The Great Grid Upgrade

North Humber to High Marnham

Preliminary Environmental Information Report

Volume 1: Chapter 12 Geology and Hydrogeology

February 2025

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North Humber to High Marnham
Document control

Document Properties	
Organisation	Stantec UK Limited
Author	Stantec UK Limited
Approved by	National Grid
Title	Preliminary Environmental Information Report Chapter 12 Geology and Hydrogeology
Document Register ID	NHHM-NG-ENV-REP-001
Data Classification	Public

Version History

Document	Version	Status	Description / Changes
Chapter 12	1.0	Final	First Issue

12. Geology and Hydrogeology

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12. Geology and Hydrogeology

12.1 Introduction

12.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents information about the preliminary environmental assessment of the likely significant geology and hydrogeology effects identified to date, that could result from the Proposed Overhead Line between the proposed Birkhill Wood Substation and the proposed High Marnham Substation as described in **Chapter 4 Description of the Project**.

12.1.2 **Chapter 1 Introduction** explains that the proposed Birkhill Wood Substation and proposed High Marnham Substation are proposed to be authorised through separate consenting procedures, however, they have also been included as part of the Project. **As explained in Chapter 5 Approach to Preparing the PEIR**, the environmental effects of these two substations including their associated overhead line reconfigurations, hereafter referred to as the Proposed Substation Works, have accordingly been considered within **Chapter 20 Substations and Associated Works**. For the purpose of this chapter the Proposed Overhead Line between the proposed Birkhill Wood Substation and the proposed High Marnham Substation is hereafter referred to as the Proposed Overhead Line.

12.1.3 To ensure that the Project as a whole has been assessed a summary has been included within this preliminary assessment of the likely significant effects on geology and hydrological which brings together the assessment of the Proposed Overhead Line and Proposed Substation Works for this topic. This chapter describes the: methodology used, datasets that have informed the preliminary assessment, baseline conditions, mitigation, and the preliminary geology and hydrogeology residual significant effects that could result from the Proposed Overhead Line.

12.1.4 This chapter covers effects on the following during construction (noting that operation and maintenance effects are scoped out as discussed in section 12.3):

- Geology including designated geological sites and minerals;
- Contaminated land and the receptors that could be affected by existing contaminants within the soil; and
- Hydrogeology including groundwater quality, levels and flow.

12.1.5 This chapter should be read in conjunction with:

- **Chapter 4 Description of the Project**;
- **Chapter 5 Approach to Preparing the PEIR**; and
- **Chapter 20 Substations and Associated Works**.

12.1.6 There are interrelationships between the potential effects on geology and hydrogeology and on other environmental topics. Therefore, please also refer to the following chapters:

- **Chapter 6 Agriculture and Soils**;

- **Chapter 8 Ecology**;
- **Chapter 11 Water Environment**; and
- **Chapter 21 Cumulative Effects**.

12.1.7 Effects on agricultural soil resources and soil quality are considered in **Chapter 6 Agriculture and Soils**. Ecological aspects including potential significant effects on Groundwater Dependent Terrestrial Ecosystems (GWDTE) are considered in **Chapter 8 Ecology**, however this chapter will identify where ground conditions and/or groundwater within the draft Order Limits insofar as they relate to the Proposed Overhead Line may impact the groundwater supporting these ecosystems (in relation to groundwater quality, levels and flow). The assessment of effects on surface water and groundwater in terms of the Water Framework Directive (WFD) are considered in **Chapter 11 Water Environment**.

12.1.8 This chapter is supported by the following figures in Volume 2 and appendices in Volume 3:

- **Figure 12.1 Superficial Geology**;
- **Figure 12.2 Bedrock Geology**;
- **Figure 12.3 Geologically Designated Sites**;
- **Figure 12.4 Source Protection Zones**;
- **Appendix 12.1 Preliminary Contamination Risk Assessment;** and
- **Appendix 12.2 Preliminary Qualitative Minerals Resource Assessment**.

12.2 Regulatory and Planning Context

12.2.1 This section sets out the legislation and planning policy that is relevant to the preliminary geology and hydrogeology assessment. A full review of compliance with relevant national and local planning policy will be provided within the Planning Statement that will be submitted as part of the application for Development Consent.

12.2.2 **Chapter 2 Regulatory and Planning Context** describes the overall regulatory and planning policy context for the Project. Key legislation, policy and planning guidance relevant to the assessment of potential geology and hydrology effects associated with the construction of the Project (noting that operation and maintenance effects are scoped out) is presented below.

Legislation

12.2.3 The legislation listed below has been considered when identifying potential constraints to the Project, design options, and mitigation.

- Environmental Protection Act 1990 (Ref 12.1) and associated statutory guidance on contaminated land (Contaminated Land Statutory Guidance, 2012) (Ref 12.2);
- The Environment Act, 2021 (Ref 12.3);
- The Contaminated Land (England) Regulations 2006 (Ref 12.4) as amended by;
- The Contaminated Land (England) (Amendment) Regulations 2012 (Ref 12.5);

- Environmental Damage (Prevention and Remediation) Regulations 2015 (Ref 12.6);
- Environmental Permitting (England and Wales) Regulations 2016 (Ref 12.7);
- Environmental Permitting (England and Wales) (Amendments)(England) Regulations 2023 (Ref 12.7);
- Landfill Directive (Ref 12.9);
- Water Resources Act 1991 (Ref 12.10);
- The Water Environment (Water Framework Directive) Regulations 2017 (Ref 12.11);
- The Water Supply (Water Quality) Regulations 2016 (Ref 12.12); and
- Environment Agency (EA) Groundwater Position Statements 2018 (Ref 12.13).

National Policy Statements (NPSs)

12.2.4 **Chapter 2 Regulatory and Planning Context** sets out the overarching policy context relevant to the Project, including the Overarching NPS for Energy (EN-1) (Ref 12.14). This is supported by the NPS for Electricity Networks Infrastructure (EN-5) (Ref 12.15).

12.2.5 Paragraph 5.4.19 of EN-1 states *'the applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests.'* Paragraph 5.4.42 of EN-1 states *'development should at the very least aim to avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives; where significant harm cannot be avoided, then appropriate compensation measures should be sought'.*

12.2.6 Paragraph 2.2.6 of EN-5 states *'applicants must take into account Schedule 9 to the Electricity Act 1989, which places a duty on all transmission and distribution licence holders, in formulating proposals for new electricity networks infrastructure, to "have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest'.*

12.2.7 Sites designated for their geological importance have been identified within section 12.5 and the potential effects are discussed in section 12.7 of this chapter.

12.2.8 Paragraph 5.11.8 of EN-1 states *'For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination and how it is proposed to address this'*. Paragraph 5.11.18 goes on to state that *'For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination, and where contamination is present, applicants should consider opportunities for remediation where possible'*. A Preliminary Contamination Risk Assessment is presented within Appendix 12.1 and the potential effects are discussed in section 12.7 of this chapter.

12.2.9 Paragraph 5.11.19 of EN-1 states *'Applicants should safeguard any mineral resources on the proposed site as far as possible, taking into account the long-term potential of the land use after any future decommissioning has taken place'*. Paragraph 5.11.28 also states *'Where a proposed development has an impact upon a Mineral Safeguarding Area, the Secretary of State should ensure that appropriate mitigation measures have been put in place to safeguard mineral resource'*. A Preliminary Qualitative Minerals Resource Assessment is presented within Appendix 12.2 which identifies the minerals resources within the draft Order Limits.

12.2.10 Paragraph 5.16.7 of EN-1 states that the Environmental Statement (ES) should describe *'any impacts of the proposed project on… source protection zones (SPZs) around potable groundwater abstractions'.* Groundwater receptors, including any source protection zones crossed by the draft Order Limits are identified within the Preliminary Contamination Risk Assessment presented in Appendix 12.1.

Other National Policy

12.2.11 Although the Project will be tested in line with the National Policy Statements stated above, the preliminary assessment has also been undertaken in accordance with, and with reference to, the following national policy:

- National Planning Policy Framework (NPPF) 2024 (Ref 12.16);
- Land Affected by Contamination Planning Practice Guidance (Ref 12.17); and
- Land Stability Planning Practice Guidance (Ref 12.18).

Regional and Local Policy

12.2.12 **Chapter 2 Regulatory and Planning Context** lists relevant regional and local policy documents. Key local policies relevant to geology and hydrogeology, that have informed this preliminary assessment and will inform the assessment within the ES, comprise:

- East Riding Local Plan 2012-2029, Adopted 2016 (Ref 12.19) EC5: Supporting the energy sector
  - ENV6: Managing Environmental Hazards
- North Lincolnshire Local Development Framework Core Strategy 2006 – 2026, Adopted 2011 (Ref 12.20)
  - CS17: Biodiversity
  - CS21: Minerals
- East Riding of Yorkshire Local Plan Update 2020 – 2039 (Ref 12.19)
  - ENV6: Managing environmental hazards
  - EC6: Protecting mineral resources
- Bassetlaw District Local Plan 2020-2038, Adopted 2024 (Ref 12.24)[1]
  - Policy 47: Contaminated and Unstable Land
  - Policy ST35: Biodiversity and Geodiversity
  - Policy ST51: Protecting Water Quality and Management
- East Riding of Yorkshire and Kingston Upon Hull Joint Minerals Local Plan, Adopted 2019 (Ref 12.25)
  - EC6: Protecting Mineral Resources

[1] The Bassetlaw District Local Plan 2020-2038 was adopted in May 2024 and now replaces the Bassetlaw Core Strategy and Development Management Policies Development Plan Document, 2011 which was referenced at the scoping stage. As such this report now only makes reference to the latest document.

- Nottinghamshire Minerals Local Plan, Adopted 2021 (Ref 12.26)
  - SP7: Minerals Safeguarding, Consultation Areas and Associated Minerals Infrastructure

12.2.13 North Lincolnshire Council submitted the New Local Plan for Examination in November 2022. The Examination progressed however the authority took the decision to formally withdraw the New Local Plan from the Examination in September 2024. The Saved Policies in the Local Plan (2003) as updated in October 2024 (Ref 12.56), North Lincolnshire Local Development Framework Core Strategy (2011) (12.20) from the adopted Development Plan and have been considered in the PEIR where relevant.

12.3 Scoping Opinion and Consultation

Scoping Opinion

12.3.1 The scope of the assessment has been informed by the Scoping Opinion (Ref 12.27) provided by the Planning Inspectorate on behalf of the Secretary of State, following submission of the Environmental Impact Assessment (EIA) Scoping Report (Ref 12.28). The scope has also been informed through consultation and engagement with relevant stakeholders.

12.3.2 A summary of the Scoping Opinion (Ref 12.27) together with a response from National Grid against each point of relevance to geology and hydrogeology is provided in Table 12.1.

Table 12.1 - Comments raised in the Scoping Opinion

ID	Inspectorate's comments	Response
3.6.1	**Exposure to existing contamination and the mobilisation of existing contamination as a result of ground disturbance from construction activities – Construction** The Applicant proposes to scope out this matter for the phase identified on the basis that the baseline has identified a generally very low/low risk of existing significant contamination within the study area. Appendix 11.A of the Scoping Report presents the Tier 1 Preliminary Contamination Risk Assessment, which is described as a qualitative assessment of historical and published information. It identifies locations where there is potential for significant source of contamination and further analyses the potential risk of these sites in Table 11.A.3.2. Nine sites (as identified in paragraph 11.4.38 of the Scoping Opinion) are stated to present moderate or above potential risk but Table 11.A.3.2 concludes that this risk could be mitigated to low through a commitment to use appropriate Personal	Noted – where sites with a moderate or above risk are identified within the study area further assessment will be undertaken and any mitigation measures required are included within section 12.6 and **Appendix 4.1 Draft Outline Code of Construction Practice (CoCP)** in Volume 3.

ID	Inspectorate's comments	Response
	Protective Equipment for construction workers to prevent exposure (GH03 within the CoCP) and that, in instances of moderate risk, there may not be an interaction between the Proposed Development and the contaminated ground. Table 11.3 of the Scoping Report states that these sites will be subject to a targeted investigation and where appropriate, a further risk assessment will be undertaken to identify any mitigation measures required. The Inspectorate is content that this matter can be scoped out for the sites identified as being at very low/ low risk as identified in Table 11A.3.2 on the basis of the explanation provided, subject to the appropriate risk assessments and mitigation measures being secured. For the sites identified as being moderate risk or above, the Inspectorate does not have sufficient information to exclude the possibility of significant effects. An assessment of likely significant effects arising from mobilisation of existing contamination should be provided in the ES where proposed works intersect or result in impact pathways at these locations. The assessment should be informed by the further targeted investigation and risk assessment described in the Scoping Report unless it can be demonstrated through agreement with the relevant consultation bodies that this is not required. The Applicant's attention is drawn to the response of the Environment Agency (see Appendix 2 of this Opinion) in this regard. It should be clear how any mitigation measures required are secured in the DCO.	
3.6.2	**Creation of pathways and the mixing of aquifers as a result of piling – Construction** The Applicant proposes to scope out this matter for the phase identified on the basis that the baseline has identified a generally very low/low risk of existing significant contamination within the study area. Therefore, the Applicant proposes that significant effects related to piling are unlikely. In addition, there is to be a commitment (GH02) in the CoCP to undertake a risk assessment in accordance with Environment Agency guidance. The Inspectorate is content that this matter can be scoped out subject to clear evidence regarding the risk of contamination being	Noted, **Appendix 12.1 Preliminary Contamination Risk Assessment** presents a Preliminary Contamination Risk Assessment for the Project.

ID	Inspectorate's comments	Response
	provided as part of the DCO application and subject to the appropriate risk assessment being carried out.	
3.6.3	**Reducing groundwater levels and impacts on groundwater quality and flows due to dewatering activities (to lower the groundwater table around an excavation) – Construction (overhead line only)** The Applicant proposes to scope out this matter for Overhead Lines for the phase identified on the basis that dewatering is not required. The Inspectorate is content that this matter can be scoped out in relation to the Overhead Lines only subject to dewatering not being required.	Noted, dewatering that actively lowers the groundwater table is not anticipated and therefore remains scoped out in areas of overhead line
3.6.4	**Physical and chemical changes to groundwater as a result of discharges of groundwater from dewatering – Construction** The Applicant proposes to scope out this matter for the phase identified on the basis that if discharges of groundwater are required an environmental permit will be obtained, and impacts/effects will be controlled by the permit (in accordance with commitment GH07 of the CoCP).The Inspectorate is content that this matter can be scoped out, subject to an environmental permit being obtained in the event that dewatering and thereby discharges of groundwater is required.	The applicant notes the Inspectorate's comments
3.6.5	**Ground Instability including coal mining due to general construction activities – Construction** The Applicant proposes to scope out this matter for the phase identified on the basis that embedded and control measures relating to best practice engineering design are included and therefore significant effects are not likely. The Inspectorate is content that this matter can be scoped out on the basis of the explanation provided and subject to the relative embedded and control measures being secured and implemented.	Noted this point can be scoped out and any mitigation measures required are included within section 12.6 and **Appendix 4.1 Draft Outline CoCP**.
3.6.6	**Introduction of new contamination due to general construction activities – Construction** The Applicant proposes to scope out this matter for the phase identified on the basis that	Noted this point can be scoped out. Any mitigation measures required are included within section 12.6 and

ID	Inspectorate's comments	Response
	significant effects are not likely and commitments GH04 and GH05 are proposed in the CoCP. The Inspectorate is content that this matter can be scoped out subject to the relative commitments being secured and agreed with relevant stakeholders.	**Appendix 4.1 Draft Outline CoCP**.
3.6.7	**Exposure of unexpected contamination due to general construction activities – Construction** The Applicant proposes to scope out this matter for the phase identified on the basis that significant effects are not likely and commitment GH08 is proposed in the CoCP. The Inspectorate is content that this matter can be scoped out on the basis that significant effects are not likely and subject to the relative commitment being secured and agreed with relevant stakeholders.	Noted this point can be scoped out. Any mitigation measures required are included within section 12.6 and **Appendix 4.1 Draft Outline CoCP**.
3.6.8	**Accumulation of ground gas and radon in confined spaces resulting in explosion/asphyxiation/exposure due to general construction activities - Construction and Operation** The Applicant proposes to scope out this matter for the phases identified on the basis that significant effects are not likely and embedded and control measures GH01 and GH03 are included in the CoCP. In addition, the majority of the Proposed Development is in a radon low risk area where radon protection measures wouldn't be required. For the small area where the radon potential is slightly higher, the Applicant will consider the need to obtain radon reports in accordance with the embedded and control measures. Furthermore, the Applicant proposes that, if required, entry to confined spaces would be undertaken in accordance with appropriate Health and Safety guidance and National Grid's health and safety working procedures. The Inspectorate is content that this matter can be scoped out on the basis of the explanation provided, that significant effects are not likely and subject to the relative commitments being set out within the relevant control documents and secured within the DCO.	Noted this point can be scoped out. Any mitigation measures required are included within section 12.6 and **Appendix 4.1 Draft Outline CoCP.**

ID	Inspectorate's comments	Response
3.6.9	**Impact on geological designated sites due to the permanent presence of the overhead line – Operation** The Applicant proposes to scope out this matter for the phase identified on the basis that significant effects are not likely and as the potential effects on Sites of Geological Importance are considered during the construction phase. The Inspectorate is content with this approach. Should, however, the assessment for the construction phase identifies the potential for significant effects, the Applicant should consider whether further assessment in relation to the operational phase of the proposed development is necessary.	The applicant notes the Inspectorate's comments
3.6.10	**Sterilisation of safeguarded minerals due to the permanent presence of the overhead line – Operation** The Applicant proposes to scope out this matter for the phase identified on the basis that significant effects are not likely and has prepared a preliminary qualitative minerals resource assessment in support of their conclusions. The Inspectorate is content that this matter can be scoped out for the phase identified.	The applicant notes the Inspectorate's comments
3.6.11	**Introduction of new potential contaminants to the environment from leaks, spills, fuels and oils due to general operational activities or as a result of general maintenance activities – Operation (maintenance activities)** The Applicant proposes to scope out this matter for the phase identified on the basis that significant effects are not likely and that the use is not considered to be contaminative given the nature of the project and in consideration of best practice measures and maintenance. The Inspectorate draws the Applicant's attention to ID 2.1.11. The Inspectorate is content to scope out the specific maintenance activities that are planned to occur during the operational phase, on the basis of the explanation provided and subject to best practice measures being set out within the relevant control documents, secured within the DCO and fully implemented.	The applicant notes the Inspectorate's comments

ID	Inspectorate's comments	Response
3.6.12	**Changes to groundwater levels and/or recharge rates due to the permanent presence of impermeable surfaces – Operation** The Applicant proposes to scope out this matter for the phase identified on the basis that significant effects are not likely and due to the small surface area of the permanent footprint of the Proposed Development. In addition, where new or additional surfacing is required, the Applicant proposes that permeable surfacing would be utilised and designed to meet current drainage standards. The Inspectorate is content with this approach.	The applicant notes the Inspectorate's comments
3.6.13	**Ingress and accumulation of ground gas in buildings resulting in explosion/asphyxiation/ exposure as a result of general maintenance activities – Operation** The Applicant proposes to scope out this matter for the phase identified on the basis that existing contamination is considered during the construction phase. In addition, confined spaces entry during the operation phase is unlikely and, where required, appropriate Health and Safety requirements will be followed and the general National Grid health and safety working procedures. Therefore, significant effects are not likely. The Inspectorate is content that this matter can be scoped out on the basis of the explanation provided.	The applicant notes the Inspectorate's comments
3.6.14	**Groundwater abstractions** The Inspectorate advises that the Applicant should ensure that all groundwater abstractions are included in the assessment, namely licensed and private supplies.	Groundwater abstractions will be included within the baseline assessment where there is the potential for impacts to those receptors.
3.6.15	**Pollution prevention measures** The Inspectorate advises that for surface water drainage, pollution prevention measures should be incorporated, particularly in areas that pass through the source protection zones. Parts of the Proposed Development boundary overlie the Chalk which is classified as a Principal Aquifer, therefore pollution prevention, especially during the construction phase, will be	Pollution prevention measures are included within **Appendix 4.1 Draft Outline CoCP**.

ID	Inspectorate's comments	Response
	required in order to prevent issues with fine sediment. Any pollution prevention measures should be secured within the DCO.	
3.6.16	**HDD** The Inspectorate advises that details of where and how HDD will be carried out, if required, should be provided within the ES, as this activity has the potential to cause pollution if not completed in a controlled manner. This should include details of any risk assessments / permits required. Early discussion with the Environment Agency is advised and the potential use of HDD techniques should be included in the CEMP, if it is to be utilised.	As a result of ongoing assessment and appraisal, no sections of undergrounding on the proposed overhead line are proposed. There is the requirement to divert existing utilities including low voltage wood pole and telecommunication overhead lines. This includes undergrounding of these assets and may include the use of Horizontal Directional Drill (HDD) to cross features such and roads and watercourses. Where trenchless techniques are included within the design presented at ES stage, suitable details, assessment and mitigation will be included within the ES and CoCP, as discussed within section 12.4.

Project Engagement and Consultation

12.3.3 National Grid has held several meetings with relevant consultees including the Environment Agency and relevant local planning authorities. Correspondence from these discussions will be detailed in the ES.

12.4 Assessment Approach and Methods

12.4.1 **Chapter 5 Approach to Preparing the PEIR** sets out the overarching approach which has been used in developing the preliminary environmental information. This section describes the technical methods used to determine the baseline conditions, the sensitivity of receptors and magnitude of impacts, and sets out the criteria that have been used for the preliminary geology and hydrogeology assessment. This section also identifies further assessment needed to be undertaken and reported within the ES.

Guidance Specific to the Geology and Hydrogeology Assessment

12.4.2 Relevant guidance specific to geology and hydrogeology, that has informed this Preliminary assessment and will inform the assessment within the ES, comprises:

- Environment Agency: Land Contamination: Risk Management (LCRM), 2023 (Ref 12.29);
- CIRIA 552: Contaminated Land Risk Assessment, A guide to good practice, 2001 (Ref 12.30);
- BS 10175:2011+A2:2017 Investigation of potentially contaminated sites. Code of Practice (Ref 12.31);
- The Environment Agency's Guiding Principles for Managing and Reducing Land Contamination (GPLC2), 2016 (Ref 12.32);
- Design Manual for Roads and Bridges (DMRB) LA 109: Geology and soils, 2019 (Ref 12.33);
- DMRB LA 113: Road drainage and the water environment, 2020 (Ref 12.34); and
- Environment Agency: Hydrogeological impact appraisal for dewatering abstractions, 2007 (Ref 12.35).

Study Area

12.4.3 For the purpose of establishing the baseline conditions, a study area encompassing the draft Order Limits plus a 250 m buffer has been defined for geology and contaminated land, as shown on **Figure 12.1 Superficial Geology** and **Figure 12.2 Bedrock Geology**. The study area for hydrogeological baseline information (e.g. SPZ, water abstractions etc.) has been defined as the draft Order Limits plus a 500 m buffer (as shown on **Figure 12.4 Source Protection Zones)** due to the mobile nature of groundwater and the corresponding potential for the Project to affect receptors at a greater distance. The study areas shown on these the figures is presented for the Project, inclusive of both the Proposed Overhead Line and Proposed Substation Works.

12.4.4 Given the scale and nature of the Project, this is generally considered a robust yet proportionate approach. The study area is also based on professional judgement, knowledge of similar Projects and the DMRB LA 109 (Ref 12.33) and LA 113 (Ref 12.34). Although not directly relevant for this Project development type, the study areas accord with the study area recommended in Guidance for the Safe Development of Housing on Land Affected by Contamination (Ref 12.36).

Baseline Data Gathering and Forecasting Methods

Data sources

12.4.1 The baseline assessment has been informed by a desk study which has drawn on the following key information sources:

- British Geological Survey (BGS) 1:50,000 scale geological mapping (Ref 12.37);
- BGS GeoIndex Viewer (Ref 12.38);
- BGS Lexicon of Named Rock Units (Ref 12.39);
- BGS Hydrogeological Maps of the UK (Ref 12.40);

- EA, Catchment Data Explorer (Ref 12.41);
- Natural England, Designated Sites View (Ref 12.42);
- Multi-Agency Geographic Information for the Countryside (MAGIC) interactive map (Ref 12.43);
- EA Report SC040016/R, New Groundwater Vulnerability Mapping Methodology in England and Wales (Ref 12.44);
- Georeferenced historical Ordnance Survey maps for the United Kingdom (Ref 12.45);
- Ordnance Survey (OS) 1:10,000, 1:25,000, 1:50,000 and 1:250,000 base mapping;
- Historical aerial imagery; and
- Information on potentially contaminated land provided from East Riding of Yorkshire Council, North Lincolnshire Council and Bassetlaw Council.

Further Data to be collected to inform the ES

12.4.2 In addition to the data collected for this preliminary assessment, the ES will be informed by information from Local Planning Authorities regarding private water supplies which have not been received to date from some local authorities.

Assessment Methods and Criteria

12.4.3 The methodology which has been followed for the work undertaken to date, and which will be developed during the EIA process if required, builds on the guidance set out earlier in this chapter for environmental effects assessed as likely to be significant.

12.4.4 The preliminary geology and hydrogeology assessment determines if effects as a result of the Project, following the implementation of mitigation, are likely or unlikely to be significant. Following on from the identification of whether an effect is considered to be likely or unlikely, a confidence level in the prediction is given (high, moderate or low) in accordance with the methodology presented in **Chapter 5 Approach to Preparing the PEIR**.

12.4.5 The methodology adopted in this assessment is qualitative with a progression from published and readily available factual information (stated with reasonable certainty) regarding the baseline conditions, to appraisal informed by professional judgement and expression of opinions on the relative significance.

Contaminated land

12.4.6 The assessment methodology which has been used for assessing contaminated land and for developing the baseline is presented within **Appendix 12.1 Preliminary Contamination Risk Assessment**. This appendix provides a Preliminary Risk Assessment (PRA) (Tier 1) and identifies locations where there is potential for significant sources of contamination to be present.

12.4.7 Full details of how the contamination risk assessment will be transposed into EIA methodology will be presented in the ES, describing how it integrates the topic specific requirement for effects to be assessed via a risk-based approach into the EIA methodology requiring effects and significance of effects to be assessed. For each potential effect, the receptor sensitivity and impact magnitude will be assigned which will then be combined to give a significance of effect.

Geology and hydrogeology

12.4.8 For effects relating to geology and hydrogeology, and for consistency, a similar approach has been adopted to assess these effects (i.e., combination of receptor identification and associated sensitivity and magnitude of potential impacts) as stated.

12.4.9 A preliminary qualitative Minerals Resource Assessment (MRA) has been prepared to develop the baseline and inform the assessment in relation to minerals. This is presented within **Appendix 12.2 Preliminary Qualitative Minerals Resource Assessment** and includes the methodology used for the assessment.

12.4.10 The risk assessment approach proposed in this methodology will be transposed into EIA classification as follows, which integrates the topic specific requirement for effects to be assessed via a risk-based approach into the EIA methodology. For each potential effect the receptor sensitivity and impact magnitude will be assigned using the Tables Table 12.2 and Table 12.3 below, which will then be combined to give a significance of effect using the matrix provided in Table 12.4.

12.4.11 If further hydrogeological assessment is required as the Project design evolves (e.g. to include undergrounding/trenchless crossings), a hydrogeological risk assessment (for each separate location) will be undertaken to identify impacts and effects in relation to the trenchless crossing and any associated dewatering. This will utilise a source-pathway-receptor linkage approach to assess the potential effects on groundwater which relate to the specific geological/hydrogeological settings between the draft Order Limits and identified groundwater abstractions and receptors, in accordance with the policy guidance outlined at the start of this chapter. Assessment of the impacts on groundwater receptors will be undertaken based on the approach and methodology described in Environment Agency, Hydrogeological Impact Appraisal for dewatering abstractions guidance (Ref 12.35).

Sensitivity

12.4.12 The criteria used to determine the value and sensitivity of receptors specific to geology and hydrogeology are set out in Table 12.2. These values are based on Table 3.70 of DMRB LA 113: Road drainage and the water environment (Ref 12.34), Table 3.11 of DMRB LA 109: Geology and soils (Ref 12.33) and professional judgement.

Table 12.2 - Value/sensitivity criteria

Value / sensitivity	General criteria
Very High	Very high importance and rarity. International scale and limited potential for substitution. **Geology**: Very rare and of international importance with no potential for replacement (e.g. UNESCO World Heritage Sites, UNESCO Global Geoparks, Site of Special Scientific Interest (SSSI) and Geological Conservation Review (GCR) where citations indicate features of international importance). Geology meeting international designation citation criteria which is not designated as such. **Minerals:**

Value / sensitivity	General criteria
	Existing Mineral sites. **Contamination:** 1) human health: very high sensitivity land use such as residential or allotments. 2) surface water: Watercourse having a Water Framework Directive (WFD) classification shown in a River Basin Management Plan (RBMP) and Q95 ≥ 1.0 m^3/s. Site protected/designated under EC or UK legislation (Special Areas of Conservation (SAC), Special Protection Areas (SPA), Sites of Special Scientific Interest (SSSI), Ramsar site). 3) groundwater: Principal aquifer providing a regionally important resource and regionally important public water supplies, SPZ 1. **Hydrogeology:** Principal aquifer providing a regionally important source and regionally important public water supplies. Groundwater quality associated with SPZ 1 associated with licensed abstractions. Water supplying GWDTEs with a high groundwater dependence with a high environmental importance and international or national value, such as Ramsar sites, SACs, SPAs and SSSIs.
High	High importance and rarity. National scale and limited potential for substitution. **Geology:** Rare and of national importance with little potential for replacement (e.g. geological SSSI, Area of Special Scientific Interest (ASSI), National Nature Reserves (NNR)). Geology meeting national designation citation criteria which is not designated as such. **Minerals:** Mineral preferred areas. **Contamination:** 1) human health: high sensitivity land use such as public open space, and construction workers. 2) surface water: Watercourse having a WFD classification shown in a RBMP and Q95 <1.0 m^3/s. 3) groundwater: Principal aquifer providing locally important resource or supporting a river ecosystem, SPZ2. **Hydrogeology:** Principal aquifer providing a locally important source and locally important public water supplies, SPZ2. Water supplying GWDTEs with a moderate groundwater dependence with high environmental importance and international or national value, such as Ramsar sites, SACs, SPAs and SSSIs; or water feeding highly groundwater dependent GWDTE with a national non-statutory UK Biodiversity Action Plan (BAP) priority.
Medium	Medium or high importance and rarity, regional scale, limited potential for substitution

Value / sensitivity	General criteria
	Geology: Regional importance with limited potential for replacement (e.g. Regionally Important Geological Sites). Geology meeting regional designation citation criteria which is not designated as such. **Minerals:** Mineral Safeguarded Areas and Mineral Consultation Area. **Contamination**: 1) human health: medium sensitivity land use such as commercial or industrial; 2) surface water: Watercourses not having a WFD classification shown in a RBMP and Q95 >0.001 m^3/s. 3) groundwater: Secondary A Aquifers. Extensive non-licensed private water abstractions (i.e., supplying ten or more properties or supplying large farming/animal estates). SPZ3. **Hydrogeology:** Secondary A aquifer. Groundwater flow and yield and quality associated with extensive non-licensed private water abstractions (i.e., supplying ten or more properties or supplying large farming/animal estates). Groundwater quality associated with SPZ2 (Outer Protection Zone) associated with licensed abstractions. Residential and commercial properties. Water supplying GWDTEs of low groundwater dependence with a high environmental importance and international or national value, such as Ramsar sites, SACs, SPAs and SSSIs; or water feeding moderately groundwater dependent GWDTE with a national non-statutory UK Biodiversity Action Plan (BAP) priority
Low	Low or medium importance and rarity, local scale **Geology:** Local importance/interest with potential for replacement (e.g. non designated geological exposures, former quarries/mining sites). **Minerals:** Mineral present but outside of any MPS/MSA/MCA. **Contamination:** 1) human health: low sensitivity land use such as highways and rail; 2) surface water: Watercourses not having a WFD classification shown in a RBMP and Q95 ≤0.001 m^3/s. 3) groundwater: Secondary B or Secondary Undifferentiated aquifer. Small scale private water abstractions (i.e., supplying fewer than ten properties). **Hydrogeology:** Secondary B or Secondary Undifferentiated aquifer. Groundwater flow and yield and quality associated with small scale private water abstractions (i.e., feeding fewer than ten properties). Groundwater quality associated with SPZ3 (Source Catchment Protection Zone)

Value / sensitivity	General criteria
	associated with licensed abstractions and with licensed abstractions for which no SPZ is defined. Water supplying GWDTEs of low groundwater dependence with a national non-statutory UK BAP priority; or water supplying highly or moderately groundwater dependent GWDTE sites with no conservation designation.
Negligible	Very low importance and rarity, local scale. **Geology:** No geological exposures, little/no local interest. **Mineral:** No mineral identified. **Contamination:** 1) human health: undeveloped surplus land/no sensitive land use proposed. 2) surface water: not present. 3) groundwater: Unproductive strata. **Hydrogeology:** Very poor groundwater quality and/or very low permeability make exploitation of groundwater unfeasible. No active groundwater supply. Water supplying GWDTEs of low groundwater dependence with no designation or groundwater that supports a wetland not classified as a GWDTE, although may receive some minor contribution from groundwater.

Magnitude

12.4.13 The criteria used to determine the magnitude of change for geology and hydrogeology are set out in Table 12.3. These values are based on Table 3.71 of DMRB LA 113 (Ref 12.34), Table 3.12 of DMRB LA 109 (Ref 12.33) and professional judgement. No beneficial changes are predicted for geology receptors as a result of the Project, and therefore no such criteria are provided.

Table 12.3 - Magnitude criteria

Magnitude	General criteria
Large	**Geology Adverse**: Permanent loss of geological feature/designation and/or quality and integrity, severe damage to key characteristics, features or elements.
	Contamination Adverse: Significant contamination identified, and contamination level significantly exceed human health and environmental assessment criteria with the potential for significant harm to be caused. Contamination heavily restricts future use of land.

Magnitude	General criteria
	Contamination Beneficial: Substantial betterment of ground or groundwater quality/contamination conditions through remediation and/or mitigation.
	Hydrogeology Adverse: Major or irreversible change to groundwater aquifer(s) flow, water level, quality or available yield which endangers the resources currently available. Groundwater resource use/abstraction is irreparably impacted upon, with a major or total loss of an existing supply or supplies. Changes to water table level or quality would result in a major or total change in, or loss of, a groundwater dependent area, where the value of a site would be severely affected. Changes to groundwater aquifer(s) flow, water level and quality would result in major changes to groundwater baseflow contributions to surface water and/or alterations in surface water quality. **Hydrogeology Beneficial**: Major increase in groundwater resource availability. Results in the achievement of Good Status for a WFD groundwater body or GWDTE which is currently failing its WFD objectives. Removal of existing or potential polluting discharge to groundwater
Medium	**Geology Adverse**: partial loss of geological feature/designation, potentially adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.
	Contamination Adverse: Contamination levels marginally exceed human health and environment assessment criteria. Control/remediation measures are required to reduce risks to human health/make land suitable for intended use. **Contamination Beneficial** Moderate betterment of ground or groundwater quality/contamination conditions through remediation and/or mitigation.
	Hydrogeology Adverse: Moderate long term or temporary significant changes to groundwater aquifer(s) flow, water level, quality or available yield which results in moderate long term or temporarily significant decrease in resource availability. Groundwater resource use/abstraction is impacted slightly, but existing supplies remain sustainable. Changes to water table level or groundwater quality would result in partial change in or loss of a groundwater dependent area, where the value of the site would be affected, but not to a major degree. Changes to groundwater aquifer(s) flow, water level and quality would result in moderate changes to groundwater baseflow contributions to surface water and/or alterations in surface water quality, resulting in a moderate shift from baseline conditions. **Hydrogeology Beneficial**: Moderate increase in groundwater resource availability. Contributes, in combination with other effects, to the achievement of Good Status for a WFD groundwater body or GWDTE which is currently failing its WFD objectives. Significant reduction of existing or potential polluting discharge to groundwater.

Magnitude	General criteria
Small	**Geology Adverse**: minor measurable change in geological feature/designation attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
	Contamination Adverse: Contamination levels below human health and environmental assessment criteria and remediation is not required. Significant contamination is unlikely with a low risk to human health. Best practice measures can be required to minimise risks to human health. **Contamination Beneficial**: Slight betterment of ground or groundwater quality/contamination conditions through remediation and/or mitigation.
	Hydrogeology Adverse: Minor changes to groundwater aquifer(s) flow, water level, quality or available yield leading to a noticeable change, confined largely to the Project area. Changes to water table level, groundwater quality and yield result in little discernible change to existing resource use. Changes to water table level or groundwater quality would result in minor change to groundwater dependent areas, but where the value of the site would not be affected. Changes to groundwater aquifer(s) flow, water level and quality would result in minor changes to groundwater baseflow contributions to surface water and/or alterations in surface water quality, resulting in a minor shift from baseline conditions. **Hydrogeology Beneficial**: Minor increase in groundwater resource availability. Leads to improvement of a WFD groundwater body which is currently failing its WFD objectives but insufficient effect to achieve Good Status. Minor reduction of existing or potential polluting discharge to groundwater.
Negligible	**Geology**: Very minor change to one or more characteristics, features or elements of geological feature/designation. Overall integrity of resource not affected.
	Contamination: Contamination levels substantially below human health and environment assessment criteria and remediation is not required. No requirement for control measures to reduce risks to human health/make land suitable for intended use.
	Hydrogeology: Very slight change from groundwater baseline conditions, approximating to 'no change' conditions. Dewatering effects create no or no noticeable effects.

Significance of effects

12.4.14 Significance would be derived using the matrix set out in Table 12.4. This may be supplemented/informed by professional judgement, which, where used, would be explained to give the rationale behind the values assigned. Significant effects, in the context of The Town and Country Planning (Environmental Impact Assessment) Regulations 2017, would be effects of moderate or greater significance.

Table 12.4 - Significance matrix

		Value/Sensitivity of Receptor				
		Very High	**High**	**Medium**	**Low**	**Negligible**
Magnitude	**Large**	Major	Major/Moderate	Major/ Moderate/ Minor	Moderate/ Minor	Minor/ Negligible
	Medium	Major/ Moderate	Major/Moderate	Moderate/ Minor	Minor/ Negligible	Negligible
	Small	Major/ Moderate	Moderate/Minor	Moderate/ Minor	Minor/ Negligible	Negligible
	Negligible	Minor/ Negligible	Minor/Negligible	Minor/ Negligible	Negligible	Negligible

Approach to defining significance in the PEIR

12.4.15 As set out in **Chapter 5 Approach to Preparing the PEIR** the approach taken to determining the significance of effect in this preliminary assessment is only to state whether effects are likely or unlikely to be significant, rather than assigning significance levels.

12.4.16 Following on from the identification of whether an effect is considered likely to be significant or not significant, confidence in the prediction is given a rating of high, moderate or low in line with the confidence level definitions presented in **Chapter 5 Approach to Preparing the PEIR**.

Preliminary Assessment Assumptions and Limitations

12.4.17 This assessment has been undertaken based on preliminary design information for the Proposed Overhead Line as presented in **Chapter 4 Description of the Project**. This information is likely to develop further in response to ongoing design, assessment and stakeholder feedback, and will be updated for the ES as the design evolves.

12.4.18 All conclusions and assessments are, by their nature, preliminary. All assessment work has applied, and continues to apply, a precautionary principle, in that where limited information is available (in terms of the proposals for the Project), a realistic worst-case scenario is assessed.

12.4.19 The key parameters and assumptions considered within this preliminary assessment include:

- Piling assumptions: Piling may be required at some pylon locations, depending on ground conditions. The assessment set out in this chapter assumes that piling is required at all pylon locations (as a reasonable worst-case scenario);

- Abstractions: It is assumed, based on available Project information, that no consumptive groundwater abstractions are required to facilitate construction of the Project, nor during operation (and maintenance) of the Project;
- Proactive groundwater lowering (through, for example, pre planned and installed groundwater abstraction wells) is not anticipated in areas outside of trenchless crossing locations.
- Trenchless crossings: The specific locations of potential trenchless crossings that are required for the diversion of existing third-party infrastructure crossed by the Proposed Overhead Line are not known at this stage of the design; however suitable assessment will be undertaken as part of the ES.

12.4.20 The key parameters and assumptions will be reviewed based on the final Project description and, where required, updated, or refined. The ES will present the final key parameters and assumptions used within that assessment, particularly drawing attention to any areas that may have evolved from those presented in this preliminary assessment.

Further Assessment within the ES

12.4.21 This assessment provides a preliminary assessment based on the development of the Project to date and the data currently obtained. The ES will present a further detailed assessment, assigning the value or sensitivity of the receptor and the magnitude of a potential change (impact) will be presented, and the resulting significance of effect determined.

12.4.1 As part of the EIA assessment process a hydrogeological risk assessment will be undertaken if any areas of trenchless crossing are identified during the evolution of the Project design. This will utilise a source-pathway-receptor linkage approach to assess the potential effects on groundwater which relate to the specific geological/hydrogeological settings between the Order Limits and identified groundwater abstractions and receptors. Assessment of the impacts on groundwater receptors will be undertaken based on the approach and methodology described in Environment Agency, Hydrogeological Impact Appraisal for dewatering abstractions guidance (Ref 12.35).

12.5 Baseline Conditions

12.5.1 This section describes the baseline geology and hydrogeology conditions for the Proposed Overhead Line.. The baseline geology and hydrogeology conditions for the Proposed Substations Works are set out in **Chapter 20 Substations and Associated Works**.

12.5.2 Baseline information is only presented below for the Route Sections where receptors have been identified within the study area that might be impacted in relation to the topics that have been scoped into the geology and hydrogeology assessment (see section 12.3)

12.5.3 Baseline conditions have been gathered from desk-based information and are presented with reference to the Route Section that they are located within. For more information on the Route Sections see **Chapter 4 Description of the Project**.

Geology

12.5.4 The details of the superficial and bedrock geology anticipated to be present beneath the study area is presented in **Appendix 12.1 Preliminary Contamination Risk Assessment** and shown on **Figure 12.1 Superficial Geology** and **Figure 12.2 Bedrock Geology**. A summary is presented in the paragraphs that follow,

12.5.5 Superficial deposits are present across parts of the study area, as described in **Appendix 12.1 Preliminary Contamination Risk Assessment,** however they are indicated to be variable.

12.5.6 Bedrock geology is indicated to predominantly comprise the Burnham Chalk Formation to the north-east and the Mercia Mudstone Group to the west and south. Additional information on these and other bedrock strata indicated to be present is contained within **Appendix 12.1 Preliminary Contamination Risk Assessment**.

Minerals

12.5.7 Potential impacts on minerals have been scoped out of the assessment. Further details on minerals are provided within **Appendix 12.2 Preliminary Qualitative Minerals Resource Assessment.**

Geo-conservation

12.5.8 Where geo-conservation receptors have been identified within the study area these are discussed under the relevant sections below and are presented on **Figure 12.3 Geologically designated sites**. The baseline information indicates that there are no geo-conservation receptors in Route Sections 1, 3, 5, 6, 8, 9, 10, or 11.

Route Section 2: Skidby to A63 Dual Carriageway

12.5.9 A review of the East Riding of Yorkshire Policy maps (Ref 12.46) indicates that the Proposed Overhead Line crosses a dismantled railway line in Little Weighton (chalk exposure) and Brantingham Dale Plantation (a dry valley landscape) which are designated as Local Geological Sites (LGS).

12.5.10 The review of the Natural England Site Search (Ref 12.42) indicates that Brantingham Dale Plantation is also a SSSI; however, this designation is not for geological reasons.

Route Section 4: River Ouse Crossing

12.5.11 A review of the Natural England Site Search (Ref 12.42) indicates that the Proposed Overhead Line crosses the Humber Estuary SSSI which has also been designated as a Geological Conservation Review site due to its geological importance. However, a review of the citation for this SSSI indicates that the geological parts of the designation (South Ferriby Cliffs and Spurn) are located approximately 15 km and 50 km southwest respectively from the study area, therefore this site is not considered further.

Route Section 7: M180 Motorway to Graizelound

12.5.12 A review of the North Lincolnshire Local Plan interactive map (Ref 12.47) indicates that the Proposed Overhead Line crosses the Melwood Park LGS.

Existing Contamination

12.5.13 The majority of the study area is indicated to have remained as undeveloped/agricultural land since the earliest available historical mapping (from the National Library of Scotland (Ref 12.45)) dated 1885. In these areas it is considered that there is a very low risk of a significant source of potential contamination.

12.5.14 However, there are discrete areas within the draft Order Limits and wider study area where either the historical land use or the current land use have been identified as potentially contaminative. Where these areas are identified, readily available information relating to the Potential Source of Contamination (PSC) has been gathered and an initial assessment have been undertaken to provide a classification score for their potential for generating contamination. This assessment is presented within **Appendix 12.1 Preliminary Contamination Risk Assessment**.

12.5.15 Based on the assessment presented in **Appendix 12.1 Preliminary Contamination Risk Assessment,** following the Tier 1 assessment, there were no sites assessed to have a moderate or above risk to sensitive receptors within the study area from existing contamination, which could result in the potential for significant effects. Therefore, there is no further baseline information presented below in relation to contamination.

Hydrogeology

Aquifer designation

12.5.16 A review of the aquifer designations provided on DEFRA's MAGIC map (Ref 12.43) indicates that the superficial deposits present within the 500 m study area are classified as follows:

- **Secondary A Aquifer** - Bielby Sand Member, Alluvium, Warp, Breighton Sand Formation. Sutton Sand Formation, Glaciofluvial deposits, Holme Pierrepont sand and gravel member;
- **Secondary Undifferentiated Aquifer** - Till (Devensian and Mid Pleistocene) and Head Deposits; and
- **Unproductive Strata** - Hemingbrough Glaciolacustrine Formation and Peat.

12.5.17 DEFRA's MAGIC map (Ref 12.43) indicates that the bedrock deposits present within the 500 m study area are classified as follows:

- **Principal Aquifer** - Burnham Chalk Formation, Welton Chalk Formation, Ferriby Chalk Formation, Hunstanton Formation, Brantingham Member, Upper Lincolnshire Limestone Member, Lower Lincolnshire Limestone Member;
- **Secondary A Aquifer** - Kellaways Sand Member, Thorncroft Sand Member, Frodingham Ironstone;
- **Secondary B Aquifer** - Mercia Mudstone, Scunthorpe Mudstone Formation;
- **Secondary Undifferentiated** - Clarborough Member, Charmouth Mudstone Formation, Penarth Group; and
- **Unproductive Strata** - Ancholme Group, Whitby Mudstone Formation.

12.5.18 Principal Aquifers are defined by the EA as rock layers that '*provide significant quantities of drinking water, and water for business needs. They may also support rivers, lakes and wetlands*' (Ref 12.48).

12.5.19 Secondary A Aquifers are described by the EA as "*permeable layers that can support local water supplies and may form an important source of base flow to rivers*" (Ref 12.48).

12.5.20 Secondary B Aquifers are described by the EA as '*mainly lower permeability layers that may store and yield limited amounts of groundwater through characteristics like thin cracks (called fissures) and openings or eroded layers*'.

12.5.21 The Secondary Undifferentiated Aquifer classification is applied by the EA '*where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type. These have only a minor value*' (Ref 12.48).

12.5.22 Unproductive Strata are described by the EA as '*largely unable to provide usable water supplies and are unlikely to have surface water and wetland ecosystems dependent on them*' (Ref 12.48).

Groundwater vulnerability

12.5.23 DEFRA's MAGIC map (Ref 12.43) indicates that the groundwater within the majority of the 500 m study area is classified as 'high' or 'medium-high' vulnerability. Within small discrete sections of the draft Order Limits the groundwater is classified as 'medium' or 'low', and these are coincidental with areas where clay rich, low permeability, superficial deposits are located overlying the bedrock deposits or where the bedrock is identified as being Unproductive Strata or a Secondary Undifferentiated Aquifer.

12.5.24 The EA define High vulnerability as '*Areas able to easily transmit pollution to groundwater. They are likely to be characterised by high leaching soils and the absence of low permeability superficial deposits*", and areas of Low vulnerability as "*Areas that provide the greatest protection to groundwater from pollution. They are likely to be characterised by low leaching soils and/or the presence of superficial deposits characterised by a low permeability*'. Medium vulnerability is described as intermediate between Low and High vulnerability (Ref 12.44).

Groundwater source protection zones

12.5.25 A groundwater source protection zone (SPZ) is a zone placed around a groundwater source, such as a well, borehole or spring, by the Environment Agency to protect a drinking water supply from pollution. Groundwater SPZ's are generally split into three zones showing the level of risk to a groundwater source from contamination.

12.5.26 A SPZ 1 is defined as the inner zone which is a 50-day travel time of a pollutant to the abstraction point. A SPZ 2 Outer Zone is defined as a 400-day travel time of a pollutant to an abstraction point. A SPZ 3 is defined as the total catchment, which is the area around an abstraction within which all the groundwater ends at the abstraction point (Ref 12.49).

12.5.27 DEFRA's MAGIC map (Ref 12.43) indicates that the majority of the study area is not within a groundwater Source Protection Zone (SPZ). However, the exception to this is a small part of the draft Order Limits and study area within Route Section 1: Creyke Beck to Skidby where the draft Order Limits crosses a SPZ 1 and associated SPZ 2 and SPZ 3 Route Section 2: Skidby to A63 Dual Carriageway which crosses SPZ2 and SPZ3.

12.5.28 The SPZ's crossed by the study area are shown on **Figure 12.4 Source Protection Zone**.

12.5.29 The DEFRA MAGIC map (Ref 12.43) also shows that the majority of study area are not located within a groundwater Drinking Water Safeguard Zone (DWSZ), with the exception of the same areas that are within the groundwater SPZ's, discussed above.

Groundwater abstractions

12.5.30 Information is currently in the process of being obtained from the relevant organisations for groundwater abstractions and private water supplies within the study area which will be assessed in due course and reported in the ES.

Future Baseline

12.5.31 Predicting future baseline requires projecting forward any trends in change and considering how they may affect the baseline conditions over time. The nature of future baseline is influenced by a combination of natural and human processes, including climate change.

12.5.1 As detailed in **Chapter 5 Approach to Preparing the PEIR**, a review has been undertaken to determine whether the existing baseline conditions might change between the time of undertaking the assessment and the future years in which the Project is planned to be constructed and become operational.

12.5.2 There are no foreseeable significant changes anticipated in relation to geology and hydrogeology either prior to, or during, the construction and operation (and maintenance) phases of the Project. It is assumed that any manufactured changes (i.e., new developments or extensions) would be appropriately permitted/controlled and operated in accordance with current legislation to prevent or limit adverse effects to ground conditions or controlled waters from contamination.

12.5.3 Climate change predictions for the UK indicate a trend of wetter winters, drier summers, higher average temperatures, and higher intensity rainfall events. These could have effects on soil erosion, groundwater levels, slope stability and indirectly (through groundwater level changes) in relation to the potential for mobilisation of contamination.

12.5.4 In the context of slope stability, soil erosion and groundwater levels, it is not considered these would have a notable impact on the significance of effects given the nature of the Project and the inherent engineering design. In relation to contamination, as any areas that may have a potential impact would be remediated or mitigated during design and construction of the Project, it is not considered that climate change would have an impact on the significance of effects for contamination.

12.5.5 The future baseline includes committed developments which are not yet present in the landscape but are expected to be constructed, and therefore should be assessed as part of the Future baseline in the ES. Committed developments that have considerable overlap with the draft Order Limits and therefore the potential to significantly affect the current baseline are detailed below. These are identified in **Chapter 21 Cumulative Effects,** at section 21.6.

12.5.6 Following the assessment undertaken of the cumulative developments, it was concluded that the nature of the developments are such that significant effects on geology and hydrogeology are not anticipated.

12.5.7 In addition, legislation and planning requires that for new development, risks to human health and controlled waters from potential contamination are appropriately mitigated. Therefore, cumulative adverse effects, in relation to geology and hydrogeology, are unlikely. Furthermore, each development will be bound by its own Code of Construction Practice (CoCP), and in turn a Construction Environmental Management Plan (CEMP) where applicable, and it is assumed each development will apply best practice construction methods so as to minimise impacts from contamination on ground conditions and groundwater.

12.6 Mitigation

12.6.1 As set out in **Chapter 5 Approach to Preparing the PEIR** mitigation measures fall into one of three categories: embedded measures; control and management measures; and additional mitigation measures. Those measures relevant to the assessment of geology and hydrogeology effects are set out below.

Embedded Mitigation Measures

12.6.2 Environmental appraisal has been an integral part of the Project design from the outset, which has meant that the Project has been able to avoid environmentally sensitive features as far as reasonably practicable.

12.6.3 National Grid has also embedded measures into the design of the Project to avoid or reduce significant effects that may otherwise be experienced during construction and operation (and maintenance) of the Project.

12.6.4 Embedded measures are those that are intrinsic to and built into the design of the Project, which have been presented in Table 4.2 in **Chapter 4 Description of the Project**. Measures of relevance to geology and hydrogeology include:

- Sensitive Routeing and Siting to develop the draft overhead line alignment, siting of substations and draft Order Limits.

Control and Management Measures

12.6.5 Control and management measures, comprising management activities and techniques, will be implemented during construction of the Project to limit effects through adherence to good site practices and achieving legal compliance.

12.6.6 An Outline Code of Construction Practice (CoCP) is provided in **Appendix 4.1 Draft Outline CoCP** in Volume 3. Measures contained in the Outline CoCP relevant to the control and management of impacts that could affect the geology and hydrogeology assessment are:

- GH01: Intrusive ground investigations and assessment will be undertaken prior to construction which will inform appropriate geotechnical design in relation to the site/structure specific ground conditions including, where appropriate, ground instability/adverse ground conditions/ground gas.
- GH02: Construction methods such as appropriate piling techniques (if required) to minimise the risk of mixing of aquifer bodies through the creation of new pathways will be applied. This includes the provision of a foundation works risk assessment undertaken by the Contractor, in areas where the use of piled foundations is proposed and at trenchless crossings. This would be undertaken once detailed

design has been undertaken and in accordance with Environment Agency guidance Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination (Ref 12.48).

- GH03: Use of appropriate occupational health and safety measures e.g., Personal Protective Equipment (PPE), and statutory health and safety compliance (e.g., compliance with the Confined Spaces Regulations 1997 in relation to ground gas from working in confined spaces/trenches) to minimise the risks associated with anticipated/unexpected contamination. Based on risk assessment informed by site specific information.
- GH04: Appropriate training of construction and maintenance workers in the handling and use of potentially hazardous substances and the associated risks.
- GH05: All use and storage of chemicals and fuels are to be undertaken in accordance with Environment Agency guidance and the Control of Pollution (Oil Storage) Regulations, 2001 (Ref 12.51). The use and storage of chemicals and fuels will also be controlled and monitored under the CoCP which will include, for example, procedures for good general construction site practices, environmental and waste management procedures, regular vehicle checks, use of spill kits, correct waste storage and disposal, use of oil-water separators as necessary (for example, for drainage from refuelling areas), collection of process water from the washout/cleaning of ready-mix concrete vehicles and equipment for treatment/disposal.
- GH06: The control of earthworks or materials movement (including any re-use of materials) under appropriate Environmental Permits, exemptions or CL:AIRE The definition of Waste: The DoWCoP (Ref 12.52).
- GH07: Any temporary dewatering activities during construction will be undertaken in accordance with Environment Agency guidance (including appropriate assessment undertaken as required by the guidance), and if required, an Abstraction Licence and Environmental Permit (for the discharge) and will be limited to the depth and time required to facilitate construction activities.
- GH08: A protocol for dealing with any unexpected contamination will be included within the CoCP.
- GH09: In any areas of trenchless crossings, a hydrogeological risk assessment will be undertaken to assess the specific risks to groundwater and groundwater receptors at those locations and identify any additional mitigation or remediation that may be required. The nature and scope of any mitigation or remediation will be agreed with the Environment Agency or other stakeholders, as appropriate.
- GH10: The provision of a drilling fluid breakout plan, where horizontal directional drilling is proposed, will be developed by the Contractor and included within the CoCP.
- GH11: Where specific sites have been identified in the study area with a moderate (or above) potential for generating contamination– these sites will initially be reviewed against the draft Order Limits. Where the draft Order Limits and proposed construction activities do not interact with these sites, no further assessment will be required. However, where there is potential for any interaction of the draft Order Limits or proposed construction activities with these sites, each site will be individually investigated and assessed to determine any mitigation measures or

remediation requirements required. The nature and scope of any mitigation or remediation will be agreed with the Environment Agency and LA (as appropriate).

12.6.7 For the purpose of assessing the effects of the Project, it has been assumed that best practice health and safety and environmental controls will be in place during construction, in accordance with standard good practice across the construction industry.

Additional Mitigation Measures

12.6.8 Additional mitigation comprises measures over and above any embedded and Control and Management Measure, to further reduce significant environmental effects.

12.6.9 The preliminary assessment reported in this PEIR has not identified any requirements for additional mitigation at this stage, over and above the embedded or control and management measures identified. This will continue to be reviewed as the assessment progresses and the preliminary design develops further Preliminary Assessment.

12.6.10 This section first identifies the potential effects that could occur as a result of the construction, operation and maintenance of the Proposed Overhead Line. The preliminary assessment is then presented for the relevant Route Sections of the Project as described in **Chapter 4 Description of the Project**. The preliminary assessment of the Proposed Substation Works is presented in **Chapter 20 Substations and Associated Works**.

12.6.11 The preliminary assessment takes into account the embedded, control and management and additional mitigation measures as set out in section 12.6.

Potential Effects

12.6.12 The potential for the Proposed Overhead Line to result in likely significant effects on geology and hydrogeology receptors was determined through the EIA Scoping process. This section lists those potential effects that have been scoped into the assessment within the Scoping Report (Ref 12.28), taking into account the comments received within the Scoping Opinion (Ref 12.27).

Construction

12.6.13 The potential effects that could result from the construction of the Proposed Overhead Line are:

- Potential for exposure to existing contamination and the mobilisation of existing contamination as a result of ground disturbance from construction activities including piling, on sites that are identified as being a moderate or above risk;
- Potential for effects on local geological designated sites from ground disturbance during construction.
- Potential effects on groundwater levels, quality and flows from dewatering activities to reduce groundwater levels at trenchless crossing locations. Connection of aquifer units creating potential pathways due to excavations at trenchless crossing locations.

Operation

12.6.14 Potential geology and hydrogeology effects from the operation of the Proposed Overhead Line have been scoped out.

Maintenance

12.6.15 Potential geology and hydrogeology effects associated with maintenance of the Proposed Overhead Line have been scoped out.

Geo-conservation

Route Section 2: Skidby to A63 Dual Carriageway

12.6.16 In the area of Little Weighton, physical disturbance within the site is not anticipated as infrastructure would be located outside of the construction site boundary, with the exception of a haul road which is not anticipated to require intrusive works except the removal of topsoil. Therefore, the magnitude of impact is considered to be negligible.

12.6.17 In the area where the draft Order Limits interact with Brantingham Dale Plantation, the works proposed are predominantly limited to reconductoring, utilising the existing road infrastructure for access. One new build pylon is required which is located on the boundary of the site where some groundworks may be required to ensure a safe working area which may include a small area on the valley side, however the works will remain within the draft Order Limits and therefore, the magnitude of impact is considered to be small.

12.6.18 Therefore, based on the LGS with a medium sensitivity, significant effects are considered unlikely. The confidence in this assessment is considered to be high.

Route Section 7: M180 Motorway to Graizelound

12.6.19 During the construction of the Project, there could by physical disturbance and therefore potential damage or loss to Melwood Park LGS. However, in the area where the draft Order Limits interact with Melwood Park physical disturbance within the designated site is not anticipated as infrastructure has been located outside of the LGS site boundary, with the exception of access tracks along the LGS site boundary. Therefore, the magnitude of impact is considered to be negligible and based on a medium receptor sensitivity, significant effects are considered to be unlikely. The confidence in this assessment is considered to be high.

Existing Contamination

12.6.20 The preliminary risk assessment has identified that there are no sites with a moderate or above risk rating, following the further assessment presented in **Appendix 12.1 Preliminary Contamination Risk Assessment**, in relation to existing contamination, and therefore it is considered that for groundwater receptors with a low to high sensitivity, and construction workers with a high sensitivity, the potential impacts are negligible and significant effects are considered to be unlikely and confidence in this assessment is considered to be high.

Hydrogeology

12.6.21 Dewatering during construction at trenchless crossings has the potential to affect groundwater due to the reduction in groundwater levels, and also affect groundwater quality and groundwater flows, which could have a potential impact on surrounding sensitive receptors, such as groundwater abstractions and lead to significant effects. The location of trenchless crossings and therefore the requirement for and location of potential dewatering as part of the Proposed Overhead Line has not currently been confirmed.

12.6.22 As part of the ES, once the requirement for and potential locations of any dewatering is known, a groundwater risk assessment will be undertaken to assess the potential impacts and effects on groundwater and identified groundwater receptors. The groundwater risk assessment will identify where additional hydrogeological risk assessment is likely to be required once detailed design is complete, to determine any mitigation that may be required. In addition, as per commitment GH07 temporary dewatering would be undertaken in accordance with Environment Agency guidance and if required the appropriate permits/licences would be obtained.

12.6.23 At trenchless crossing locations, and where piling is required, there is the potential for connection of aquifers that are currently separated by aquitards/aquicludes (a geological formation of low(er) permeability).

12.6.24 However, further groundwater risk assessment, and if required, localised hydrogeological risk assessment (in accordance with GH09) will be undertaken to identify any potential effects in relation to proposed construction methods and dewatering, and identify any additional mitigation required. In addition, commitment GH02 secures the requirement for provision of a FWRA which would be undertaken once the proposed foundation solutions and trenchless crossing technique is known. The FWRA would be undertaken in accordance with Environment Agency guidance and determine any mitigation required, such that significant effects are considered unlikely.

12.6.25 Therefore, based on the implementation of the mitigation measures mentioned above and the additional assessment required as part of the ES, the magnitude of impact is considered to be negligible and based on a low to very high receptor sensitivity, significant effects (in relation to dewatering and connection of aquifer units) are considered to be unlikely. The confidence in this assessment is considered to be high.

Summary of the Preliminary Assessment of the Proposed Overhead Line with the Proposed Substation Works

12.6.26 The preliminary assessment of the Proposed Substation Works is presented in **Chapter 20 Substations and Associated Works**.

12.6.27 Shared receptors with the Proposed Substation Woks at Birkhill Wood include potential effects on hydrogeology.

12.6.28 Shared receptors with the Proposed Substation Works at High Marnham include potential effects from existing contamination and on hydrogeology.

12.6.29 Taking account of the embedded measures set out in **Chapter 4 Description of the Project** and the control and management measures as set out in **Appendix 4.1 Draft Outline Code of Construction Practice** any potential effects from the Proposed Substation Works are not likely to be significant, and, when considered together are unlikely to change the preliminary significance that is presented in this Chapter.

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