be indicative of poor water quality, particularly nutrient enrichment, when found at high abundances.

Keadby Boundary Drain

12B4.1.47. The LWS supported 32 aquatic plant species (excluding algae). The assemblage is considered diverse for the habitat conditions and supported a range of submerged, floating and emergent species. Two notable species were recorded:

- Whorled water-milfoil is a species of calcareous freshwaters with good water clarity. It has declined substantially nationally and is of unfavourable status (Red Data List (RDL) Vulnerable). It was recorded as occasional during the survey and the LWS was judged to support a healthy viable population.
- Water-violet (Hottonia palustris) is of patchy distribution in Britain. It has declined substantially nationally and is of unfavourable status (RDL Vulnerable). It was recorded as occasional during the survey and the LWS was judged to support a healthy viable population.

12B4.1.48. A single non-native plant species, Nuttall's waterweed, was recorded and was abundant along the length of the drain. This is a controlled weed species listed under Schedule 9 of the WCA, as such it is an offence to cause it to spread in the wild.

Invasive Non-Native Species

12B4.1.49. One species listed on Schedule 9 of the Wildlife and Countryside Act (WCA) was recorded from the Site, this being Nuttall's waterweed (*Elodea nuttallii*). This species was recorded from Drain 1, Keadby

Boundary Drain LWS and Stainforth and Keadby Canal. The Act makes it illegal to cause the spread of this species in the wild.

12B4.1.50. Although not listed on Schedule 9 of the WCA, the presence of zebra mussel (*Dreissena polymorpha*) (combined with the dominance Nuttall's waterweed) within the Stainforth and Keadby Canal may lead to issues relating to the clogging of water supply pipework and intake screens for the Proposed Development in the event that the preferred Canal Water Abstraction option is selected as this could affect the operation of the Proposed Development, as well as increase the frequency and cost of essential maintenance and repairs. Given this, the implications arising from the presence of zebra mussel should be considered further during detailed design to mitigate the potential risk to the effective operation of the Proposed Development.

12B4.1.51. The other non-native species recorded are also not listed on the Schedule 9 of the WCA but are considered a significant design constraint. It is possible that species such as the demon shrimp (*Dikerogammarus haemobaphes*) may further compound the blocking of pipework, as they are known to occur at high densities but if steps are taken to overcome the issues relating to the zebra mussel and Nuttall's waterweed, this is likely to mitigate the potential risk posed by this species.

12B4.1.52. It is important to highlight that given the number of INNS recorded within Stainforth and Keadby Canal, this demonstrates that there are a number of existing pathways (but particularly boat traffic) that have facilitated the spread and establishment of these aquatic INNS in the local area. Given this, there is likely to be an ongoing risk of other INNS becoming established which may further impact operation of the preferred Canal Water Abstraction Option on the Stainforth and Keadby Canal. Such INNS might include high risk species such as quagga mussel (*Dreissena bugensis rostrigormis*) and floating pennywort (Hydrocotyle ranunculoides), both of which can also block pipework). Therefore, it is recommended that the detailed design also consider this risk so that the Proposed Development is resilient to potential additional INNS risks.

Sites of Ecological Importance

12B4.1.53. Relevant international and national conservation designations, together with local nature conservation designations, are summarised in **ES Volume I Chapter 11:** Biodiversity and Nature Conservation

(**Application Document Ref. 6.2**). A brief summary is provided below of the most proximal sites.

Humber Estuary Designations

12B4.1.54. The Humber Estuary is recognised as being of international importance and classified as a Special Area of Conservation (SAC) and Special Protection Area (SPA) under the Habitats Directive, an international important wetland under the Ramsar Convention and nationally designated as a SSSI.

12B4.1.55. Nationally important habitats including Atlantic salt meadows and a range of sand dune types in the outer estuary, together with Sandbanks which are slightly covered by sea water all the time, extensive intertidal mudflats, Salicornia and other annuals colonising mud and sand, and Coastal lagoons.

12B4.1.56. The site is also of national importance for the geological interest at South Ferriby Cliff (Late Pleistocene sediments) and for the coastal geomorphology of Spurn. The estuary supports a full range of saline conditions from the open coast to the limit of saline intrusion on the tidal rivers of the Ouse and Trent.

12B4.1.57. The range of salinity, substrate and exposure to wave action influences the estuarine habitats and the range of species that utilise them. Therefore, it supports nationally important numbers of wintering waterfowl and passage waders, in addition to a nationally important assemblage of breeding birds of lowland open waters and their margins.

12B4.1.58. The Humber Estuary is also nationally important for a breeding colony of grey seals (*Halichoerus grypus*), river lamprey (*Lampetra fluviatilis*), and sea lamprey (Petromyzon marinus). It supports a diverse vascular plant assemblage and rare amphibians such as the natterjack toad (*Bufo calamita).*

12B4.1.59. The River Trent forms part of the Humber Estuary SSSI and SAC designations. Tidal reaches of the River Trent, including the reach where the Site is located, are within these designations. Upstream (and

north of) Althorpe Station the River Trent is also included within the Humber Estuary Ramsar, SAC and SSSI.

Other Ecologically Designated Sites

12B4.1.60. Approximately 2 km to the south-west of the Site, south of the canal lies the Crowle Borrow Pits SSSI and the Hatfield Chase Ditches SSSI sites.

12B4.1.61. The Crowle Borrow Pits SSSI lies either side of the embankment of a disused railway line and supports a mosaic of habitats including alder (*Alnus glutinosa)* carr, scrub, fen and several small ponds in which several locally uncommon plant species occur. This SSSI comprises four units, three of which are in a Favourable condition, however Unit 3 is categorised as Unfavourable-Recovering. The condition threat risk is High for all units.

12B4.1.62. The Hatfield Chase Ditches SSSI is an area of former marsh and wetland which has been extensively drained, but these ditches make up the majority of nature conservation interest in an insensitively farmed area. They hold water throughout the year and have a range of water depths, Furthermore, the ditches support a rich assemblage of aquatic and emergent plants, nationally scarce invertebrates (reed beetles), and water vole (*Arvicola amphibius*). This SSSI comprises fifteen units, twelve of which are categorised as Unfavourable-Declining due to a number of reasons, including poor species richness and diversity, and % cover of non-natives and algae. Units 12, 14 and 15 are categorised as Favourable due to good water quality. The condition threat risk is High for all units.

Local Wildlife Sites within 1 km of the Site

12B4.1.63. Keadby Warping Drain LWS is approximately 300m north of the Main Site and bisected by existing line of discharge from Keadby 1 Power Station. It is designated for supporting 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*).

12B4.1.64. Stainforth and Keadby Canal Corridor falls within the boundary of the Stainforth and Keadby Canal Corridor LWS, which is designated for its a rich aquatic flora and associated bankside habitats.

12B4.1.65. The Hatfield Waste Drain is crossed by Mabey Bridge at the southern extent of the Site and is designated for supporting a rich aquatic,

emergent and marginal flora with a surrounding mosaic of neutral grassland and common reed swamp.

12B4.1.66. Keadby Boundary Drain LWS is adjacent to the Site to the west of Keadby Common and is designated as it supports abundant aquatic vegetation throughout.

12B4.1.67. North Engine Drain Belton LWS is approximately 20m south of the Site and supports aquatic habitats which in turn support a rich aquatic flora and a mosaic of neutral grassland and wetland habitats.

12B4.1.68. River Torne LWS is approximately 45m south of the Site and support a rich aquatic flora, neutral grassland and a mosaic of associated grassland and wetland habitats.

12B4.1.69. South Soak Drain LWS is approximately 25 m south of the Site and supports rich aquatic, emergent and marginal flora. The site is also designated for its swamp habitat which is dominated by common reed.

12B4.1.70. The Keadby Wetland LWS is approximately 25 m south-east of the Site and is designated for its mosaic habitat of willow scrub, wetland vegetation including large bindweed (*Calystegia sepum*).

12B4.1.71. The Keadby Wet Grassland LWS is approximately 50 m south of the Site and is designated for its marsh, swamp and drains supporting large number of wetland plants.

12B4.1.72. Three Rivers LWS is approximately 90m south of the Site and is designated for its three parallel canalised watercourses which support a rich aquatic, emergent and marginal flora.

12B4.1.73. South Engine Drain LWS is approximately 100m south of the Site and support a rich aquatic flora and neutral grassland.

ANNEX 5 WATER RESOURCES BASELINE

12B. Annex 5

12B.1. Water Resources Baseline

12B.1.1. The following provides information on water activity permits (i.e. discharges), water abstractions and past pollution incidents based on the Enviro+Geo Insight report (Groundsure, 2024).

Water Activity Permits

12B.1.2. There are 11 active water permits (i.e. formerly discharge consents) within 500 m of the Proposed Development. These are listed in **Table 12B5.1** and shown in **ES Volume III Figure 12.1:** Surface Waterbodies and their Attributes **(Application Document Ref. 6.4).**

Table 12B5.1: Water activity permits within 500 m of the Proposed Development

Licence	Distance	Discharge Type	Receiving Water
3/28/83/0806 (Keadby 400KV Substation)	Within boundary	Sewage Discharges – Final/treated effluent – not water company	Underground Strata
T/83/45559/R (Althorpe STW)	120 m East	Sewage Discharges – Final/treated effluent – water company	River Trent & New Idle River
pT/83/00749/S (Vazon Swing Bridge House)	150 m East	Sewage Discharges – Final/treated effluent – not water company	Stainforth/Keadby Canal
T749 (Vazon Swing Bridge House)	150 m East	Sewage Discharges – Final/Treated	Keadby Canal

Licence	Distance	Discharge Type	Receiving Water
		Effluent – not water company	
WQ/72/1350 (Keadby Sanitary Station)	174 m East	Sewage Discharges – Final/treated effluent – not water company	Underground strata
WQ/72/137 (Canal Side)	245 m East	Sewage Discharges – Final/treated effluent – not water company	Underground strata
T/84/45990/R (Gunness Sewage Treatment Works)	247 m East	Sewage Discharges – STW storm overflow/storm tank and final/treated effluent – water company	River Trent
T/83/21614/O (Woodcarr Avenue Storm Overflow)	348 m East	Sewage Discharges – Sewer Storm Overflow – Water company	Three Rivers
T/83/45559/R (Althorpe STW)	481 m Southeast	Sewage Discharges – STW Storm Overflow/storm tank – water company	River Trent and New Idle River

12B.1.3. 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

12B.1.4. Data derived from the Groundsure report indicates that there are 20 licensed water abstractions within the 1 km study area surrounding the Proposed Development, which are presented in **Table 12B5.2** and **ES Volume III Figure 12.1:** Surface waterbodies and their Attributes **(Application Document Ref. 6.4).** It is noted that all these licensed abstractions are from surface water, with no active groundwater abstractions in the study area.

Table 12B5.2: Abstraction licenses within the study area

Licence Holder	Abstraction Licence	Use	Abstraction Point	Distance
Canal and River Trust	03/28/83/0171	Boiler Feed	Keadby Power Station – Stainforth Canal	Within boundary
Canal and River Trust	MD/028/0083/014	Boiler Feed. Make-up or top up water. General use relating to secondary category (medium loss). Evaporative Cooling.	Keadby Power Station	Within boundary
Canal and River Trust	MD/028/0083/014	Make-up or top up water. General use relating	Keadby 2 Power Station	Within Boundary

Licence Holder	Abstraction Licence	Use	Abstraction Point	Distance
		to secondary category (medium loss). Evaporative Cooling. Boiler Feed.		
ER Woodhouse	MD/028/0084/002/R01	Spray Irrigation – Direct	Near Keadby – Warping Drain	Within Boundary
RJ & AE Godfrey	MD/028/0084/005	Spray Irrigation – Direct	Warping Drain at Keadby, North Lincs	61 m East
Warterton Hall Farms	03/28/83/0257/1	Spray Irrigation – Direct	North Pilfrey Farm, Keadby – North Soak Drain	67 m West
Maw	MD/028/0083/005	Spray Irrigation – Direct	Hatfield Waste Drain at Curlews Farm, Crowle	125 m southwest
J J & D S Stubley Ltd	03/28/83/0193	Spray Irrigation – Direct	Parish of Belton – South Engine Drain	148 m southwest
G R Bletcher	03/28/83/0088	Spray Irrigation – Direct	Near Althorpe, Scunthorpe	452 m southwest

Licence Holder	Abstraction Licence	Use	Abstraction Point	Distance
and Son Ltd			– River Torne	
G R Bletcher and Son Ltd	03/28/83/0161	Spray Irrigation – Direct	North Moor, Belton – Folly Drain	571 m southwest
R Smith & Son	03/28/83/0245	Spray Irrigation – Direct	Keadby with Althorpe – Unnamed Drain E and B	649 m southeast
M & J Agriculture	03/28/83/0246	Spray Irrigation – Direct	Keadby with Althorpe – Unnamed Drain A and B	649 m southeast
R Smith & Son	03/28/83/0245	Spray Irrigation – Direct	Keadby with Althorpe – Unnamed Drain A and B	649 m southeast
RJ & AE Godfrey	03/28/84/0020/1/ R01	Spray Irrigation – Direct	Keadby Common, Keadby, Scunthorpe – Trib of Sewer Drain	679 m northwest
Higgins Agriculture Ltd	03/28/84/0014/1/ R01	Spray Irrigation – Direct	Eastoft – Crowle and Eastcroft Boundary Drain	680 m northwest

Licence Holder	Abstraction Licence	Use	Abstraction Point	Distance
Higgins Agriculture Ltd	03/28/84/0014/1/ R01	Spray Irrigation – Direct	Eastcroft – Eastcroft Boundary Drain	682 m northwest
R Smith & Son	03/28/83/0245	Spray Irrigation – Direct	Keadby with Althorpe – Unnamed Drain – C & D	843 m southeast
Rockscape Contract Services Ltd	MD/028/0083/019	Spray Irrigation – Direct	Moody Drain at North Moor Farm	847 m southwest
Higgins Agriculture Ltd	03/28/84/0014/1/ R01	Spray Irrigation – Direct	Eastoft – Old Sewer Drain	867 m north
Rockscape Contract Services Ltd	MD/028/0083/019	Spray Irrigation – Direct	North Moor Drain at North Moor Farm	874 m southwest

12B.1.5. There are four abstractions directly related to Keadby Power Station, with the remaining abstractions being for agricultural use (direct spray irrigation).

12B.1.6. NLC has confirmed (September 2024) that there are no records of any private water supplies in the study area.

Water Pollution Incidents

12B.1.7. The Groundsure report confirms that there have been no category 1 or 2 pollution incidents in the last 10 years.