CONTENTS

13.0 GEOLOGY, HYDROGEOLOGY AND LAND CONTAMINATION 1
13.1 Introduction 1
13.2 Legislation, Planning Policy and Guidance 1
13.3 Assessment Methodology 10
13.4 Baseline Conditions 30
13.5 Development Design and Impact Avoidance 48
13.6 Likely Impacts and Effects 52
13.7 Mitigation, Monitoring and Enhancement Measures 71
13.8 Limitations or Difficulties 72
13.9 Summary of Likely Significant Residual Effects 73
13.10 References 73

TABLES

Table 13.1: Relevant NPS EN-1 policies for geology, hydrogeology and contaminated land assessment 4
Table 13.2: Relevant NPPF policies for geology, hydrogeology and contaminated land assessment 7
Table 13.3: Consultation summary table 11
Table 13.4: Summary of key changes to chapter since publication of the PEI Report and addendum 24
Table 13.5: Estimation level of risk 27
Table 13.6: Significance criteria (defined by AECOM) 28
Table 13.7: Geological succession from published mapping and on-site BGS logs 31
Table 13.8: Estimated soil chemistry 32
Table 13.9: Surface water features 35
Table 13.10: Environment Agency licensed surface water abstractions 38
Table 13.11: Summary of potential sources of contamination within the study area 43
Table 13.12: Potential areas of contamination (baseline risk scores 3 to 5) 53
Table 13.13: Summary of baseline CSM for sites which may pose a contaminative risk in relation to the Proposed Development Site 57
Table 13.14: Summary of temporary effects (during construction) 67
Table 13.15: Summary of permanent effects (post-construction) 69

13.0 GEOLOGY, HYDROGEOLOGY AND LAND CONTAMINATION

13.1 Introduction

13.1.1 This chapter of the Environmental Statement (ES) addresses the potential effects of the construction, operation (including maintenance) and decommissioning of the Proposed Development on geology, hydrogeology and land contamination (considering effects to and from any existing contamination and also any potential to cause contamination). The assessment considers:

- the present-day and future baseline geological and hydrogeological conditions during construction and at opening;
- the likely nature and existing sources of contamination which may be present at the Proposed Development Site;
- the effects of construction and operation of the Proposed Development on geology, geo-environmental ground conditions and groundwater; and
- the potential effects of the eventual decommissioning of the Proposed Development.

13.1.2 This chapter is supported by **Appendix 13A:** Phase 1 Desk Based Assessment (ES Volume II - **Application Document Ref. 6.3**). It should be noted that given the considerable overlap between disciplines, some of the potential impacts and effects relating to hydrogeology are also addressed within **Chapter 12**: Water Environment and Flood Risk (ES Volume I - **Application Document Ref. 6.2**).

13.1.3 At the time of writing, no scheme specific ground investigation (GI) has been undertaken. This is scheduled to be undertaken in quarter Q3/Q4 2021. The GI will verify the baseline conditions within the Proposed PCC Site and relevant assumptions made in the desk-based assessment presented in **Appendix 13A:** Phase 1 Desk Based Assessment (ES Volume II - **Application Document Ref. 6.3**) and will be used to inform the early design development.

13.2 Legislation, Planning Policy and Guidance

13.2.1 This section outlines the planning policy of relevance to geology, hydrogeology and contaminated land. An overview of all relevant planning policy is provided in **Chapter 7:** Legislative Context and Planning Policy Framework (ES Volume I - **Application Document Ref. 6.2**), which also sets out the primacy of National Policy Statements (NPS) in decision-making on nationally significant infrastructure projects (NSIP), such as the Proposed Development.

Legislation

13.2.2 The following key legislation (UK Acts/ Regulations) are of direct relevance to the assessment of effects of the Proposed Development on geo-environmental ground conditions:

The Environmental Protection Act 1990 and Part 2A (the Contaminated Land Regime)

13.2.3 Current legislation relating to contaminated land in the UK is contained within Part 2A of The Environmental Protection Act (EPA), which was inserted by s57 of the Environment Act 1995 and by s86 of the Water Act 2003 and elaborated upon within the Contaminated Land (England) Regulations 2006). Under Part 2A, sites are identified as 'contaminated land' if they are: causing significant harm, if there is a significant possibility of significant harm, or if a site is causing, or could cause, significant pollution of controlled waters (i.e. both surface and groundwater).

The Water Act 2003

13.2.4 The Water Act 2003 introduced a revision to the wording of the EPA, which requires that if a site is causing or could cause significant pollution of controlled waters, it may be determined as contaminated land. Once a site is determined to be contaminated land then remediation may be required to render significant pollutant linkages insignificant (i.e. the source-pathway-receptor relationships that are associated with significant harm to human health and/ or significant pollution of controlled waters), subject to a test of reasonableness.

The Water Resources Act 1991

13.2.5 The Water Resources Act 1991 provides statutory protection for controlled waters (i.e. streams, rivers, canals, marine environment and groundwater) and makes it an offence to discharge to controlled waters without the permission or consent of the regulators of these areas.

The Building Act 1984 and the Building Regulations & c (Amendment) Regulations 2016

13.2.6 The Building Act 1984 and in particular the associated Building Regulations & c (Amendment) Regulations 2016 are key when considering structural and design aspects of a development in terms of the geotechnical properties of the ground. The Building Act 1984 requires that buildings are constructed so that ground movement caused by swelling, shrinkage, freezing, landslip or subsidence of the sub-soils will not impair the stability of any part of the building. Notably, the Building Regulations & c (Amendment) Regulations 2016 also control ground gas mitigation which is a particularly pertinent consideration when considering land contamination.

Other relevant legislation

13.2.7 Other legislation (EU Directives, followed by UK Acts then Regulations) of reference to this topic, and not already outlined above, includes:

- Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (as amended 2015 & 2016) ('WFD')[1];
- The Environment Act 1995;
- Environmental Permitting (England and Wales) Regulations 2016;
- Hazardous Waste (England and Wales) (Amendment) Regulations 2016;
- Contaminated Land (England) (Amendment) Regulations 2012;
- Environmental Damage (Prevention and Remediation) (England) Regulations 2015; and
- Anti-Pollution Works Regulations 1999.

Planning policy

13.2.8 The following planning policy and guidance documents are of direct relevance to the assessment of effects of the Proposed Development on geo-environmental ground conditions.

Overarching National Policy Statements for Energy (EN-1)

13.2.9 The primary basis for deciding whether or not to grant a Development Consent Order (DCO) is the National Policy Statement (NPS) for Energy (EN-1) (DECC, 2011a) which, at Part 5, sets out policies to guide how DCO applications will be decided and how the impacts of energy infrastructure should be considered.

Overarching National Policy Statement for Fossil Fuel Generating Infrastructure (EN-2)

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

[1] Following the United Kingdom's referendum vote to leave the European Union, the requirements of the WFD remain applicable until such time as new legislation is passed either revoking or amending the current 2017 WFD Regulations.

demonstrate measures to minimise adverse impacts on water quality and resources'. (paragraph 2.10.2)

13.2.11 Table 13.1 identifies the policies in NPS EN-1 and NPS EN-2 relevant to geology, hydrogeology and contaminated land, and where in this ES chapter, information is provided to address the policies.

Table 13.1: Relevant NPS EN-1 policies for geology, hydrogeology and contaminated land assessment

Relevant NPS paragraph reference	Policy of the NPS	Where in the ES Chapter is information provided to address this policy
NPS EN-1		
Section 4.10 (Pollution control and other environmental regulatory regimes)	Details that issues relating to discharges or emissions from a proposed project which may affect air quality, land quality and the marine environment, or which include noise and vibration may be subject to separate regulation under the pollution control framework or other consenting and licensing regimes. Before consenting any potentially polluting developments it should be confirmed that: • the relevant pollution control authority is satisfied that potential releases can be adequately regulated under the pollution control framework; and • the effects of existing sources of pollution in and around the site are not such that the cumulative effects of pollution when the proposed development is added would make that development unacceptable, particularly in relation to statutory environmental quality limits.	Consultation on the Preliminary Environmental Information (PAI) chapter was undertaken with North Lincolnshire Council contaminated land officer and comments raised in formal consultation have been taken into account.

Relevant NPS paragraph reference	Policy of the NPS	Where in the ES Chapter is information provided to address this policy
5.3.3	Where the development is subject to Environmental Impact Assessment (EIA) the applicant should ensure that the Environmental Statement (ES) clearly sets out any effects on internationally, nationally and locally designated sites of … geological conservation importance.	13.4 – 'Local Geological Sites/ Regionally Important Geological Sites'
5.3.4	The applicant should show how the project has taken advantage of opportunities to conserve and enhance … geological conservation interests.	13.4 – 'Local Geological Sites/ Regionally Important Geological Sites'
5.10.8	For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination.	Notably 13.4 and 13.6 – 'Land contamination'
5.15.2	Where the project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of, and impacts of the proposed project on, water quality, water resources and physical characteristics of the water environment as part of the ES or equivalent.	Notably 13.4 and 13.6 and is assessed as a receptor to contamination. See also **Chapter 12**: Water Environment and Flood Risk (ES Volume I - **Application Document Ref. 6.2**)
5.15.3	The ES should in particular describe: • the existing quality of waters affected by the proposed project and the impacts of the proposed project on water quality, noting any relevant existing discharges, proposed new discharges and proposed changes to discharges;	Notably 13.4 and 13.6 and is assessed as a receptor to contamination. See also **Chapter 12**: Water Environment and Flood Risk (ES Volume I - **Application Document Ref. 6.2**)

Relevant NPS paragraph reference	Policy of the NPS	Where in the ES Chapter is information provided to address this policy
	• existing water resources affected by the proposed project and the impacts of the proposed project on water resources, noting any relevant existing abstraction rates, proposed new abstraction rates and proposed changes to abstraction rates (including any impact on or use of mains supplies and reference to Catchment Abstraction Management Strategies); and • any impacts of the proposed project on water bodies or protected areas under the Water Framework Directive and source protection zones (SPZ) around potable groundwater abstractions.	
NPS EN-2		
2.10.2	Effects on water quality or resources, the applicant for development consent should undertake an assessment which should particularly demonstrate that appropriate measures will be put in place to avoid or minimise adverse impacts of abstraction and discharge of cooling water. The applicant for development consent should demonstrate measures to minimise adverse impacts on water quality and resources.	See **Chapter 12**: Water Environment and Flood Risk (ES Volume I - **Application Document Ref. 6.2**)

National Planning Policy Framework

13.2.12 The latest version of the National Planning Policy Framework (NPPF) was adopted in June 2019 (Ministry of Housing, Communities and Local Government, 2019a). The policies contained within the NPPF are expanded

upon and supported by the 'Planning Practice Guidance' (Ministry of Housing, Communities and Local Government, 2019b). Neither are applicable to NSIP where the requirements of the NPS apply however the PPG does constitute the most up to date guidance for development in general.

13.2.13 The section of the NPPF that is of particular relevance relevant to the scope of the geology, hydrogeology and contaminated land chapter is Section 15 – Conserving and enhancing the natural environment. Table 13.2 identifies the NPPF policies relevant to geology, hydrogeology and contaminated land. However, parts of other sections may also be of relevance.

Table 13.2: Relevant NPPF policies for geology, hydrogeology and contaminated land assessment

Relevant NPPF paragraph reference	Policy in the NPPF
117	Planning policies and decisions should promote an effective use of land in meeting the need for homes and other uses, while safeguarding and improving the environment and ensuring safe and healthy living conditions. Strategic policies should set out a clear strategy for accommodating objectively assessed needs, in a way that makes as much use as possible of previously-developed or 'brownfield' land.
118 c)	Planning policies and decisions should give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land.
170 a)	Planning policies and decisions should contribute to and enhance the natural and local environment by: • protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan).

Relevant NPPF paragraph reference	Policy in the NPPF
170 e)	Planning policies and decisions should contribute to and enhance the natural and local environment by: • preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans.
170 f)	Planning policies and decisions should contribute to and enhance the natural and local environment by: • remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.
171	Plans should: distinguish between the hierarchy of international, national and locally designated sites; allocate land with the least environmental or amenity value, where consistent with other policies in this Framework.
178 a)	Planning policies and decisions should ensure that: a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation).
178 b)	Planning policies and decisions should ensure that: after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990.
178 c)	Planning policies and decisions should ensure that: adequate site investigation information, prepared by a competent person, is available to inform these assessments.
179	Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.

Relevant NPPF paragraph reference	Policy in the NPPF
180	Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development.
183	The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.

Local planning policy

13.2.14 Other relevant policies and guidance have been considered as part of the geology, hydrogeology and land contamination chapter where these have informed the identification of receptors and resources and their sensitivity; the potential for significant environmental effects; and required mitigation. These policies include:

- North Lincolnshire Core Strategy (North Lincolnshire Council, 2011a) - adopted June 2011 (Chapter 11, Environment and Resources); and
- Saved Policies of North Lincolnshire Local Plan (Local Development Frameworks Government Office for Yorkshire and The Humber, 2007) - adopted May 2003, saved September 2007 (LC1 - Special Protection Areas, Special Areas of Conservation and Ramsar Sites, LC2 - Sites of Special Scientific Interest and National Nature Reserves, DS7 - Contaminated Land, DS13 - Groundwater Protection and Land Drainage and DS15 - Water Resources).

13.2.15 North Lincolnshire Council is preparing a new Local Plan to 2036. Once agreed (formally adopted), it will replace the current North Lincolnshire Local Plan and the Core Strategy. The Council undertook their Regulation 18 'Preferred Options' between February and March 2020.

Guidance/ best practice

13.2.16 The following includes a non-exhaustive list of additional guidance considered pertinent and applicable to the geology, hydrogeology and land contamination topic:

- BS 10175 (2011 +A2 2017), Investigation of Potentially Contaminated Sites - Code of Practice;
- BS 8576 (2013), Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOC);
- BS 8485 (2019), Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings;
- CIRIA C665, assessing risks posed by hazardous ground gases to buildings, 2007;
- CIRIA C552 Contaminated Land Risk Assessment: A Guide to Good Practice, 2001;
- CIRIA C692 3rd Edition 'Environmental Good Practice on Site' 2010;
- Environment Agency's published online guidance for the management of land contamination 'Land contamination: risk management (LCRM)'; and
- Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D Publication 66, 2008.

13.3 Assessment Methodology

Consultation

13.3.1 The consultation undertaken with statutory consultees to inform this chapter, including a summary of comments raised via the formal Scoping Opinion (**Appendix 1B** (ES Volume II - **Application Document Ref. 6.3**)) and in response to the formal consultation and other pre-application engagement is summarised in Table 13.3.

Table 13.3: Consultation summary table

Consultee or Organisation Approached	Date and Nature of Consultation	Summary of Response	How comments have been addressed in this Chapter
Planning Inspectorate	June 2020 Scoping Opinion	Due to potential deforming, desiccating and aerobic effects of any development, the Planning Inspectorate considers that the ES should characterise hydrogeological sediments in line with relevant guidance, using appropriate sources and data from surveys and modelling. Specific attention should be given to commissioning geophysical and geotechnical surveys, with groundwater monitoring via boreholes at different times of year, and at different locations across the site. Tidal influences on the River Trent and groundwater levels should be considered, along with the complex network of drainage feature in the area. The design of the proposed foundations and construction programme should be informed by specialist advice.	This chapter outlines guidance used in assessment, along with sources and data. An assessment of geotechnical risks is presented in the accompanying **Appendix 13A:** Phase 1 Desk Based Assessment (ES Volume II – **Application Document Ref. 6.3**). Specialist hand augering and geophysical surveys to characterise the extent of peat deposits have been completed and are presented in **Appendix 15B:** Geoarchaeological Hand Auger Survey Fieldwork Report and **Appendix 15C**: Geophysical Survey Fieldwork Report (ES Volume II – **Application Document Ref. 6.3**). Ground investigation will be undertaken before construction to inform the development of the preliminary and detailed design. Depending on the information gathered through this ground investigation, monitoring of groundwater and surface water may be undertaken.

Consultee or Organisation Approached	Date and Nature of Consultation	Summary of Response	How comments have been addressed in this Chapter
		As part of the baseline, the ES should detail the mitigation measures currently employed on site by the existing operations and clarify if/how they interact with and influence the findings in the assessment. The ES should also include the results of further commissioned assessments to ensure that baseline data are appropriately described and quantified.	Section 13.5 outlines proposed impact avoidance measures mitigation measures. Both the existing operational Keadby 1 Power Station and the newly constructed Keadby 2 Power Station fall under the Environmental Permitting Regulations (EPR) 2016 and existing mitigation measures currently employed on site for Keadby 1 and those proposed for Keadby 2 accord with BAT for the purposes of EPR 2016.
		A full description of the assessment methodology for a site investigation should be included within the ES. Again, specialist advice should be sought, and reference made to appropriate literature.	An initial site investigation is proposed, as described in **Chapter 13:** Geology, Hydrogeology and Land Contamination (ES Volume I - **Application Document Ref. 6.2**) and **Appendix 13A:** Phase 1 Desk Based Assessment (ES Volume II - **Application Document Ref. 6.3**). Relevant literature and desk based assessment to inform the ground investigation is cited.

Consultee or Organisation Approached	Date and Nature of Consultation	Summary of Response	How comments have been addressed in this Chapter
		The ES should include detailed supporting figures of appropriate size and scale to present the results of the detailed hydrogeological survey and modelling. 3-D modelling of the receiving geological and hydrogeological environment is also encouraged.	The Proposed Development will not release any discharges to groundwater and therefore detailed hydrogeological survey and modelling is not considered proportionate to the nature and scale of the Proposed Development. **Figure 12.2**: Groundwater Bodies and their Attributes is included in ES Volume III – **Application Document Ref. 6.4** and informs the Water Framework Directive Assessment (**Appendix 12B** (ES Volume I – **Application Document Ref. 6.3**)). Supporting figures and Envirocheck Reports are included as Annexes of **Appendix 13A:** Phase 1 Desk Based Assessment (ES Volume II - **Application Document Ref. 6.3**).
		The ES should explain with reference to Agricultural Land Classifications, the nature and quantity of the soils that will be affected by the Proposed Development. If the soil is classified as Best and Most	Section 13.4 and **Chapter 3:** The Site and It's Surroundings (ES Volume I - **Application Document Ref. 6.2**) outline the soil classification of the site, including the Agricultural Land Classification and appropriate mitigation measures have been

Consultee or Organisation Approached	Date and Nature of Consultation	Summary of Response	How comments have been addressed in this Chapter
		Versatile (BMV) BMV, then appropriate remediation and mitigation measures should be described within the ES.	proposed in the Soil Resources Plan (SRP) within the Framework CEMP (**Application Document Ref. 7.1**) to manage this resource. Controls will be via the final CEMP.
Environment Agency	Surrounding landfill sites	The EA supports the approach to undertake a Phase I Desk Study, followed by a Phase II Intrusive Investigation as required but advises that the historical landfills present around and within the perimeter of the application boundary should be considered thoroughly, especially in areas where new buildings and their foundations are proposed to be built on the former landfills.	Landfill sites present around and within the perimeter of the application boundary have been considered, and details are contained within **Appendix 13A:** Phase 1 Desk Based Assessment (ES Volume II - **Application Document Ref. 6.3**) and are shown on **Figure 13.2**: Identified Historical and Current Areas of Contamination (ES Volume III – **Application Document Ref. 6.4**).
		The MMO notes the difference in study area extent between hydrogeology and soil chemical quality and advises that the study area should only cover the zone of worst-case impacts and justification should be provided.	**Chapter 13:** Geology, Hydrogeology and Land Contamination (ES Volume I - **Application Document Ref. 6.2**) outlines a study area that extends 250m from the boundary of the Proposed Development Site has been adopted. This is extended for hydrogeology to 1km from the

Consultee or Organisation Approached	Date and Nature of Consultation	Summary of Response	How comments have been addressed in this Chapter
			boundary of the Proposed Development Site. This is appropriate to assess the local geological and hydrogeological setting and any influence that potential land contamination might have on the Proposed Development or local receptors.
Natural England	Query (via email) sent on 22 July requesting information on: • Designated Local Geological Sites (LGS)/ Regionally Important Geological Sites (RIGS); or contacts for Local Geology Groups (LGG) – up to 250m from the Proposed Development Site.	Email received on 31 July advising that Natural England does not hold the required information.	Indicated in Section 13.4.24, LGS/RIGS are scoped out of the assessment.
Greater Lincolnshire Nature Partnership	Query (via email) sent on 22 July requesting information on: • Designated LGS/ RIGS; or contacts for LGG – up to 250m from the Proposed Development Site.	Email received on 22 July indicating that no such sites were identified.	

Consultee or Organisation Approached	Date and Nature of Consultation	Summary of Response	How comments have been addressed in this Chapter
North Lincolnshire Council – Ecology	Query (via email) sent on 5 August requesting information on: • Designated LGS/ RIGS; or contacts for LGG – up to 250m from the Proposed Development Site.	Email received on 5 August advising a search through Greater Lincolnshire Nature Partnership (see above).	
North Lincolnshire Council – Environmental Protection	Query (via email) sent on 5 August requesting information on: • Landfills – up to 250m from the Proposed Development Site; • Ground investigation reports – up to 50m from the Proposed Development Site; and • Potential or known contaminated land/ known or potential Part 2A sites – up to 250m from the Proposed Development Site.	Email received on 20 November with information regarding the landfills within 250m of the Proposed Development Site. North Lincolnshire Council are not aware of any known contamination on the site. However, it was indicated that due to the current and historic industrial use of the Proposed Development Site, the presence of contamination cannot be ruled out without further investigation. It was indicated that there are currently no Part 2A Contaminated Land designations or notices for the Proposed Development Site or the immediate surrounding area.	Additional landfill information has been included throughout this chapter and in **Appendix 13A:** Phase 1 Desk Based Assessment (Annex B) (ES Volume II - **Application Document Ref. 6.3**). Future ground investigation is described in Section 13.5.3.

Consultee or Organisation Approached	Date and Nature of Consultation	Summary of Response	How comments have been addressed in this Chapter
North Lincolnshire Council – Spatial Planning	Query (via email) sent on 5 August requesting information on: • Mineral Safeguarding Areas (MSA)/ Mineral Consultation Areas (MCA)/ designated or safeguarded sites – up to 250m from the Proposed Development Site; and • Mining/ quarrying – up to 250m from the Proposed Development Site.	Email received on 5 August indicating that no such constraints were identified.	Indicated in Sections 13.4.22 and 13.4.23. Mineral, mining and quarrying sites are scoped out of the assessment.
North Lincolnshire Council	Query (via email) sent on 20 July requesting information on: • Private Water Supplies and whether they are a surface or groundwater source – 1km from the Proposed Development Site.	Email received on 18 February 2021 indicating that there are no private water supplies within 1km from the Proposed Development Site.	Indicated in Section 13.4.15.
Environment Agency	Query (via email) sent on 5 August requesting information on: • Landfills – up to 250m from the Proposed Development Site;	Email received on 19th August confirming that no licensed landfills are located within 250m of the Proposed Development Site and that eight historical landfills are located within 250m of the	Any relevant landfill information has been included throughout this chapter and in **Appendix 13A:** Phase 1 Desk Based Assessment (Annex B) (ES Volume II - **Application Document Ref. 6.3**).

Consultee or Organisation Approached	Date and Nature of Consultation	Summary of Response	How comments have been addressed in this Chapter
	• Ground investigation reports – up to 50m from the Proposed Development Site; • Potential or known contaminated land/ known or potential Part 2A sites – up to 250m from the Proposed Development Site; • Designated LGS/ RIGS; or contacts for LGG – up to 250m from the Proposed Development Site; • MSA/ MCA/ designated or safeguarded sites – up to 250m from the Proposed Development Site; and • Mining/ quarrying – up to 250m from the Proposed Development Site.	Proposed Development Site. No other constraints were identified.	
Environment Agency	Query (via email) sent on 20 July requesting information on: • Active abstraction licences (groundwater and surface water) including location	Email received on 18th August 2020 included abstraction licence details, water activity permits and aquifer status. No Category 3 or worse water pollution incidents have been recorded in the past 5	Data received has been included in Section 13.4 and in **Appendix 13A:** Phase 1 Desk Based Assessment (Annex B) (ES Volume II - **Application Document Ref. 6.3**).

Consultee or Organisation Approached	Date and Nature of Consultation	Summary of Response	How comments have been addressed in this Chapter
	(NGR), user, and purpose – 1km from the Proposed Development Site; • Active water activity permits (i.e. formerly discharge consents) including location (NGR) and effluent type – 1km from the Proposed Development Site; • Any Category 3 or worse water pollution incidents within the past 5 years as recorded on NIRS (including location (NGR), pollution source, category and affected water body) – 1km from the Proposed Development Site; • Aquifer status and groundwater levels – 1km from the Proposed Development Site; and • Comments on any issues of concern regarding water resources, both surface and groundwater, in the study area	years, and no groundwater level monitoring sites are located within the study area.	See also **Chapter 12**: Water Environment and Flood Risk (ES Volume I - **Application Document Ref. 6.2**).

Consultee or Organisation Approached	Date and Nature of Consultation	Summary of Response	How comments have been addressed in this Chapter
	– 1km from the Proposed Development Site.		
Environment Agency	January 2021 (Stage II Consultation / PEI Report)	We have reviewed Chapter 13 and considered your proposal for assessing risks to controlled waters from the previous uses of the site and construction of the new power station. The proposed approach is acceptable. Additional intrusive site investigation work is proposed, and we look forward to reviewing this in due course.	No response required.
North Lincolnshire Council (NLC)	January 2021 (Stage II Consultation / PEI Report)	The NLC Environmental Protection Team recommend the following conditions: Unless otherwise agreed by the Local Planning Authority, development other than that required to be carried out as part of an approved scheme of remediation must not commence until parts 1 to 4 as shown below have been complied with. If unexpected contamination is found after development has begun,	A desk study is included as **Appendix 13A:** Phase 1 Desk Based Assessment (Annex B) (ES Volume II - **Application Document Ref. 6.3**). Future ground investigation is described in Section 13.5.3.

Consultee or Organisation Approached	Date and Nature of Consultation	Summary of Response	How comments have been addressed in this Chapter
		development must be halted on that part of the site affected by the unexpected contamination **Part 1**: the completion of a Phase 1 desk study and an investigation and risk assessment. **Part 2**: submission of remediation scheme. **Part 3**: Implementation of Approved Remediation Scheme **Part 4**: Reporting of unexpected contamination.	
Natural England	January 2021 (Stage II Consultation / PEI Report)	Natural England outline that soil is a finite resource and it is important that the soil resources are protected and used sustainably. NE notes that 8.6ha of agricultural land within the development area has been assessed as 'best and most versatile' (BMV) agricultural land (land graded as 1, 2 and 3a in the ALC system. NE recommend that the applicant undertakes a Soil Resources Survey in line with the	Included in Section 13.4 (soils classification). A Soil Resources Survey will be covered in the final CEMP. The framework Soil Resources Plan is included in the Framework CEMP (**Application Document Ref. 7.1**).

Consultee or Organisation Approached	Date and Nature of Consultation	Summary of Response	How comments have been addressed in this Chapter
		Defra Construction Code for the Sustainable Use of Soil on Construction Sites in order to inform the design and construction of development and protect soil resources. Should the development proceed, NE advise that the developer uses an appropriately experienced soil specialist to advise on, and supervise soil handling, including identifying when soils are dry enough to be handled and how to make the best use of soils on site.	
Public Health England	January 2021 (Stage II Consultation / PEI Report)	Further clarity regarding the area used for the baseline assessment is required. In Section 13.3.13 of Chapter 13, the study area is described as extending 250m from the boundary of the proposed development site. However, it is stated that the baseline in terms of soil chemical quality will be based on information directly within the development site only.	Text regarding the study area in Section 13.3.13 has been amended and the soil chemical quality data (Section 13.4.8) covers the area within the Proposed Development Site and the study area. The baseline risk score methodology is described in Sections 13.3 (screening assessment),13.6 (land contamination), and further details are also included in **Appendix 13B:** Land

Consultee or Organisation Approached	Date and Nature of Consultation	Summary of Response	How comments have been addressed in this Chapter
		Further details should be provided regarding the source of the baseline risk score methodology, how this informs the preliminary risk assessment and why S8 Historic Landfill Site has a baseline risk score of 3 (Table 13.11; Chapter 13).	Contamination Methodology Tables (ES Volume II - **Application Document Ref. 6.3**).

Summary of Key Changes to Chapter 13 since Publication of the Preliminary Environmental Information (PEI) Report and PEI Report Addendum

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

13.3.3 The key changes relevant to this chapter since the PEI Report and PEI Report Addendum were published are summarised in Table 13.4 below.

Table 13.4: Summary of key changes to chapter since publication of the PEI Report and addendum

Summary of change since PEI Report and addendum	Reason for change	Summary of change to chapter text in the ES
The final risk and impact assessment has now been completed and chapter updated on this basis.	To assess the potential impacts of the Proposed Development and determine the potential significance of the effects of land contamination.	Minor text changes throughout this ES chapter, with additional level of detail regarding the assessment and its outcome, particularly in Sections 13.6 and 13.9. The full risk and impact assessment tables are presented in **Appendix 13C:** Potential Areas of Contamination Further Risk and Impact Assessment (ES Volume II - **Application Document Ref. 6.3**).
Addressing comments from stakeholder consultation.	Consultation updates.	Indicated in Table 13.3.
Minor changes to **Appendix 13A**: Phase 1 Desk Based Assessment (Annex B) (ES Volume II -	Ensuring consistency between this ES chapter and the desk study (terminology, study area definition, information	Minor changes throughout **Appendix 13A**: Phase 1 Desk Based Assessment (Annex B) (ES Volume II

Summary of change since PEI Report and addendum	Reason for change	Summary of change to chapter text in the ES
Application Document Ref. 6.3).	arising from consultation).	- **Application Document Ref. 6.3**).
Updated for final Proposed Development Site boundary and the study area (particularly the proposed access road from the A18 and the final laydown areas in adjacent agricultural fields).	At PEI Report stage, these areas were subject to ongoing feasibility assessment. Therefore, had not been included as part of the Proposed Development Site. Additional desk-based review work has been undertaken to update the baseline conditions section of this chapter for these areas.	Minor additions of information relevant to the proposed access road from the A18 and the potential laydown options in adjacent agricultural fields, particularly in Section 13.4. Minor changes to **Appendix 13A**: Phase 1 Desk Based Assessment (Annex B) (ES Volume II - **Application Document Ref. 6.3**).

Assessment methods

Geology and hydrogeology

13.3.4 Geological and hydrogeological conditions at the Proposed Development Site are summarised in Section 13.4 and are assessed, where applicable, as potential receptors to land contamination.

13.3.5 The resource value of groundwater is addressed within **Chapter 12**: Water Environment and Flood Risk (ES Volume I - **Application Document Ref. 6.2**).

Land contamination

13.3.6 For this ES chapter, areas of potential contamination have been identified within the study area of the Proposed Development Site.

13.3.7 In line with the Environment Agency's LCRM, the assessment of land contamination uses a tiered, risk-based approach, as summarised below:

- Tier 1: qualitative risk assessment based on a desk top study of available information to identify potential sources of contamination, receptors to contamination and potential pathways between them. The identified sources, pathways and receptors are presented in the form of a

Conceptual Site Model (CSM) showing the potential contaminant linkages (PCL);

- Tier 2: If PCL are identified, this means there is a theoretical risk to receptors from contamination and intrusive investigation should be used to provide data to inform a generic quantitative risk assessment (GQRA). The GQRA involves comparison of site-specific, laboratory analytical data against appropriate generic assessment criteria (GAC) for human health and/ or controlled waters which represent minimal or tolerable risk; and
- Tier 3: detailed quantitative risk assessment to identify whether contamination identified above minimal or tolerable risk levels represents an unacceptable risk and therefore requires remediation.

Screening assessment (undertaken as part of Tier 1)

13.3.8 A qualitative assessment of the risks posed by land contamination within the study area has been undertaken as part of this ES chapter by first assigning a 'baseline risk score' to each identified historical or current area of potential land contamination identified in the baseline review. The baseline risk score has been determined using the tables provided in **Appendix 13B:** Land Contamination Methodology Tables (ES Volume II - **Application Document Ref. 6.3**). The baseline risk score is based partly on the relationship between the identified area of potential land contamination and its proximity to the Proposed Development Site (**Appendix 13B:** Land Contamination Methodology Tables, Table 13B.1 (ES Volume II - **Application Document Ref. 6.3**)) together with the proposed cut/ fill of the Proposed Development design at its closest point (**Appendix 13B:** Land Contamination Methodology Tables, Table 13B.3 (ES Volume II - **Application Document Ref. 6.3**)). The baseline risk score also considers the nature of the current and/ or historical land use, as certain land uses typically result in a greater potential for contamination of the ground to have occurred (**Appendix 13B:** Land Contamination Methodology Tables, Table 13B.2 (ES Volume II - **Application Document Ref. 6.3**)). The lower the baseline risk score then the lower the perceived level of risk.

13.3.9 Professional judgement has been applied in reviewing the generated baseline risk scores. Generally, baseline risk scores of two or less are considered not to pose a significant risk and will not be considered for further assessment. Baseline risk scores of three or more will be considered for further risk and impact assessment.

13.3.10 The next stage of screening relates to a review of sensitive receptors and their proximity to the potential area of land contamination. A combination of this review and the baseline risk score defines whether a site advances to the detailed assessment stage for further risk and impact assessment which is described in the following sections . The review of sensitive receptors and their proximity to the potential contaminated site are presented in **Appendix**

13C: Potential Areas of Contamination Further Risk and Impact Assessment (ES Volume II - **Application Document Ref. 6.3**).

13.3.11 A flow chart summarising the screening, risk and impact assessment steps that have been undertaken, and signposting to where relevant data and assessments can be found is presented in **Plate 13.1**.

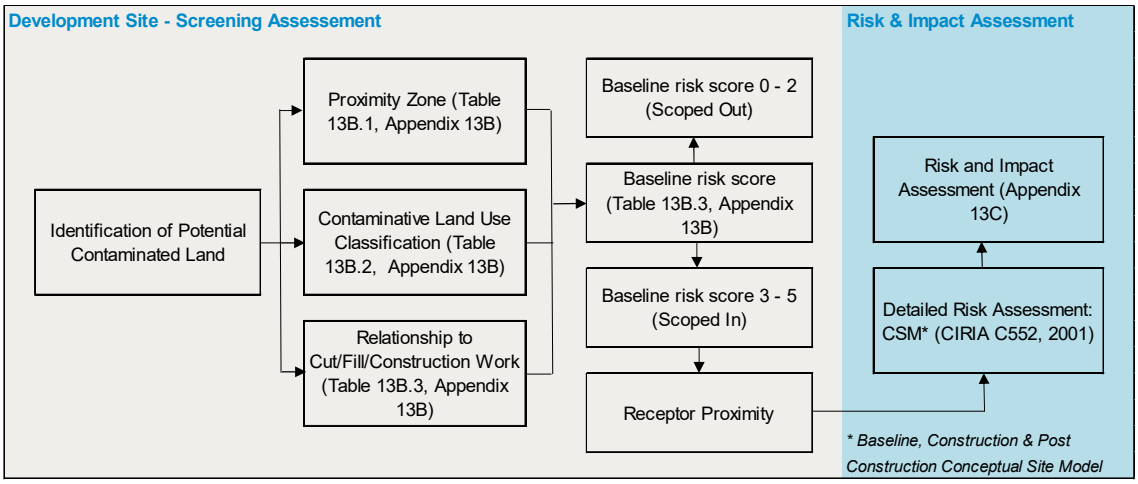

Plate 13.1: Land contamination assessment flow chart

Risk and impact assessment

13.3.12 The approach to assessing the potential impacts of the Proposed Development has been undertaken by comparing the risk levels at baseline with the CSM and the risk levels for the construction and post-construction stages respectively, to determine any change in risk at each stage.

13.3.13 Potential risks have been determined and assessed based on the likelihood (or probability) and consequence using the principles given in the Section 6.3 of CIRIA C552, 2001. This provides guidance on development and application of the consequence and probability matrix to risk assessment and broad definitions of consequence. The risk matrix is presented in Table 13.5.

Table 13.5: Estimation level of risk

Probability	Consequence			
	Severe	Medium	Mild	Minor
High likelihood	Very high risk	High risk	Moderate risk	Low risk
Likely	High risk	Moderate risk	Moderate/low risk	Low risk

Probability	Consequence			
	Severe	Medium	Mild	Minor
Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

13.3.14 The significance of the effects of land contamination has been assessed by comparing the difference in risk for each contaminant linkage at baseline to those at construction and at post construction stages. Where there is shown to be a decrease in contamination risk the Proposed Development is assessed as having a beneficial effect on the environment in the long term.

13.3.15 The definitions of the significance criteria used are presented in Table 13.6 below. This provides details of how increases and decreases in the contamination risks identified are related to the significance criteria adopted. Potential effects that are determined as being moderate or major are classed as 'significant' effects. Where an effect has been anticipated to be neutral or minor, these effects are classed as 'not significant'. Predicted effects of minor or neutral/ negligible significance are acceptable and do not require further consideration. It is only predicted effects of moderate or high that require a more detailed assessment.

Table 13.6: Significance criteria (defined by AECOM)

Significance Criteria	Definition
Major adverse effect	An increase in contamination risk of 4 or 5 risk levels in the risk matrix, e.g. from land that has a very low contamination risk in the baseline becomes a high or very high risk.
Moderate adverse effect	An increase in contamination risk of 2 or 3 risk levels in the risk matrix, e.g. land that has a low contamination risk in the baseline becomes a moderate or high risk.
Minor adverse effect	An increase in contamination risk of 1 risk level in the risk matrix, e.g. land that has a low contamination risk in the baseline becomes a moderate/low risk.
Neutral effect	No change in contaminated land risks.
Minor beneficial effect	A reduction in contamination risk of 1 risk level in the risk matrix, e.g. land that has a moderate/low contamination risk in the baseline becomes a low risk.

Significance Criteria	Definition
Moderate beneficial effect	A reduction in contamination risk of 2 or 3 risk levels in the risk matrix, e.g. land that has a high contamination risk in the baseline becomes a moderate/low or low risk.
Major beneficial effect	A reduction in contamination risk of 4 or 5 risk levels in the risk matrix, e.g. land that has a very high contamination risk in the baseline becomes a low or very low risk.

Study area

13.3.16 For the purposes of determining the local baseline conditions with respect to geology and land contamination, a study area that extends 250m from the boundary of the Proposed Development Site is adopted (see **Figure 13.1** (ES Volume III - **Application Document Ref. 6.4**)). This is extended for hydrogeology to 1km from the boundary of the Proposed Development Site. This is appropriate to assess the local geological and hydrogeological setting and any influence that potential land contamination might have on the Proposed Development or local receptors.

13.3.17 The proposed access road from the A18 and the potential laydown options in adjacent agricultural fields are included in the final assessment, having been subject to ongoing feasibility assessment during Stage 2 consultation. Additional third-party data from the Landmark Information Group has not been obtained for all of this area, and specific additional stakeholder engagement has not been carried out. However, a review of publicly available data sources has been undertaken to supplement the baseline conditions information for these areas and this has included a review of potential sources of contamination. The data sources referenced are indicated in Section 13.3.18, below.

Data sources

13.3.18 This ES chapter draws on information from a combination of the following sources:

- historical mapping included as part of a professional Envirocheck Report provided by the Landmark Information Group (April 2020) (see **Appendix 13A**: Phase 1 Desk Based Assessment (Annex B) (ES Volume II - **Application Document Ref. 6.3**));
- Envirocheck (in GIS data format – April 2020);
- British Geological Survey (BGS) Geological Mapping and Memoirs;
- Environment Agency website;

- BGS website;
- Cranfield Soil and AgriFood Institute (CSAI) Soilscapes website;
- stakeholder consultation
- Department for Environment Food and Rural Affairs (DEFRA) Multi Agency Geographic Information for the Countryside (MAGIC) website;
- National Library of Scotland website (for additional historical mapping); and
- current and recent-historical aerial imagery from Google Earth Pro (2021) (for additional historical information).

Use of Rochdale Envelope

13.3.19 As set out in **Chapter 4**: The Proposed Development (ES Volume I – **Application Document Ref. 6.2**), there are areas for which there is currently variability in the design that could affect the assessment. The Rochdale Envelope defined for building sizes and limits of deviation for building locations set out in the Works Plan (**Application Document Ref. 4.3**) does not affect this assessment as it has been assumed that the buildings and structures are to the maximum extent specified in the Rochdale Envelope.

13.4 Baseline Conditions

13.4.1 This section presents the baseline conditions for geology, soils and hydrogeology . It also considers potential receptors that could be impacted upon by any existing or resulting ground contamination. There is therefore reference made to surface water, groundwater and ecological features in this section which are discussed in more detail in **Chapter 11:** Biodiversity and Nature Conservation and **Chapter 12**: Water Environment and Flood Risk (ES Volume I - **Application Document Ref. 6.2**).

Soils classification

13.4.2 Information obtained from CSAI, (2020) describes the soils on the Proposed Development Site to be loamy and clayey soils of coastal flats with naturally high groundwater (Soilscape identification description number 21). Land within this soil type is described as generally draining to local groundwater and mostly drained. Shallow groundwater and marginal ditches to most fields mean that the water resource is vulnerable to pollution from nutrients, pesticides and wastes that may be applied to the land.

13.4.3 According to the Landmark Information Group GIS data, Natural England reports the Agricultural Land Classification (ALC) to be Grade 2 for the majority of the Proposed Development Site. This is classed as soil of '*very good quality*'. This land is further described as having only minor limitations which affect crop yield, cultivations or harvesting. It can support a wide range

of agricultural and horticultural crops but there can be some reduced flexibility on land within the grade, which causes difficulty in the production of more demanding crops.

13.4.4 The ALC within and around the proposed access road from the A18 and the potential laydown options in adjacent agricultural fields is Grade 1. This is classed as soil of '*excellent quality*'. This land is further described as having no or very minor limitations. A very wide range of agricultural and horticultural crops can be grown.

13.4.5 The soils within the laydown areas have been classified by hand augering, which whilst primarily for archaeological purposes, provides useful baseline data on the soil profiles and status (refer to **Appendix 15B**: Geoarchaeological Hand Auger Survey Fieldwork Report (ES Volume II – **Application Document Ref. 6.3**).

Geology

13.4.6 The BGS Geoindex website and published 1:50,000 scale geological maps of the area (Sheet 88, Doncaster and Sheet 79, Goole) have been reviewed, alongside selected historical BGS borehole records available from the Proposed PCC Site and historical ground investigations (summarised in **Appendix 13A:** Phase 1 Desk Based Assessment (Annex B) (ES Volume II - **Application Document Ref. 6.3**)). These records indicate that the Proposed Development Site is underlain by the geological succession summarised in Table 13.7.

Table 13.7: Geological succession from published mapping and on-site BGS logs

Geological stratum	Location	Anticipated thickness	Description
Made Ground	Although not mapped at the site, Made Ground is expected across the Proposed Development Site given the historical site use.	Up to 2m	Artificial deposits on the natural ground's surface.
Warp (artificially induced Alluvium)	Across the majority of the Proposed Development Site and the study area.	12 – 17m	Clay and silt.
Cohesive Alluvium	Eastern extent of the Proposed		Normally soft to firm consolidated, compressible silty clay,

Geological stratum	Location	Anticipated thickness	Description
	Development Site and study area.		but can contain layers of silt, sand, peat and basal gravel.
Granular Alluvium	Beneath the Cohesive Alluvium.		Sands, silts and clays, with occasional peat layers (peat layers recorded between 0.45m and 1.6m thickness). Sands sometimes described as '*blown sands*'[1].
Mercia Mudstone Group (bedrock)	Across the Proposed Development Site and study area, beneath the superficial deposits.	Up to 200m	Dominantly red, less commonly green-grey, mudstones and subordinate siltstones with thick halite-bearing units in some basinal areas. Thin beds of gypsum/ anhydrite widespread; sandstones are also present.

[1] *Blown sand; defined by BGS as sand that has been transported by wind, or sand consisting predominantly of wind-borne particles*

Soil chemistry

13.4.7 The BGS Soil Chemistry datasets detail the topsoil concentrations of five potentially harmful elements (PHE): arsenic (As), cadmium (Cd), copper (Cu), nickel (Ni) and lead (Pb). Elevated concentrations of these PHE can exist because of natural geological conditions or possible anthropogenic sources. The estimated soil chemistry levels attributed to the Proposed Development Site and study area are set out in Table 13.8.

Table 13.8: Estimated soil chemistry

Potentially Harmful Element	Estimated geometric mean concentration range within the Proposed Development Site boundary (mg/kg)
Arsenic	South-western area (around the northern area of the proposed A18 access road and laydown area) 18.9 – 25.8

Potentially Harmful Element	Estimated geometric mean concentration range within the Proposed Development Site boundary (mg/kg)
	Remainder of the Proposed Development Site and study area 14.1 – 18.9
Cadmium	South-central area of the Proposed Development Site 0.49 – 0.85 Remainder of the Proposed Development Site and study area <0.33
Copper	Whole of the Proposed Development Site and study area 15.4 – 35.0
Lead	South-western area (around the northern area of the proposed A18 access road and laydown area) 99.5 – 242 Remainder of the Proposed Development Site and study area 47.1 – 99.5
Nickel	South-western area (around the northern area of the proposed A18 access road and laydown area) 31.9 – 40.1 Remainder of the Proposed Development Site and study area 23.5 – 31.9

Hydrogeology

Aquifer classification

13.4.8 The Environment Agency's Groundwater Protection Policy (Environment Agency, 2018) adopts aquifer designations that are consistent with the WFD regime.

13.4.9 The superficial geology (Alluvium/ Warp) is classified as a Secondary A aquifer. These are 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. Based on the WFD this groundwater body currently is at "Good Overall Status" (quality). Further details are provided in **Appendix 12B**: Water Framework Directive Assessment (ES Volume II - **Application Document Ref. 6.3**) (Annex A, Table A2.).

13.4.10 The bedrock geology (Mercia Mudstone Formation) is classified as a Secondary B aquifer. These are predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers. Based on the Water Framework Directive this groundwater body currently is at "Good Overall Status" (quality). Further details are provided in **Appendix 12B**: Water Framework Directive Assessment (ES Volume II - **Application Document Ref. 6.3**).

Groundwater vulnerability

13.4.11 The Environment Agency's simplified Groundwater Vulnerability Map (Environment Agency, 2017) shows that the Proposed Development Site is located in an area where the groundwater vulnerability to pollution is classified as medium-high. These are high priority groundwater resources that have limited natural protection. These areas are likely to be characterised by generally high leaching soils. This results in a medium-high overall pollution risk to groundwater from surface activities. Activities in these areas may require additional measures over and above good practice to ensure they do not cause groundwater pollution.

Groundwater Source Protection Zones

13.4.12 The Proposed Development Site does not lie within a SPZ. There are no SPZ within 1km of the Proposed Development Site.

Groundwater abstractions

13.4.13 According to the Envirocheck Report (see **Appendix 13A:** Phase 1 Desk Based Assessment (Annex B) (ES Volume II - **Application Document Ref. 6.3**), there is one licenced groundwater abstraction recorded within the Proposed Development Site and none within the extended 1km study area for groundwater abstractions. This abstraction point is indicated to be within the footprint of the existing Keadby Power Station (National Grid Reference 482619, 411656). It has multiple variations to the licence, with the most recent licensed to '*Siemens Public Limited Company*' (Md/028/0083/040). The abstraction is listed as being for '*industrial/commercial/public services/dewatering*' and is related to the Keadby 2 Power Station (under construction).

13.4.14 Based on local authority consultation carried out, there are no records of private water abstractions within a 1km radius of the Proposed Development Site.

Groundwater levels

13.4.15 Groundwater levels within the historical borehole records reviewed indicate generally shallow groundwater levels within the superficial geology of between 0.9m - 3.0m below ground level (bgl). Occasionally, deeper groundwater strikes were recorded between 5.4m - 6.9m bgl. There is insufficient information to conclude at this stage whether these levels are representative of true groundwater levels across the wider area. The Environment Agency do not hold any groundwater level monitoring data within a 1km radius from the Proposed Development Site boundary.

Hydrology

Surface watercourses and drainage

13.4.16 There are numerous surface water features located within the Proposed Development Site and wider study area. These are detailed, along with river quality information (where available) in Table 13.9.

Table 13.9: Surface water features

Surface water feature name	Location	River Quality Information
Various unnamed drains	Located on-site and within the study area; various directions.	Not available.
River Trent (tidal river) (Humber Upper)	Overlaps slightly onto the eastern spurs of the Proposed Development Site; north-south direction.	Reach: A631 Gainsborough To Keadby River Quality C Flow greater than 80 cumecs Year: 2000
Paupers Drain (includes Warping Drain and Eastoft Moors Drain)[2] / Eastoft Moors (Warping) Drain (inland river)[3]	Overlaps slightly onto the north-eastern spur of the Proposed Development Site; west-east direction.	Reach: Track Bridge to Confluence of River Trent River Quality D Flow less than 0.31 cumecs Year: 2000

[2] Source, Water Framework Directive (WFD)
[3] Source, Envirocheck data

Surface water feature name	Location	River Quality Information
Sewer Drain (drain)	Overlaps slightly onto the north-eastern spur of the Proposed Development Site; west-east direction.	Not available.
North Soak Drain (inland river)	Overlaps slightly onto the southern boundary of the Proposed Development Site and crosses the northern section of the A18 access road; west-east direction.	Reach: Medge Hall To Confluence of South Soak Drain River Quality E Flow less than 0.31 cumecs Year: 2000
Sheffield and South Yorkshire Navigation/ Stainforth and Keadby Canal (canal)	Overlaps slightly onto the southern boundary of the Proposed Development Site and crosses the northern section of the A18 access road; west-east direction.	Reach: Thorne Lock to Trent River Quality C Flow greater than 80 cumecs Year: 2000 Reach: River Don Navigation to Thorne Lock River Quality Chemistry General Quality Assessment (GQA) Grade A - Very Good Year: 2009 Reach: Thorne Lock to Trent River Quality Chemistry GQA Grade A - Very Good Year: 2009
South Soak Drain (inland river)	Crossed by the Construction and Operational Access Route and crosses the northern section of the A18 access road at its	Reach: Moors Bridge to Confluence of Three Rivers River Quality D Flow less than 0.31 cumecs

Surface water feature name	Location	River Quality Information
	closest point; west-east direction.	Year: 2000
Torne/Three Rivers (includes South Engine Drain and Folly Drain)[4] / Three Rivers (inland river)[5]	100m south of the Waterborne Transport Off-loading Area at its closest point; south-west to north-east direction	Reach: Pilfrey Bridge to Keadby Pumping Station River Quality C Flow less than 1.25 cumecs Year: 2000 Reach: Pilfrey Bridge to Keadby Pumping Station River Quality Chemistry GQA Grade D - Fair Year: 2009
Hatfield Waste Drain	Adjacent to the A18 junction and crossed by Mabey Bridge, to be replaced	Reach: Goodcop Farm to Pilfrey Bridge River Quality E Flow less than 1.25 cumecs Year: 2000
North Level Engine Drain	5m south of the A18 junction	Reach: Woodcarr Pumping Station to Pilfrey Bridge River Quality E Flow less than 0.31 cumecs Year: 2000

[4] Source, WFD
[5] Source, Envirocheck data

Surface water feature name	Location	River Quality Information
River Torne	20m south of the A18 junction	Reach: B1396 Rd Br Auckley To Pilfrey Bridge River Quality D Flow less than 1.25 cumecs Year: 2000
South Level Engine Drain	100m south of the A18 junction	Reach: Bull Hassocks Pump Station To Pilfrey Bridge River Quality D Flow less than 0.31 cumecs Year: 2000

13.4.17 Further information on the quality and status of relevant watercourses can be found in **Chapter 12**: Water Environment and Flood Risk (ES Volume I - **Application Document Ref. 6.2**) and **Appendix 12B**: Water Framework Directive Assessment (ES Volume II - **Application Document Ref. 6.3**) including surface water quality data in Annex C for relevant watercourses, where available.

Surface water abstractions

13.4.18 Eight surface water abstractions have been identified within 250m of the Proposed Development site. These are listed in Table 13.10 and shown on **Figure 12.1** (ES Volume III – **Application Document Ref. 6.4**).

Table 13.10: Environment Agency licensed surface water abstractions

References (Figure 12.1)	National Grid Reference	Approximate distance	Licence number and operator*	Use
A5/A6	483540, 411640	On the Proposed Development Site, located on the eastern extent of the eastern spur	03/28/85/0007 Keadby Generation Ltd Includes two variations of the licence.	Production of energy: boiler feed; and Non-evaporative cooling
A13	481780, 412230	23m north-west	03/28/84/0008	General agriculture:

References (Figure 12.1)	National Grid Reference	Approximate distance	Licence number and operator*	Use
			Mr W Foster-Thornton	spray irrigation - direct
A7	482790, 411490	10m east of the Canal Water Abstraction Option	03/28/83/0171 Canal and River Trust/ British Waterways	Production of energy: boiler feed
A1	482790, 411490	10m east of the Canal Water Abstraction Option	Md/028/0083/014 Canal and River Trust	Mechanical non-electrical; evaporative cooling
A14	481800, 411400	160m south of the Construction and Operational Access Route	03/28/83/0094 J A Chapman Farms	General agriculture: spray irrigation - direct
A15	483700, 411795	190m east	03/28/85/0006/1 Holly Hall Farms Ltd	Spray irrigation
A16	483700, 411795	190m east	03/28/85/0010 T F Belton Limited	General agriculture: spray irrigation - direct
A12	483171, 412204	230m north	Md/028/0084/005 RJ & AE Godfrey	General agriculture: spray irrigation - direct

**Permit end dates for these abstractions are specified as 'not supplied', and therefore all are assumed to be active abstractions.*

Nitrate vulnerable zones

13.4.19 The Proposed Development Site and the study area are located within a nitrate vulnerable zone – surface water. Designations of nitrate vulnerable zones occur where land drains contribute to nitrate concentrations found in polluted water. Polluted waters include:

- surface waters that contain at least 50 mg/l of nitrate;

- surface waters that are likely to contain at least 50 mg/l of nitrate if no action is taken; and
- waters which are eutrophic, or are likely to become eutrophic, if no action is taken.

Drinking Water Protected Areas

13.4.20 The Proposed Development Site and the study area are not located within a Drinking Water Protected Area (surface water).

Mining and mineral resources

13.4.21 The adopted 2003 Local North Lincolnshire Plan does not refer to any MSA or MCA in the study area. The 2003 Local North Lincolnshire Plan is due to be replaced by the North Lincolnshire Local Plan which will run to 2037. This is currently at Preferred Options Consultation stage. Furthermore, local authority consultation carried out confirms no MSA or MCA at, or in the study area of the Proposed Development Site. Therefore, these features are scoped out of the assessment.

13.4.22 Based on available data and local authority consultation carried out there are no records of aggregate/ mineral quarrying or mining, non-coal mining or coal mining at or in the study area of the Proposed Development Site. Therefore, these features are scoped out of the assessment.

Local Geological Sites/ Regionally Important Geological Sites

13.4.23 Based on available data and consultation carried out with the local authority, Greater Lincolnshire Nature Partnership and Natural England, there are no records of LGS or RIGS at or in the study area of the Proposed Development Site. Therefore, these features are scoped out of the assessment.

Land contamination

Regulated processes and pollution incidents

13.4.24 Information on regulated processes and pollution incidents has been collated from Environment Agency and Local Authority datasets within the Landmark Information Group GIS data presented in **Appendix 13A**: Phase 1 Desk Based Assessment (Section 5) (ES Volume II - **Application Document Ref. 6.3**). Recorded pollution incidents can indicate a potential for land contamination, whilst regulated processes provide a good indicator as to the nature of the processes undertaken at a site, which whilst regulated may nonetheless have, over time, resulted in the potential for some residual land contamination. Key information is summarised as follows:

- Integrated Pollution Controls – 1 no. located within the Proposed Development Site, 11 no. located within the study area. All named under 'Keadby Generation Limited' and concern combustion processes within the Fuel & Power Industry;
- Integrated Pollution Prevention and Control – 7 no. located within the Proposed Development Site, 6 located within the study area. For 'Keadby Generation Limited' or 'National Grid Gas plc' and concern combustion; any fuel greater or equal to 50Mw and gasification, liquefaction and refining; odorising natural gas/LPG;
- Local Authority Pollution Prevention and Controls – 1 no. located within the current Keadby 1 Power Station (within the study area) (for odourising natural gas and liquified petroleum gas) and 3 no. located south of the Waterborne Transport Off-Loading Area and Additional Abnormal Indivisible Load Route (within the study area) (all for coal, coke and coal product processes);
- Planning Hazardous Substances Consents – 1 no. located within the study area. This is located 40m south of the Additional Abnormal Indivisible Load Route and it concerns ammonium nitrate-based fertilisers which conforms to the Fertilisers Regulations 1991(a) and composite fertilisers containing phosphate and/or potash. However, its status is indicated to have been withdrawn;
- there are no Registered Radioactive Substances or records of COMAH (Control of Major Accidents Hazards) sites or licenses listed on the Proposed Development Site or in the study area;
- there is one recorded pollution incident to controlled waters (Category 3) listed for the Proposed Development Site. This is indicated to have been at the eastern extent of the proposed Water Connection Corridor and concerned raw sewage in filter pipes which impacted an abstraction. The receiving water was identified as a saline estuary (River Trent) and the incident occurred in 1999;
- there are a further four Category 3 pollution incidents to controlled waters within the study area. The closest of these was 10m north of the proposed Waterborne Transport Off-Loading Area and concerned oil pollutants to an unknown receiving water in 1996. Of the remaining three incidents, these are either older than 30 years or in excess of 100m from the Proposed Development Site; and
- in response to the submitted data request, the Environment Agency have stated that there have been no Category 3 or above pollution incidents in the area of interest within the last 5 years.

Proposed Development Site and surrounding area history

13.4.25 Historical mapping has been reviewed to evaluate the potential for past activities, both on and adjacent to the Proposed Development Site, to have impacted upon the site's environmental and land quality. A detailed appraisal is presented in **Appendix 13A**: Phase 1 Desk Based Assessment (ES Volume II - **Application Document Ref. 6.3**) and an overall summary provided here.

13.4.26 Earliest available mapping (circa 1885 – 1886) indicates that at this time the Proposed Development Site was largely undeveloped comprising predominantly open fields, with Keadby Common at the centre with properties limited to the eastern-most spur of the Proposed Development Site. A railway passed just over the southern boundary near to Keadby Junction. By 1967 – 1969 a power station was developed in the central/ eastern area with railway sidings in the south-west which led to, and terminated, at the power station. An area of marshland is also shown in the south-west along with a small refuse heap. By 1978 – 1982, approximately seven mixed circular and rectangular tanks are shown to occupy the land directly south of the main power station building. Keadby Common Farm was also indicated as present.

13.4.27 Mapping indicates that the power station was disused by 1991 – 1994 and by this time Keadby Common Farm was also no longer shown.

13.4.28 From 1995 onwards, the disused power station became an electric generation station and a change in site layout had occurred. A set of small tanks and a single tank were indicated on mapping located to the west; with five tanks parallel to the south, and an additional set of tanks located east of the electric generation station. Further west from the electric generation station, towards the centre of the Proposed Development Site, a further three large tanks were shown. The refuse heap and area of marshland to the south-west of the Proposed Development Site were by this time indicated to be absent.

13.4.29 Within the wider study area historical features of note include a railway line parallel and adjacent to the south of the Proposed PCC Site, areas of marshland to the south extending up to 50m away from the boundary, and also to the south a gasometer that was approximately 60m away.

13.4.30 Around 1966 – 1969, 220m west of the Proposed Development Site, a large slag heap with two sludge beds and a pond were indicated. A drain was also present adjacent to the slag heap and pond, which appears to be connected to one of the sludge beds and the Proposed Development Site, passing through the centre. An additional drain is also present north of the slag heap that passes past the northern boundary of the Proposed Development Site, with a drain adjacent to the south of the slag heap which runs onto the Proposed Development Site.

13.4.31 To the east, adjacent to the Proposed Development Site, a coal wharf was present on mapping (1966 – 1969) on the banks of the River Trent, with a loading bay on train tracks further inland approximately 30m from the Proposed Development Site. Further south and to the east is a depot approximately 120m south, along with a set of tanks present approximately 220m from the Proposed Development Site. A pond is also present which by 1994 appears to have been infilled.

13.4.32 Historical maps from 1995 show the slag heap to the west of the Proposed Development Site as a disused spoil heap. The two sludge beds, pond and drains associated with this area are no longer apparent and are assumed to have been infilled.

13.4.33 Historical maps from the National Library of Scotland dated 1885, 1905 – 1906 and 1948 indicate that the location of the proposed access road from the A18 and the laydown areas in adjacent agricultural fields were agricultural fields during this time period. Recent historical maps viewed on Google Earth Pro indicate that this area has been agricultural land and a track since 2002. On these maps, North Pilfrey Farm and Pilfrey Farm have been present since 1885. These are located approximately 100m north of the northern extent of the proposed A18 access road, and approximately 200m east of the southern extent of the proposed A18 access road, respectively.

Potential land contamination sources

13.4.34 Data obtained from the Environment Agency and the local authorities that is contained in the Envirocheck data, along with historical Ordnance Survey mapping (see **Appendix 13A:** Phase 1 Desk Based Assessment (Annex B) (ES Volume II - **Application Document Ref. 6.3**)), aerial mapping and site walkover records, have been reviewed to identify current and historical potential contaminative land uses. A summary of the areas of potential land contamination identified within the study area is presented in Table 13.11. The sites are mapped and have been allocated a unique reference number as shown on **Figure 13.2** (ES Volume III - **Application Document Ref. 6.4**).

Table 13.11: Summary of potential sources of contamination within the study area

Site title and site identification[1]	Location
Industrial sites including:	
Keadby Power Station (formerly coal fired, current gas fired). Keadby Power Landfill (deposited waste included inert and industrial waste) also within S1 area, along with numerous tanks and former railway	Located partly within the central/ eastern area of the Proposed Development Site (land required for utility connections including 132kv Electrical Connection Option and

Site title and site identification[1]	Location
(southern-most boundary) and former farms (west and north) – (S1)	Cooling Water Discharge Corridor), and partly in the study area[2].
Current PD Ports Marina and wharf, including current warehouse, former railway and gasometer and infilled pond – (S12)	Located partly within the eastern extent of the Proposed Development Site (Waterborne Transport Offloading Area and Additional Abnormal Indivisible Load (AIL) route, and partly in the study area.
Former tanks – (S19)	Located within the eastern extent of the Proposed Development Site (River Water Abstraction option).
Potential current tanks – (S22)	Located in the study area, 220m south of the proposed Waterborne Transport Off-Loading Area.
Historical landfill sites including:	
Historic Landfill and BGS Recorded Landfill Site - Keadby Power Station. Deposited waste included inert and industrial waste – (S2)	Located in the northern area of the Proposed Development Site (Proposed PCC Site) and extends beyond the Proposed Development Site boundary to the west.
Historic Landfill and Licensed Waste Management Facility - John Brown Engineering Landfill. Deposited waste included inert and industrial waste, and liquid sludge – (S3)	Located 15m north of the Proposed Development Site (existing access road) at its closest point.
Historic Landfill and Licensed Waste Management Facility - Keadby Power Station. Deposited waste included inert, commercial and household waste – (S4)	Located adjacent to and slightly overlaps into the south-western boundary of the Proposed Development Site (existing access road).
Historic Landfill - Keadby Central Electricity Generating Board. Deposited waste included inert, industrial, commercial and household waste, ash (from Keadby Power Station after lagoon settlement), construction, colliery tailings, refractories (from Keadby Power Station), asbestos – (S5)	Located adjacent to and slightly overlaps into the south-western boundary of the Proposed Development Site (existing access road).
Historic Landfill - Former Keadby Power Station and Registered Landfill - Transtore Industries.	Located adjacent to and slightly overlaps into the south-western boundary of the Proposed

Site title and site identification[1]	Location
Deposited waste included inert, industrial, commercial, household and special waste – (S6)	Development Site (existing access road).
Historic Landfill Site - Pulverised Fuel Ash (PFA) Settlement Lagoon – (S7)	Located to the east of the Keadby Power Station landfill and 45m west of the Proposed Development Site (Proposed PCC Site) at its closest point.
Historic Landfill Site - Keadby Power Station – (S8)	Located to the west of the PFA Settlement Lagoon and 80m west of the Proposed Development Site (Proposed PCC Site) at its closest point.
Railway sites including:	
Former railway sidings and conveyor system – (S11)	Located partly within the western area of the Proposed Development Site (including Proposed PCC Site and permanent laydown), and partly in the study area, extending west.
Current railway – (S9)	Located in the study area, 15m south of the Proposed Development Site at its closest point.
Former railway – (S10)	Slightly overlaps into the southern boundary of the Proposed Development Site (Canal Water Abstraction Option).
Light industrial sites including:	
Current pumping station – (S14)	Located within the eastern extent of the Proposed Development Site (River Water Abstraction Option).
Current pumping stations – (S15) and(S18)	Located in the study area, various distances from the Proposed Development Site.
Depot – (S13)	Located in the study area, 80m from the proposed Waterborne Transport Off-Loading Area.
Former S L Cleaning Services; commercial cleaning services – (S21)	Located in the study area, 200m north and south-east of the proposed Water Connection Corridors.
Agricultural sites including:	

Site title and site identification[1]	Location
Current and former agricultural land and buildings, including North Pilfrey Farm (S23), Pilfrey Farm (S24) and Roe Farm (S20)	Located in the study area, various distances from the Proposed Development Site.
Peat;	
Peat deposits could be present anywhere within the superficial deposits layer (historically proven up to 1.6m thickness in isolated areas).	Located in the Proposed Development Site and in the study area.

*[1] Each potentially contaminated site is allocated a unique reference number (e.g.S1) as shown on **Figure 13.2** (ES Volume III - **Application Document Ref. 6.4**) and also indicated in brackets above.*
[2] Study area is between 0 – 250m from the Proposed Development Site boundary.

Potential pathways

13.4.35 The following potential pathways have been identified which outline the mechanism through which any potential land contamination could impact upon a receptor:

- direct contact/ ingestion of contaminants within Made Ground/ soils, together with soil derived dust and groundwater;
- inhalation of organic vapours from Made Ground/ soils, soil derived dust, and groundwater;
- leaching of soluble contaminants and migration of mobile contaminants into shallow groundwater;
- vertical groundwater flow through Made Ground and superficial deposits to underlying bedrock aquifer;
- lateral groundwater flow and direct run-off to surface waters;
- vertical migration of ground gases to indoor and outdoor air and migration of ground gases into enclosed spaces (inhalation/ asphyxiation/ explosion);
- inhalation of asbestos fibres;
- direct contact of buried concrete with contaminated soils (i.e. hydrocarbons) and aggressive ground conditions (pH and sulphate)/ direct contact of services and supply pipes with contaminated soils; and
- indirect pathway: migration of hazardous gases/ vapours via permeable strata into enclosed spaces and service/ utility trenches.

Identified receptors

13.4.36 Potential receptors associated with the Proposed Development Site are as follows:

- current on-site human health users including;
  - commercial users (workers at Keadby 1 Power Station);
  - public open space users (Keadby Common users);
  - residential users (on the eastern-most spur only);
- future on-site human health users including;
  - commercial users (workers at Keadby 2 and the Proposed Development);
- current and future off-site human health users including;
  - commercial and public open space users (surrounding);
  - residential users (Keadby village, adjacent to the east);
- groundwater including;
  - superficial geology (Alluvium/ Warp) which is classified as a Secondary A aquifer;
  - groundwater abstraction located on-site (not potable);
  - bedrock geology (Mercia Mudstone Formation) which is classified as a Secondary B aquifer;
- surface water located on-site and off-site including;
  - watercourses: various unnamed drains, River Trent (Humber Upper), Paupers Drain (includes Warping Drain and Eastoft Moors Drain)/ Eastoft Moors (Warping) Drain, Sewer Drain, North Soak Drain, Sheffield and South Yorkshire Navigation/ Stainforth and Keadby Canal, South Soak Drain, Three Rivers, Hatfield Waste Drain, North Level Engine Drain, South Level Engine Drain and River Torne;
  - surface water abstractions located on-site and off-site (not potable);
- building and infrastructure located on-site and off-site: infrastructure at risk from ignition of gas in confined space, below ground infrastructure at risk from aggressive ground conditions;
- ecological sites including;
  - Ramsar Site, SSSI and SAC – Humber Estuary; and
  - Non-statutory designated ecological sites: Local Wildlife Sites (LWS) – Keadby Warping Drain, Stainforth and Keadby Canal Corridor, Keadby Boundary Drain, Keadby Wetland, South Soak Drain, Keadby, Keadby Wet Grassland, Three Rivers, Hatfield Waste Drain, North Engine Drain, Belton, River Torne, South Engine Drain, Belton.

13.5 Development Design and Impact Avoidance

13.5.1 Measures that have been integrated into the Proposed Development in order to avoid or reduce adverse environmental effects are described in the following section. The assessment of impacts and effects takes account of these measures already being in place.

13.5.2 As part of the Proposed Development, any on-site contamination that poses a potential unacceptable risk to any of the receptors will need to be further investigated, and where necessary, mitigated or remediated such that potential risks to identified receptors are minimised to a standard suitable for the proposed end use of the site. In implementing any such measures, it will be necessary to prevent potential pollution of the environment occurring, either through disturbance of land contamination or through the introduction of potential contaminative materials during construction.

Ground Investigation

13.5.3 Ground investigation will be undertaken before construction to inform the development of the preliminary and detailed design. The ground investigation will validate the assumptions made in the initial Conceptual Site Model and Preliminary Risk Assessment (**Appendix 13A:** Phase 1 Desk-based Assessment (ES Volume II - **Application Document Ref. 6.3**) and provide site-specific data upon which to base a land contamination risk assessment. The ground investigation will be designed to target the potentially contaminative sources identified, including the historical landfilling activities identified on the Proposed Development Site. Where risks are deemed to be unacceptable, further detailed quantitative risk assessment and if required, detailed remediation strategies will be developed accordingly, pursuant to the process set out by the planning authorities.

Construction

Legislation and Regulation

13.5.4 A final Construction Environmental Management Plan (CEMP) will be developed that will contain measures to ensure compliance with relevant standards and legislation. The CEMP will set out the environmental mitigation requirements and also the project level expectations on how the Proposed Development will be constructed. Measures contained within the CEMP would be designed to limit the potential for dispersal and accidental releases of potential contaminants, soil derived dusts and uncontrolled run-off to occur during construction. For example, the CEMP will set out how material is to be excavated, segregated and stockpiled to minimise the potential for run-off, soil quality degradation and wind dispersal of dusts. The CEMP will also establish procedures for dealing with unexpected soil or groundwater contamination that may be encountered. A Framework CEMP accompanies

the DCO Application (**Application Document Ref. No. 7.1**). The submission, approval and implementation of the final CEMP will be secured by a requirement in Schedule 2 of the draft DCO (**Application Document Ref. No. 2.1**).

Soil and groundwater pollution control mitigation

13.5.5 It is assumed that the majority of structures at the Proposed PCC Site will require piling. There will be a requirement to avoid creating flow paths between potentially contaminated soils and/ or groundwater in the underlying superficial deposits which are classified as Secondary A aquifers and the bedrock which is classified as a Secondary B aquifer.

13.5.6 Piling design and construction works would be completed following preparation of a piling and penetrative foundation design method statement, informed by a risk assessment, completed in accordance with the Environment Agency's 'Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention' (Environment Agency 2001). The method statement would be submitted to, and after consultation with the Environment Agency, approval sought from NLC prior to relevant works commencing, secured by a Requirement of the draft DCO (**Application Document Ref. 2.1**).

13.5.7 Potential impacts specific to construction workers during site preparation and construction would be mitigated by the following measures and through working in accordance with CIRIA C692, 2010:

- measures to minimise dust generation;
- provision of PPE, such as gloves, barrier cream, overalls etc. to minimise direct contact with soils;
- provision of adequate hygiene facilities and clean welfare facilities for all construction site workers;
- monitoring of confined spaces for potential ground gas accumulations, restricting access to confined spaces, i.e. to suitably trained personnel only, and use of specialist Personal Protective Equipment (PPE), where necessary; and
- preparation and adoption of a site and task specific health and safety plan as is required under Health and Safety legislation.

13.5.8 A Pollution Response Plan will be in place prior to the commencement of construction works. The plan will outline key pollution mitigation measures to be adopted including a Control of Substances Hazardous to Health (COSHH)/ fuel inventory and key contacts to be notified in the event of a significant pollution incident, which may subsequently lead to the contamination of controlled waters or soils. All bulk fuel and COSHH items will be stored in

accordance with the relevant Environment Agency Guidance for Pollution Prevention (GPP) or where GPP are yet to be published, Pollution Prevention Guidance (PPG) notes (withdrawn but widely considered good practice) and storage regulations – refer to Section 5, **Chapter 12**: Water Environment and Flood Risks (ES Volume I – **Application Document Ref. 6.2**). Tanks and dispensing pumps will be locked when not in use to prevent unauthorised access.

13.5.9 Any hazardous materials will be stored in designated locations with specific measures to prevent leakage and the release of their contents. This will include a requirement to position storage areas at least 10m away from surface water features/ drains (and take into consideration the positions of any groundwater abstraction wells), on an impermeable base with an impermeable bund that has no outflow and is of adequate capacity to contain at least 110% of the contents. Valves and trigger guns will be protected from vandalism and kept locked when not in use.

13.5.10 Only well-maintained plant will be used during construction to minimise the potential for accidental pollution from leaking machinery or damaged equipment. Static machinery and plant are expected to be stored in hardstanding areas when not in use and, where necessary, to make use of drip trays beneath oil tanks/ engines/ gearboxes/ hydraulics. Spill response kits containing equipment that is appropriate to the types and quantities of materials being used and stored during construction will be maintained on Project Area for the duration of the works.

13.5.11 The CEMP will set out procedures for dealing with unexpected soil or groundwater contamination that may be encountered. This would typically require affected works to stop to enable appropriate people to be notified, and further characterisation and risk assessment to be undertaken before remediation or mitigation proposals are agreed with all required stakeholders.

13.5.12 Specific mitigation measures may be required in the form of treating/ remediating any contamination encountered during construction (e.g. any contamination that may be associated with any potentially contaminative sites identified as part of the assessment, notably the landfills and areas of potentially infilled land). This will be confirmed based on information gathered through ground investigation and is proposed to be secured by Requirement of the draft DCO (**Application Document Ref. 2.1**).

13.5.13 Any remediation works, or the removal of contaminated soils or waters associated with the construction of the Proposed Development, should this be required, would be expected to result in the enhancement of the local environment.

Excavated materials management

13.5.14 Prior to construction, a strategy will be prepared as part of the design development, which will set out how the earthworks stage of the construction phase will be undertaken. Where necessary the strategy will consider what excavated materials can be reused or are required for the various components of the Proposed Development as part of the Materials Management Plan, and what materials are surplus and require either disposal or onward management to ensure appropriate re-use.

13.5.15 To minimise the effects on soil resources during any earthworks, including materials management following foundation construction in relation to the Proposed Development, high standards of soil handling and management will be employed with a view to minimising where possible the double handling of soils and the extent to which exposed soils will be left vulnerable to erosional processes.

13.5.16 The re-use of excavated materials during construction will be governed by either a Materials Management Plan developed in accordance with the CL:AIRE Definition of Waste: Development Industry Code of Practice (2011), an environmental permit or a relevant exemption. The CL:AIRE Code of Practice is a voluntary framework for excavated materials management and re-use. Following this framework results in a level of information being generated that is sufficient to demonstrate to any regulator that excavated material has been re-used appropriately and is suitable for its intended use. It demonstrates that waste material has not been used in the development. The Materials Management Plan details the procedures and measures that will be taken to classify, track, store, reuse and dispose of all excavated materials that will be encountered during the development works.

13.5.17 The disposal of soil waste, contaminated or otherwise, to landfill sites would be best mitigated by minimisation of the overall quantities of waste generated during construction, and by ensuring that excavated material consigned to landfill cannot, as an alternative, be put to use either on the Proposed Development or on other sites.

13.5.18 Where there is a requirement to dispose of surplus excavated materials off site as waste, the material will be characterised to determine firstly whether it is Hazardous or Non-Hazardous waste in accordance with the Environment Agency's Technical Guidance WM3 and then once this is established, the appropriate disposal facility will be determined through Waste Acceptance Criteria (WAC) analysis, as required.

Operation

13.5.19 Operational materials, including chemicals, waste solvent, waste acid (if applicable), fuels and oils (acetylene, lubricating oils, distillate fuels, or other

fuels), will be provided with secondary containment appropriate to the level of risk to ensure that in the event of any spillage, the materials are safely contained. Secondary containment will be included in the installed design.

13.5.20 The design of the Proposed Development includes measures that would contain and control any releases of contaminants to ground and surface and foul drainage network. Drainage control for the Proposed Development is considered further in Section 5 (Conceptual Drainage Strategy) of **Appendix 12A**: Flood Risk Assessment (ES Volume II - **Application Document Ref. 6.3**). The final drainage design will be secured through a requirement of the draft DCO (**Application Document Ref. 2.1**), in consultation with the Lead Local Flood Authority (LLFA).

13.5.21 Good housekeeping and management practices will be adopted and adhered to through the operational lifetime, in compliance with the Environmental Permit to minimise impacts to soil and groundwater.

Decommissioning

13.5.22 The Proposed Development is expected to operate for at least 25 years. At the end of its operating life, the most likely scenario is that the Proposed Development would be shut down and all above ground structures removed. The Proposed Development Site would then be suitably remediated as required to facilitate re-use.

13.5.23 A Decommissioning Plan (including Decommissioning Environmental Management Plan (DEMP)) would be produced and agreed with the Environment Agency as part of the Environmental Permitting and site surrender process and also secured as a requirement in Schedule 2 of the draft DCO (**Application Document Ref. 2.1**). The DEMP would consider in detail all potential environmental risks on the Proposed Development Site and contain guidance on how risks can be removed or mitigated.

13.6 Likely Impacts and Effects

Construction

Land contamination

13.6.1 **Figure 13.2** (ES Volume III - **Application Document Ref. 6.4**) illustrates the identified historical and current areas of potential contamination within the Proposed Development Site boundary and 250m study area. In accordance with the screening methodology presented in Section 13.3, a baseline risk score has been assigned to each of these areas and this is presented in Table 1 of **Appendix 13C:** Potential Areas of Contamination Further Risk and Impact Assessment (ES Volume II - **Application Document Ref. 6.3**), and is also visually represented on **Figure 13.2** (ES Volume III - **Application**

Document Ref. 6.4). For the purposes of this ES chapter, it has been assumed at this stage that excavation (cut) may occur anywhere within the Proposed Development Site boundary. Those areas with a baseline risk score of three and above have been considered for further risk and impact assessment in this ES chapter (see Section 13.6.3 for further details). Those with a baseline risk score of two or below are not considered to pose an unacceptable risk within the context of Proposed Development construction or operation and have therefore been scoped out.

13.6.2 Table 13.12 presents a summary of the potential areas of contamination with baseline risk scores of 3 to 5.

Table 13.12: Potential areas of contamination (baseline risk scores 3 to 5)

Site ID	Site name	Proximity zone[1]	Land use class[2]	Relationship to cut/ fill/ construction work	Baseline risk score[3]
S1	Keadby Power Station (formerly coal fired, current gas fired). Keadby Power Landfill (deposited waste included inert and industrial waste) also within S1 area, along with numerous tanks and former railway (southern-most boundary) and former farms (west and north)	Zone 1	Class 3	Cut	5
S2	Historic Landfill and BGS Recorded Landfill Site - Keadby Power Station. Deposited waste included inert and industrial waste	Zone 1	Class 3	Cut	5
S3	Historic Landfill and Licensed Waste	Zone 2	Class 3	Cut	4

Site ID	Site name	Proximity zone[1]	Land use class[2]	Relationship to cut/ fill/ construction work	Baseline risk score[3]
	Management Facility - John Brown Engineering Landfill. Deposited waste included inert and industrial waste, and liquid sludge				
S4	Historic Landfill and Licensed Waste Management Facility - Keadby Power Station. Deposited waste included inert, commercial and household waste	Zone 1	Class 3	Cut	5
S5	Historic Landfill - Keadby Central Electricity Generating Board. Deposited waste included inert, industrial, commercial and household waste, ash (from Keadby Power Station after lagoon settlement), construction, colliery tailings, refractories (from Keadby Power Station), asbestos	Zone 1	Class 3	Cut	5
S6	Historic Landfill - Former Keadby Power Station and Registered Landfill - Transtore Industries.	Zone 1	Class 3	Cut	5

Site ID	Site name	Proximity zone[1]	Land use class[2]	Relationship to cut/ fill/ construction work	Baseline risk score[3]
	Deposited waste included industrial, commercial, household and special waste				
S7	Historic Landfill Site - PFA Settlement Lagoon	Zone 2	Class 3	Cut	4
S8	Historic Landfill Site - Keadby Power Station	Zone 3	Class 3	Cut	3
S9	Current railway	Zone 2	Class 2	Cut	3
S10	Former railway	Zone 1	Class 2	Cut	4
S11	Former railway sidings and conveyor system	Zone 1	Class 2	Cut	4
S12	Current PD Ports Marina and wharf including current warehouse, former railway and gasometer and infilled pond	Zone 1	Class 2	Cut	4
S14	Current pumping station	Zone 1	Class 1	Cut	3
S18	Current pumping station	Zone 1	Class 1	Cut	3
S19	Former tanks	Zone 1	Class 3	Cut	5
S22	Potential current tanks	Zone 3	Class 3	Cut	3

[1] *Proximity zone definition is included within* ***Table 13B.1, Appendix 13B***
[2] *Land use class types are defined within* ***Table 13B.2, Appendix 13B***
[3] *Baseline risk scoring method is defined within* ***Table 13B.3, Appendix 13B***

13.6.3 For the sites identified for further assessment (listed in Table 13.12), site-specific CSM have been produced and are presented in **Appendix 13C:** Potential Areas of Contamination Further Risk and Impact Assessment (ES Volume II – **Application Document Ref. 6.3**). These include a CSM for each of the following:

- baseline conditions;
- construction phase; and
- post-construction (operational) phase.

13.6.4 All sites with a baseline risk score of 5 have been assessed on their own, with the exception of S4, S5 and S6. These have been grouped as they are all landfills and all located within the same area (to the west of the Proposed Development Site). There is considered to be the same risk outcome from these sites for all the receptors assessed.

13.6.5 The remaining sites that have a baseline risk score of 3 and 4 have been grouped based on their land use type which is either; landfills, industrial sites, railway land or light industrial sites.

13.6.6 Peat deposits are known to be present but could not be identified as a site, or defined area, as the Peat deposits are not mapped. They could therefore be present anywhere within the superficial deposits layer (which has been proven to be up to 1.6m in thickness). Therefore, for Peat and the potential for ground gas, a more generalised risk and impact assessment has been undertaken.

13.6.7 Table 13.13 presents a summary of the groups of sites/individual sites, together with justification as to why the site has been considered in the assessment to be within or outside of the Proposed Development Site boundary, recognising that some sites fall within both. The table also includes a summary of the corresponding baseline CSM.

13.6.8 It should be noted that the potential impacts and baseline risks presented in Table 13.13 are those before any mitigation (including embedded mitigation outlined in Section 13.5) is applied.. The detailed baseline CSM are presented in **Appendix 13C:** Potential Areas of Contamination Further Risk and Impact Assessment (ES Volume II - **Application Document Ref. 6.3**).

Table 13.13: Summary of baseline CSM for sites which may pose a contaminative risk in relation to the Proposed Development Site

Group/ individual site	Site title (site ID) and land use class (Figure 13.2)	Consideration of whether 'within or outside of the Proposed Development Site boundary (Figure 13.2)	Human health risk	Groundwater risk	Surface water risk	Ecosystem risk	Buildings risk
Potential areas of contamination located within the Proposed Development Site boundary							
Baseline risk score 5 industrial site – current Keadby 1 Power Station	Keadby Power Station (formerly coal fired, current gas fired). Keadby Power Landfill (deposited waste included inert and industrial waste) also within S1 area, along with numerous tanks and former railway (southern-most boundary) and former farms (west and north) – (S1) Class 3.	S1 is located partly within and partly outside of the Proposed Development Site boundary. As at least half of S1 is located where multiple services, access routes and laydown areas are proposed, it has been assessed as being 'within' the Proposed Development Site boundary.	Low risk	Moderate/ low risk	Low to moderate/ low risk	Low risk	Low risk

Group/ individual site	Site title (site ID) and land use class (Figure 13.2)	Consideration of whether 'within or outside of the Proposed Development Site boundary (Figure 13.2)	Human health risk	Groundwater risk	Surface water risk	Ecosystem risk	Buildings risk
Baseline risk score 5 landfill site – historic landfill	Historic Landfill and BGS Recorded Landfill Site - Keadby Power Station. Deposited waste included inert and industrial waste – (S2) Class 3.	S2 is located partly within and partly outside of the Proposed Development Site boundary. As a significant proportion of S2 crosses the northern area of the main development area of the Proposed Power Station and Carbon Capture Site (Proposed PCC Site), it has been assessed as being 'within' the Proposed Development Site boundary.	Very low to moderate/ low risk	Low to moderate/ low risk	Moderate/ low risk	Low risk	Low to moderate/ low risk
Baseline risk score 5 industrial site – former tanks	Former tanks – (S19) Class 3.	S19 is located entirely within the Proposed Development Site boundary.	Very low to low risk	Low to moderate/ low risk	Low risk	Low risk	Very low risk

Group/ individual site	Site title (site ID) and land use class (Figure 13.2)	Consideration of whether 'within or outside of the Proposed Development Site boundary (Figure 13.2)	Human health risk	Groundwater risk	Surface water risk	Ecosystem risk	Buildings risk
Railway site – former railway	Former railway sidings and conveyor system – (S11) Class 2.	S11 is located partly within and partly outside the Proposed Development Site boundary. As a significant proportion of S11 crosses the southern area of the main development of the Proposed PCC Site, it has been considered as 'within' the Proposed Development Site boundary.	Very low to low risk	Moderate/ low risk	Low risk	Very low risk	N/A
Industrial site – current marina and wharf including current warehouse, former railway and gasometer	Current PD Ports Marina and wharf including current warehouse, former railway and gasometer and infilled pond – (S12) Class 2.	S12 is located partly within and partly outside of the Proposed Development Site boundary. Approximately a third of S12 is located within the Proposed Development Site boundary which has been proposed for a haulage route and transport offloading. As this area	Very low to low risk	Very low to low risk	Low to moderate/ low risk	Low to moderate/ low risk	Very low to low risk

Group/ individual site	Site title (site ID) and land use class (Figure 13.2)	Consideration of whether 'within or outside of the Proposed Development Site boundary (Figure 13.2)	Human health risk	Groundwater risk	Surface water risk	Ecosystem risk	Buildings risk
and infilled pond		does not currently have any access road, it has been assumed that cut operations are likely in this area. Therefore, S12 has been conservatively considered as being 'within' the Proposed Development Site boundary.					
Light industrial site – current pumping station	Current pumping station – (S14) Class 1.	S14 is located entirely within the Proposed Development Site boundary.	Very low risk	Very low risk	Low risk	Low risk	Very low risk
Potential areas of contamination located outside of the Proposed Development Site boundary							
Baseline risk score 5 landfill sites – historic landfills	Historic Landfill and Licensed Waste Management Facility - Keadby Power Station. Deposited waste	S4, S5 and S6 extend slightly to within the Proposed Development Site boundary within an area proposed for vehicular site access with a track already present. Therefore,	Very low to moderate/ low risk	Low to moderate/ low risk	Low to moderate/ low risk	Low risk	N/A

Group/ individual site	Site title (site ID) and land use class (Figure 13.2)	Consideration of whether 'within or outside of the Proposed Development Site boundary (Figure 13.2)	Human health risk	Groundwater risk	Surface water risk	Ecosystem risk	Buildings risk
	included inert, commercial and household waste – (S4) Class 3.	it has been assumed that cut operations are likely to be limited in this area. These sites have been assessed as being 'outside' of the Proposed Development Site boundary.					
	Historic Landfill - Keadby Central Electricity Generating Board. Deposited waste included inert, industrial, commercial and household waste, ash (from Keadby Power Station after lagoon settlement), construction, colliery tailings, refractories (from Keadby Power Station), asbestos – (S5) Class 3.						

Group/ individual site	Site title (site ID) and land use class (Figure 13.2)	Consideration of whether 'within or outside of the Proposed Development Site boundary (Figure 13.2)	Human health risk	Groundwater risk	Surface water risk	Ecosystem risk	Buildings risk
	Historic Landfill - Former Keadby Power Station and Registered Landfill - Transtore Industries. Deposited waste included inert, industrial, commercial, household and special waste – (S6) Class 3.						

Group/ individual site	Site title (site ID) and land use class (Figure 13.2)	Consideration of whether 'within or outside of the Proposed Development Site boundary (Figure 13.2)	Human health risk	Groundwater risk	Surface water risk	Ecosystem risk	Buildings risk
Landfill sites – historic landfills	Historic Landfill and Licensed Waste Management Facility - John Brown Engineering Landfill. Deposited waste included inert and industrial waste, and liquid sludge – (S3) Class 3.	S3, S7 and S8 are located entirely outside of the Proposed Development Site boundary.	Very low to moderate/ low risk	Low to moderate/ low risk	Low to moderate/ low risk	M/A	N/A
	Historic Landfill Site - Pulverised Fuel Ash (PFA) Settlement Lagoon – (S7) Class 3.						
	Historic Landfill Site - Keadby Power Station – (S8) Class 3.						

Group/ individual site	Site title (site ID) and land use class (Figure 13.2)	Consideration of whether 'within or outside of the Proposed Development Site boundary (Figure 13.2)	Human health risk	Groundwater risk	Surface water risk	Ecosystem risk	Buildings risk
Railway sites – current and former railways	Former railway – (S10) Class 2. Current railway – (S9) Class 2.	S9 is located entirely outside of the Proposed Development Site boundary. S10 extends to slightly within the Proposed Development Site boundary which is an area proposed for canal water supply connection works. It is assumed that cut operations are likely to be limited in this area. Therefore, this site has been assessed as being 'outside' of the Proposed Development Site boundary.	Very low to low risk	Low risk	Moderate/ low risk	Low risk	Very low risk
Industrial site – potential current tanks	Potential current tanks – (S22) Class 3.	S22 is located entirely outside of the Proposed Development Site boundary.	Very low to low risk	Low to moderate/ low risk	Moderate/ low risk	Low risk	Very low to low risk

Group/ individual site	Site title (site ID) and land use class (Figure 13.2)	Consideration of whether 'within or outside of the Proposed Development Site boundary (Figure 13.2)	Human health risk	Groundwater risk	Surface water risk	Ecosystem risk	Buildings risk
Light industrial site – current pumping station	Current pumping station – (S18) Class 1.	S18 is located entirely outside of the Proposed Development Site boundary.	N/A	Very low risk	N/A	N/A	N/A
Peat deposits	N/A	Within and outside of the Proposed Development Site boundary.	Very low to low risk	N/A	N/A	N/A	Very low risk

Construction impacts and temporary effects

13.6.9 In the locations of the identified potentially contaminative land uses and in the event of ground disturbance occurring, there is the potential for construction to affect human, controlled waters, building and infrastructure, and ecological receptors, and for the ground conditions to impact upon the design of the Proposed Development.

13.6.10 Potential impacts include but are not limited to:

- mobilising existing contamination in soil and groundwater as a result of ground disturbance and potential de-watering during construction;
- increasing the potential for contaminants in unsaturated soils to leach to groundwater in open excavations during construction;
- increasing the potential for contaminated surface run-off to migrate to surface water and groundwater receptors as a result of leaching from uncovered stockpiles;
- introducing new sources of contamination, such as fuels and oils used in construction plant;
- creating preferential pathways for the migration of soil contamination and gases, for example, along new below ground service routes, service ducts and as a result of potential de-watering; and
- introducing new human health receptors such as site staff during and post construction.

13.6.11 Construction activities can also result in physical damage to soil, including soil compaction as a result of heavy construction vehicle movements or the exacerbation of soil erosion through handling and storage of soils.

13.6.12 To determine whether there are any potential temporary effects on human, controlled waters, building and infrastructure, and ecological receptors during the construction phase, the baseline condition risk and construction risk levels (see Table 13.6), as defined in their respective CSM have been compared in **Appendix 13C:** Potential Areas of Contamination Further Risk and Impact Assessment (ES Volume II - **Application Document Ref. 6.3**).

13.6.13 Where there is no predicted change between the main baseline risk and the main construction risk, the construction effect significance is assessed as a neutral effect, even if the risk from the land contamination site is deemed to be high.

13.6.14 An increase in risk at the construction stage compared to baseline would result in an adverse effect and conversely, any improvement resulting from construction, for example where remediation is undertaken or a contaminant linkage is broken or removed, would result in a beneficial effect.

13.6.15 Whilst adoption of the measures included as part of a CEMP would make it unlikely that there would be significant adverse effects during construction, there may still be some temporary minor adverse effects during construction from ground disturbance or groundwater controls which may inadvertently mobilise contamination or create preferential pathways; in particular for groundwater and ground gas migration, which may cause a temporary adverse impact on groundwater quality or increased ground gas risk compared to the baseline risk.

13.6.16 A summary of the assessment of construction temporary effects is provided in Table 13.14. Further detail on these comparisons is presented in **Appendix 13C:** Potential Areas of Contamination Further Risk and Impact Assessment (ES Volume II - **Application Document Ref. 6.3**).

Table 13.14: Summary of temporary effects (during construction)

Risk and impact assessment CSM – group/ individual CSM	**Site ID(s)**	**Classification of effect**	**Concerning groundwater and/or ground gas migration (which may cause a temporary worsening in groundwater quality or increased ground gas risk compared to baseline)**
Potential areas of contamination located within the Proposed Development Site boundary			
Baseline risk score 5 industrial site – current Keadby 1 Power Station	S1	Neutral to minor adverse (**not significant**)	Groundwater and ground gas
Baseline risk score 5 landfill site – historic landfill	S2	Neutral to minor adverse (**not significant**)	Groundwater and ground gas
Baseline risk score 5 industrial site – former tanks	S19	Neutral to minor adverse (**not significant**)	Groundwater
Railway site – former railway	S11	Neutral to minor adverse (**not significant**)	Groundwater
Industrial site – current marina and wharf including current warehouse, former railway and	S12	Neutral to minor adverse (**not significant**)	Groundwater

Risk and impact assessment CSM – group/ individual CSM	**Site ID(s)**	**Classification of effect**	**Concerning groundwater and/or ground gas migration (which may cause a temporary worsening in groundwater quality or increased ground gas risk compared to baseline)**
gasometer and infilled pond			
Light industrial site – current pumping station	S14	Neutral to minor adverse (**not significant**)	Groundwater
Potential areas of contamination located outside of the Proposed Development Site boundary (in the study area)			
Baseline risk score 5 landfill sites – historic landfills	S4, S5, S6	Neutral to minor adverse (**not significant**)	Groundwater
Landfill sites – historic landfills	S3, S7, S8	Neutral to minor adverse (**not significant**)	Groundwater
Railway sites – current and former railways	S9, S10	Neutral to minor adverse (**not significant**)	Groundwater
Industrial site – potential current tanks	S22	Neutral	-
Light industrial site – current pumping station	S18	Neutral	-
Peat deposits	-	Neutral	-

Permanent effects

13.6.17 To determine whether there are any potential permanent effects, the baseline risks posed to receptors and post-construction risks to receptors based on the CSM have been compared (**Appendix 13C:** Potential Areas of Contamination Further Risk and Impact Assessment (ES Volume II - **Application Document Ref. 6.3**)). Where there is no change between the main baseline risk and the post-construction risk, the permanent effect significance is deemed to be neutral even if the risk is assessed to remain as high, post construction. This will be the case where the construction of the Proposed Development Site will have no impact on the risks from a potentially contaminated site. These are

sites that are within the study area, i.e. outside the Proposed Development Site boundary. The assessment indicates there will be no adverse permanent effects on the sites outside the study area post construction.

13.6.18 It is anticipated that if any remediation is carried out on potentially contaminated sites identified within the Proposed Development Site boundary, there will, in most instances, be overall beneficial effects. However, the risk and impact assessment has not considered these to be significant beneficial effects to ensure that a precautionary approach is adopted. If required, (subject to ground investigation at the Proposed Development Site), site-specific permanent remediation measures, which will focus on source removal, pathway breakage or receptor protection, will be developed during the detailed design stage. If required, such measures will reduce risks to human health, controlled waters and/ or property from contamination, gas and vapours in the ground (the principal risks in this area), to an acceptable level.

13.6.19 A summary of the assessment is provided in Table 13.15 and the details of these comparisons are presented in **Appendix 13C:** Potential Areas of Contamination Further Risk and Impact Assessment (ES Volume II - **Application Document Ref. 6.3**).

Table 13.15: Summary of permanent effects (post-construction)

Risk and impact assessment CSM – group/ individual CSM	**Site ID(s)**	**Post-construction classification of effect**
Potential areas of contamination located within the Proposed Development Site boundary;		
Baseline risk score 5 industrial site – current Keadby 1 Power Station	S1	Neutral to minor beneficial **(not significant)**
Baseline risk score 5 landfill site – historic landfill	S2	Neutral to minor beneficial **(not significant)**
Baseline risk score 5 industrial site – former tanks	S19	Neutral to minor beneficial **(not significant)**
Railway site – former railway	S11	Neutral to minor beneficial **(not significant)**
Industrial site – current marina and wharf including current warehouse, former railway and gasometer and infilled pond	S12	Neutral

Risk and impact assessment CSM – group/ individual CSM	Site ID(s)	Post-construction classification of effect
Light industrial site – current pumping station	S14	Neutral
Potential areas of contamination located outside the Proposed Development Site boundary (in the study area);		
Baseline risk score 5 landfill sites – historic landfills	S4, S5, S6	Neutral
Landfill sites – historic landfills	S3, S7, S8	Neutral
Industrial site – potential current tanks	S22	Neutral
Railway sites – current and former railways	S9, S10	Neutral
Light industrial site – current pumping station	S18	Neutral
Peat deposits	-	Neutral

Operation impacts

13.6.20 During the operational stage of the Proposed Development, conditions may have altered from the baseline as a result of, but not limited to:

- introducing commercial users (workers at the Proposed Development), and development infrastructure as new receptors;
- contamination which has been encountered having been removed, remediated or mitigated, if required;
- additional drainage and discharge routes and the potential for polluted surface water run-off and drainage to be directed towards groundwater and surface water receptors with the new drainage system acting as a more efficient pollutant pathway;
- the potential for impacts arising from leaks/ spills of pollutants to pass directly into the underlying ground/ aquifers, bypassing the drainage system; and
- reduction in soil erosion through additional hardstanding, improved drainage design and improvement in surface water runoff quality from on-site surface water attenuation features required which would be incorporated into the layout of the Proposed Development.

13.6.21 It is anticipated that there will be no significant effects during the operation of the Proposed Development as maintenance and operation of the Proposed Development will be in accordance with the Environmental Permit Site

Condition Report and relevant site protection and monitoring programme (SPMP) arrangements therein.

Decommissioning

13.6.22 During the decommissioning of the Proposed Development, conditions may alter from the baseline as a result of, but not limited to:

- mobilising existing contamination in soil and groundwater as a result of ground disturbance during decommissioning;
- increasing the potential for contaminants in unsaturated soils to leach to groundwater in open excavations during decommissioning;
- increasing the potential for contaminated surface run-off to migrate to surface water and groundwater receptors as a result of leaching from uncovered stockpiles; and
- introducing new sources of contamination, such as fuels and oils used in decommissioning plant.

13.6.23 It is anticipated that there may be some temporary minor adverse effects during the decommissioning period from ground disturbance. The DEMP to be secured by a requirement of the draft DCO (**Application Document Ref. 2.1**) will mitigate the potential for any risks that could otherwise result in significant adverse effects during decommissioning. Therefore, any temporary minor adverse effects would be no worse than those effects at the construction stage i.e. not significant.

13.7 Mitigation, Monitoring and Enhancement Measures

13.7.1 As no significant effects have been identified, no additional mitigation, compensation and enhancement measures are considered to be required during the construction, operation or decommissioning phase in order to further reduce the potential impacts and effects from the ground conditions on the Proposed Development.

13.7.2 As detailed in Section 13.5, ground investigation will be undertaken before construction to inform the development of the preliminary and detailed design. Depending on information gathered through this ground investigation, monitoring of groundwater and surface water may be recommended before construction commences, during construction works and post-construction.

13.7.3 Requirements of the draft DCO (**Application Document Ref. 2.1**) outline measures to be taken to address any contamination of land, including groundwater at the Proposed Development Site and secure the provision of:

- a scheme to deal with the contamination of land, including groundwater, likely to cause significant harm, including a risk assessment, supported by

site investigation data, to identify the extent of any contamination and the remedial measures to be taken, together with a materials management plan, which sets out long-term measures with respect to any contaminants remaining on the site. The authorised development, including any remediation, must be carried out in accordance with the approved scheme unless otherwise agreed with the relevant planning authority;

- a CEMP, which will be prepared prior to the commencement of construction activities. The CEMP will set out the expectations with regards to how works will be delivered, and specific requirements associated with control of soils, sediment and monitoring; and
- a DEMP which would consider potential environmental risks on the Proposed Development Site and how risks can be mitigated.

13.8 Limitations or Difficulties

13.8.1 Additional third-party data from the Landmark Information Group has not been obtained for the laydown areas south of the Stainforth and Keadby Canal and adjacent to the A18 junction improvement (Areas 1, 2a, 2b and 2c on **Figure 5.1** (ES Volume III – **Application Document Ref. 6.4**), and specific additional stakeholder engagement has not been carried out in respect of these areas. However, a review of publicly available data sources has been undertaken to supplement the baseline conditions information for these areas and this has included a review of potential sources of contamination.

13.8.2 The current assessment has been based on the collation and evaluation of readily available documentation provided by the Environment Agency, BGS, Envirocheck historical mapping, Envirocheck site sensitivity data, and other data sources made available.

13.8.3 The assessed baseline risks presented in Table 13.13 are based on the information provided at the time of the assessment. Where limited information is available, the assessment is based on precautionary, worst case assumptions and may, therefore, report a higher risk than that which actually exists.

13.8.4 Any borehole data from BGS sources are included on the basis that: 'The British Geological Survey accept no responsibility for omissions or misinterpretation of the data from their Data Bank as this may be old or obtained from non-BGS sources and may not represent current interpretation'.

13.8.5 This chapter should be read in light of the legislation, statutory requirements and/ or industry good practice applicable at the time of the works being undertaken. Any subsequent changes in this legislation, guidance or design may necessitate the findings to be reassessed in the light of these circumstances.

13.9 Summary of Likely Significant Residual Effects

13.9.1 Assuming that the design and impact avoidance measures detailed in Section 13.5 would be employed, the effects related to potential geological and land contamination related impacts associated with the Proposed Development during the construction, operation and decommissioning periods are likely to be negligible or minor adverse (**not significant**).

13.10 References

British Geological Survey (BGS) (2020) website (accessed 2020). Available online: https://www.bgs.ac.uk/

British Geological Survey (BGS) *Geological Mapping and Memoirs*.

British Standard BS 10175 (2011 +A1 2013). *Investigation of Potentially Contaminated Sites - Code of Practice.*

British Standard Institute (BSI) (2011). BS 8485:2015 +A1:2019 (2019). *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.*

British Standard Institute (BSI) (2013). BS 8576. *Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs).*

CIRIA C552 (2001). *Contaminated Land Risk Assessment: A Guide to Good Practice.*

CIRIA C665 (2007). *Assessing risks posed by hazardous ground gases to buildings*.

CIRIA C692 (2010). 3rd Edition 'Environmental Good Practice on Site'

CL:AIRE, (March 2011). *Definition of Waste: Development Industry Code of Practice.*

Cranfield Soil and AgriFood Institute (CSAI) *Soilscapes website* (accessed 2020). Available online:
http://www.landis.org.uk/soilscapes/

Department of Energy and Climate Change (2011b). *Overarching National Policy Statement for Energy EN-2.* Available online:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/37047/1939-nps-for-fossil-fuel-en2.pdf

Department for Environment Food and Rural Affairs (DEFRA) Multi Agency Geographic Information for the Countryside (MAGIC) website (accessed 2020). Available online:
https://magic.defra.gov.uk/MagicMap.aspx

Department of Energy and Climate Change (2011a). *Overarching National Policy Statement for Energy (EN-1).* Available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf

Environment Agency (2015). *Waste classification guidance on the classification and assessment of waste. 1st Edition.* Available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/948735/Waste_classification_technical_guidance_WM3.pdf

Environment Agency (2018) *The Environment Agency's Approach to Groundwater Protection.* Available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/692989/Envirnment-Agency-approach-to-groundwater-protection.pdf

Environment Agency (2020). *'Land contamination: risk management (LCRM)'.* Available online: https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm

Environment Agency (2001). *Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention*. *Reference NC/99/73.* Available online: http://www.merseygateway.co.uk/publicinquirydocs/Core-docs/CD-256.pdf

Environment Agency website (accessed 2020). Available online: https://www.gov.uk/government/organisations/environment-agency

Environmental good practice on site guide (fourth edition) (C741) (2015).

EU (2000). *The Water Framework Directive (2000/60/EC).*

EU (2004). *The Environmental Liability Directive (2004/35/EC).*

EU (2006). *The Groundwater Directive (2006/118/EC).*

EU (2008). *The Environmental Quality Standards (EQS) Directive (2008/105/EC).*

Google Earth Pro (2021) Current and recent-historical mapping from Google Earth Pro (accessed February 2021).

Her Majesty's Stationery Office (1984). The Building Act 1984; The Building Regulations & c (Amendment) Regulations 2016 (SI 2016 No. 490). Available online: https://www.legislation.gov.uk/uksi/2016/490/made

Her Majesty's Stationery Office (1990). *Part 2A of the Environment Protection Act 1990 Contaminated Land Statutory Guidance (April 2012)*. Available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/223705/pb13735cont-land-guidance.pdf

Her Majesty's Stationery Office (1990). Town and Country Planning Act 1990 (c. 8). Available online: https://www.legislation.gov.uk/ukpga/1990/8/contents

Her Majesty's Stationery Office (1995), The Environment Act 1995 (c. 25). Available online: https://www.legislation.gov.uk/ukpga/1995/25/contents

Her Majesty's Stationery Office (1999). Anti-Pollution Works Regulations 1999 (SI 199 No. 1006). Available online: https://www.legislation.gov.uk/uksi/1999/1006/contents/made

Her Majesty's Stationery Office (2003). The Water Act 2003 (c. 37). Available online: https://www.legislation.gov.uk/ukpga/2003/37/contents

Her Majesty's Stationery Office (2015). Environmental Damage (Prevention and Remediation) Regulations, 2015 (SI 2015 No. 810). Available online: https://www.legislation.gov.uk/uksi/2015/810/contents

Her Majesty's Stationery Office (1991). The Water Resources Act 1991 (c. 57). Available online: https://www.legislation.gov.uk/ukpga/1991/57/contents

Her Majesty's Stationery Office (2012). Contaminated Land (England) (Amendment) Regulations, 2012 (SI 2012 No. 263). Available online: https://www.legislation.gov.uk/uksi/2012/263/made

Her Majesty's Stationery Office (2016). The Environmental Permitting (England and Wales) Regulations 2016 (SI 2016 No. 1154). Available online: https://www.legislation.gov.uk/uksi/2016/1154/contents/made

Her Majesty's Stationery Office (2016). The Hazardous Waste (England and Wales) (Amendment) Regulations 2016 (SI 2016 No. 336). Available online: https://www.legislation.gov.uk/uksi/2016/336/contents/made

Landmark Information Group (2020) *Standard Envirocheck data and site sensitivity information (in GIS data format – April 2020).*

Local Development Frameworks Government Office for Yorkshire and The Humber (2007, adopted 2003), *North Lincolnshire Local Plan*. Available

online:
https://www.northlincs.gov.uk/planning-and-environment/planning-policy-the-north-lincolnshire-local-plan/#1593095254001-ec189f5a-67c8

Ministry of Housing, Communities and Local Government (2019a). *National Planning Policy Framework.* Available online:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf

Ministry of Housing, Communities and Local Government (2019b). *Planning Practice Guidance.* Available online:
https://www.gov.uk/government/collections/planning-practice-guidance

National House Building Council, Environment Agency and Chartered Institute of Environmental Health (2008), *Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D Publication 66.*

National Library of Scotland website (accessed February 2021). Available online:
https://www.nls.uk/

NetRegs website (2020): *Environmental Guidance for your Business in Northern Ireland and Scotland.* Available online: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/ (Accessed September 2020);

North Lincolnshire Council (2011a). *North Lincolnshire Core Strategy, Chapter 11, Environment and Resources.* Adopted June 2011. Available online:
http://www.planning.northlincs.gov.uk/planningreports/corestratergy/adopteddpd/11.pdf

Planning Inspectorate (2018) *Advice Note 9: Using the Rochdale Envelope.* Available online:
https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2013/05/Advice-note-9.-Rochdale-envelope-web.pdf

The Health and Safety Commission and the Health and Safety Executive, (1974). Health and Safety at Work etc. Act (c. 37). Available online: https://www.legislation.gov.uk/ukpga/1974/37/contents