

Outer Dowsing Offshore Wind Preliminary Environmental Information Report

Volume 1, Chapter 23: Onshore Geology and Ground Conditions

Date: June 2023

Outer Dowsing Document No: 6.1.23

Internal Reference: PP1-ODOW-DEV-CS-REP-0028

Rev: V1.0

Company:	Outer Dowsing Offshore Wind	Asset:	Whole Asset			
Project:	Whole Wind Farm	Sub Project/Package:	Whole Asset			
Document Title or Description:	Onshore Geology and Ground Conditions					
Document Number:	6.1.23	3 rd Party Doc No (if applicable):	N/A			
<i>Outer Dowsing Offshore Wind accepts no liability for the accuracy or completeness of the information in this document nor for any loss or damage arising from the use of such information.</i>						
Rev No.	Date	Status/Reason for Issue	Author	Checked by	Reviewed by	Approved by
V1.0	June 2023	Final	SLR	GoBe	Shepherd and Wedderburn	Outer Dowsing Offshore Wind

Table of Contents

23	Onshore Geology and Ground Conditions.....	10
23.1	Introduction.....	10
23.2	Statutory and Policy Context.....	11
	National Legislation	11
	National Planning Policy	11
	Regional and Local Planning Policy.....	12
	Guidance.....	13
23.3	Consultation	22
23.4	Baseline Environment	26
	Study Area	26
	Data Sources.....	26
	Existing Environment.....	27
	Agricultural Land Classification	28
	Future Baseline.....	95
23.5	Basis of Assessment	96
	Scope of the Assessment.....	96
	Impacts Scoped Out of Assessment	96
	Realistic Worst-Case Scenario	97
	Embedded Mitigation.....	101
23.6	Assessment Methodology.....	104
	Assessment Criteria and Assignment of Significance.....	104
	Assumptions and Limitations	108
23.7	Impact Assessment	109
	Construction	109
	Operations and Maintenance.....	114
	Decommissioning	115
23.8	Cumulative Impact Assessment	115
23.9	Inter-Relationships	116
23.10	Transboundary Effects.....	116
23.11	Conclusions.....	116

23.12	References	119
-------	------------------	-----

List of tables

Table 23.1:	Legislation and policy context.....	14
Table 23.2:	Summary of consultation relating to Geology and Ground Conditions	23
Table 23.3	Data Sources.....	26
Table 23.4:	LN1 ALC Grades.....	29
Table 23.5:	LN2 ALC Grades	34
Table 23.6:	Landfall to A52 – Hogsthorpe WM1 ALC Grades	39
Table 23.7:	A52 Hogsthorpe to Marsh Lane WM2 ALC Grades.....	55
Table 23.8:	Marsh Lane to A158 Skegness Road WM3 ALC Grades.....	58
Table 23.9:	A158 Skegness Road to Steeping River WM4 and WM5 ALC Grades.....	60
Table 23.10:	Steeping River to Ivy House Farm/Marsh Yard WM6 ALC Grades	63
Table 23.11:	Ivy House Farm/Marsh Yard to Staples Farm WM7 ALC Grades	66
Table 23.12:	Staples Farm to Crowhall Lane WM8 ALC Grades	68
Table 23.13:	Crowhall Lane to Church End Lane WM9 ALC Grades	70
Table 23.14:	Church End Lane to The Haven WM10 ALC Grades.....	73
Table 23.15:	The Haven to Marsh Road WM11 ALC Grades	75
Table 23.16:	Marsh Road to Fosdyke Bridge WM12 ALC Grades.....	77
Table 23.17:	Fosdyke to Weston Marsh Substation Search Area (North) WM13 ALC Grades	80
Table 23.18:	Fosdyke to Weston Marsh Substation Search Area (South) WM14 ALC Grades	82
Table 23.19:	Low Road to Steeping River A1 ALC Grades.....	84
Table 23.20:	Steeping River to Fodder Dike Bank A2 ALC Grades.....	87
Table 23.21:	Fodder Dike Bank to Broadgate A3 ALC Grades	89
Table 23.22:	Broadgate to Ings Drove A4 ALC Grades.....	91
Table 23.23:	Broadgate to Ings Drove A5 ALC Grades.....	94
Table 23.24:	Maximum design scenario for Geology and Ground Conditions for the Project alone	98
Table 23.25:	Embedded mitigation relating to geology and ground conditions.....	101
Table 23.26:	Impact magnitude definitions.....	105
Table 23.27:	Sensitivity/importance of the environment	106
Table 23.28:	Matrix to determine effect significance	108
Table 23.29	Summary of Residual Effects.....	117

List of Figures

Figure 23.1:	Landfall to Lincolnshire Node - Superficial Geology.....	31
Figure 23.2:	Landfall to Lincolnshire Node - Bedrock Geology.....	32
Figure 23.3:	Landfall to Lincolnshire Node - Historic Landfill Sites.....	38
Figure 23.4:	Landfall to Weston Marsh - Superficial Geology	42
Figure 23.5:	Landfall to Weston Marsh - Bedrock Geology.....	46
Figure 23.6:	Landfall to Weston Marsh - Historic Landfill Sites.....	51

Abbreviations

Acronym	Expanded name
ALC	Agricultural Land Classification
AOD	Above Ordnance Datum
AoS	Area of Search
BEIS	Department for Business, Energy and Industrial Strategy (now the Department for Energy Security and Net Zero (DESNZ))
BGS	British Geological Survey
BMV	Best and Most Versatile
CIRIA	Construction Industry Research and Information Association
CoCP	Code of Construction Practice
DCO	Development Consent Order
DECC	Department of Energy & Climate Change (now the Department for Energy Security and Net Zero (DESNZ))
DEFRA	Department for Environment, Food & Rural Affairs
DESNZ	Department for Energy Security and Net Zero, formerly Department of Business, Energy and Industrial Strategy (BEIS), which was previously Department of Energy & Climate Change (DECC)
EA	Environment Agency
ECC	Export Cable Corridor (offshore ECC or indicative onshore ECC)
EIA	Environmental Impact Assessment
EPA	Environmental Protection Act 1990
ES	Environmental Statement
ETG	Expert Topic Group
HDD	Horizontal Directional Drilling
IEMA	Institute of Environmental Management & Assessment
LCRM	Land Contamination Risk Management
LDP	Local Development Plan
LoGS	Local Geological Site
km	Kilometre
m	Metre
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs
MLP	Minerals Local Plan
MSA	Mineral Safeguarding Area
NPS	National Policy Statement
NPPF	National Planning Policy Framework
NSIP	Nationally Significant Infrastructure Project
ODOW	Outer Dowsing Offshore Wind Farm (The Project)
OnSS	Onshore Substation
OWF	Offshore Wind Farm
PCL	Potential Contaminant Linkages
PEIR	Preliminary Environmental Information Report

Acronym	Expanded name
PPEIRP	Pollution Prevention and Emergency Incident Response Plan
PPE	Personal protective equipment
SPZ	Source Protection Zone
SSS	Site Selection Study
SSSI	Site of Special Scientific Interest
TCC	Temporary Construction Compound
TJB	Transition Joint Bay
UXO	Unexploded Ordnance
WTG	Wind Turbine Generator

Terminology

Term	Definition
Array area	The area offshore within the PEIR Boundary within which the generating stations (including wind turbine generators (WTG) and inter array cables), offshore accommodation platforms, offshore transformer substations and associated cabling are positioned.
Baseline	The status of the environment at the time of assessment without the development in place.
Cumulative effects	The combined effect of the Project acting cumulatively with the effects of a number of different projects, on the same single receptor/resource.
Cumulative impact	Impacts that result from changes caused by other past, present or reasonably foreseeable actions together with the Project.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for a Nationally Significant Infrastructure Project (NSIP) from the Secretary of State (SoS) for Department for Energy Security and Net Zero (DESNZ).
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of an impact with the sensitivity of a receptor, in accordance with defined significance criteria.
Environmental Impact Assessment (EIA)	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the Environmental Impact Assessment (EIA) Regulations, including the publication of an Environmental Statement (ES).
EIA Directive	European Union 2011/92/EU of 13 December 2011 (as amended in 2014 by Directive 2014/52/EU)
EIA Regulations	Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.
Environmental Statement (ES)	The suite of documents that detail the processes and results of the Environmental Impact Assessment (EIA).

Term	Definition
Haul Road	The track within the onshore ECC which the construction traffic would use to facilitate construction.
Impact	An impact to the receiving environment is defined as any change to its baseline condition, either adverse or beneficial.
Indicative Working Width	The indicative working width within the Export Cable Corridor (ECC), required for the construction of the onshore cable route.
Intertidal	Area where the ocean meets the land between high and low tides.
Joint bays	A joint bay provides a secure environment for the assembly of cable joints as well as bonding and earthing leads. A joint bay is installed between each length of cable.
Landfall	The location at the land-sea interface where the offshore export cable will come ashore.
Maximum Design Scenario	The maximum design parameters of the combined project assets that result in the greatest potential for change in relation to each impact assessed.
Mitigation	Mitigation measures, or commitments, are commitments made by the Project to reduce and/or eliminate the potential for significant effects to arise as a result of the Project. Mitigation measures can be embedded (part of the project design) or secondarily added to reduce impacts in the case of potentially significant effects.
National Policy Statement (NPS)	A document setting out national policy against which proposals for Nationally Significant Infrastructure Projects (NSIPs) will be assessed and decided upon.
Non-statutory consultee	Organisations that the Applicant may be required to (under Section 42 of the 2008 Act) or may otherwise choose to engage during the pre-application phases (if, for example, there are planning policy reasons to do so) who are not designated in law but are likely to have an interest in a proposed development.
Outer Dowsing Offshore Wind (ODOW)	The Project
Onshore Export Cable Corridor (ECC)	The Onshore Export Cable Corridor (Onshore ECC) is the area within which the export cable running from the landfall to the onshore substation will be situated.
Onshore substation (OnSS)	The Project's onshore substation, containing electrical equipment to enable connection to the National Grid.
Onshore Infrastructure	The combined name for all onshore infrastructure associated with the Project from landfall to grid connection.
Preliminary Environmental Information Report (PEIR)	The PEIR is written in the style of a draft Environmental Statement (ES) and provides information to support and inform the statutory consultation process in the pre-application phase. Following that consultation, the PEIR documentation will be updated to produce the Project's ES that will accompany the application for the Development Consent Order (DCO).

Term	Definition
PEIR Boundary	The PEIR Boundary is outlined in Figure 3.1 of Volume 1, Chapter 3: Project Description and comprises the extent of the land and/or seabed for which the PEIR assessments are based upon.
Project design envelope	A description of the range of possible elements that make up the Project's design options under consideration, as set out in detail in the project description. This envelope is used to define the Project for Environmental Impact Assessment (EIA) purposes when the exact engineering parameters are not yet known. This is also often referred to as the "Rochdale Envelope" approach.
Receptor	A distinct part of the environment on which effects could occur and can be the subject of specific assessments. Examples of receptors include species (or groups) of animals or plants, people (often categorised further such as 'residential' or those using areas for amenity or recreation), watercourses etc.
Statutory consultee	Organisations that are required to be consulted by the Applicant, the Local Planning Authorities and/or The Inspectorate during the pre-application and/or examination phases, and who also have a statutory responsibility in some form that may be relevant to the Project and the DCO application. This includes those bodies and interests prescribed under Section 42 of the Planning Act 2008. Not all prescribed bodies and interests will be statutory consultees (see non-statutory consultee definition). Organisations
study area	Area(s) within which environmental impact may occur – to be defined on a receptor-by-receptor basis by the relevant technical specialist.
The Applicant	GT R4 Ltd. The Applicant making the application for a DCO. The Applicant is GT R4 Limited (a joint venture between Corio Generation, TotalEnergies and Gulf Energy Development (GULF)), trading as Outer Dowsing Offshore Wind. The project is being developed by Corio Generation (a wholly owned Green Investment Group portfolio company), TotalEnergies and GULF.
The Planning Inspectorate	The agency responsible for operating the planning process for Nationally Significant Infrastructure Projects (NSIPs).
The Project	Outer Dowsing Offshore Wind including proposed onshore and offshore infrastructure.
Transition Joint Bay (TJBs)	The offshore and onshore cable circuits are jointed on the landward side of the sea defences/beach in a Transition Joint Bay (TJB). The TJB is an underground chamber constructed of reinforced concrete which provides a secure and stable environment for the cable.
Transboundary impacts	Transboundary effects arise when impacts from the development within one European Economic Area (EEA) state affects the environment of another EEA state(s)
Trenchless technique	Trenchless technology is an underground construction method of installing, repairing and renewing underground pipes, ducts and cables using techniques which minimize or eliminate the need for

Term	Definition
	excavation. Trenchless technologies involve methods of new pipe installation with minimum surface and environmental disruptions. These techniques may include Horizontal Directional Drilling (HDD), thrust boring, auger boring, and pipe ramming, which allow ducts to be installed under an obstruction without breaking open the ground and digging a trench.

23 Onshore Geology and Ground Conditions

23.1 Introduction

- 23.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents the results to date of the Environmental Impact Assessment (EIA) process for the potential impacts of Outer Dowsing Offshore Wind (the Project) on Onshore Geology and Ground Conditions. Specifically, this chapter considers the potential impact of the Project from Mean High Water Springs (MHWS), along the Onshore Export Cable Corridor (ECC), and incorporating the Onshore substation (OnSS) during the construction, operation and maintenance, and decommissioning phases.
- 23.1.2 GTR4 Limited (trading as Outer Dowsing Offshore Wind) hereafter referred to as the 'Applicant', is proposing to develop the Project. The Project will be located approximately 54km from the Lincolnshire coastline in the southern North Sea. The Project will include both offshore and onshore infrastructure including an offshore generating station (windfarm), export cables to landfall, onshore cables, and connection to the electricity transmission network, and ancillary and associated development (see Volume 1, Chapter 3: Project Description for full details).
- 23.1.3 This Geology and Ground Conditions chapter will:
- Detail the existing baseline established from desk studies, dedicated surveys and consultation;
 - Outline the potential environmental effects on geology and ground conditions arising from the Project, based on the information gathered and the analysis and assessments undertaken to date;
 - Provide an assessment of the potential direct and indirect impacts of the Project, including the construction and operation and decommissioning phases, on geology and ground conditions;
 - Identify any assumptions and limitations encountered in compiling the environmental information; and
 - Highlight any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible environmental effects identified at the relevant stage in the PEIR process.
- 23.1.4 This chapter should be read alongside the following chapters:
- Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk;
 - Volume 1, Chapter 25: Land Use;
 - Document reference 8.1.3: Outline Soil Management Plan; and
 - Document reference 8.1.4: Outline Pollution Prevention and Emergency Incident Response Plan.

23.2 Statutory and Policy Context

- 23.2.1 This section identifies the legislation and policy that has informed the assessment of effects with respect to geology and ground conditions.
- 23.2.2 The Project will be developed in accordance with the following National legislation, National and Local Planning Policy and Strategy, and other relevant guidance.

National Legislation

- 23.2.3 The objectives of the directives discussed above that are relevant to this assessment are met through the following UK legislation, relevant to the protection of the ground environment:
- The Environmental Permitting (England and Wales) Regulations 2016;
 - The Environment Act 1995 sets out roles and responsibilities for the Environment Agency;
 - Construction (Design & Management) Regulations 2015 (CDM Regulations); and
 - Infrastructure Planning (Environmental Impact Assessment (EIA) Regulations 2017 set out the key stages in the assessment process, including review and monitoring.
- 23.2.4 Part 2A of the Environmental Protection Act 1990 (section 78A (2)) defines contaminated land as land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that:
- Significant harm is being caused or there is the significant possibility of such harm being caused; or
 - Significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused.
- 23.2.5 Part 2A requires all local authorities to identify contaminated land in its area and secure its remediation to a condition suitable for its use. A key element of the Part 2A regime is the Source-Pathway-Receptor contaminant linkage concept. Each element is defined as follows:
- The source is the contamination in, on or under the land;
 - The pathway is the route by which the contaminated land reaches the receptor; and
 - The receptor is defined as living organisms, ecological systems or property which may be harmed.
- 23.2.6 Without the clear identification of all three elements of the contaminant linkage, land cannot be identified as contaminated land under the regime.

National Planning Policy

- 23.2.7 The National Policy Statements (NPS) are a series of principal decision-making documents to appropriately assess Nationally Significant Infrastructure Projects (NSIP). As such, this assessment has made explicit reference to the relevant NPS requirements. Those relevant to the proposed Project are:

- Overarching NPS for Energy (EN-1, (DECC 2011a)); NPS for Renewable Energy Infrastructure (EN-3 (DECC, 2011b)); and
- 23.2.8 NPS for Electricity Networks Infrastructure (EN-5 (DECC 2011c)). The NPS sets out the need for, and Government’s policies to deliver, development of NSIPs in England. The NPS sets out policy in relation to geology and soils for the following:
 - Pollution control and other environmental protection regimes;
 - Biodiversity and ecological conservation which includes geological conservation;
 - Land stability; and
 - Land use including open space, green infrastructure and Green Belt pertaining to Agricultural Land Classification (ALC), soil quality and consideration of the risk posed by land contamination and how it is proposed to address this.
- 23.2.9 The NPSs provide the main policy tests in relation to the Project. The NPSs are currently being revised and draft versions were published for consultation in 2023. In addition to the current NPS, the draft NPSs have therefore also been reviewed in Table 23.1 to determine the emerging expectations and changes from previous iterations of the NPSs. This includes the Draft Overarching NPS EN-1 (DESNZ, 2023a), Draft NPS EN-3 (DESNZ, 2023b) and Draft NPS EN-5 (DESNZ, 2023c). Draft policies are included in the table where they differ from the extant policy. The National Planning Policy Framework (NPPF) prepared by the Department for Communities and Local Government was published in March 2012 and revised in July 2021, sets out the Government’s planning policies for England and how these are expected to be applied, along with the National Planning Practice Guidance (PPG) which expands on policies contained in the NPPF.
- 23.2.10 Section 15 of the NPPF sets out the requirements for conserving and enhancing the natural environment. Applicants should seek to recognise benefits from natural capital and ecosystem services including the economic value and other benefits of best and most versatile agricultural land.

Regional and Local Planning Policy

- 23.2.11 The Project is located within Lincolnshire County Council. The Lincolnshire Minerals and Waste Local Plan documents and policies have been reviewed as part of this assessment. Policy M11 of the Core Strategy and Development Policies (adopted June 2016) sets out Mineral Safeguarding Areas and the need for safeguarding of mineral resources within the county.
- 23.2.12 The Project crosses several Local Planning Authorities (LPA), East Lindsey, Boston, and South Holland Districts. The core strategies and local plans within the districts set out the spatial vision for the district and set out objectives and policies to achieve that vision. The following policies are of relevance to this chapter:
 - East Lindsey District Council Local Plan – Core Strategy (2018); and
 - Policy SP24 – Biodiversity and Geodiversity.
 - South East Lincolnshire Local Plan 2011 to 2036 (2019) covering Boston Borough Council and South Holland District Council:

- Policy 2 – Development Management;
- Policy 3 – Design of New Development;
- Policy 28 – The Natural Environment; and
- Policy 30 – Pollution.

Guidance

23.2.13 The Land Contamination Risk Management (LCRM)' guidance (Environment Agency, 2021) is a detailed technical framework for investigating and dealing with land affected by contamination.

23.2.14 The following additional guidance documents relevant to geology and ground conditions have been considered when undertaking this assessment:

- Contaminated Land Statutory Guidance 2012 (ref: PB13735) is intended to explain how Local Authorities should implement the regime as detailed by EPA 1990, including how they should go about deciding whether land is contaminated land in the legal sense of the term;
- Construction Industry Research and Information Association (CIRIA) C552 (Contaminated Land Risk Assessment. A guide to good practice) examines the risk assessment of contaminated land and explains the key elements of risk assessment practices and procedures;
- Environmental impact assessment guidance produced by CIRIA, Institute of Environmental Management and Assessment (IEMA);
- Design Manual for Roads and Bridges (DMRB), (2020) LA104 Environmental assessment and monitoring;
- DMRB LA 109 Geology and Soils (2019), which provides a framework for assessing and managing the effects associated with geology and soils;
- Department for Environment, Food & Rural Affairs (DEFRA) Construction Code of Practice for the Sustainable Use of Soil on Construction Sites (2009);
- IEMA Guide: A New Perspective on Land and Soil in Environmental Impact Assessment (2022);
- Ministry of Agriculture, Fisheries and Food, Agricultural land classification of England and Wales - revised guidelines and criteria for grading the quality of agricultural land (1988);
- Institute of Quarrying, Good Practice Guide for Handling Soils in Mineral Workings (2021); and
- Greater Lincolnshire Nature Partnerships Geodiversity Strategy 2022-26 (2021), which aims to promote action to conserve and enhance the diverse geological heritage of Greater Lincolnshire whilst promoting and managing the sustainable use of its geodiversity resources. A key part of the LGAP is the survey and designation of Local Geological Sites.

23.2.15 The relevant legislation and planning policy for offshore renewable energy Nationally Significant Infrastructure Projects (NSIPs), specifically in relation to Geology and Ground Conditions is outlined in Table 23.1 below.

Table 23.1: Legislation and policy context

Legislation/policy	Key provisions	Section where legislation or policy addressed
Environmental Protection Act (EPA) (1990). Part 2A - Contaminated Land Statutory Guidance	The legislation should manage the identification of contamination sources, pathways and receptors which are “likely” to represent an “unacceptable” risk either to human health or the surrounding environment; The legislation in relation to contaminated land thus enables central government to protect and improve environmental quality of historical contamination and in pursuing policies to re-use and redevelop sites ensures developers and local authorities are aware of potential contamination issues.	The identification of potential contamination is presented in Section 23.4. The PEIR boundary has been selected to avoid sites with known contamination, such as landfills and industrial land use areas.
Land Contamination Risk Management Guidance	Makes provision for the identification and remediation of contaminated land under Part 2A of the Environmental Protection Act 1990.	The identification of potential contamination is presented in Section 23.4.
The Overarching National Policy Statement for Energy (EN-1)	Paragraph 5.4.3: ‘Where the development is subject to EIA the applicant should ensure that the ES clearly sets out any effects on internationally, nationally, and locally designated sites of ... geological conservation importance; The Draft Overarching National Policy Statement for Energy (EN-1) (Department for Energy Security & Net Zero, DESNZ 2023) Paragraph 5.4.19: ‘The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests.’	The effects of onshore infrastructure associated with the Project on designated sites of geological conservation importance are considered in Section 23.7.
	Paragraph 5.3.4: ‘The applicant should show how the project has taken advantage of opportunities to	The Project has avoided geological conservation interests where possible. The

Legislation/policy	Key provisions	Section where legislation or policy addressed
	<p>conserve and enhance biodiversity and geological conservation interests.’</p> <p>The Draft Overarching National Policy Statement for Energy (EN-1) (DESNZ, 2023) Paragraph 5.4.21 expands on this further by referencing Biodiversity Net Gain and how the applicant should consider biodiversity enhancements which can lead to wider environmental gains.</p>	<p>effects of onshore infrastructure associated with the Project on designated sites of geological conservation importance are considered in Section 23.7.</p>
	<p>Paragraph 5.3.7: ‘As a general principle, and subject to the specific policies below, development should at the very least aim to avoid significant harm to ... 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.’</p> <p>The Draft Overarching National Policy Statement for Energy (EN-1) (DESNZ, 2023) Paragraph 5.4.42 ‘As a general principle, and subject to the specific policies below, development should, in line with the mitigation hierarchy, aim to avoid significant harm to biodiversity and geological conservation interests, including through consideration of reasonable alternatives (as set out in Section 4.2 above). Where significant harm cannot be avoided, impacts should be mitigated and as a last resort, appropriate compensation measures should be sought.’</p>	<p>The effects of onshore infrastructure associated with the Project on designated sites of geological conservation importance are considered in Section 23.7.</p>
	<p>Paragraph 5.10.8 ‘Applicants should seek to minimise impacts on the best and most versatile agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification)</p>	<p>The evolution of the design is set out Volume 1, Chapter 4: Site Selection and Alternatives and Volume 1, Chapter 3: Project Description.</p>

Legislation/policy	Key provisions	Section where legislation or policy addressed
	<p>and preferably use land in areas of poorer quality (grades 3b, 4 and 5) except where this would be inconsistent with other sustainability considerations. Applicants should also identify any effects and seek to minimise impacts on soil quality taking into account any mitigation measures proposed. For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination.'</p> <p>The Draft Overarching National Policy Statement for Energy (EN-1) (DESNZ, 2023). Paragraph 5.10.8 in the 2011 NPS EN-1 has been expanded and separated into a number of paragraphs set out below: Paragraph 5.11.12 'Applicants should seek to minimise impacts on the best and most versatile agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification) and preferably use land in areas of poorer quality (grades 3b, 4 and 5).'</p> <p>5.11.13 'Applicants should also identify any effects and seek to minimise impacts on soil health and protect and improve soil quality taking into account any mitigation measures proposed.'</p> <p>5.11.14 'Applicants are encouraged to develop and implement a Soil Management Plan which could help minimise potential land contamination. The sustainable reuse of soils needs to be carefully considered in line with good practice guidance where large quantities of soils are surplus to requirements or are affected by contamination.'</p>	<p>The effects of onshore infrastructure associated with the Project on best and most versatile agricultural land is considered within Volume 1, Chapter 25: Land Use.</p> <p>Although the onshore infrastructure does not utilize previously developed land, an assessment of the potential for impacts to occur from contamination is provided in Section 23.7.</p>

Legislation/policy	Key provisions	Section where legislation or policy addressed
	<p>5.11.15 'Developments should contribute to and enhance the natural and local environment by preventing new and existing developments 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'.</p> <p>5.11.16 '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.'</p> <p>5.11.17 'Applicants 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.'</p> <p>5.11.18 '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. It is important to do this as early as possible as part of engagement with the relevant bodies before the official pre-application stage.'</p>	
	<p>Paragraph, 5.10.9 'Applicants should safeguard any mineral resources on the proposed site, taking into account the long-term potential of the land use after any future decommissioning has taken place.'</p>	<p>The identification of potential mineral resources is presented in Section 23.4.</p>
<p>National Statement (DECC, 2011)</p>	<p>Policy EN-5</p> <p>Paragraph 2.8.9 25 sets out the considerations of the IPC when granting development consent of underground cables in favour of overhead alternatives. In relation to</p>	<p>The evolution of the design is set out Volume 1, Chapter 4: Site Selection and Alternatives and Volume 1, Chapter 3: Project Description.</p>

Legislation/policy	Key provisions	Section where legislation or policy addressed
	<p>geology and soils the following bullet point applies:</p> <ul style="list-style-type: none"> ▪ ‘the environmental and archaeological consequences (undergrounding a 400kV line may mean disturbing a swathe of ground up to 40 metres across, which can disturb sensitive habitats, have an impact on soils and geology, and damage heritage assets, in many cases more than an overhead line would).’ <p>Draft National Policy Statement EN-5 (DESNZ, 2023) paragraph 2.9.25 sets out the considerations of the Secretary of State when granting development consent of underground cables in favour of overhead alternatives. In relation to geology and soils the following bullet points apply:</p> <ul style="list-style-type: none"> ▪ ‘The potentially very disruptive effects of undergrounding on local communities, habitats, archaeological and heritage sites, soil, geology, and, for a substantial time after construction, landscape and visual amenity. (Undergrounding an overhead line will mean digging a trench along the length of the route, and so such works will often be disruptive – albeit temporarily – to the receptors listed above than would an overhead line of equivalent rating);’ and ▪ ‘The applicant’s commitment, as set out in their ES, to mitigate the potential detrimental effects of undergrounding works on any relevant agricultural land and soils, particularly regarding Best and Most Versatile land. Such a 	<p>The effects of onshore infrastructure associated with the Project on geology and ground conditions are considered in Section 23.7.</p> <p>The effects of onshore infrastructure associated with the Project on best and most versatile agricultural land is considered within Volume 1, Chapter 25: Land Use.</p>

Legislation/policy	Key provisions	Section where legislation or policy addressed
	<p>commitment must guarantee appropriate handling of soil, backfilling, and return of the land to the baseline Agricultural Land Classification (ALC), thus ensuring no loss or degradation of agricultural land. Such a commitment should be based on soil and ALC surveys in line with the 1988 ALC criteria and due consideration of the Defra construction Code.’</p>	
<p>National Planning Policy Framework</p>	<p>Para 174. “Planning policies and decisions should contribute to and enhance the natural and local environment by: a) 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); b) recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland; c) maintaining the character of the undeveloped coast, while improving public access to it where appropriate; d) minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures; e) 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</p>	<p>The identification of designated sites of geological conservation, and potential contamination is presented in Section 23.4. The effects of onshore infrastructure associated with the Project on designated geological sites and land contamination are considered in Section 23.7. The effects of onshore infrastructure associated with the Project on best and most versatile agricultural land is considered within Volume 1, Chapter 25: Land Use.</p>

Legislation/policy	Key provisions	Section where legislation or policy addressed
	possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.	
	Para 183, 'Planning policies and decisions should ensure that: a) 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)'	The identification of potential contamination is presented in Section 23.4. The effects of onshore infrastructure associated with the Project on land contamination are considered in Section 23.7.
	Para 210 Planning Policies should: 'c) safeguard mineral resources by defining Mineral Safeguarding Areas (MSA) and Mineral Consultation Areas; and adopt appropriate policies so that known locations of specific minerals resources of local and national importance are not sterilised by non-mineral development where this should be avoided (whilst not creating a presumption that the resources defined will be worked); d) set out policies to encourage the prior extraction of minerals, where practical and environmentally feasible, if it is necessary for non-mineral development to take place;'	The Project does not overlie an MSA. The identification of the baseline is presented in Section 23.4.
Lincolnshire Minerals and Waste Local Plan - Core Strategy and Development Policies (adopted June 2016)	Policy M11 Mineral Safeguarding Areas set out areas where potential mineral resources are considered to be of current or future economic importance that should be protected from permeant sterilisation by non-minerals developments. The policy	The Project does not overlie an MSA. The identification of the baseline is presented in Section 23.4.

Legislation/policy	Key provisions	Section where legislation or policy addressed
	requires that 'Applications for non-minerals development in a minerals safeguarding area must be accompanied by a Minerals Assessment.'	
East Lindsey District Council Local Plan - Core Strategy (2018)	Policy SP24 'Development proposals should seek to protect and enhance the biodiversity and geodiversity value of land and buildings and minimise fragmentation and maximise opportunities for connection between natural habitats. The Council will protect sites designated internationally, nationally or locally for their biodiversity and geodiversity importance, ... Development, which could adversely affect such a site, will only be permitted in exceptional circumstances...'	The effects of onshore infrastructure associated with the Project on designated sites of geological conservation importance are considered in Section 23.7.
South East Lincolnshire Local Plan 2011 to 2036 (2019)	Policy 2. 'Proposals requiring planning permission for development will be permitted provided that sustainable development considerations are met, specifically in relation to 1. ... 3. maximising the use of sustainable materials and resources; ...impact on the potential loss of sand and gravel mineral resources.'	The identification of potential mineral resources is presented in Section 23.4.
	Policy 3. 'Development proposals will demonstrate how the following issues, where they are relevant to the proposal, will be secured: ... 13. The use of locally sourced building materials, minimising the use of water and minimising land take, to protect best and most versatile soils;'	The effects of onshore infrastructure associated with the Project on land is considered within Section 23.7. Best and most versatile agricultural land is considered within Volume 1, Chapter 25: Land Use.
	Policy 28. '3. iv. conserving or enhancing biodiversity or geodiversity conservation features that will provide new habitat and help wildlife to adapt to climate change, and if the development is within a Nature Improvement Area (NIA), contributing to the aims and objectives of the NIA.'	The effects of onshore infrastructure associated with the Project on designated sites of geological conservation importance are considered in Section 23.7.

Legislation/policy	Key provisions	Section where legislation or policy addressed
	Policy 30. 'Development proposals will not be permitted where, taking account of any proposed mitigation measures, they would lead to unacceptable adverse impacts upon: ...3. the natural...environment 7. land quality or condition.'	The effects of onshore infrastructure associated with the Project on natural environment and land quality are considered in Section 23.7.

23.3 Consultation

- 23.3.1 Consultation is a key part of the Development Consent Order (DCO) application process. Consultation regarding geology and ground conditions has been conducted through the Evidence Plan Process (EPP) Expert Topic Group (ETG) meetings and the EIA scoping process (ODOW, 2022). An overview of the Project consultation process is presented within Volume 1, Chapter 6: Consultation.
- 23.3.2 A summary of the key issues raised during consultation to date, specific to geology and ground conditions, is outlined in Table 23.2 below, together with how these issues have been considered in the production of this PEIR.

Table 23.2: Summary of consultation relating to Geology and Ground Conditions

Date and consultation phase/type	Comments	Section where comment addressed
Scoping Opinion (the Inspectorate, 9 September 2022) Comment ID: 3.16.1, Table 8.4.7	Operational impacts on geology/ground conditions and associated longer term risks to human and environmental receptors – O&M: The ES should include an assessment of operational impacts on geology/ground conditions and associated longer term risks to human and environmental receptors, where likely significant effects could occur.	Significant ground disturbance is considered unlikely during the operation phase. Contractors appointed to carry out repair and/or maintenance activities using existing access infrastructure. This is addressed within Section 23.7.
Scoping Opinion (the Inspectorate, 9 September 2022) Comment ID: 3.16.2, Table 8.4.7	Loss of agricultural land from operation of underground cables – O&M: The ES should include consideration of such effects during construction. Where this has been appropriately considered and mitigated (where applicable), the Inspectorate agrees that long-term effects on agricultural land can be scoped out of the assessment. Although see also point 3.16.9below.	The onshore export cable corridor (onshore ECC) does, indeed, route through areas of predominantly agricultural land. Whilst there is predicted to be a temporary impact upon agricultural land during the construction phase, the reinstatement of land above the buried cable will allow agricultural cultivation to re-commence once the cable has been installed. This is further addressed within Section 23.7.
Scoping Opinion (the Inspectorate, 9 September 2022) Comment ID: 3.16.3, Table 8.4.7	Routine maintenance effects on sterilisation of minerals and loss of agricultural land – O&M: Given the small-scale of likely O&M activities, the Inspectorate agrees that this matter can be scoped out of the assessment as significant effects are unlikely to occur.	This is noted.
Scoping Opinion (the Inspectorate, 9 September 2022) Comment ID: 3.16.4, Paragraph 8.4.43	Transboundary effects on geology, ground conditions and land quality: The Inspectorate agrees that given the localised nature of the Proposed Development, significant transboundary effects are unlikely to occur and can be scoped out of the assessment.	This is noted.

Date and consultation phase/type	Comments	Section where comment addressed
Scoping Opinion (the Inspectorate, 9 September 2022) Comment ID: 3.16.5, Table 8.4.1	Local geological sites: The ES should assess effects on local geological sites, where significant effects are likely to occur.	Local Geological Sites are identified within Section 23.4, and the effects of the Project addressed within Section 23.7.
Scoping Opinion (the Inspectorate, 9 September 2022) Comment ID: 3.16.6, Paragraph 8.4.3	Reference to other aspect chapters and assessment: The geology, ground conditions and land quality assessment should also refer to the Land Use aspect chapter (for information on soil and agricultural land quality) and Onshore Ecology (for information in relation to Sites of Special Scientific Interest (SSSI) that have both ecological and geological interest features) to ensure there is complete consideration of potential effects on receptors.	Where relevant this chapter refers to the Land Use, and Onshore Ecology Chapter. The baseline data is identified within Section 23.4, and the effects of the Project addressed within Section 23.7.
Scoping Opinion (the Inspectorate, 9 September 2022) Comment ID: 3.16.7, Paragraphs 8.4.25 to 8.4.34	Assessment methodology: The ES should explain what aspect-specific criteria are used to define receptor value/sensitivity and magnitude of change for the geology, ground conditions and land quality assessment.	The assessment methodology is described within Section 23.6.
Scoping Opinion (the Inspectorate, 9 September 2022) Comment ID: 3.16.8, Paragraph 8.6.12	Guidance documents: The Inspectorate also suggests consideration of the Institute of Environmental Management and Assessment (IEMA) Guidance – Land and Soil in EIA (2022).	This guidance has been considered within this assessment.
Scoping Opinion (the Inspectorate, 9 September 2022) Comment ID: 3.16.9	Effects on agricultural land quality and soil conditions: The ES should ensure it is possible to easily locate information in relation to significant effects and to ensure that effects are	Where necessary this chapter refers to the Land Use chapter. The identification and assessment of agricultural production is addressed Volume 1, Chapter 25: Land Use.

Date and consultation phase/type	Comments	Section where comment addressed
	not under-represented, or indeed unnecessarily duplicated, as a result of inclusion in two aspect chapters.	
Expert Topic Group (ETG) Meeting (online) 12 th October 2022	Scoping opinion comments discussed. Methodology and baseline study area and next steps set out. No comments from stakeholders.	The assessment methodology is described within Section 23.6.
ETG Meeting (online) 26 th January 2023	Provided an update on the scope of assessment, study area and key receptors and embedded mitigation set out. Proposed that the risks posed to sensitive surface water and groundwater resources will be assessed as part of the Hydrology Chapter. No comments from stakeholders.	The assessment methodology is described within Section 23.6. The impacts to be assessed within this chapter are set out within Section 23.5. The baseline data and receptors are described within Section 23.4. Embedded mitigation is set out within Table 23.25.
ETG Meeting (online) 16 th March 2023	Agreement log discussed. No areas of disagreement and no objections raised during the meeting or minutes.	n/a

23.3.3 As identified in Volume 1, Chapter 4: Site Selection and Alternatives and Volume 1, Chapter 3: Project Description, the Project design envelope has been refined and will be refined further prior to DCO submission. This process is reliant on stakeholder consultation feedback.

23.4 Baseline Environment

Study Area

- 23.4.1 The study area for the baseline data collection for geology and ground conditions is defined by the PEIR boundary as shown on Figure 23.1 to Figure 23.6 and comprises the onshore elements of the Project from MHWS to the National Grid connection point, plus a buffer of 1km buffer around the OnSS locations, and a 250m buffer around the landfall and the onshore ECC (including haul roads and temporary construction areas).
- 23.4.2 The 250m buffer is from relatively shallow excavations for the onshore ECC, with no disturbance outside the ECC and reinstatement of current land use following construction. The wider 1km buffer for the OnSS reflects the permanent nature of this development.
- 23.4.3 The study area and available data have been discussed and agreed with stakeholders. It is considered that beyond the study area there is geographic separation between development and any potential receptors. This results in the absence of an effect to geology and ground conditions.

Data Sources

- 23.4.4 Baseline data with respect to geology and ground conditions has been collected from publicly available information and open-source data from a range of sources.
- 23.4.5 A desk-based review of soil and geological maps, Ordnance Survey (OS) mapping and Digital Terrain Model (DTM) mapping has been undertaken.
- 23.4.6 Third party data from bodies such as the Environment Agency (EA) and DEFRA's MAGIC website has been used to characterise the geological features and identify any geological designated areas. The data review those sources shown in Table 23.3.

Table 23.3 Data Sources

Data	Reference/Source
Various datasets	Find open data - data.gov.uk Envirocheck Report (Digital GIS layers)
Soil Type and Character	UK Soil Observatory; http://www.ukso.org/static-maps/soils-of-england-and-wales.html and Cranfield Soil and Agrifood Institute Soilscales map viewer
Geology	British Geological Survey (BGS) Onshore Geindex; https://www.bgs.ac.uk/map-viewers/geindex-onshore/
Groundwater Source Protection Zones (SPZ)	
Mines and quarries	

Data	Reference/Source
Coal Authority Map	The Coal Authority website interactive mapping https://mapapps2.bgs.ac.uk/coalauthority/home.html
Historic Active Landfills and Waste Management Sites	Environment Agency and Lincolnshire County Council & Groundsure Enviro Data Viewer https://www.groundsure.io/#
Statutory and Non-Statutory Environmental Designations	DEFRA Multi-Agency Geographic Information for the Countryside (MAGIC) https://magic.defra.gov.uk/magicmap.aspx
Locally Important Geological Sites	Greater Lincolnshire Nature Partnership ecology records relating to Local Geological Sites (LoGs) and Regionally Important Geological/Geomorphological Sites (RIGS).
Radon	Public Health England: UK Radon Map
Unexploded Ordnance (UXO)	Zetica UXO: Risk Maps
Land use	Google Earth aerial photography
Historical Maps	Envirocheck Data

23.4.7 A site walkover survey of the Study Area was undertaken in March 2023. This survey was undertaken by SLR Consulting Ltd, access to the proposed OnSS locations and ECC was obtained on foot by Public Rights of Way and local roads.

Existing Environment

23.4.8 This section describes the present conditions which constitute the existing baseline environment for geology and soils within the onshore study area.

23.4.9 Different options are being assessed for the onshore ECC; landfall to Lincolnshire Node, landfall to Weston Marsh, via south of the A52 and landfall to Weston Marsh, via north of the A52. A description of the proposed works relevant to each of the ECCs is detailed in Volume 1, Chapter 3: Project Description.

23.4.10 The onshore study area for geology and ground conditions is defined by the PEIR Boundary; this has been split into a number of segments which describe the significant local features along the ECCs.

23.4.11 The study area segments from landfall to Lincolnshire Node are listed below:

- LN1 - Landfall to A52 - Mumby; and
- LN2 - A52 - Mumby to Lincolnshire Node.

23.4.12 The study area segments from landfall to Weston Marsh, via south of the A52, are listed below:

- WM1 - Landfall to A52 - Hogsthorpe;
- WM2 - A52 - Hogsthorpe to Marsh Lane;
- WM3 - Marsh Lane to A158 - Skegness Road;
- WM4 - A158 - Skegness Road to Low Road;
- WM5 - Low Road to Steeping River;

- WM6 - Steeping River to Ivy House Farm/Marsh Yard;
- WM7 - Ivy House Farm/Marsh Yard to Staples Farm;
- WM8 - Staples Farm to Crowhall Lane;
- WM9 - Crowhall Lane to Church End Lane;
- WM10 - Church End Lane to The Haven;
- WM11 - The Haven to Marsh Road;
- WM12 - Marsh Road to Fosdyke Bridge;
- WM13 - Fosdyke Bridge to Weston Marsh North OnSS; and
- WM14 - Fosdyke Bridge to Weston Marsh South OnSS.

23.4.13 The study area segments from landfall to Weston Marsh, via north of the A52, are listed below:

- A1 - Low Road to Steeping River;
- A2 - Steeping River to Fodder Dike Bank/Fen Bank;
- A3 - Fodder Dike Bank/Fen Bank to Broadgate;
- A4 - Broadgate to Ings Drove; and
- A5 - Ings Drove to Church End Lane.

Agricultural Land Classification

23.4.14 The majority of the onshore ECC crosses agricultural land. The ECCs have been assessed using Agricultural Land Classification (ALC) which provides a method for assessing the quality of farmland to enable informed choices to be made about its future use within the planning system. It is the only approved system for grading agricultural land quality in England and Wales.

23.4.15 The Natural England Provisional ALC maps have been used to classify the soils across the Study Area. The majority of the ECCs cross agricultural land, and the land has been categorised within this section into one of the following grades:

- Grade 1: excellent quality agricultural land;
- Grade 2: good quality agricultural land;
- Grade 3a: good to moderate quality agricultural land;
- Grade 3b: moderate quality agricultural land;
- Grade 4: poor quality agricultural land;
- Grade 5: very poor-quality agricultural land; and
- Urban.

Lincolnshire Node

LN1 - Landfall to A52 – Mumby

Designated Sites

- 23.4.16 Within the study area for LN1, the Chapel Point – Wolla Bank SSSI and Geological Conservation Review site (GCR) is present. This SSSI and GCR is a 1.5km length of coastline comprising the foreshore section of intertidal deposits stretching from the Coastguard lookout at Chapel Point to the car park at Wolla Bank. The site covers an area of 39.57ha and is located at British National Grid reference TF 560 471. The SSSI lies within the southernmost part of the landfall section of the PEIR boundary.
- 23.4.17 The site is notified for intertidal deposits which represent the global sea level rise during the Holocene (flandrian) Stage. These deposits comprise interbedded peats, saltmarsh deposits and shelly clays, incorporated within these deposits are the flora and fauna present at the time of deposition. These deposits are noted to be of national importance for the representation of the Holocene stratigraphy and environment.
- 23.4.18 To the north of the Chapel Point Wolla Bank site situated along the beach and coast for approximately 9.4km is the Lincolnshire Coast Submerged Forest non-statutory selected Local Geological Site (LGS). This LGS is located within the landfall section of the PEIR boundary.
- 23.4.19 A document prepared by the University of York (Derret and Selby, 2020) described the extent and condition of the ‘*Lincolnshire Coast Submerged Landscape*’. It concludes that the submerged landscape has reduced in extent and is rarely exposed compared to what was once visible for many miles. The deposits are subject to natural shore erosion and are buried below the annual beach replenishment scheme imported sand coverage. It does however note that an in-situ section on the foreshore between Anderby Creek and Wolla Bank is exposed despite beach replenishment, and it thought to be a long-term exposure.
- 23.4.20 The SSSI, GCR and LGS are located within the study area for LN1 and therefore are of major sensitivity.

Soils

- 23.4.21 The UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscales) online mapping identifies the soils across the study area as loamy clayey soils, further defining them as two soilscales:
- Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils; and
 - Loamy and clayey soils of coastal flats with naturally high groundwater.
- 23.4.22 The Natural England Provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 23.4.15.

Table 23.4: LN1 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 2	5.47	2.36

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 3	186.85	80.48
Not Graded (coastal area)	39.84	17.16
Total	232.16	100

23.4.23 ALC mapping does not extend to the MHWS mark. Therefore, the coastal areas around landfall have not been graded as part of the ALC classification.

23.4.24 The ALC maps indicate that the study area is dominated by Grade 3 and is therefore considered to be of moderate to good quality. It is not possible with the published ALC mapping to differentiate between Grade 3a and 3b, where Grade 3 is mapped as present. As outlined in Table 23.27 Grade 3a would be determined as high sensitivity, whereas Grade 3b would be medium sensitivity.

23.4.25 As the majority of the study area is mapped as Grade 2 or 3 and Grade 3 land may be Grade 3a and therefore Best and Most Versatile (BMV) agricultural land, a worst-case scenario will be assumed, and the sensitivity of the soil resource and function is determined as major.

Superficial Geology

23.4.26 British Geological Survey (BGS) map 1:50,000 Series Solid and Drift Geology Map England and Wales, 104 - Mablethorpe, indicates the superficial geology within the study area comprise Quaternary deposits of blown sand, Terrington Beds (salt marsh and tidal deposits), glaciofluvial sand and gravel and Till (boulder clay). The published superficial geology is illustrated in Figure 23.1 .

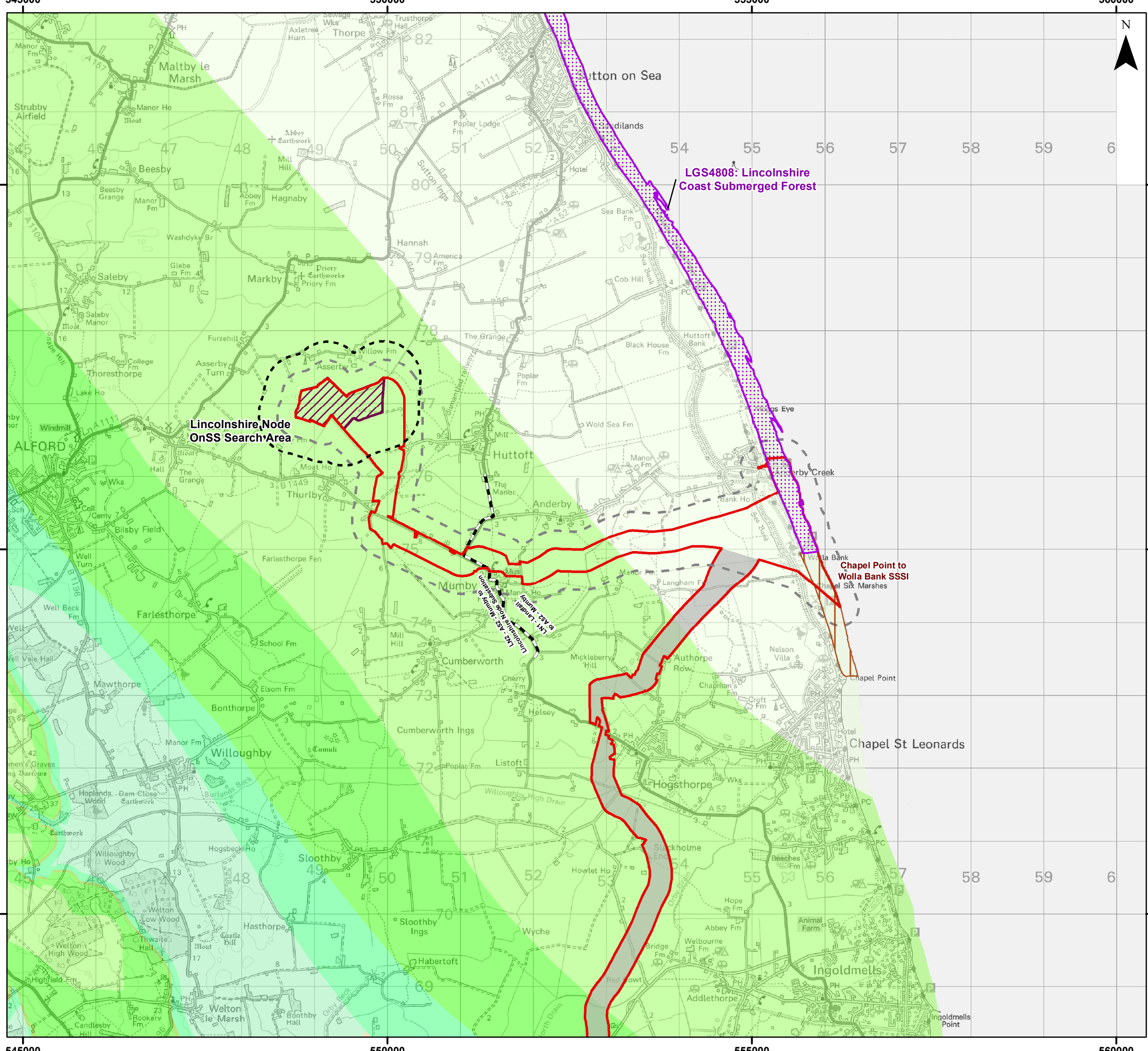
23.4.27 Published borehole records indicate that in general the superficial geology comprises soils and up to 2m of sand and gravels often clayey in composition, overlying a stiff chalky boulder clay with a proven thickness of 15m.

23.4.28 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

The BGS mapping indicates that the bedrock geology within the study area comprises the Burnham Chalk Formation and the Welton Chalk Formation of Cretaceous age. The Burnham Chalk is described by the BGS Lexicon as '*white, thinly bedded chalk with common tabular discontinuous flint bands; sporadic marl seams*', and the Welton Chalk is described as '*white, massive or thickly bedded chalk with common flint nodules...*'. The published bedrock geology is illustrated in

23.4.29 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.



Legend

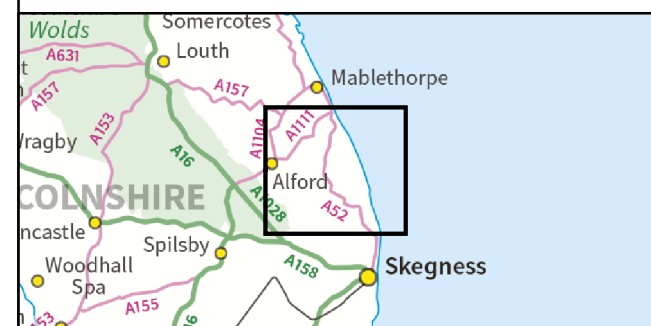
- Onshore PEIR Boundary
- Onshore Segment Break
- Lincolnshire Node OnSS Search
- Onshore PEIR Boundary Lincolnshire Node 250 m Buffer
- Lincolnshire Node Onshore Substation 500 m Buffer
- Site of Special Scientific Interest (SSSI) Cited for Geological Features
- Local Geological Site

Sedimentary Bedrock

- Burnham Chalk Formation – Chalk
- Welton Chalk Formation – Chalk
- Ferriby Chalk Formation – Chalk
- Hunstanton Formation – Chalk
- Carstone Formation – Sandstone
- Roach Formation - Mudstone And Limestone, Interbedded

Cretaceous

Sources:
Bedrock Geology data obtained via BGS WMS. British Geological Survey © NERC. All Rights Reserved.



Coordinate System: British National Grid

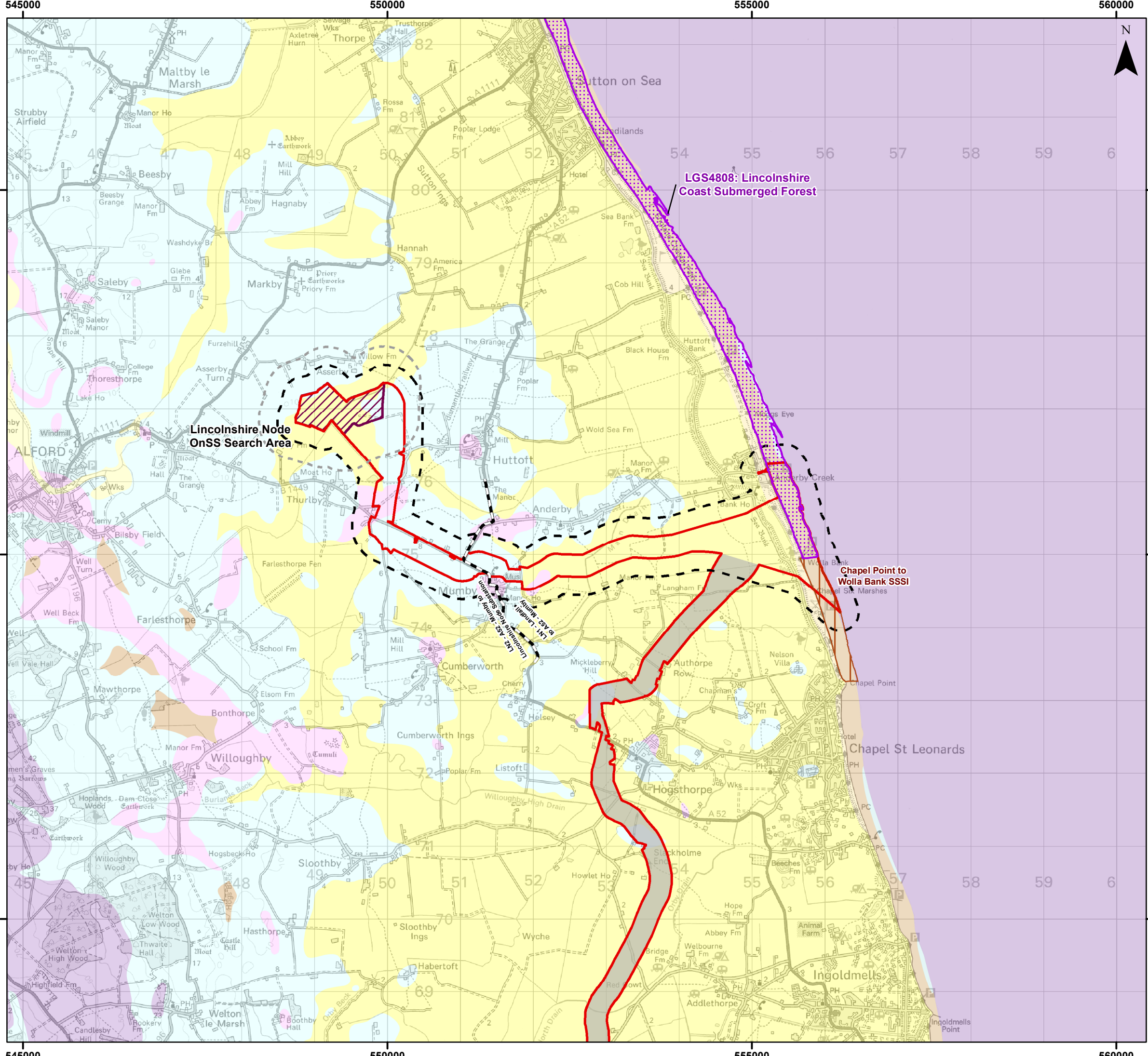
Scale: 1:50,000

Preliminary Environmental Information Report
Landfall to Lincolnshire Node
Bedrock Geology

Figure 23.2



Document Path: P:\05356 - Gobe Consultants Ltd\0012 GTR4 Outer Dowsing\GIS\DWG\Wing\2023 01 PEIR\Geology and Ground Conditions\05356 00012 0326 0 PEIR Wolla Bank to Lincolnshire Node - Bedrock Geology.mxd



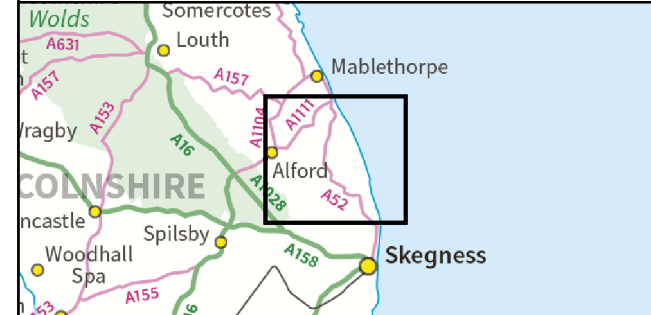
Legend

- Onshore PEIR Boundary
- Onshore Segment Break
- Lincolnshire Node OnSS Search
- Onshore PEIR Boundary Lincolnshire Node 250 m Buffer
- Lincolnshire Node Onshore Substation 500 m Buffer
- Site of Special Scientific Interest (SSSI) Cited for Geological Features
- Local Geological Site

Superficial Deposits

- Alluvium - Clay, Silt, Sand And Gravel
- Beach And Tidal Flat Deposits - Clay, Silt And Sand
- Bedrock at or Near Surface
- Blown Sand – Sand
- Glaciofluvial Deposits, Devensian - Sand And Gravel
- Peat – Peat
- Tidal Flat Deposits - Clay And Silt
- Till, Devensian – Diamicton

Sources:
Superficial Geology data obtained via BGS WMS. British Geological Survey © NERC. All Rights Reserved.



Coordinate System: British National Grid

Scale: 1:50,000

Preliminary Environmental Information Report
Landfall to Lincolnshire Node
Superficial Geology

Figure 23.1

Date: 13/04/2023
Produced By: JCS
Revision: 0.1

© Crown copyright [and database rights] (2022) 0100031673

Document Path: P:\05356 - Gobe Consultants Ltd\0012 GTR4 Outer Dowsing\GIS\DWG\Wing\2023 01 PEIR\Geology and Ground Conditions\05356 00012 0327 0 PEIR Wolla Bank to Lincolnshire Node - Superficial Geology.mxd

Mineral Resources

- 23.4.30 The study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.
- 23.4.31 There is one BGS record of a closed brickworks in Anderby Creek. The brickworks is estimated to have been worked until the early 1940's¹, the brick pit is now a large water feature in the settlement. There were a small number of clay pits along the coast to the south of Anderby Creek that may have been associated with the brickworks. These clay pits are now designated as the Sea Bank Clay Pits SSSI for ecological aspects.
- 23.4.32 The BGS mapping has no records of active quarries or evidence of modern brickworks within the study area or surrounding area. The geological units within the study area and environs are widespread throughout Lincolnshire.
- 23.4.33 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole records, where available indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

- 23.4.34 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

- 23.4.35 The 1:10,000, 1:2,500 and 1:1,250 scale historical maps for the study area have been reviewed. In general, these show that the study area has been predominantly under agricultural use, with scattered settlements, from the 1800s to the present day.
- 23.4.36 Whilst the historical maps do not show evidence of potentially contaminative land use within the study area it has been noted that agricultural land use may result in some very limited contamination. Contamination from agricultural land use may result from a number of activities and include, for example, usage of pesticides and fertilizers, small spillages and leakages of fuel or oil and deposition of waste materials. The majority of the study area is located away from farm infrastructure so risk from contamination is very low.
- 23.4.37 The study area crosses the Triton Knoll 'Electrical System' cables, at British National Grid reference TF 534 751. The onshore construction was completed in October 2021. There is no contamination expected from this construction project.
- 23.4.38 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the study area comprising:
- Landfills (authorised and historic) - the search identified no authorised landfills within 250m of the ECC route;

¹ <https://anderbycreek.weebly.com/history---now--then.html>

- Pollution incidents - no pollution incidents relating to ground condition or land use have been noted within the study area; and
- Past contaminative uses –the brickworks at Anderby Creek lie within the landfall study area. However, this area has now been redeveloped for housing and holiday homes and therefore these areas are not considered to be of concern.

23.4.39 As a consequence, assessment of the baseline data in relation to contaminated land has been determined as having a negligible sensitivity.

Radon Gas

23.4.40 The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the National Radiological Protection Board (NRPB) action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.41 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576². Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

Unexploded Ordnance (UXO)

23.4.42 The Zetica UXO mapping indicates the potential for UXO to be present as a result of World War Two (WWII) bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

LN2 – A52 – Mumby to Lincolnshire Node OnSS Search Area

Designated Sites

23.4.43 There are no designated sites for geological interests within the LN2 study area.

Soils

23.4.44 The UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscales) online mapping identifies the soils across the study area as loamy clayey soil, further defining it as the soilscape:

- Loamy and clayey soils of coastal flats with naturally high groundwater.

23.4.45 The Natural England provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within the study area into one of the grades described in paragraph 23.4.15.

Table 23.5: LN2 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 2	0.25	0.15

² BSI Standards Publication 2013, BS 8576:2013 Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs).

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 3	174.11	99.85
Total	174.36	100

23.4.46 The ALC maps indicate that the study area is dominated by Grade 3 and is therefore considered to be of moderate to good quality land. It is not possible with the published ALC mapping to differentiate between Grade 3a and 3b, where Grade 3 is mapped as present. As outlined in Table 23.27, 3a would be determined as high sensitivity, whereas Grade 3b as medium sensitivity.

23.4.47 As all of the study area is mapped as Grade 2 or 3 and the Grade 3 land may be Grade 3a and therefore BMV agricultural land, a worst-case scenario will be assumed, and the sensitivity of the soil resource and function is determined as major.

Superficial Geology

23.4.48 The BGS map 1:50,000 Series Solid and Drift Geology Map England and Wales, 104 - Mablethorpe, indicates the superficial geology within the study area comprises Quaternary deposits of Terrington Beds (salt marsh and tidal deposits), glaciofluvial sand and gravel and Till (boulder clay). The published superficial geology is illustrated in Figure 23.1 .

23.4.49 Published borehole records indicate that in general the superficial geology comprises soils and sandy clay of between 5m to c.15m in thickness, overlying chalk which has been proven in water well borehole records to a depth of 70m below ground level (bgl).

23.4.50 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

23.4.51 The BGS mapping indicates that the bedrock geology within the study area comprises the Welton Chalk Formation of Cretaceous age. The Welton Chalk is described as '*white, massive or thickly bedded chalk with common flint nodules...*'. The published bedrock geology is illustrated in Figure 23.2 .

23.4.52 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.

Mineral Resources

23.4.53 The study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.

23.4.54 The BGS mapping has no records of historic or active quarries within the study area or surrounding area. The geological units within the onshore study area and environs are widespread throughout Lincolnshire.

23.4.55 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole records, where available indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

23.4.56 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

23.4.57 The 1:10,000, 1:2,500 and 1:1,250 scale historical maps for the study area have been reviewed. In general, these show that the study area has been predominantly under agricultural use, with scattered settlements, from the 1800s to the present day.

23.4.58 Whilst the historical maps do not show evidence of potentially contaminative land use within the study area it has been noted that agricultural land use may result in some very limited contamination. Contamination from agricultural land use may result from a number of activities and include, for example, usage of pesticides and fertilizers, small spillages and leakages of fuel or oil and deposition of waste materials. The majority of the study area is located away from farm infrastructure so risk from contamination is very low.

23.4.59 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the study area comprising:

- Landfills (authorised and historic) - the search identified no authorised landfills within 250m of the ECC (see Figure 23.3);
- Pollution incidents - no pollution incidents relating to ground condition or land use have been noted within the study area; and
- Past contaminative uses – there are no records of any past contaminative uses within the study area.

23.4.60 As a consequence, assessment of the baseline data in relation to contaminated land has been determined as having a negligible sensitivity.

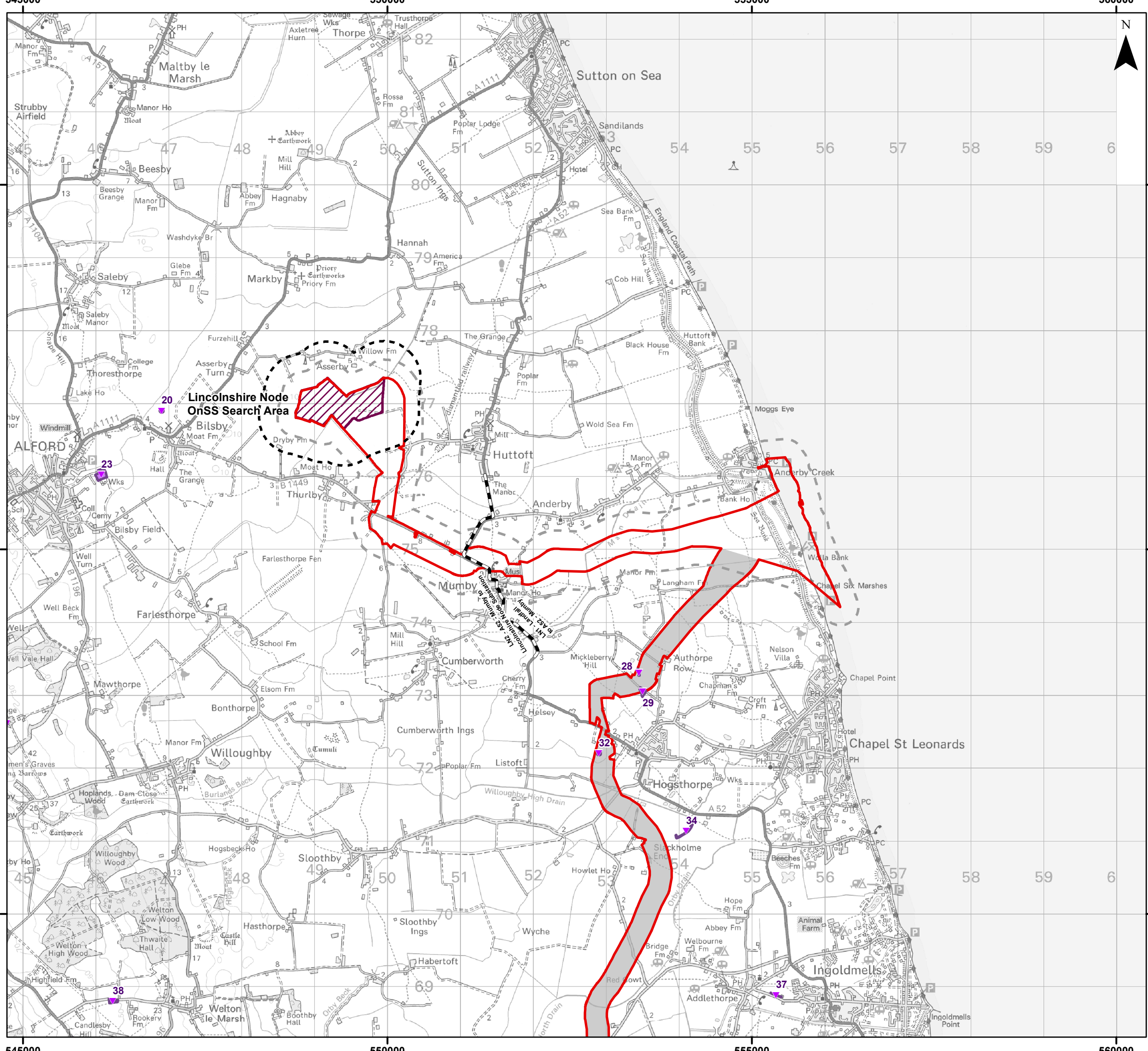
Radon Gas

23.4.61 The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.62 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

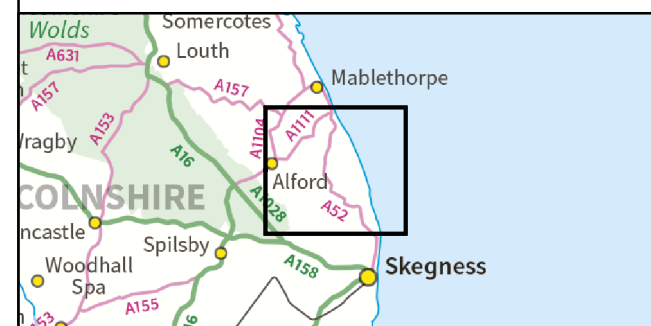
UXO

23.4.63 The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.



- ### Legend
- Onshore PEIR Boundary
 - Onshore Segment Break
 - Lincolnshire Node OnSS Search Area
 - Onshore PEIR Boundary Lincolnshire Node 250 m Buffer
 - Lincolnshire Node Onshore Substation 500 m Buffer
 - ▼ Historic Landfill Site (Centroid)
 - Historic Landfill Site (Boundary)

Sources:
 © Environment Agency copyright and/or database right 2018. All rights reserved.
 Contains information © Local Authorities



Coordinate System: British National Grid
 0 1 2 km
 Scale: 1:50,000

Preliminary Environmental Information Report
 Landfall to Lincolnshire Node
 Historic Landfill Sites
 Figure 23.3



Date: 13/04/2023
 Produced By: JCS
 Revision: 0.1



© Crown copyright [and database rights] (2022) 0100031673

Document Path: P:\05356 - Gobe Consultants Ltd\0012 GTR4 Outer Dowsing\GIS\DWG\Wing\2023 01 PEIR\Geology and Ground Conditions\05356_00012_0329_0 PEIR\Wolla Bank to Lincolnshire Node - Historic Landfill Sites.mxd

Weston Marsh, via south of the A52

WM1 – Landfall to A52 – Hogsthorpe

Designated Sites

- 23.4.64 Within the WM1 study area, the Chapel Point – Wolla Bank SSSI and GCR is present. This SSSI and GCR is a 1.5km length of coastline comprising the foreshore section of intertidal deposits stretching from the Coastguard lookout at Chapel Point to the car park at Wolla Bank. The site covers an area of 39.57ha and is located at British National Grid reference TF 560 471. The SSSI lies within the southernmost part of the landfall section of the PEIR boundary.
- 23.4.65 The site is notified for intertidal deposits which represent the global sea level rise during the Holocene (flandrian) Stage. These deposits comprise interbedded peats, saltmarsh deposits and shelly clays, incorporated within these deposits are the flora and fauna present at the time of deposition. These deposits are noted to be of national importance for the representation of the Holocene stratigraphy and environment.
- 23.4.66 To the north of the Chapel Point - Wolla Bank site situated along the beach and coast for approximately 9.4km is the Lincolnshire Coast Submerged Forest non-statutory selected LGS.
- 23.4.67 A document prepared by the University of York (Derret and Selby, 2020) described the extent and condition of the ‘*Lincolnshire Coast Submerged Landscape*’. It concludes that the submerged landscape has reduced in extent and is rarely exposed compared to what was once visible for many miles. The deposits are subject to natural shore erosion and are buried below the annual beach replenishment scheme imported sand coverage. It does however note that an in-situ section on the foreshore between Anderby Creek and Wolla Bank is exposed despite beach replenishment, and it thought to be a long-term exposure.
- 23.4.68 The SSSI, GCR and LGS are located within the study area for the study area and therefore are of major sensitivity.

Soils

- 23.4.69 The UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilsapes) online mapping identifies the soils across the study area as loamy clayey soil, further defining it as the soilscape:
- Loamy and clayey soils of coastal flats with naturally high groundwater.
- 23.4.70 The Natural England provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 23.4.15.

Table 23.6: Landfall to A52 – Hogsthorpe WM1 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 3	180.16	81.82
Not Graded (coastal area)	40.04	18.18

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Total	220.2	100

23.4.71 ALC mapping does not extend to the mean low water spring mark. Therefore, the coastal areas around landfall have not been graded as part of the ALC classification.

23.4.72 The ALC maps indicate that the study area is dominated by Grade 3 and is therefore considered to be of moderate to good quality. It is not possible with the published ALC mapping to differentiate between Grade 3a and 3b, where Grade 3 is mapped as present. As outlined in Table 23.27, Grade 3a would be determined as high sensitivity, whereas Grade 3b as medium sensitivity.

23.4.73 As the majority of the study area is mapped as Grade 3 and may be Grade 3a and therefore BMV agricultural land, a worst-case scenario will be assumed, and the sensitivity of the soil resource and function is determined as major.

Superficial Geology

23.4.74 The BGS map 1:50,000 Series Solid and Drift Geology Map England and Wales, 104 – Mablethorpe and 116 - Skegness, indicates the superficial geology within the study area comprise Quaternary deposits of blown sand, Terrington Beds (salt marsh and tidal deposits), glaciofluvial sand and gravel and Till (boulder clay). The published superficial geology is illustrated in Figure 23.4.

23.4.75 Published borehole records indicate that in general the superficial geology comprises varying thicknesses of soils and silty sand, overlying a stiff brown or blue clay that becomes chalky with depth.

23.4.76 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

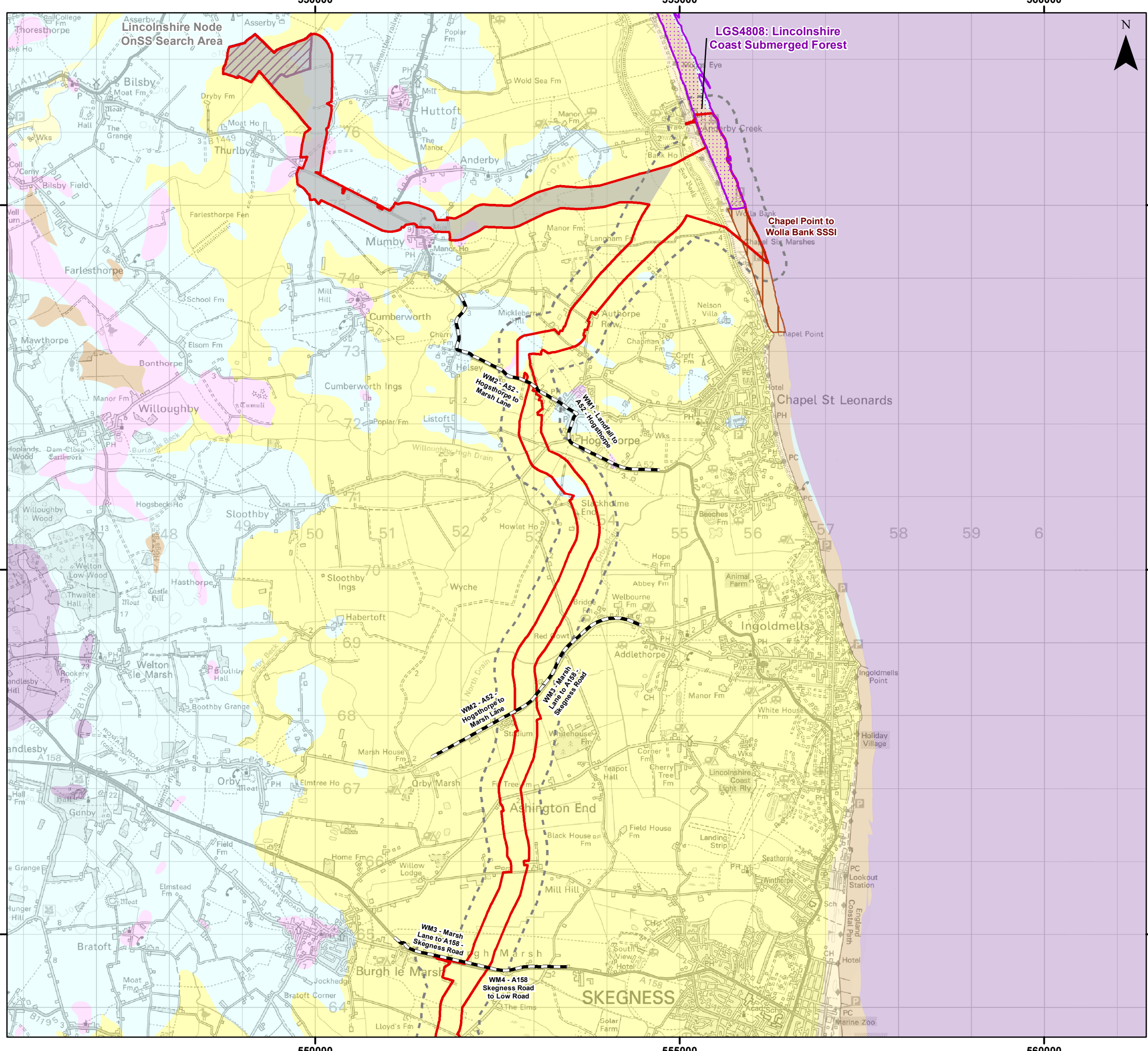
23.4.77 The BGS mapping indicates that the bedrock geology within the study area the Welton Chalk Formation of Cretaceous age. The Welton Chalk is described as '*white, massive or thickly bedded chalk with common flint nodules...*'. The published bedrock geology is illustrated in Figure 23.5.

23.4.78 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.

Mineral Resources

23.4.79 The study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.

23.4.80 There is one BGS record of a closed brickworks in Anderby Creek. The brickworks is estimated to have been worked until the early 1940's, the brick pit is now a large water feature in the settlement. There were a small number of clay pits along the coast to the south of Anderby Creek that may have been associated with the brickworks. These clay pits are now designated as the Sea Bank Clay Pits SSSI for ecological aspects.



Legend

- Onshore PEIR Boundary
- Onshore Segment Break
- Lincolnshire Node OnSS Search Area
- Onshore PEIR Boundary Weston Marsh 250 m Buffer
- Site of Special Scientific Interest (SSSI) Cited for Geological Features
- Local Geological Site

Superficial Deposits

- Alluvium - Clay, Silt, Sand And Gravel
- Beach And Tidal Flat Deposits - Clay, Silt And Sand
- Bedrock at or Near Surface
- Blown Sand – Sand
- Glaciofluvial Deposits, Devensian - Sand And Gravel
- Peat – Peat
- Tidal Flat Deposits - Clay, Silt And Sand
- Till, Devensian – Diamicton

Sources:
 Superficial Geology data obtained via BGS WMS. British Geological Survey © NERC. All Rights Reserved.



Coordinate System: British National Grid

Scale: 1:50,000

Preliminary Environmental Information Report

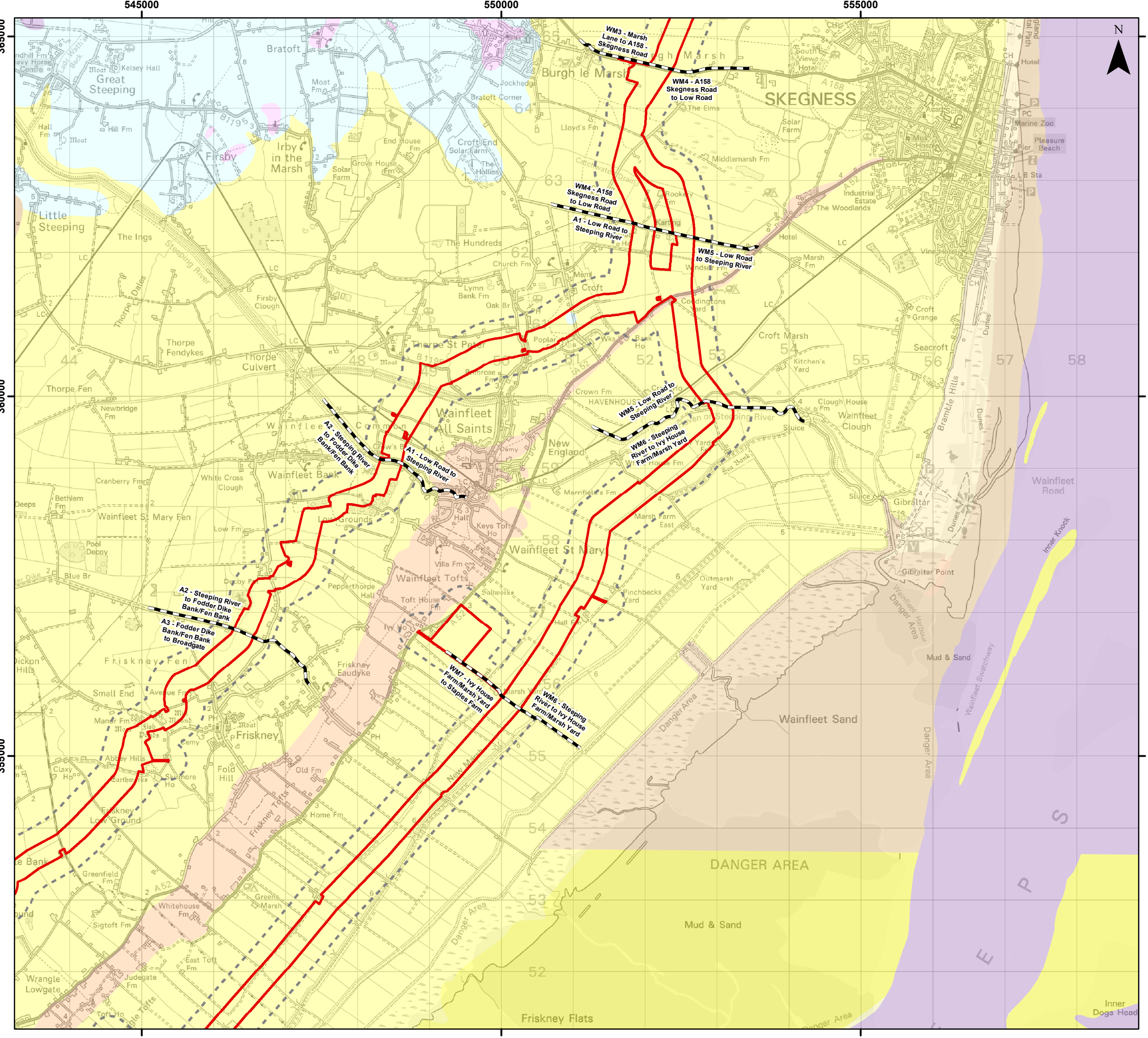
Landfall to Weston Marsh
 Superficial Geology

Figure 23.4.1

Date: 13/04/2023
 Produced By: JCS
 Revision: 0.1

© Crown copyright [and database rights] (2022)
 0100031673

Document Path: P:\05356 - Gobe Consultants Ltd\01012 GTR4 Outer Dowsing\GIS\DWG\Wing\2023 01 PEIR\Geology and Ground Conditions\05356 00012 0325 0 PEIR Wolla Bank to Weston Marsh - Superficial Geology.mxd



Legend

- Onshore PEIR Boundary
- Onshore Segment Break
- Onshore PEIR Boundary Weston Marsh 250 m Buffer

Superficial Deposits

- Bank Deposits – Sand
- Beach And Tidal Flat Deposits - Clay, Silt And Sand
- Bedrock at or Near Surface
- Blown Sand – Sand
- Glaciofluvial Deposits, Devensian - Sand And Gravel
- Peat – Peat
- Storm Beach Deposits - Sand And Gravel
- Storm Beach Deposits - Sand And Silt
- Tidal Flat Deposits - Clay And Silt
- Till, Devensian – Diamicton

Sources:
 Superficial Geology data obtained via BGS WMS. British Geological Survey © NERC. All Rights Reserved.



Coordinate System: British National Grid
 0 1 2 km
 Scale: 1:50,000

Preliminary Environmental Information Report
 Landfall to Weston Marsh
 Superficial Geology
 Figure 23.4.2

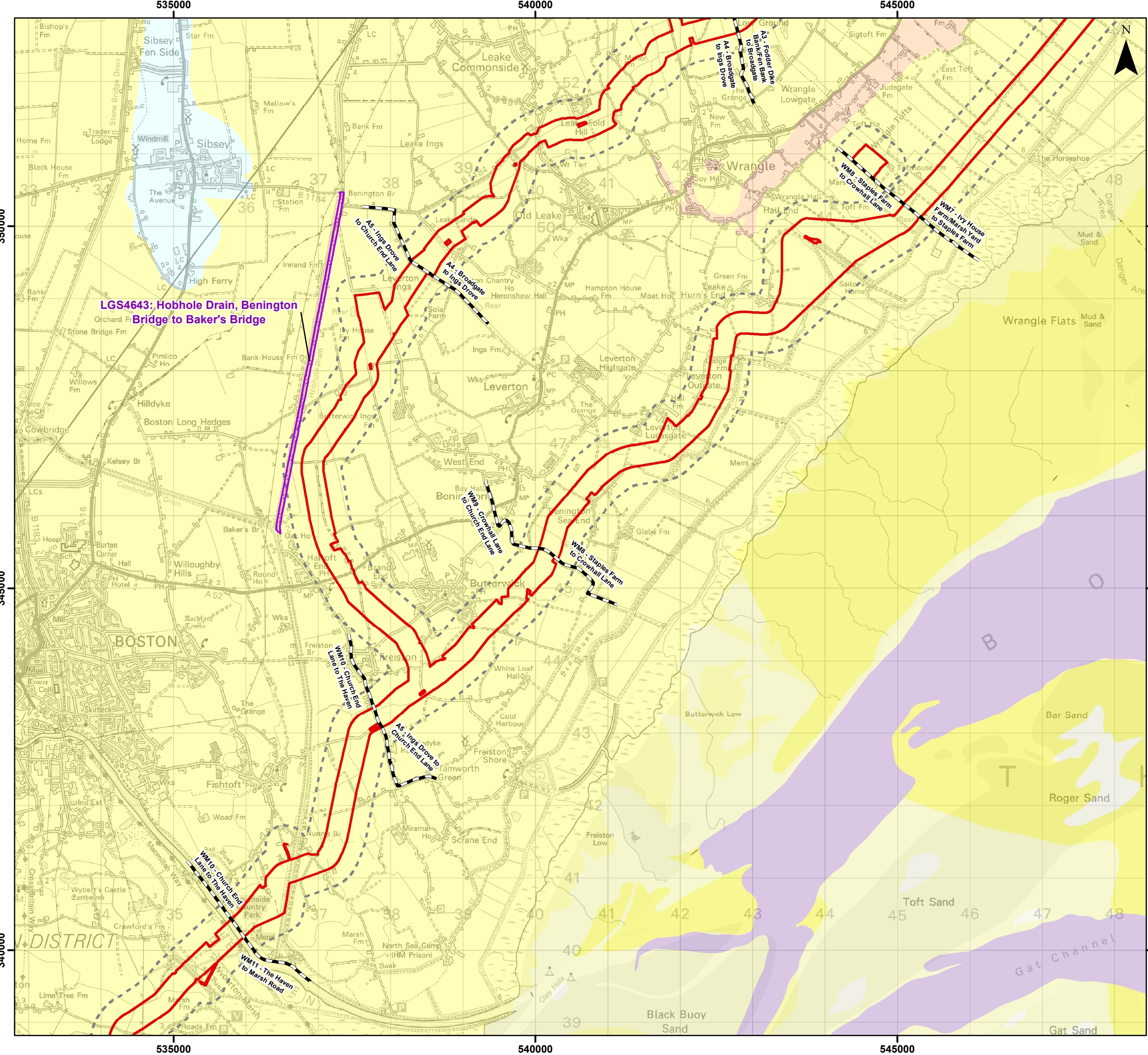




Date: 13/04/2023
 Produced By: JCS
 Revision: 0.1

© Crown copyright [and database rights] (2022)
 0100031673

Document Path: P:\05356 - Gobe Consultants Ltd\0012 GTR Outer Dosing\Tech\GIS\DWgs\Wing\2023 01 PEIR\Geology and Ground Conditions\05356 00012 0325 0 PEIR Wolla Bank to Weston Marsh - Superficial Geology.mxd



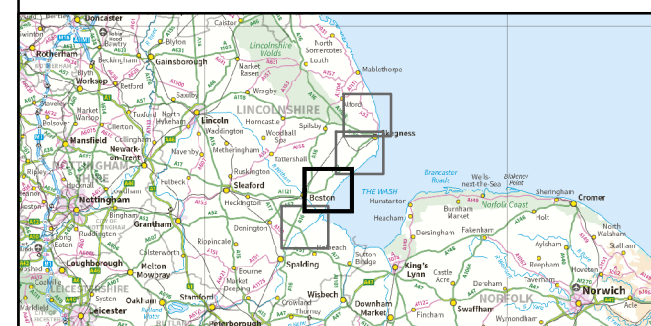
Legend

- Onshore PEIR Boundary
- Onshore Segment Break
- Onshore PEIR Boundary Weston Marsh 250 m Buffer
- Local Geological Site

Superficial Deposits

- Bank Deposits – Sand
- Bedrock at or Near Surface
- Blown Sand – Sand
- Intertidal Deposits - Sand, Silt And Clay
- Shell Bank - Sediment, Shell (Shells)
- Storm Beach Deposits - Sand And Silt
- Tidal Flat Deposits - Clay And Silt
- Tidal Flat Deposits, 1 - Clay And Silt
- Till, Devensian – Diamicton

Sources:
 Superficial Geology data obtained via BGS WMS. British Geological Survey © NERC. All Rights Reserved.



Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

Preliminary Environmental Information Report

Landfall to Weston Marsh
 Superficial Geology

Figure 23.4.3



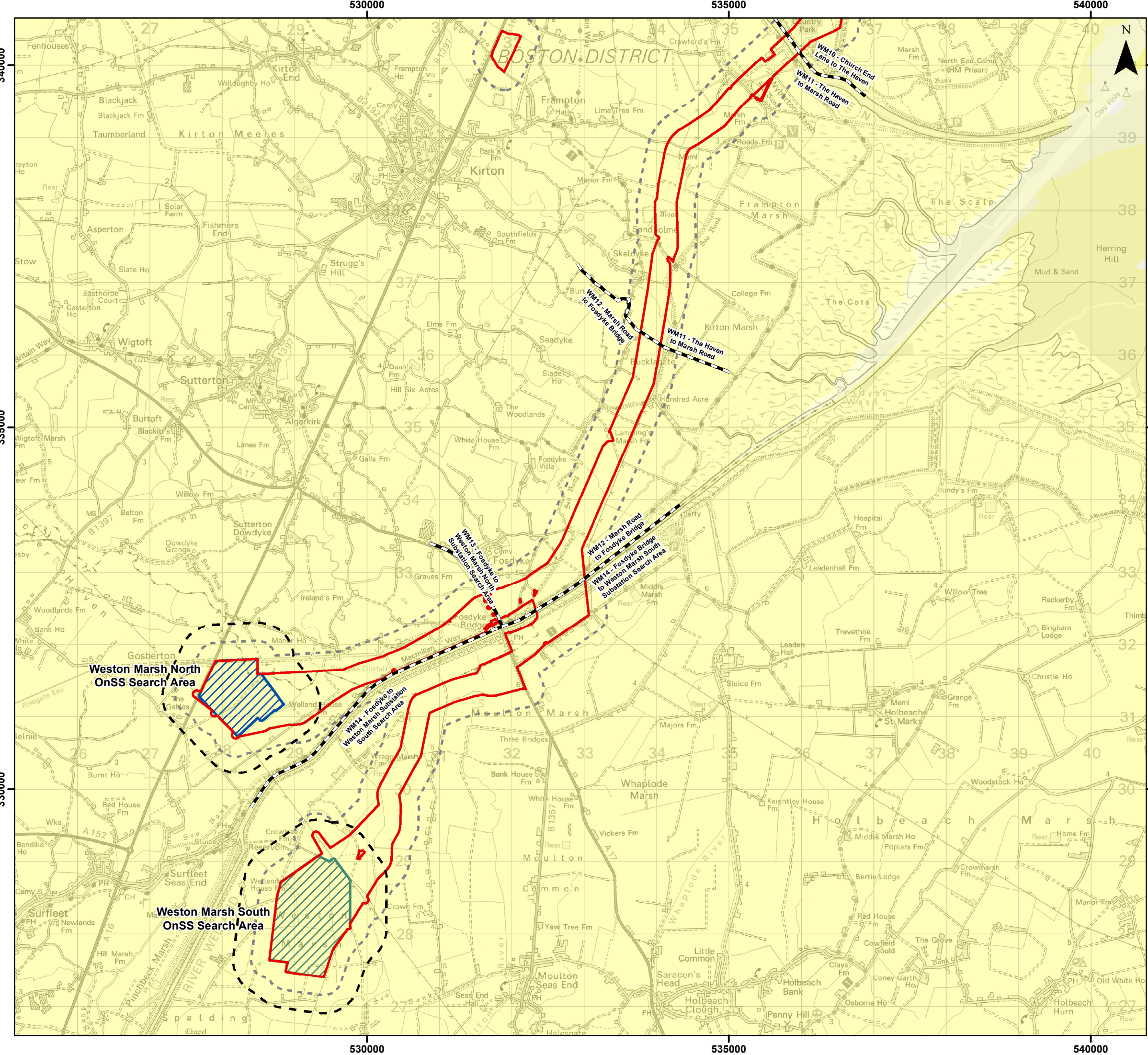
OUTER DOWSING
OFFSHORE WIND



Date: 13/04/2023
 Produced By: JCS
 Revision: 0.1

© Crown copyright [and database rights] (2022)
 0100031673

Document Path: P:\05356 - Gobe Consultants Ltd\0012 GTR4 Outer Dosing\Tech\GIS\DWG\Wing\2023 01 PEIR\Geology and Ground Conditions\05356_00012_0235_0 PEIR\Wolla Bank to Weston Marsh - Superficial Geology.mxd



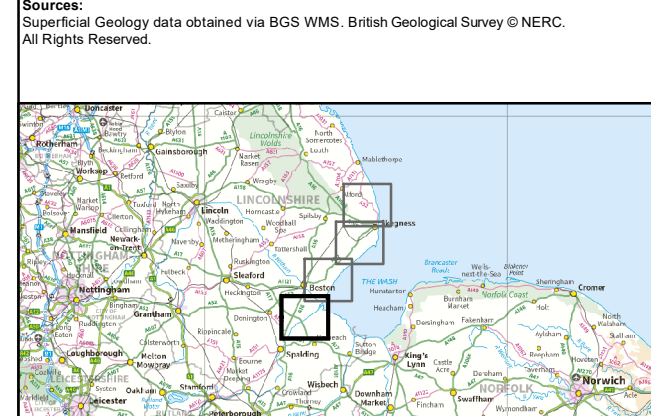
Legend

- Onshore PEIR Boundary
- Onshore Segment Break
- Weston Marsh North OnSS Search
- Weston Marsh South OnSS Search
- Onshore PEIR Boundary Weston Marsh 250 m Buffer
- Weston Marsh Onshore Substations 500 m Buffer

Superficial Deposits

- Intertidal Deposits - Sand, Silt And Clay
- Shell Bank - Sediment, Shell (Shells)
- Tidal Flat Deposits - Clay And Silt
- Tidal Flat Deposits - Clay, Silt And Sand

Sources:
 Superficial Geology data obtained via BGS WMS. British Geological Survey © NERC. All Rights Reserved.



Coordinate System: British National Grid
 0 1 2 km
 Scale: 1:50,000

Preliminary Environmental Information Report
 Landfall to Weston Marsh
 Superficial Geology
 Figure 23.4.4



OUTER DOWING
OFFSHORE WIND

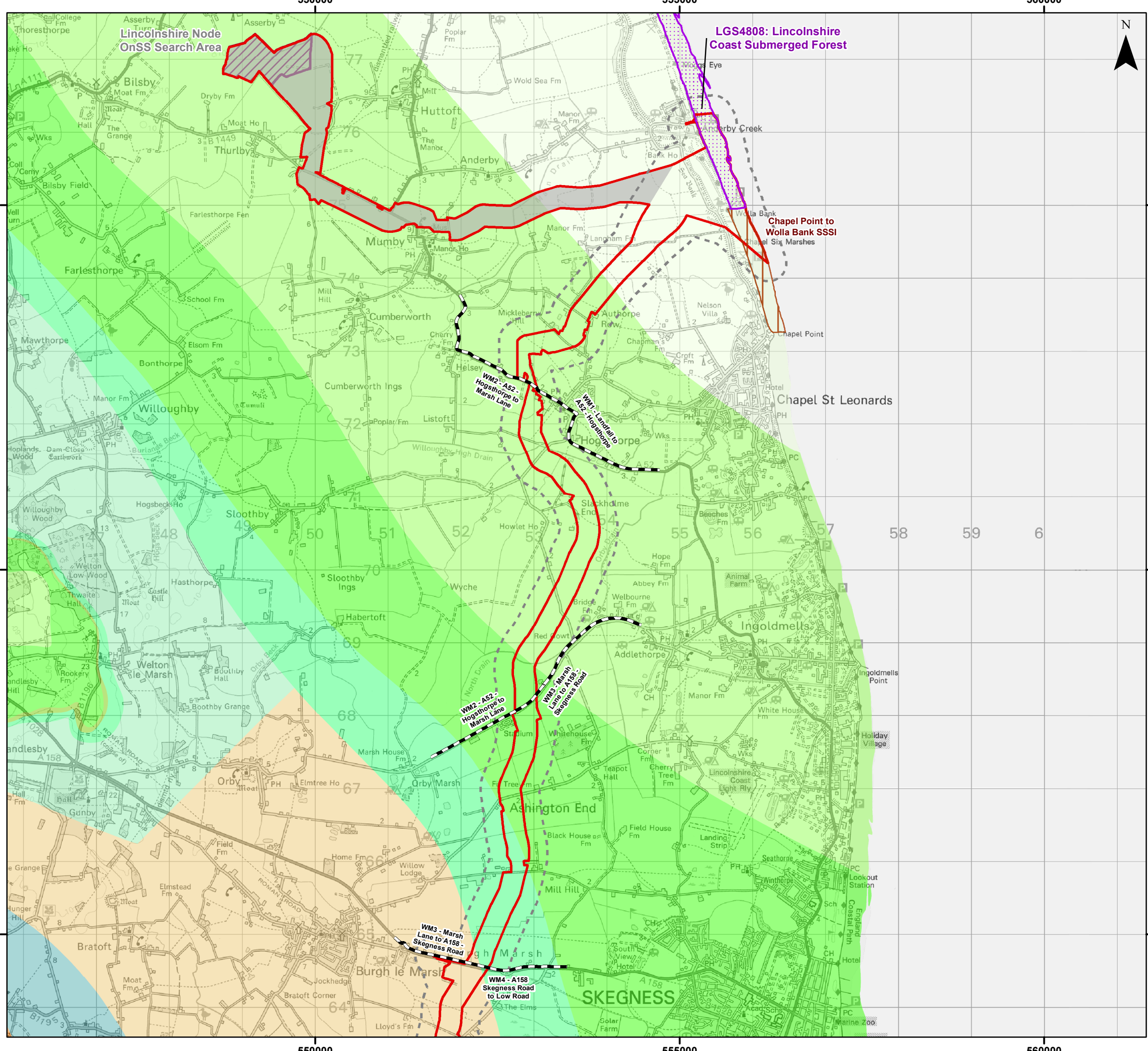


SLR

Date: 13/04/2023
 Produced By: JCS
 Revision: 0.1

© Crown copyright [and database rights] (2022)
 0100031673

Document Path: P:\05356 - Gobe Consultants Ltd\00012 GTR4 Outer Dowing\Tech\GIS\DWG\Wing\2023 01 PEIR\Geology and Ground Conditions\05356 00012 0235 0 PEIR Wellia Bank to Weston Marsh - Superficial Geology.mxd



Legend

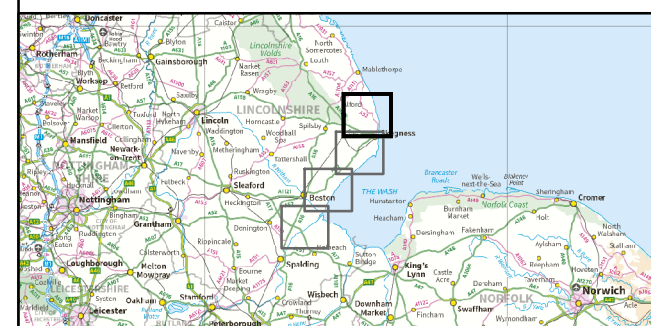
- Onshore PEIR Boundary
- Onshore Segment Break
- Lincolnshire Node OnSS Search Area
- Onshore PEIR Boundary Weston Marsh 250 m Buffer
- Site of Special Scientific Interest (SSSI) Cited for Geological Features
- Local Geological Site

Sedimentary Bedrock

- Burnham Chalk Formation – Chalk
- Welton Chalk Formation – Chalk
- Ferriby Chalk Formation – Chalk
- Hunstanton Formation – Chalk
- Carstone Formation – Sandstone
- Roach Formation - Mudstone And Limestone, Interbedded
- Claxby Ironstone Formation, Tealby Formation And Roach Formation - Mudstone And Limestone, Interbedded
- Spilby Sandstone Formation – Sandstone

Cretaceous
Jurassic

Sources:
Bedrock Geology data obtained via BGS WMS. British Geological Survey © NERC. All Rights Reserved.



Coordinate System: British National Grid

Scale: 1:50,000

Preliminary Environmental Information Report

Landfall to Weston Marsh
Bedrock Geology

Figure 23.5.1

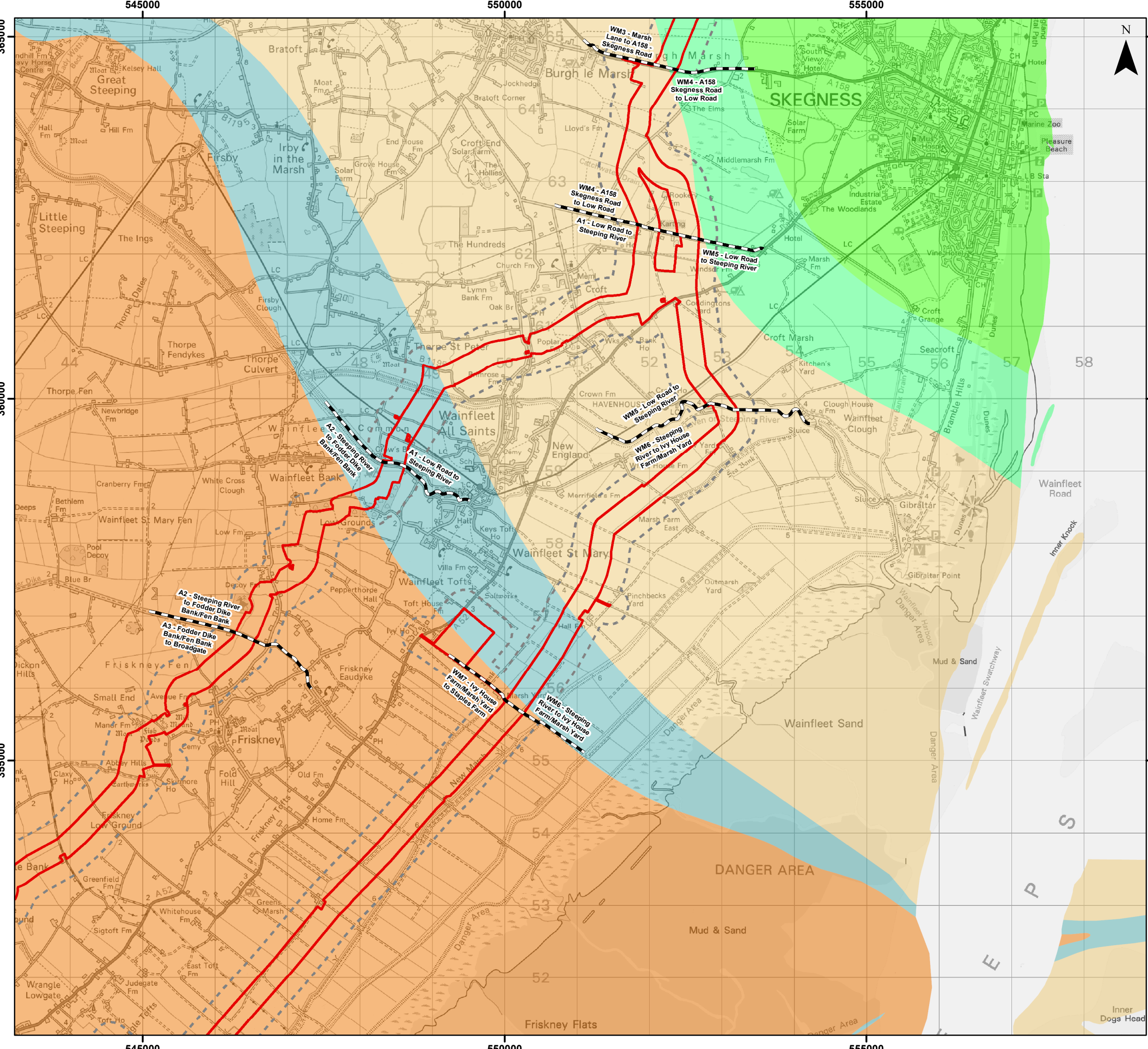
OUTER DOWSING
OFFSHORE WIND

SLR

Date: 13/04/2023
Produced By: JCS
Revision: 0.1

© Crown copyright [and database rights] (2022)
0100031673

Document Path: P:\05356 - Gobe Consultants Ltd\0012 GTR4 Outer Dowsing\GIS\DWG\Wing\2023 01 PEIR\Geology and Ground Conditions\05356_00012_0310_0 PEIR Wolla Bank to Weston Marsh Rev 1 and 1a - Bedrock Geology.mxd



Legend

- Onshore PEIR Boundary
- Onshore Segment Break
- Onshore PEIR Boundary Weston Marsh 250 m Buffer

Sedimentary Bedrock

- Ferriby Chalk Formation – Chalk
- Carstone Formation – Sandstone
- Claxby Ironstone Formation, Tealby Formation And Roach Formation - Mudstone And Limestone, Interbedded
- Spilsby Sandstone Formation – Sandstone
- Kimmeridge Clay Formation – Mudstone

Cretaceous
Jurassic

Sources:
Bedrock Geology data obtained via BGS WMS. British Geological Survey © NERC. All Rights Reserved.



Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

Preliminary Environmental Information Report

Landfall to Weston Marsh
Bedrock Geology

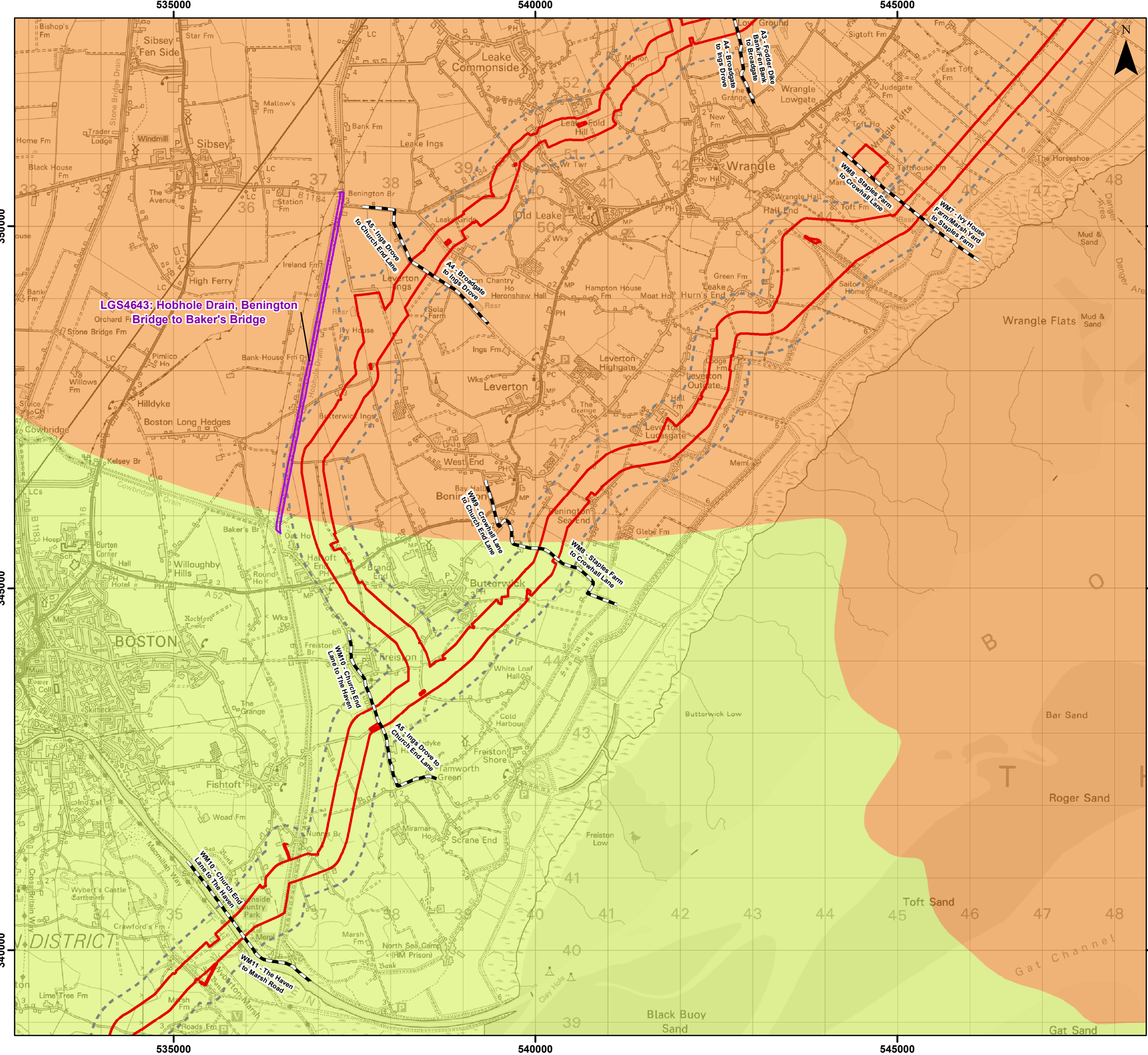
Figure 23.5.2





Date: 13/04/2023
Produced By: JCS
Revision: 0.1

© Crown copyright [and database rights] (2022)
0100031673



Legend

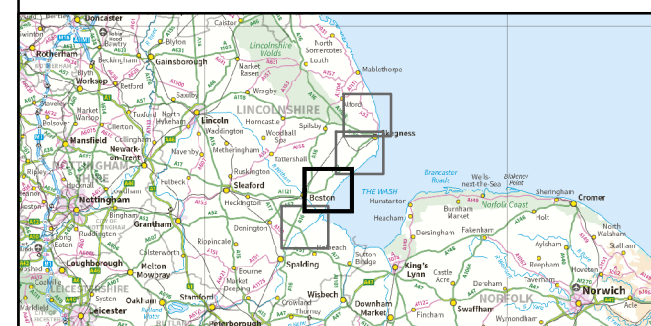
- Onshore PEIR Boundary
- Onshore Segment Break
- Onshore PEIR Boundary Weston Marsh 250 m Buffer
- Local Geological Site

Sedimentary Bedrock

- Kimmeridge Clay Formation – Mudstone
- Amphill Clay Formation – Mudstone

Jurassic

Sources:
Bedrock Geology data obtained via BGS WMS. British Geological Survey © NERC. All Rights Reserved.



Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

Preliminary Environmental Information Report

Landfall to Weston Marsh
Bedrock Geology

Figure 23.5.3

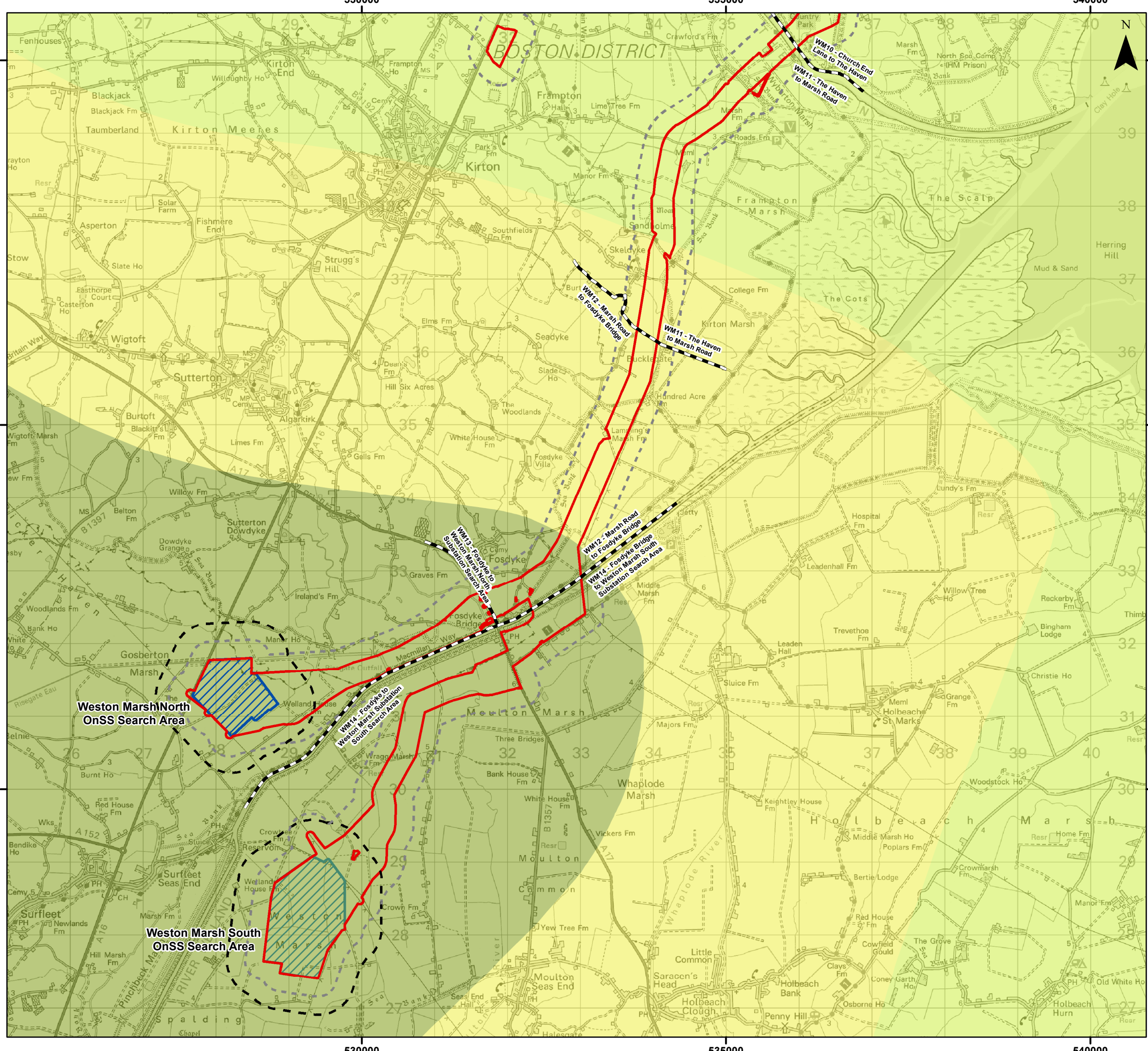


Date: 13/04/2023
Produced By: JCS
Revision: 0.1

SLR

© Crown copyright [and database rights] (2022) 0100031673

Document Path: P:\05356 - Gobe Consultants Ltd\0012 GTR4 Outer Dowsing\Tech\GIS\DWG\Wing\2023 01 PEIR\Geology and Ground Conditions\05356_00012_0310_0 PEIR\Wolla Bank to Weston Marsh Rev 1 and 1a - Bedrock Geology.mxd



Legend

- Onshore PEIR Boundary
- Onshore Segment Break
- Weston Marsh North OnSS Search
- Weston Marsh South OnSS Search
- Onshore PEIR Boundary Weston Marsh 250 m Buffer
- Weston Marsh Onshore Substations 500 m Buffer

Sedimentary Bedrock

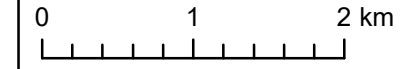
- Amphill Clay Formation – Mudstone
- West Walton Formation - Mudstone And Siltstone
- Oxford Clay Formation – Mudstone

Jurassic

Sources:
Bedrock Geology data obtained via BGS WMS. British Geological Survey © NERC. All Rights Reserved.



Coordinate System: British National Grid



Scale: 1:50,000

Preliminary Environmental Information Report

Landfall to Weston Marsh
Bedrock Geology

Figure 23.5.4



Date: 13/04/2023
Produced By: JCS
Revision: 0.1



© Crown copyright [and database rights] (2022) 0100031673

Document Path: P:\05356 - Gobe Consultants Ltd\0012 GTR Outer Dowsing\GIS\DWG\Wing\2023 01 PEIR\Geology and Ground Conditions\05356 00012 0310 0 PEIR Wellia Bank to Weston Marsh rev 1 and 1a - Bedrock Geology.mxd

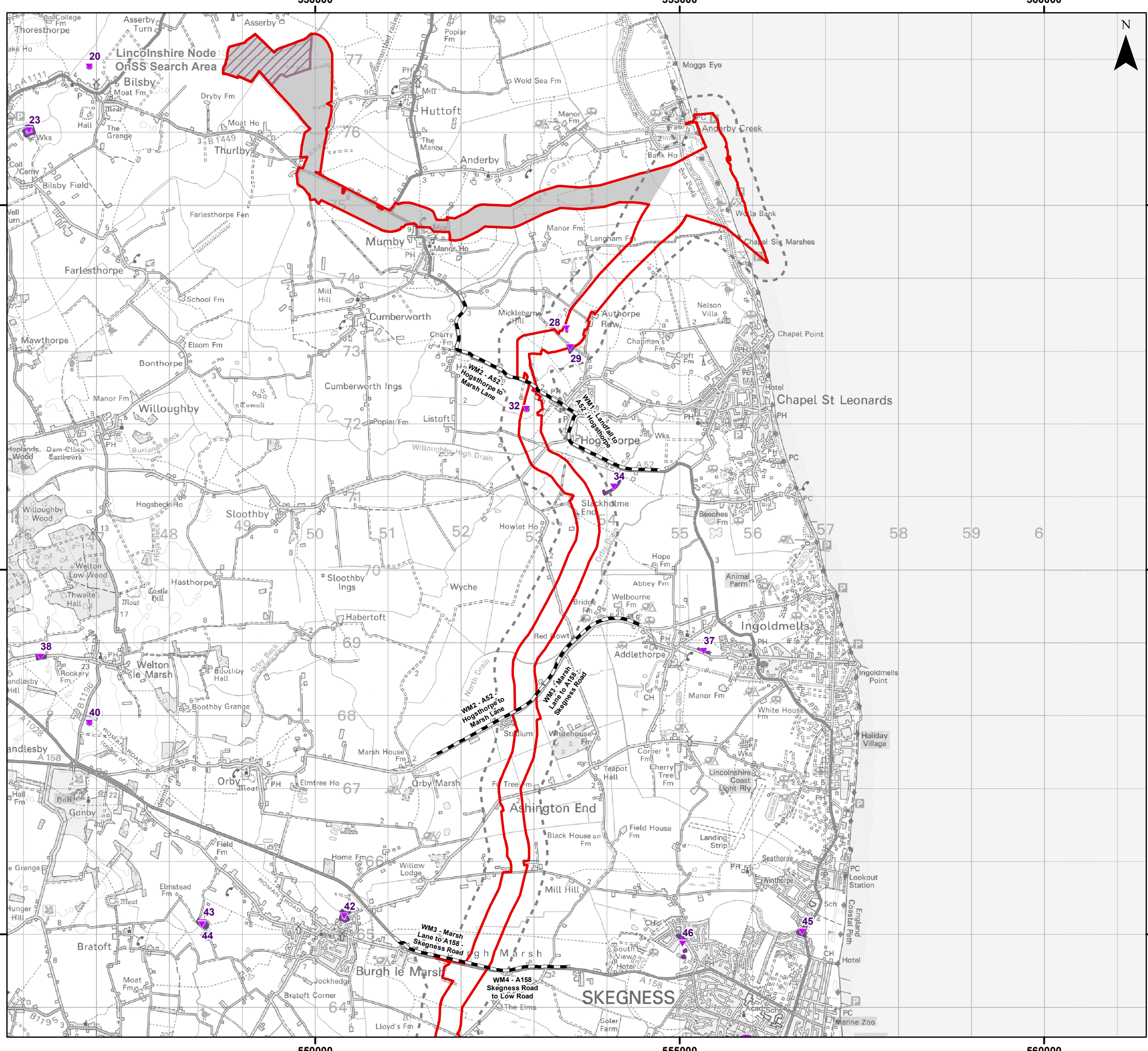
- 23.4.81 The BGS mapping has no records of active quarries or evidence of modern brickworks within the study area or surrounding area. The geological units within the study area and environs are widespread throughout Lincolnshire.
- 23.4.82 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole where available records indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

- 23.4.83 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

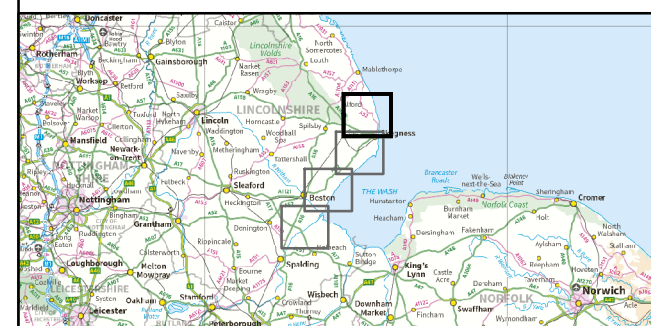
- 23.4.84 The 1:10,000, 1:2,500 and 1:1,250 scale historical maps for the WM1 study area have been reviewed. In general, these show that the study area has been predominantly under agricultural use, with scattered settlements, from the 1800s to the present day.
- 23.4.85 Whilst the historical maps do not show evidence of potentially contaminative land use within the study area it has been noted that agricultural land use may result in some very limited contamination. Contamination from agricultural land use may result from a number of activities and include, for example, usage of pesticides and fertilizers, small spillages and leakages of fuel or oil and deposition of waste materials. The majority of the study area is located away from farm infrastructure so risk from contamination is very low.
- 23.4.86 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the study area comprising:
- Landfills (authorised and historic) - the search identified two historic landfills within the PEIR Boundary; Lowgate Farm and Lowgate Road (NGR TF 5340 7330), which accepted unknown and household waste respectively (see Figure 23.6). The dates the sites were active are unknown. Aerial photography from 2005 (Google Earth) appears to suggest activity on the site at Lowgate Road, however it is not clear what the activity is;
 - Pollution incidents - no pollution incidents have been noted within the study area; and
 - Past contaminative uses – the brickworks at Anderby Creek lies within the landfall study area. However, this area has now been redeveloped for housing and holiday homes. There is also record of a clay brick and tiles manufacture site in 1981 within 250m of the PEIR boundary. These are not considered to be of concern.
- 23.4.87 The former landfills are considered to present a low risk given the nature of the fill material (inert). No potential sources of ground gases within natural soils have been identified.
- 23.4.88 As a consequence, assessment of the baseline data in relation to contaminated land has been determined as having a minor sensitivity.



Legend

- Onshore PEIR Boundary
- Onshore Segment Break
- Lincolnshire Node OnSS Search Area
- Onshore PEIR Boundary Weston Marsh 250 m Buffer
- Historic Landfill Site (Centroid)
- Historic Landfill Site (Boundary)

Sources:
 © Environment Agency copyright and/or database right 2018. All rights reserved.
 Contains information © Local Authorities



Coordinate System: British National Grid
 0 1 2 km
 Scale: 1:50,000

Preliminary Environmental Information Report
 Landfall to Weston Marsh
 Historic Landfill Sites
 Figure 23.6.1

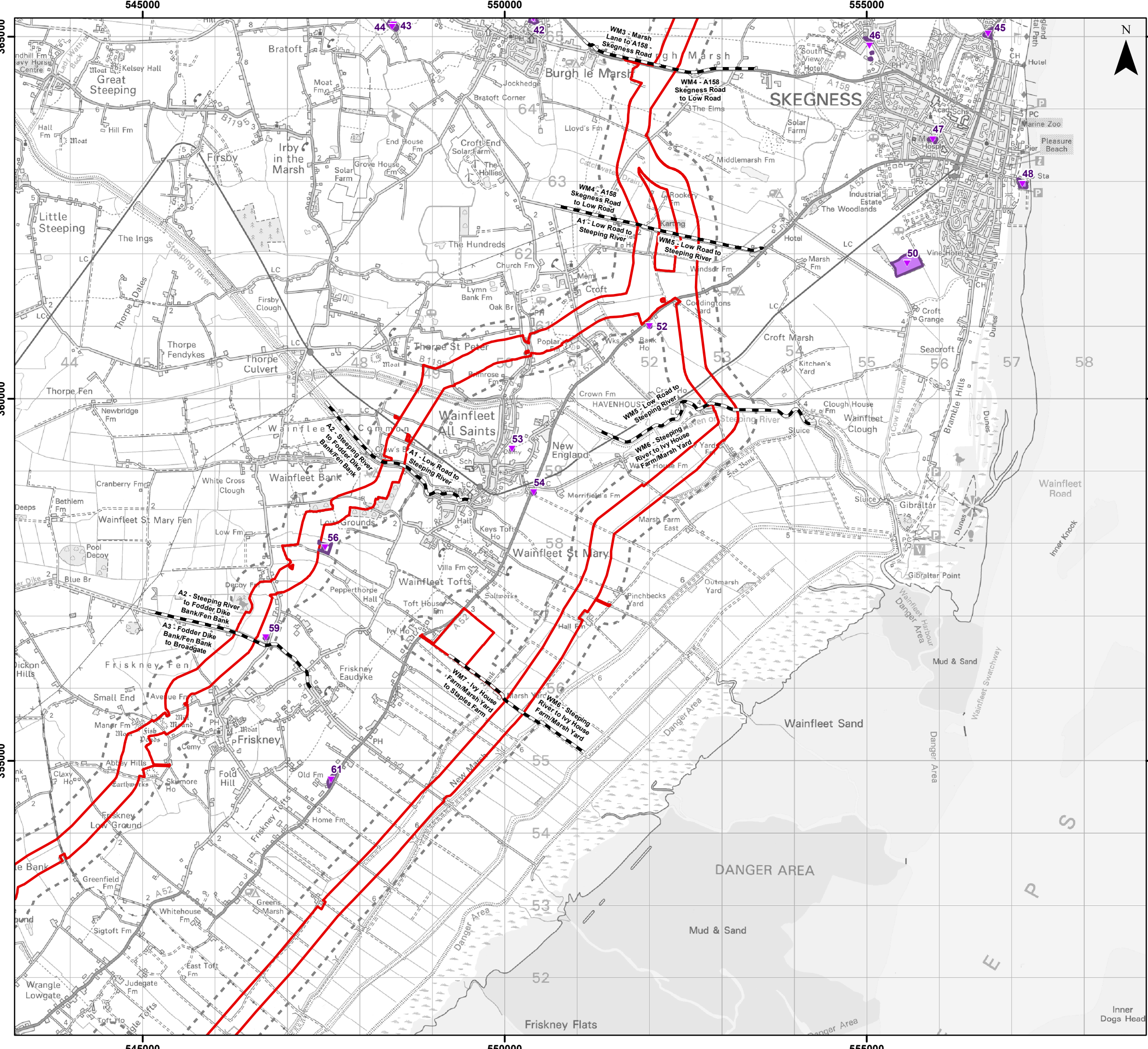


Date: 13/04/2023
 Produced By: JCS
 Revision: 0.1



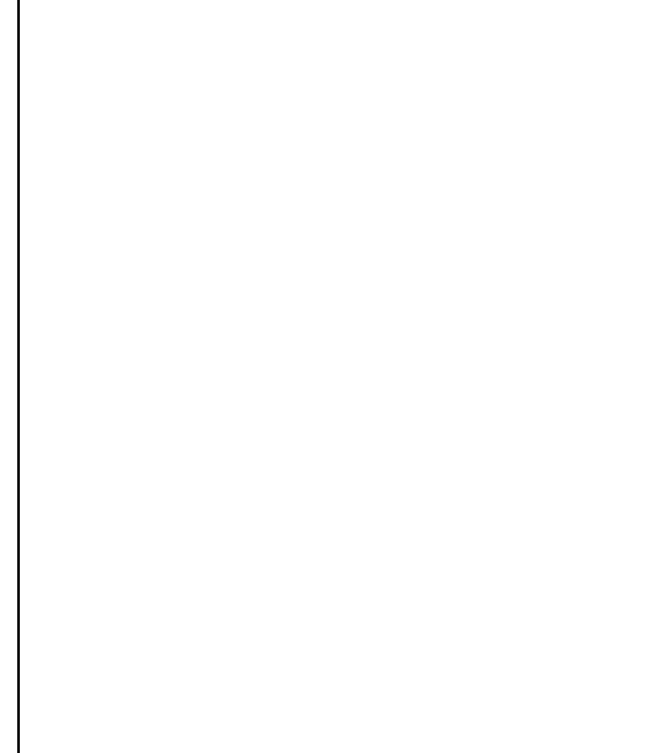
© Crown copyright [and database rights] (2022)
 0100031673

Document Path: P:\05356 - Gobe Consultants Ltd\0012 GTR4 Outer Dowsing\GIS\DWG\Wing\2023 01 PEIR\Geology and Ground Conditions\05356_00012_0328_0 PEIR Wolla Bank to Weston Marsh - Historic Landfill Sites.mxd

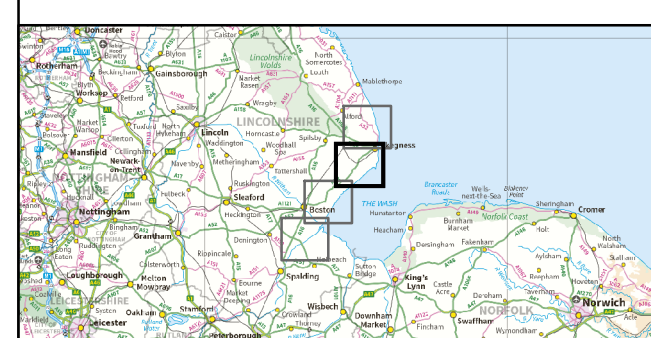


Legend

- Onshore PEIR Boundary
- Onshore Segment Break
- Onshore PEIR Boundary Weston Marsh 250 m Buffer
- ▼ Historic Landfill Site (Centroid)
- Historic Landfill Site (Boundary)



Sources:
 © Environment Agency copyright and/or database right 2018. All rights reserved.
 Contains information © Local Authorities



Coordinate System: British National Grid
Scale: 1:50,000

Preliminary Environmental Information Report
 Landfall to Weston Marsh
 Historic Landfill Sites
 Figure 23.6.2



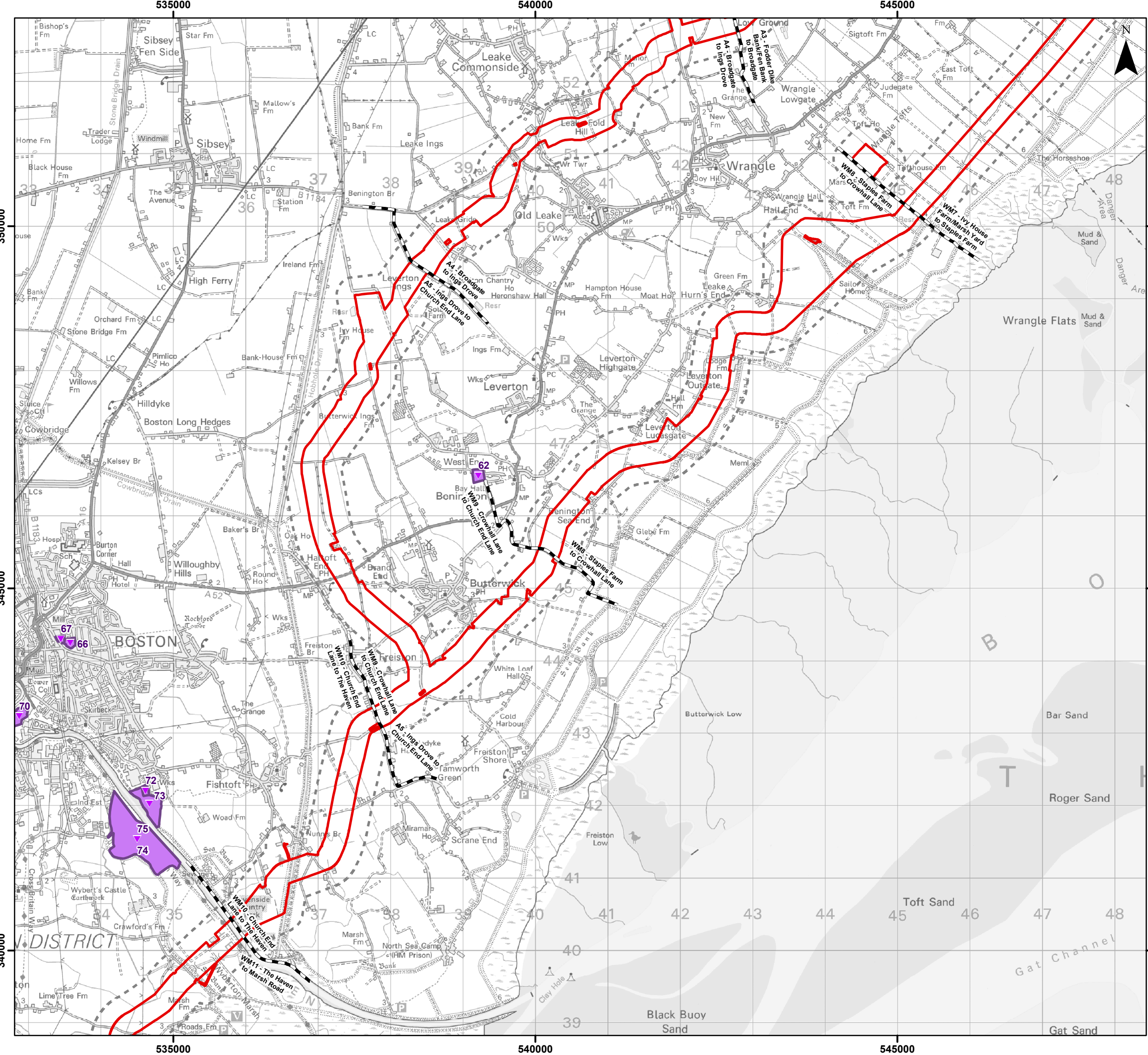
OUTER DOWSING
OFFSHORE WIND



Date: 13/04/2023
 Produced By: JCS
 Revision: 0.1

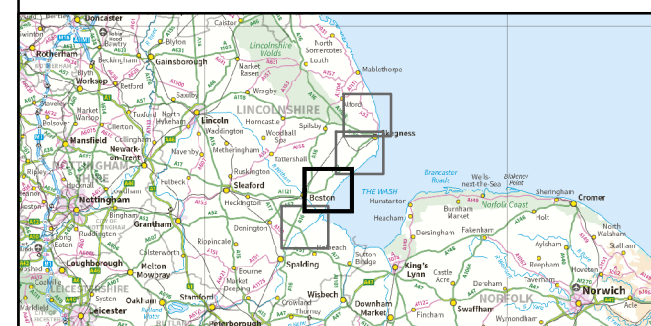
© Crown copyright [and database rights] (2022)
 0100031673

Document Path: P:\05356 - Gobe Consultants Ltd\01021 GTR4 Outer Dosing\Tech\GIS\DWG\Wing\2023 01 PEIR\Geology and Ground Conditions\05356_00012_02328_0 PEIR Wolla Bank to Weston Marsh - Historic Landfill Sites.mxd

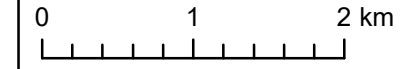


- Legend**
- Onshore PEIR Boundary
 - Onshore Segment Break
 - Onshore PEIR Boundary Weston Marsh 250 m Buffer
 - ▼ Historic Landfill Site (Centroid)
 - Historic Landfill Site (Boundary)

Sources:
 © Environment Agency copyright and/or database right 2018. All rights reserved.
 Contains information © Local Authorities



Coordinate System: British National Grid



Scale: 1:50,000

Preliminary Environmental Information Report

Landfall to Weston Marsh
 Historic Landfill Sites

Figure 23.6.3

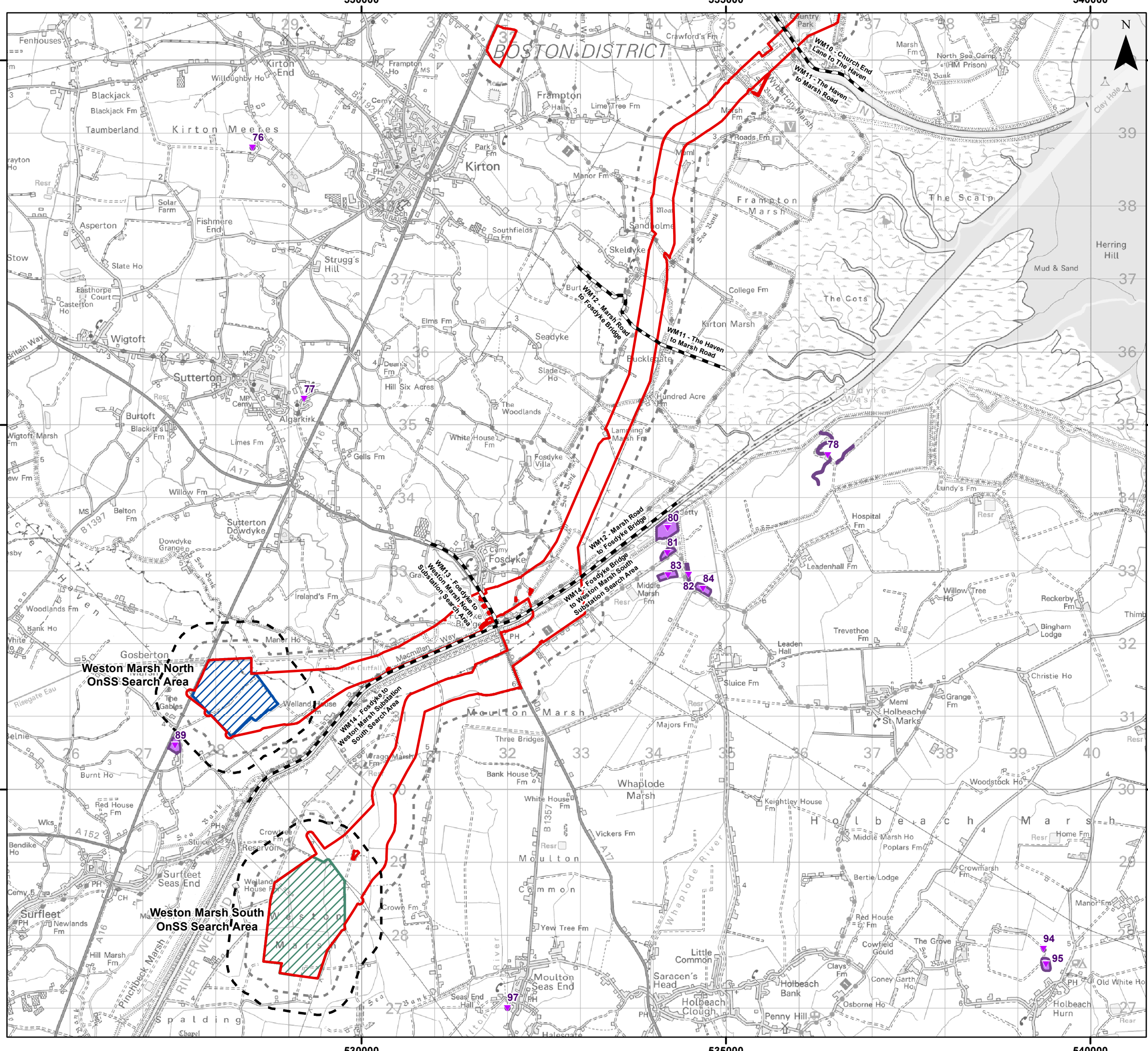


Date: 13/04/2023
 Produced By: JCS
 Revision: 0.1



© Crown copyright [and database rights] (2022)
 0100031673

Document Path: P:\05356 - Gobe Consultants Ltd\0012 GTR4 Outer Dowsing\Tech\GIS\DWG\Wing\2023 01 PEIR\Geology and Ground Conditions\05356_00012_0328_0 PEIR Wolla Bank to Weston Marsh - Historic Landfill Sites.mxd



Legend

- Onshore PEIR Boundary
- Onshore Segment Break
- Weston Marsh North OnSS Search Area
- Weston Marsh South OnSS Search Area
- Onshore PEIR Boundary Weston Marsh 250 m Buffer
- Weston Marsh Onshore Substations 500 m Buffer
- Historic Landfill Site (Centroid)
- Historic Landfill Site (Boundary)

Sources:
 © Environment Agency copyright and/or database right 2018. All rights reserved.
 Contains information © Local Authorities



Coordinate System: British National Grid
 0 1 2 km
Scale: 1:50,000

Preliminary Environmental Information Report
 Landfall to Weston Marsh
 Historic Landfill Sites
 Figure 23.6.4



Date: 13/04/2023
 Produced By: JCS
 Revision: 0.1



© Crown copyright [and database rights] (2022) 0100031673

Document Path: P:\05356 - Gobe Consultants Ltd\0012 GTR4 Outer Dowsing\GIS\DWG\Wing\2023 01 PEIR\Geology and Ground Conditions\05356_00012_02328_0 PEIR Wellia Bank to Weston Marsh - Historic Landfill Sites.mxd

Radon Gas

- 23.4.89 The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.
- 23.4.90 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

UXO

- 23.4.91 The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

WM2 A52 - Hogsthorpe to Marsh Lane

Designated Sites

- 23.4.92 There are no designated sites for geological interests within the WM2 study area.

Soils

- 23.4.93 The UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscape) online mapping identifies the soils across the study area as loamy clayey soil, further defining it as the soilscape:

- Loamy and clayey soils of coastal flats with naturally high groundwater.

- 23.4.94 The Natural England provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 23.4.15.

Table 23.7: A52 Hogsthorpe to Marsh Lane WM2 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 3	141.67	100
Total	141.67	100

- 23.4.95 The ALC maps indicate that the study area is dominated by Grade 3 and is therefore considered to be of moderate to good quality and potentially BMV agricultural land. It is not possible with the published ALC mapping to differentiate between Grade 3a and 3b, where Grade 3 is mapped as present. As outlined in Table 23.27, Grade 3a would be determined as high sensitivity, whereas Grade 3b as medium sensitivity.
- 23.4.96 As all of the study area is mapped as Grade 3 and may be Grade 3a and therefore BMV agricultural land, a worst-case scenario will be assumed, and the sensitivity of the soil resource and function is determined as major.

Superficial Geology

- 23.4.97 The BGS map 1:50,000 Series Solid and Drift Geology Map England and Wales, 116 - Skegness, indicates the superficial geology within study area comprise Quaternary deposits of Terrington Beds (salt marsh and tidal deposits) and Till (boulder clay). The published superficial geology is illustrated in Figure 23.4. There are no known published boreholes within this section.
- 23.4.98 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

- 23.4.99 The BGS mapping indicates that the bedrock geology within the study area comprises the Welton Chalk Formation and Ferriby Chalk Formation of Cretaceous age. The Welton Chalk is described as '*white, massive or thickly bedded chalk with common flint nodules...*', and the Ferriby Chalk is described as '*Grey, soft, marly, flint-free chalk, typically weathering buff in exposures; locally includes pinkish bands*'. The published bedrock geology is illustrated in Figure 23.5.
- 23.4.100 The geological features within the onshore study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.

Mineral Resources

- 23.4.101 The study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.
- 23.4.102 The BGS mapping has no records of historic or active quarries within the study area or surrounding area. The geological units within the study area and environs are widespread throughout Lincolnshire.
- 23.4.103 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole where available records indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

- 23.4.104 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

- 23.4.105 The 1:10,000, 1:2,500 and 1:1,250 scale historical maps for the study area have been reviewed. In general, these show that the study area has been predominantly under agricultural use, with scattered settlements, from the 1800s to the present day.

23.4.106 Whilst the historical maps do not show evidence of potentially contaminative land use within the study area it has been noted that agricultural land use may result in some very limited contamination. Contamination from agricultural land use may result from a number of activities and include, for example, usage of pesticides and fertilizers, small spillages and leakages of fuel or oil and deposition of waste materials. The majority of the study area is located away from farm infrastructure so risk from contamination is very low.

23.4.107 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the study area comprising:

- Landfills (authorised and historic) - the search identified two historic landfills. One within the PEIR boundary at Field Farm (NGR TF 5280 7220), which accepted commercial household between 1984 and 1994, and one historic landfill within 250m of the PEIR boundary at Hogsthorpe Landfill site (NGR TF 5400 7110), that accepted multiple types of waste stream between 1984 and 1994;
- Pollution incidents - no pollution incidents have been noted within the study area; and
- Past contaminative uses – no uses have been noted within the study area.

23.4.108 The former landfills are considered to present a low risk given the nature of the fill material (inert). No potential sources of ground gases within natural soils have been identified.

23.4.109 As a consequence, assessment of the baseline data in relation to contaminated land has been determined as having a minor sensitivity.

Radon Gas

23.4.110 The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.111 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

UXO

23.4.112 The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

WM3 - Marsh Lane to A158 Skegness Road

Designated Sites

23.4.113 There are no designated sites for geological interests within the WM3 study area.

Soils

23.4.114 The UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscales) online mapping identifies the soils across the study area as loamy clayey soil, further defining it as the soilscape:

- Loamy and clayey soils of coastal flats with naturally high groundwater.

23.4.115 The Natural England provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 23.4.15.

Table 23.8: Marsh Lane to A158 Skegness Road WM3 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 3	110.61	100
Total	110.61	100

23.4.116 The ALC maps indicate that the study area is dominated by Grade 3 and is therefore considered to be of moderate to good quality. It is not possible with the published ALC mapping to differentiate between Grade 3a and 3b, where Grade 3 is mapped as present. As outlined in Table 23.27, Grade 3a would be determined as high sensitivity, whereas Grade 3b as medium sensitivity.

23.4.117 As all of the study area is mapped as Grade 3 and may be Grade 3a and therefore BMV agricultural land, a worst-case scenario will be assumed, and the sensitivity of the soil resource and function is determined as major.

Superficial Geology

23.4.118 The BGS map 1:50,000 Series Solid and Drift Geology Map England and Wales, 116 - Skegness, indicates the superficial geology within study area comprise Quaternary deposits of Terrington Beds (salt marsh and tidal deposits). The published superficial geology is illustrated in Figure 23.4. There are no known published boreholes within this section.

23.4.119 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

23.4.120 The BGS mapping indicates that the bedrock geology within study area comprises the Ferriby Chalk Formation and the Carstone Formation of Cretaceous age. The Ferriby Chalk is described as '*Grey, soft, marly, flint-free chalk, typically weathering buff in exposures; locally includes pinkish bands*' and the Carstone Formation is described as '*greenish-brown (rusty when weathered), thick-bedded, cross-bedded, oolitic ferruginous sandstone. The formation is medium- to coarse-grained and pebbly in part, especially at the base where it becomes a conglomerate.*' The published bedrock geology is illustrated in Figure 23.5.

23.4.121 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.

Mineral Resources

23.4.122 The study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.

23.4.123 The BGS mapping has no records of historic or active quarries within the study area or surrounding area. The geological units within the study area and environs are widespread throughout Lincolnshire.

23.4.124 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole where available records indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

23.4.125 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

23.4.126 The 1:10,000, 1:2,500 and 1:1,250 scale historical maps for the study area have been reviewed. In general, these show that the study area has been predominantly under agricultural use, with scattered settlements, from the 1800s to the present day.

23.4.127 Whilst the historical maps do not show evidence of potentially contaminative land use within the study area it has been noted that agricultural land use may result in some very limited contamination. Contamination from agricultural land use may result from a number of activities and include, for example, usage of pesticides and fertilizers, small spillages and leakages of fuel or oil and deposition of waste materials. The majority of the study area is located away from farm infrastructure so risk from contamination is very low.

23.4.128 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the study area comprising:

- Landfills (authorised and historic) - the search identified no historic or active landfills within the study area;
- Pollution incidents - no pollution incidents have been noted within the study area; and
- Past contaminative uses - no records of potentially contaminated land within the study area. This also concurs with searches of historic plans which found no evidence of past contaminative uses.

23.4.129 No potential sources of ground gases within natural soils have been identified.

23.4.130 As a consequence, assessment of the baseline data in relation to contaminated land has been determined as having a negligible sensitivity.

Radon Gas

23.4.131 The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.132 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in the assessment of the Project.

UXO

23.4.133 The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

WM4 - A158 Skegness Road to Low Road and WM5 Low Road to Steeping River

Designated Sites

23.4.134 There are no designated sites for geological interests within the WM4 and WM5 study areas.

Soils

23.4.135 The UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscape) online mapping identifies the soils across the study areas as loamy clayey soil, further defining it as the soilscape:

- Loamy and clayey soils of coastal flats with naturally high groundwater.

23.4.136 The Natural England provisional ALC maps have been used to classify the soils across the study areas. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 23.4.15.

Table 23.9: A158 Skegness Road to Steeping River WM4 and WM5 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 1	27.95	11.37
Grade 2	128.68	52.36
Grade 3	89.15	36.27
Total	245.78	100

23.4.137 The ALC maps indicate that the study area is dominated by Grade 1 to Grade 3 and is therefore considered to be of excellent to good quality and BMV agricultural land.

23.4.138 As the majority of the study area is mapped as Grade 1 to 3 and therefore BMV agricultural land, a worst-case scenario will be assumed, and the sensitivity of the soil resource and function is determined as major.

Superficial Geology

- 23.4.139 BGS map 1:50,000 Series Solid and Drift Geology Map England and Wales, 116 - Skegness, indicates the superficial geology within the study areas comprise Quaternary deposits of the Terrington Beds (salt marsh and tidal deposits). The published superficial geology is illustrated in Figure 23.4.
- 23.4.140 There are no known published boreholes within these study areas.
- 23.4.141 The geological features within the study areas and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

- 23.4.142 The BGS mapping indicates that the bedrock geology within the study areas comprises the Carstone Formation of Cretaceous age and the Claxby Ironstone Formation, Tealby Formation and Roach Formation (Undifferentiated). The published bedrock geology is illustrated in Figure 23.5.
- 23.4.143 The Carstone Formation is described as *'greenish-brown (rusty when weathered), thick-bedded, cross-bedded, oolitic ferruginous sandstone. The formation is medium- to coarse-grained and pebbly in part, especially at the base where it becomes a conglomerate.'*
- 23.4.144 The Claxby Ironstone Formation is described by the BGS as *'Pale grey to dark brown, ferruginous oolitic, silty clay with varying concentrations of oolitic ironstone and pink or cream, calcareous, siltstone bands'*. The Tealby Formation is described as *'Brown and grey clays, ooidal and glauconitic in part, with a sandy limestone in the middle part of the formation'*, and the Roach Formation described as *'Sandy, bioturbated, ooidal-mudstones and very fine-grained, very clayey, bioturbated, partly ooidal sands'*.
- 23.4.145 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.

Mineral Resources

- 23.4.146 The study areas, according to the Coal Authority, do not lie within a coal mining reporting areas and there are no significant coal bearing bedrock units present.
- 23.4.147 There is one BGS record of a closed brickworks to the southeast of Burgh le Marsh, south of the A158 Sycamore Lakes roundabout. The brick pits are now a series of lakes within a holiday and caravan park.
- 23.4.148 The BGS mapping has no records of active quarries or evidence of modern brickworks within the study areas or surrounding area. The geological units within the study areas and environs are widespread throughout Lincolnshire.
- 23.4.149 The study areas do not fall within the Lincolnshire minerals safeguarding areas and published borehole where available records indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

23.4.150 The hydrological and hydrogeological setting of the study areas are described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

23.4.151 The 1:10,000, 1:2,500 and 1:1,250 scale historical maps for the study areas have been reviewed. In general, these show that the study areas have been predominantly under agricultural use, with scattered settlements, from the 1800s to the present day.

23.4.152 Whilst the historical maps do not show evidence of potentially contaminative land use within the study areas it has been noted that agricultural land use may result in some very limited contamination. Contamination from agricultural land use may result from a number of activities and include, for example, usage of pesticides and fertilizers, small spillages and leakages of fuel or oil and deposition of waste materials. The majority of the study areas are located away from farm infrastructure so risk from contamination is very low.

23.4.153 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the study areas comprising:

- Landfills (authorised and historic) - the search identified no historic or active landfills within the study areas;
- Pollution incidents - no pollution incidents have been noted within the study areas; and
- Past contaminative uses – no records of potentially contaminated land within the study areas. This also concurs with searches of historic plans which found no evidence of past contaminative uses.

23.4.154 The former landfills are considered to present a low risk given the nature of the fill material (inert). No potential sources of ground gases within natural soils have been identified.

23.4.155 As a consequence, assessment of the baseline data in relation to contaminated land has been determined as having a minor sensitivity.

Radon Gas

23.4.156 The UK Radon Map indicates that the majority of the study areas do not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.157 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

UXO

23.4.158 The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study areas are identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

WM6 - Steeping River to Ivy House Farm/Marsh Yard

Designated Sites

23.4.159 There are no designated sites for geological interests within the WM6 study area.

Soils

23.4.160 The UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscales) online mapping identifies the soils across the study area as loamy clayey soil, further defining it as the soilscape:

- Loamy and clayey soils of coastal flats with naturally high groundwater.

23.4.161 The Natural England provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 23.4.15.

Table 23.10: Steeping River to Ivy House Farm/Marsh Yard WM6 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 1	186.87	100
Total	186.87	100

23.4.162 The ALC maps indicate that the study area is entirely Grade 1 and is therefore considered to be of excellent quality and BMV agricultural land.

23.4.163 The sensitivity of the soil resource and function is determined as major.

Superficial Geology

23.4.164 BGS map 1:50,000 Series Solid and Drift Geology Map England and Wales, 116 - Skegness, indicates the superficial geology within the study area comprise Quaternary deposits of the Terrington Beds (salt marsh and tidal deposits). The published superficial geology is illustrated in Figure 23.4. There are no known published boreholes within this section.

23.4.165 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

23.4.166 The BGS mapping indicates that the bedrock geology within the study area comprises the Claxby Ironstone Formation, Tealby Formation and Roach Formation (Undifferentiated) and the Spilsby Sandstone Formation. The published bedrock geology is illustrated in Figure 23.5.

- 23.4.167 The Claxby Ironstone Formation is described by the BGS as '*Pale grey to dark brown, ferruginous oolitic, silty clay with varying concentrations of oolitic ironstone and pink or cream, calcareous, siltstone bands*'. The Tealby Formation is described as '*Brown and grey clays, ooidal and glauconitic in part, with a sandy limestone in the middle part of the formation*', and the Roach Formation described as '*Sandy, bioturbated, ooidal-mudstones and very fine-grained, very clayey, bioturbated, partly ooidal sands*'.
- 23.4.168 The Spilsby Formation comprises two members, the Upper Spilsby Sandstone and Lower Spilsby Sandstone. These members are further divided into units of differing composition. In general, the formation is described as greenish-yellow to brown soft coarse grained sandstone with phosphate nodules and large calcareous concretions³.
- 23.4.169 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.

Mineral Resources

- 23.4.170 The study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.
- 23.4.171 The BGS mapping has no records of historic or active quarries within the study area or surrounding area. The geological units within the study area and environs are widespread throughout Lincolnshire.
- 23.4.172 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole where available records indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

- 23.4.173 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

- 23.4.174 The 1:10,000, 1:2,500 and 1:1,250 scale historical maps for the study area have been reviewed. In general, these show that the study area has been predominantly under agricultural use, with scattered settlements, from the 1800s to the present day.
- 23.4.175 Whilst the historical maps do not show evidence of potentially contaminative land use within the study area it has been noted that agricultural land use may result in some very limited contamination. Contamination from agricultural land use may result from a number of activities and include, for example, usage of pesticides and fertilizers, small spillages and leakages of fuel or oil and deposition of waste materials. The majority of the study area is located away from farm infrastructure so risk from contamination is very low.

³ BGS, The geology of part of east Lincolnshire including the country near the towns of Louth, Alford and Spilsby (...Sheet 84). 1887, online at <https://pubs.bgs.ac.uk/publications.html?pubID=B01439>

23.4.176A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the study area comprising:

- Landfills (authorised and historic) - the search identified no historic or active landfills within the study area;
- Pollution incidents - no pollution incidents have been noted within the study area; and
- Past contaminative uses– no records of potentially contaminated land within the study area. This also concurs with searches of historic plans which found no evidence of past contaminative uses.

23.4.177No potential sources of ground gases within natural soils have been identified.

23.4.178As a consequence, assessment of the baseline data in relation to contaminated land has been determined as having a negligible sensitivity.

Radon Gas

23.4.179The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.180Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

UXO

23.4.181The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

WM7 - Ivy House Farm/Marsh Yard to Staples Farm

Designated Sites

23.4.182There are no designated sites for geological interests within the WM7 study area.

Soils

23.4.183The UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscales) online mapping identifies the soils across the study area as loamy clayey soil, further defining it as the soilscape:

- Loamy and clayey soils of coastal flats with naturally high groundwater.

23.4.184The Natural England provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 23.4.15.

Table 23.11: Ivy House Farm/Marsh Yard to Staples Farm WM7 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 1	234.04	100
Total	234.04	100

23.4.185 The ALC maps indicate that the study area is entirely Grade 1 and is therefore considered to be of excellent quality and BMV agricultural land.

23.4.186 The sensitivity of the soil resource and function is determined as major.

Superficial Geology

BGS map 1:50,000 Series Solid and Drift Geology Map England and Wales, 116 - Skegness, and 129 – The Wash indicates the superficial geology within the study area comprise Quaternary deposits of the Terrington Beds (salt marsh and tidal deposits). The published superficial geology is illustrated in Figure 23.4.

23.4.187 There is one published borehole within the study area which recorded a thin layer of red firm silt overlying about 12.5m of fine to very fine sand which ranges in colour.

23.4.188 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

23.4.189 The BGS mapping indicates that the bedrock geology within the study area comprises the Kimmeridge Clay Formation. Onshore, this is described as calcareous, silty or sandy mudstones with thin siltstone and cement stone beds, locally sandy and silty. The published bedrock geology is illustrated in Figure 23.5.

23.4.190 The published borehole record indicates a 0.75m thick unit of dark grey firm clay with thin units of peat, overlying 1.0m of brown stiff clay with chalk pebbles.

23.4.191 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.

Mineral Resources

23.4.192 The study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.

23.4.193 The BGS mapping has no records of historic or active quarries within the study area or surrounding area. The geological units within the study area and environs are widespread throughout Lincolnshire.

23.4.194 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole where available records indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

23.4.195 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

23.4.196 The 1:10,000, 1:2,500 and 1:1,250 scale historical maps for the study area have been reviewed. In general, these show that the study area has been predominantly under agricultural use, with scattered settlements, from the 1800s to the present day.

23.4.197 Whilst the historical maps do not show evidence of potentially contaminative land use within the study area it has been noted that agricultural land use may result in some very limited contamination. Contamination from agricultural land use may result from a number of activities and include, for example, usage of pesticides and fertilizers, small spillages and leakages of fuel or oil and deposition of waste materials. The majority of the study area is located away from farm infrastructure so risk from contamination is very low.

23.4.198 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the study area comprising:

- Landfills (authorised and historic) - the search identified no historic or active landfills within the study area;
- Pollution incidents - no pollution incidents have been noted within the study area; and
- Past contaminative uses – no records of potentially contaminated land within the study area. This also concurs with searches of historic plans which found no evidence of past contaminative uses.

23.4.199 No potential sources of ground gases within natural soils have been identified.

23.4.200 As a consequence, assessment of the baseline data in relation to contaminated land has been determined as having a negligible sensitivity.

Radon Gas

23.4.201 The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.202 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

UXO

23.4.203 The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

WM8 - Staples Farm to Crowhall Lane

Designated Sites

23.4.204 There are no designated sites for geological interests within the WM8 study area.

Soils

23.4.205 The UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscales) online mapping identifies the soils across the study area as loamy clayey soil, further defining it as the soilscape:

- Loamy and clayey soils of coastal flats with naturally high groundwater.

23.4.206 The Natural England provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 23.4.15.

Table 23.12: Staples Farm to Crowhall Lane WM8 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 1	292.02	100
Total	292.02	100

23.4.207 The ALC maps indicate that the study area is entirely Grade 1 and is therefore considered to be of excellent quality and BMV agricultural land.

23.4.208 The sensitivity of the soil resource and function is determined as **major**.

Superficial Geology

23.4.209 BGS map 1:50,000 Series Solid and Drift Geology Map England and Wales, 128 - Boston, and 129 – The Wash indicates the superficial geology within the study area comprise Quaternary deposits of the Terrington Beds (salt marsh and tidal deposits). The published superficial geology is illustrated in Figure 23.4. There are no known published boreholes within this study area.

23.4.210 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

23.4.211 The BGS mapping indicates that the bedrock geology within the study area comprises the Kimmeridge Clay Formation. Onshore, this is described as calcareous, silty or sandy mudstones with thin siltstone and cementstone beds, locally sandy and silty. At the western end of the study area overlies a small area of the Ampthill Clay Formation. The Ampthill Clay is described as smooth or slightly silty mudstone '*pale to medium grey with argillaceous limestone (cementstone) nodules*'. The published bedrock geology is illustrated in Figure 23.5.

23.4.212 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.

Mineral Resources

23.4.213 The study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.

23.4.214 The BGS mapping has no records of historic or active quarries within the study area or surrounding area. The geological units within the study area and environs are widespread throughout Lincolnshire.

23.4.215 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole where available records indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

23.4.216 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

23.4.217 The 1:10,000, 1:2,500 and 1:1,250 scale historical maps for the study area have been reviewed. In general, these show that the study area has been predominantly under agricultural use, with scattered settlements, from the 1800s to the present day.

23.4.218 Whilst the historical maps do not show evidence of potentially contaminative land use within the study area it has been noted that agricultural land use may result in some very limited contamination. Contamination from agricultural land use may result from a number of activities and include, for example, usage of pesticides and fertilizers, small spillages and leakages of fuel or oil and deposition of waste materials. The majority of the study area is located away from farm infrastructure so risk from contamination is very low.

23.4.219 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the study area comprising:

- Landfills (authorised and historic) - the search identified no historic or active landfills within the study area;

- Pollution incidents - no pollution incidents have been noted within the study area; and
- Past contaminative uses– no records of potentially contaminated land within the study area. This also concurs with searches of historic plans which found no evidence of past contaminative uses.

23.4.220 No potential sources of ground gases within natural soils have been identified.

23.4.221 As a consequence, assessment of the baseline data in relation to contaminated land has been determined as having a negligible sensitivity.

Radon Gas

23.4.222 The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.223 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

UXO

23.4.224 The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

WM9 - Crowhall Lane to Church End Lane

Designated Sites

23.4.225 There are no designated sites for geological interests within the WM9 study area.

Soils

23.4.226 The UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscales) online mapping identifies the soils across the study area as loamy clayey soil, further defining it as the soilscape:

- Loamy and clayey soils of coastal flats with naturally high groundwater.

23.4.227 The Natural England provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 23.4.15.

Table 23.13: Crowhall Lane to Church End Lane WM9 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 1	97.08	100
Total	97.08	100

23.4.228 The ALC maps indicate that the study area is entirely Grade 1 and is therefore considered to be of excellent quality and BMV agricultural land.

23.4.229 The sensitivity of the soil resource and function is determined as major.

Superficial Geology

23.4.230 BGS map 1:50,000 Series Solid and Drift Geology Map England and Wales, 128 - Boston, and 129 – The Wash indicates the superficial geology within the study area comprise Quaternary deposits of the Terrington Beds (salt marsh and tidal deposits). The published superficial geology is illustrated in Figure 23.4. There are no known published boreholes within this section.

23.4.231 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

23.4.232 The BGS mapping indicates that the bedrock geology within the study area comprises the Ampthill Clay Formation. The Ampthill Clay is described as smooth or slightly silty mudstone '*pale to medium grey with argillaceous limestone (cementstone) nodules*'. The published bedrock geology is illustrated in Figure 23.5.

23.4.233 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.

Mineral Resources

23.4.234 The study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.

23.4.235 The BGS mapping has no records of historic or active quarries within the study area or surrounding area. The geological units within the study area and environs are widespread throughout Lincolnshire.

23.4.236 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole where available records indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

23.4.237 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

23.4.238 The 1:10,000, 1:2,500 and 1:1,250 scale historical maps for the study area have been reviewed. In general, these show that the study area has been predominantly under agricultural use, with scattered settlements, from the 1800s to the present day.

23.4.239 Whilst the historical maps do not show evidence of potentially contaminative land use within the study area it has been noted that agricultural land use may result in some very limited contamination. Contamination from agricultural land use may result from a number of activities and include, for example, usage of pesticides and fertilizers, small spillages and leakages of fuel or oil and deposition of waste materials. The majority of the study area is located away from farm infrastructure so risk from contamination is very low.

23.4.240 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the study area comprising:

- Landfills (authorised and historic) - the search identified no historic or active landfills within the study area;
- Pollution incidents - no pollution incidents have been noted within the study area; and
- Past contaminative uses - no records of potentially contaminated land within the study area. This also concurs with searches of historic plans which found no evidence of past contaminative uses.

23.4.241 No potential sources of ground gases within natural soils have been identified.

23.4.242 As a consequence, assessment of the baseline data in relation to contaminated land has been determined as having a negligible sensitivity.

Radon Gas

23.4.243 The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.244 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

UXO

23.4.245 The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

WM10 - Church End Lane to The Haven

Designated Sites

23.4.246 There are no designated sites for geological interests within the W10 study area.

Soils

23.4.247 The UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscales) online mapping identifies the soils across the study area as loamy clayey soil, further defining it as the soilscape:

- Loamy and clayey soils of coastal flats with naturally high groundwater.

23.4.248 The Natural England provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 23.4.15.

Table 23.14: Church End Lane to The Haven WM10 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 1	119.3	100
Total	119.3	100

23.4.249 The ALC maps indicate that the study area is entirely Grade 1 and is therefore considered to be of excellent quality and BMV agricultural land.

23.4.250 The sensitivity of the soil resource and function is determined as major.

Superficial Geology

23.4.251 BGS map 1:50,000 Series Solid and Drift Geology Map England and Wales, 128 – Boston indicates the superficial geology within the study area comprise Quaternary deposits of the Terrington Beds (salt marsh and tidal deposits). The published superficial geology is illustrated in Figure 23.4. There are no known published boreholes within this section.

23.4.252 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

23.4.253 The BGS mapping indicates that the bedrock geology within the study area comprises the Ampthill Clay Formation. The Ampthill Clay is described as smooth or slightly silty mudstone ‘*pale to medium grey with argillaceous limestone (cementstone) nodules*’. The published bedrock geology is illustrated in Figure 23.5.

23.4.254 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.

Mineral Resources

23.4.255 The study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.

23.4.256 The BGS mapping has no records of historic or active quarries within the study area or surrounding area. The geological units within the study area and environs are widespread throughout Lincolnshire.

23.4.257 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole where available records indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

23.4.258 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

23.4.259 The 1:10,000, 1:2,500 and 1:1,250 scale historical maps for the study area have been reviewed. In general, these show that the study area has been predominantly under agricultural use, with scattered settlements, from the 1800s to the present day.

23.4.260 Whilst the historical maps do not show evidence of potentially contaminative land use within the study area it has been noted that agricultural land use may result in some very limited contamination. Contamination from agricultural land use may result from a number of activities and include, for example, usage of pesticides and fertilizers, small spillages and leakages of fuel or oil and deposition of waste materials. The majority of the study area is located away from farm infrastructure so risk from contamination is very low.

23.4.261 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the study area comprising:

- Landfills (authorised and historic) - the search identified no historic or active landfills within the study area;
- Pollution incidents - no pollution incidents have been noted within the study area; and
- Past contaminative uses – no records of potentially contaminated land within the study area. This also concurs with searches of historic plans which found no evidence of past contaminative uses.

23.4.262 No potential sources of ground gases within natural soils have been identified.

23.4.263 As a consequence, assessment of the baseline data in relation to contaminated land has been determined as having a negligible sensitivity.

Radon Gas

23.4.264 The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.265 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

UXO

23.4.266 The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

WM11 - The Haven to Marsh Road

Designated Sites

23.4.267 There are no designated sites for geological interests within the WM11 study area.

Soils

23.4.268 The UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscape) online mapping identifies the soils across the study area as loamy clayey soil, further defining it as the soilscape:

- Loamy and clayey soils of coastal flats with naturally high groundwater.

23.4.269 The Natural England provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 1.4.13.

Table 23.15: The Haven to Marsh Road WM11 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 1	155.3	100
Total	155.3	100

23.4.270 The ALC maps indicate that the study area is entirely Grade 1 and is therefore considered to be of excellent quality and BMV agricultural land.

23.4.271 The sensitivity of the soil resource and function is determined as major.

Superficial Geology

23.4.272 BGS map 1:50,000 Series Solid and Drift Geology Map England and Wales, 128 – Boston indicates the superficial geology within the study area comprise Quaternary deposits of the Terrington Beds (salt marsh and tidal deposits). The published superficial geology is illustrated in Figure 23.4. There is one published borehole within the study area which recorded brown silt and grey sand and silt to 5.79m bgl overlying an unproven thickness of brown clay.

23.4.273 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

23.4.274 The BGS mapping indicates that the bedrock geology within the study area comprises the Amptill Clay Formation and the West Walton Formation. The Amptill Clay is described as smooth or slightly silty mudstone '*pale to medium grey with argillaceous limestone (cementstone) nodules*', and the West Walton is described as '*Calcareous mudstone, silty mudstone and siltstone, with subordinate fine-grained sandstones and argillaceous limestone (cementstone) or siltstone nodules*'. The published bedrock geology is illustrated in Figure 23.5.

23.4.275 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.

Mineral Resources

23.4.276 The study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.

23.4.277 The BGS mapping has no records of historic or active quarries within the study area or surrounding area. The geological units within the study area and environs are widespread throughout Lincolnshire.

23.4.278 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole where available records indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

23.4.279 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

23.4.280 The 1:10,000, 1:2,500 and 1:1,250 scale historical maps for the study area have been reviewed. In general, these show that the study area has been predominantly under agricultural use, with scattered settlements, from the 1800s to the present day.

23.4.281 Whilst the historical maps do not show evidence of potentially contaminative land use within the study area it has been noted that agricultural land use may result in some very limited contamination. Contamination from agricultural land use may result from a number of activities and include, for example, usage of pesticides and fertilizers, small spillages and leakages of fuel or oil and deposition of waste materials. The majority of the study area is located away from farm infrastructure so risk from contamination is very low.

23.4.282 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the study area comprising:

- Landfills (authorised and historic) - the search identified no historic or active landfills within the study area;
- Pollution incidents - no pollution incidents have been noted within the study area; and
- Past contaminative uses - no records of potentially contaminated land within the study area. This also concurs with searches of historic plans which found no evidence of past contaminative uses.

23.4.283 No potential sources of ground gases within natural soils have been identified.

23.4.284 As a consequence, assessment of the baseline data in relation to contaminated land has been determined as having a negligible sensitivity.

Radon Gas

23.4.285 The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.286 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

UXO

23.4.287 The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

WM12 - Marsh Road to Fosdyke Bridge

Designated Sites

23.4.288 There are no designated sites for geological interests within the WM12 study area.

Soils

23.4.289 The UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscape) online mapping identifies the soils across the study area as loamy clayey soils, further defining it as two soilscape:

- Loamy and clayey soils of coastal flats with naturally high groundwater; and
- Loamy, saltmarsh soils.

23.4.290 The Natural England provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 23.4.15.

Table 23.16: Marsh Road to Fosdyke Bridge WM12 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 1	146.04	95.17
Not Graded (River Welland)	7.41	4.83
Total	153.45	100

23.4.291 The ALC maps indicate that agricultural land within the study area is entirely Grade 1 and is therefore considered to be of excellent quality and BMV agricultural land.

23.4.292 The sensitivity of the soil resource and function is determined as major.

Superficial Geology

- 23.4.293 BGS map 1:50,000 Series Solid and Drift Geology Map England and Wales, 128 – Boston and 144 – Spalding indicates the superficial geology within the study area comprise Quaternary deposits of the Terrington Beds (salt marsh and tidal deposits). The published superficial geology is illustrated in Figure 23.4. There is one published borehole within the study area which records 24m of sand and gravel overlying 26m of gravel and boulder clay.
- 23.4.294 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

- 23.4.295 The BGS mapping indicates that the bedrock geology within the study area comprises the West Walton Formation and Oxford Clay Formation. The West Walton is described by the BGS Lexicon as '*Calcareous mudstone, silty mudstone and siltstone, with subordinate fine-grained sandstones and argillaceous limestone (cementstone) or siltstone nodules*'. The Oxford Clay is described as '*Silicate-mudstone, grey, generally smooth to slightly silty, with sporadic beds of argillaceous limestone nodules*'. The published bedrock geology is illustrated in Figure 23.5.
- 23.4.296 The published borehole record indicates that 49m of bedrock clay was proven during drilling.
- 23.4.297 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.

Mineral Resources

- 23.4.298 The study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.
- 23.4.299 The BGS mapping has no records of historic or active quarries within the study area or surrounding area. The geological units within the study area and environs are widespread throughout Lincolnshire.
- 23.4.300 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole where available records indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

- 23.4.301 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

- 23.4.302 The 1:10,000, 1:2,500 and 1:1,250 scale historical maps for the study area have been reviewed. In general, these show that the study area has been predominantly under agricultural use, with scattered settlements, from the 1800s to the present day.

23.4.303 Whilst the historical maps do not show evidence of potentially contaminative land use within the study area it has been noted that agricultural land use may result in some very limited contamination. Contamination from agricultural land use may result from a number of activities and include, for example, usage of pesticides and fertilizers, small spillages and leakages of fuel or oil and deposition of waste materials. The majority of the study area is located away from farm infrastructure so risk from contamination is very low.

23.4.304 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the study area comprising:

- Landfills (authorised and historic) - the search identified no historic or active landfills within the study area;
- Pollution incidents - no pollution incidents have been noted within the study area; and
- Past contaminative uses - no records of potentially contaminated land within the study area. This also concurs with searches of historic plans which found no evidence of past contaminative uses.

23.4.305 No potential sources of ground gases within natural soils have been identified.

23.4.306 As a consequence, assessment of the baseline data in relation to contaminated land has been determined as having a negligible sensitivity.

Radon Gas

23.4.307 The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.308 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

UXO

23.4.309 The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

WM13 - Fosdyke to Weston Marsh North OnSS Search Area

Designated Sites

23.4.310 There are no designated sites for geological interests within the WM13 study area.

Soils

23.4.311 The UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscales) online mapping identifies the soil across the study area as loamy clayey soil, further defining it as soilscape:

- Loamy and clayey soils of coastal flats with naturally high groundwater.

23.4.312 The Natural England provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 23.4.15.

Table 23.17: Fosdyke to Weston Marsh Substation Search Area (North) WM13 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 1	218.21	100
Total	218.21	100

23.4.313 The ALC maps indicate that the study area is entirely Grade 1 and is therefore considered to be of excellent quality and BMV agricultural land.

23.4.314 The sensitivity of the soil resource and function is determined as major.

Superficial Geology

23.4.315 BGS map 1:50,000 Series Solid and Drift Geology Map England and Wales, 128 – Boston and 144 – Spalding indicates the superficial geology within the study area comprise Quaternary deposits of the Terrington Beds (salt marsh and tidal deposits). The published superficial geology is illustrated in Figure 23.4. There are several published boreholes within the study area that generally record significant thicknesses of clayey or silty sand over clay.

23.4.316 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

23.4.317 The BGS mapping indicates that the bedrock geology within the study area comprises the Oxford Clay Formation. The Oxford Clay is described as ‘*Silicate-mudstone, grey, generally smooth to slightly silty, with sporadic beds of argillaceous limestone nodules*’. The published bedrock geology is illustrated in Figure 23.5.

23.4.318 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Mineral Resources

23.4.319 The study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.

23.4.320 The BGS mapping has no records of historic or active quarries within the study area or surrounding area. The geological units within the study area and environs are widespread throughout Lincolnshire.

23.4.321 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole where available records indicate that the superficial and bedrock geology are unlikely to be of modern economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

23.4.322 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

23.4.323 The 1:10,000, 1:2,500 and 1:1,250 scale historical maps for the study area have been reviewed. In general, these show that the study area has been predominantly under agricultural use, with scattered settlements, from the 1800s to the present day.

23.4.324 Whilst the historical maps do not show evidence of potentially contaminative land use within the study area it has been noted that agricultural land use may result in some very limited contamination. Contamination from agricultural land use may result from a number of activities and include, for example, usage of pesticides and fertilizers, small spillages and leakages of fuel or oil and deposition of waste materials. The majority of the study area is located away from farm infrastructure so risk from contamination is very low.

23.4.325 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the study area comprising:

- Landfills (authorised and historic) - the search identified one historic landfill within the study area at Surfleet Bank (TF 2740 3305), the site was registered between 1993 and 2006, accepting inert materials. The site is 570m southwest of the substation search area;
- Pollution incidents - no pollution incidents have been noted within the study area; and
- Past contaminative uses – no records of potentially contaminated land within the study area. This also concurs with searches of historic plans which found no evidence of past contaminative uses.

23.4.326 No potential sources of ground gases within natural soils have been identified.

23.4.327 As a consequence, assessment of the baseline data in relation to contaminated land has been determined as having a negligible sensitivity.

Radon Gas

23.4.328 The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.329 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

UXO

23.4.330 The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

WM14 - Fosdyke to Weston Marsh South OnSS Search Area

Designated Sites

23.4.331 There are no designated sites for geological interests within the WM14 study area.

Soils

23.4.332 The UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscales) online mapping identifies the soils across the study area as loamy clayey soil, further defining it as the soilscape:

- Loamy and clayey soils of coastal flats with naturally high groundwater.

23.4.333 The Natural England provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 23.4.15.

Table 23.18: Fosdyke to Weston Marsh Substation Search Area (South) WM14 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 1	369.3	100
Total	369.3	100

23.4.334 The ALC maps indicate that the study area is entirely Grade 1 and is therefore considered to be of excellent quality and BMV agricultural land.

23.4.335 The sensitivity of the soil resource and function is determined as major.

Superficial Geology

23.4.336 BGS map 1:50,000 Series Solid and Drift Geology Map England and Wales, 128 – Boston and 144 – Spalding indicates the superficial geology within the study area comprise Quaternary deposits of the Terrington Beds (salt marsh and tidal deposits). The published superficial geology is illustrated in Figure 23.4. There are several published boreholes within the study area that generally record significant thicknesses of clayey or silty sand over clay.

23.4.337 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

23.4.338 The BGS mapping indicates that the bedrock geology within the study area comprises the Oxford Clay Formation. The Oxford Clay is described as '*Silicate-mudstone, grey, generally smooth to slightly silty, with sporadic beds of argillaceous limestone nodules*'. The published bedrock geology is illustrated in Figure 23.5.

23.4.339 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.

Mineral Resources

23.4.340 The study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.

23.4.341 The BGS mapping has no records of historic or active quarries within the study area or surrounding area. The geological units within the study area and environs are widespread throughout Lincolnshire.

23.4.342 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole where available records indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

23.4.343 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

23.4.344 The 1:10,000, 1:2,500 and 1:1,250 scale historical maps for the study area have been reviewed. In general, these show that the study area has been predominantly under agricultural use, with scattered settlements, from the 1800s to the present day.

23.4.345 Whilst the historical maps do not show evidence of potentially contaminative land use within the study area it has been noted that agricultural land use may result in some very limited contamination. Contamination from agricultural land use may result from a number of activities and include, for example, usage of pesticides and fertilizers, small spillages and leakages of fuel or oil and deposition of waste materials. The majority of the study area is located away from farm infrastructure so risk from contamination is very low.

23.4.346 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the study area comprising:

- Landfills (authorised and historic) - the search identified no historic or active landfills within the study area;
- Pollution incidents - no pollution incidents have been noted within the study area; and

- Past contaminative uses – no records of potentially contaminated land within the study area. This also concurs with searches of historic plans which found no evidence of past contaminative uses.

23.4.347 No potential sources of ground gases within natural soils have been identified.

23.4.348 As a consequence, assessment of the baseline data in relation to contaminated land has been determined as having a negligible sensitivity.

Radon Gas

23.4.349 The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.350 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

UXO

23.4.351 The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

Weston Marsh, via north of the A52

A1 - Low Road to Steeping River

Designated Sites

23.4.352 There are no designated sites for geological interests within the A1 study area.

Soils

23.4.353 The UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscales) online mapping identifies the soils across the study area as loamy clayey soil, further defining it as the soilscape:

- Loamy and clayey soils of coastal flats with naturally high groundwater.

23.4.354 The Natural England provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 23.4.15.

Table 23.19: Low Road to Steeping River A1 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 2	159.85	78.3
Grade 3	44.28	21.7

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Total	204.13	100

23.4.355 The ALC maps indicate that the study area is dominated by Grade 2 and is therefore considered to be of good quality and BMV land. It is not possible with the published ALC mapping to differentiate between Grade 3a and 3b, where Grade 3 is mapped as present. As outlined in Table 23.27, Grade 3a would be determined as high sensitivity, whereas Grade 3b as medium sensitivity.

23.4.356 As all of the study area is mapped as Grade 2 or 3, a worst-case scenario will be assumed that all the land is BMV agricultural land, and the sensitivity of the soil resource and function is determined as major.

Superficial Geology

23.4.357 British Geological Survey (BGS) map 1:50,000 Series Solid and Drift Geology Map England and Wales, 116 - Skegness, indicates the superficial geology within the study area comprises Quaternary deposits of clay and silt, Terrington Beds (salt marsh and tidal deposits), glaciofluvial sand and gravel and Till (boulder clay). The published superficial geology is illustrated in Figure 23.4. More isolated regions of the ECC (south of Croft village) comprise deposits of glacial till (boulder clay). Published boreholes records indicate that in general the superficial geology comprises soils and up to 3m of clayey sand and gravels, overlying a soft to stiff clay with a proven thickness of 10m.

23.4.358 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

23.4.359 The BGS mapping indicates that the bedrock geology within the study area comprises the Carstone Formation, Claxby Ironstone Formation, Tealby Formation and Roach Formation (Undifferentiated), and the Spilsby Formation.

23.4.360 The Carstone Formation is described as ‘greenish-brown (rusty when weathered), thick-bedded, cross-bedded, oolitic ferruginous sandstone. The formation is medium- to coarse-grained and pebbly in part, especially at the base where it becomes a conglomerate.’

23.4.361 The Claxby Ironstone Formation is described by the BGS as ‘Pale grey to dark brown, ferruginous oolitic, silty clay with varying concentrations of oolitic ironstone and pink or cream, calcareous, siltstone bands’. The Tealby Formation is described as ‘Brown and grey clays, ooidal and glauconitic in part, with a sandy limestone in the middle part of the formation’, and the Roach Formation described as ‘Sandy, bioturbated, ooidal-mudstones and very fine-grained, very clayey, bioturbated, partly ooidal sands’.

23.4.362 The Spilsby Formation comprises two members, the Upper Spilsby Sandstone and Lower Spilsby Sandstone. These members are further divided into units of differing composition. In general, the formation is described as greenish-yellow to brown soft coarse grained sandstone with phosphate nodules and large calcareous concretions.

23.4.363 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.

Mineral Resources

23.4.364 The A1 study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.

23.4.365 The BGS mapping has no records of historic or active quarries within the study area or surrounding area. The geological units within the study area and environs are widespread throughout Lincolnshire.

23.4.366 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole where available records indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

23.4.367 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

23.4.368 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the A1 study area comprising:

- Landfills (authorised and historic) - the search identified no historic or active landfills within the study area;
- Pollution incidents - no pollution incidents have been noted within the study area; and
- Past contaminative uses – no records of potentially contaminated land within the study area. This also concurs with searches of historic plans which found no evidence of past contaminative uses.

Radon Gas

23.4.369 The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.370 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

UXO

23.4.371 The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

A2 - Steeping River to Fodder Dike Bank

Designated Sites

23.4.372 There are no designated sites for geological interests within the A2 study area.

Soils

23.4.373 The UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscales) online mapping identifies the soils across the study area as loamy clayey soil, further defining it as two soilscales:

- Loamy and clayey soils of coastal flats with naturally high groundwater; and
- Loamy and sandy soils with naturally high groundwater and a peaty surface.

23.4.374 The Natural England provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 23.4.15.

Table 23.20: Steeping River to Fodder Dike Bank A2 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 2	95.46	100
Total	95.46	100

23.4.375 The ALC maps indicate that the study area is entirely Grade 2 and is therefore considered to be of good quality and BMV land.

23.4.376 As all of the study area is mapped as Grade 2 and therefore BMV agricultural land, a worst-case scenario will be assumed, and the sensitivity of the soil resource and function is determined as major.

Superficial Geology

23.4.377 British Geological Survey (BGS) map 1:50,000 Series Solid and Drift Geology Map England and Wales, 116 - Skegness, indicates the superficial geology within the study area comprises Quaternary deposits of clay and silt, Terrington Beds (salt marsh and tidal deposits). The published superficial geology is illustrated in Figure 23.4. Published boreholes records indicate that in general the superficial geology comprises soils and up to 5m of clayey sand and silts, overlying a soft to stiff clay with a proven thickness of 12m.

23.4.378 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

23.4.379 The BGS mapping indicates that the bedrock geology within the study area comprises the Spilsby Formation and Kimmeridge Clay Formation.

23.4.380 The Spilsby Formation comprises two members, the Upper Spilsby Sandstone and Lower Spilsby Sandstone. These members are further divided into units of differing composition. In general, the Spilsby Formation is described as greenish-yellow to brown soft coarse grained sandstone with phosphate nodules and large calcareous concretions. Onshore the Kimmeridge Clay Formation is described by the BGS Lexicon as ‘Mudstones (calcareous or kerogen-rich or silty or sandy); thin siltstone and cementstone beds; locally sands and silts’.

23.4.381 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.

Mineral Resources

23.4.382 The study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.

23.4.383 The BGS mapping has no records of historic or active quarries within the study area or surrounding area. The geological units within the study area and environs are widespread throughout Lincolnshire.

23.4.384 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole where available records indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

23.4.385 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

23.4.386 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the study area comprising:

- Landfills (authorised and historic) - the search identified one historic landfill within the study area at Scaldgate (TF 47436 58031 and TF 47435 57924), the site has no registered date, accepting inert type waste;
- Pollution incidents - no pollution incidents have been noted within the study area; and
- Past contaminative uses – no records of potentially contaminated land within the study area. This also concurs with searches of historic plans which found no evidence of past contaminative uses.

Radon Gas

23.4.387 The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.388 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

UXO

23.4.389 The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

A3 - Fodder Dike Bank to Broadgate

Designated Sites

23.4.390 There are no designated sites for geological interests within the A3 study area

Soils

23.4.391 The UK Soil UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscales) online mapping identifies the soils across the study area as loamy clayey soil, further defining it as two soilscales:

- Loamy and clayey soils of coastal flats with naturally high groundwater; and
- Loamy and sandy soils with naturally high groundwater and a peaty surface.

23.4.392 The Natural England provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 23.4.15.

Table 23.21: Fodder Dike Bank to Broadgate A3 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 2	166.09	100
Total	166.09	100

23.4.393 The ALC maps indicate that the A3 study area is entirely Grade 2 and is therefore considered to be of good quality and BMV land.

23.4.394 As all of the study area is mapped as Grade 2 and therefore BMV agricultural land, a worst-case scenario will be assumed, and the sensitivity of the soil resource and function is determined as major.

Superficial Geology

23.4.395 British Geological Survey (BGS) map 1:50,000 Series Solid and Drift Geology Map England and Wales, 116 - Skegness, indicates the superficial geology within the study area comprises Quaternary deposits of clay and silt, Terrington Beds (salt marsh and tidal deposits). The published superficial geology is illustrated in Figure 23.4. Published boreholes records indicate that in general the superficial geology comprises soils up to 0.5m and clayey sand and silts, overlying a soft to stiff clay with a proven thickness of 5m.

23.4.396 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

23.4.397 The BGS mapping indicates that the bedrock geology within the study area comprises the Kimmeridge Clay Formation.

23.4.398 Onshore the Kimmeridge Clay Formation is described by the BGS Lexicon as '*Mudstones (calcareous or kerogen-rich or silty or sandy); thin siltstone and cementstone beds; locally sands and silts*'.

23.4.399 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.

Mineral Resources

23.4.400 The A3 study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.

23.4.401 The BGS mapping has no records of historic or active quarries within the study area or surrounding area. The geological units within the study area and environs are widespread throughout Lincolnshire.

23.4.402 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole where available records indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

23.4.403 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

23.4.404 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the study area comprising:

- Landfills (authorised and historic) - the search identified no historic or active landfills within the study area;

- Pollution incidents - no pollution incidents have been noted within the study area; and
- Past contaminative uses – no records of potentially contaminated land within the study area. This also concurs with searches of historic plans which found no evidence of past contaminative uses.

Radon Gas

23.4.405 The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.406 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

UXO

23.4.407 The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

A4 - Broadgate to Ings Drove

Designated Sites

23.4.408 There are no designated sites for geological interests within the A4 study area.

Soils

23.4.409 The UK Soil UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscales) online mapping identifies the soils across the study area as loamy clayey soil, further defining it as the soilscape:

- Loamy and clayey soils of coastal flats with naturally high groundwater.

23.4.410 The Natural England provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 23.4.15.

Table 23.22: Broadgate to Ings Drove A4 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 1	81.23	48.5
Grade 2	86.24	51.5
Total	167.47	100

23.4.411 The ALC maps indicate that the study area is dominated by Grade 1 and Grade 2 land and is therefore considered to be of excellent/good quality and BMV land.

23.4.412 As all of the study area is mapped as Grade 1 or 2 and therefore BMV agricultural land, a worst-case scenario will be assumed, and the sensitivity of the soil resource and function is determined as major.

Superficial Geology

23.4.413 British Geological Survey (BGS) map 1:50,000 Series Solid and Drift Geology Map England and Wales, 116 - Skegness, indicates the superficial geology within the study area comprises Quaternary deposits of clay and silt, Terrington Beds (salt marsh and tidal deposits). The published superficial geology is illustrated in Figure 23.4. Published boreholes records indicate that in general the superficial geology comprises soils up to 0.3m and clayey sand and silts, overlying a soft to stiff clay with a proven thickness of 3.5m.

23.4.414 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

23.4.415 The BGS mapping indicates that the bedrock geology within the study area comprises the Kimmeridge Clay Formation.

23.4.416 Onshore the Kimmeridge Clay Formation is described by the BGS Lexicon as '*Mudstones (calcareous or kerogen-rich or silty or sandy); thin siltstone and cementstone beds; locally sands and silts*'.

23.4.417 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.

Mineral Resources

23.4.418 The study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.

23.4.419 The BGS mapping has no records of historic or active quarries within the study area or surrounding area. The geological units within the onshore study area and environs are widespread throughout Lincolnshire.

23.4.420 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole where available records indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

23.4.421 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

23.4.422 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the study area comprising:

- Landfills (authorised and historic) - the search identified no historic or active landfills within the study area;
- Pollution incidents - no pollution incidents have been noted within the study area; and
- Past contaminative uses – no records of potentially contaminated land within the study area. This also concurs with searches of historic plans which found no evidence of past contaminative uses.

Radon Gas

23.4.423 The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.424 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

UXO

23.4.425 The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

A5 - Ings Drove to Church End Lane

Designated Sites

23.4.426 There are no designated sites for geological interests within the A5 study area.

Soils

23.4.427 The UK Soil UK Soil Observatory (and Cranfield Soil and Agrifood Institute Soilscales) online mapping identifies the soils across the study area as loamy clayey soil, further defining it as the soilscape:

- Loamy and clayey soils of coastal flats with naturally high groundwater.

23.4.428 The Natural England provisional ALC maps have been used to classify the soils across the study area. The majority of the ECC crosses agricultural land, and the land has been categorised within this study area into one of the grades described in paragraph 23.4.15.

Table 23.23: Broadgate to Ings Drove A5 ALC Grades

Agricultural Land Classification grade	Total Area (ha)	% of the ECC Section
Grade 1	123.88	52.95
Grade 2	110.06	47.05
Total	233.94	100

23.4.429 The ALC maps indicate that the study area is dominated by Grade 1 and Grade 2 land and is therefore considered to be of excellent/good quality and BMV land.

23.4.430 As all of the study area is mapped as Grade 1 or 2 and therefore BMV agricultural land, a worst-case scenario will be assumed, and the sensitivity of the soil resource and function is determined as major.

Superficial Geology

23.4.431 British Geological Survey (BGS) map 1:50,000 Series Solid and Drift Geology Map England and Wales, 116 - Skegness, indicates the superficial geology within study area comprises Quaternary deposits of clay and silt, Terrington Beds (salt marsh and tidal deposits). The published superficial geology is illustrated in Figure 23.4. Published boreholes records indicate that in general the superficial geology comprises soils up to 0.3m and clayey sand and silts, overlying a soft to stiff clay with a proven thickness of 3.5m.

23.4.432 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of superficial geology throughout the study area is considered to be negligible.

Bedrock Geology

23.4.433 The BGS mapping indicates that the bedrock geology within the study area comprises the Kimmeridge Clay Formation and the Ampthill Clay Formation.

23.4.434 Onshore the Kimmeridge Clay Formation is described by the BGS Lexicon as '*Mudstones (calcareous or kerogen-rich or silty or sandy); thin siltstone and cementstone beds; locally sands and silts*'. The Ampthill Clay is described as smooth or slightly silty mudstone '*pale to medium grey with argillaceous limestone (cementstone) nodules*'. The published bedrock geology is illustrated in Figure 23.5.

23.4.435 The geological features within the study area and environs are widespread throughout Lincolnshire and of limited use for knowledge, the sensitivity of bedrock geology throughout the study area is considered to be negligible.

Mineral Resources

23.4.436 The study area, according to the Coal Authority, does not lie within a coal mining reporting area and there are no significant coal bearing bedrock units present.

23.4.437 The BGS mapping has no records of historic or active quarries within the study area or surrounding area. The geological units within the study area and environs are widespread throughout Lincolnshire.

23.4.438 The study area does not fall within the Lincolnshire minerals safeguarding areas and published borehole where available records indicate that the superficial and bedrock geology are unlikely to be of economic value. The sensitivity of mineral resource throughout the study area is considered to be negligible.

Hydrogeological Setting

23.4.439 The hydrological and hydrogeological setting of the study area is described in detail, together with the determination of receptor sensitivity and assessment of impact within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

Contaminated Land

23.4.440 A number of sources including the Environment Agency, Lincolnshire County Council, and the Envirocheck report were consulted for evidence of other potentially polluting activities in the A5 study area comprising:

- Landfills (authorised and historic) - the search identified no historic or active landfills within the study area;
- Pollution incidents - no pollution incidents have been noted within the study area; and
- Past contaminative uses – no records of potentially contaminated land within the study area. This also concurs with searches of historic plans which found no evidence of past contaminative uses.

Radon Gas

23.4.441 The UK Radon Map indicates that the majority of the study area does not lie within a Radon Affected Area, as less than 1% of properties are at or above the above the NRPB action level therefore the risk of significant ingress of radon into structures on-site is considered negligible.

23.4.442 Given the anticipated ground conditions, the risk associated with ground gas is considered generally low risk in accordance with BS8576. Current advice confirms that protection measures would not be required for any permanently enclosed structure. This is therefore not considered further in this assessment of the Project.

UXO

23.4.443 The Zetica UXO mapping indicates the potential for UXO to be present as a result of WWII bombing. The study area is identified as a Low-Risk site. Therefore, this is not considered further within this assessment.

Future Baseline

23.4.444 The future baseline in relation to geology and ground conditions is unlikely to change significantly in the short, medium or long term unless there is a significant change in land use within the vicinity of the site.

23.5 Basis of Assessment

Scope of the Assessment

Impacts Scoped in for Assessment

23.5.1 The following impacts have been scoped into this assessment:

- Construction:
 - Impact 1: Short term risks to construction workers during development of onshore ECC and associated infrastructure, including the OnSS;
 - Impact 2: Risks to offsite human receptors, such as occupants of residential properties bordering the onshore ECC;
 - Impact 3: Construction phase impacts upon soil/land quality;
 - Impact 4: Sterilisation of mineral deposits;
 - Impact 5: Risk to designated sites; and
 - Impact 6: Agricultural Drainage.
- Operation and maintenance:
 - Impact 1: Ingress and accumulation of hazardous ground gases;
 - Impact 2: Structures and services laid in direct contact with contaminated soils and groundwater;
 - Impact 3: Operational impacts on geology/ground conditions and associated longer term risks to human and environmental receptors; and
 - Impact 4: Agricultural Drainage.
- Decommissioning:
 - Impact 1: Short term risks to construction workers during decommissioning of onshore ECC and associated infrastructure; and
 - Impact 2: Risks to offsite human receptors, such as occupants of residential properties bordering the onshore ECC; and
- Cumulative:
 - Impact 1: Risks to offsite human receptors, such as occupants of residential properties bordering the onshore ECC.

Impacts Scoped Out of Assessment

23.5.2 In line with the Scoping Opinion (The Inspectorate, 2022), and based on the receiving environment, expected parameters of the Project (Volume 1, Chapter 3: Project Description), and expected scale of impact/potential for a pathway for effect on the environment, the following impacts have been scoped out of the assessment:

- Construction:

- Impact 1: Risks posed to sensitive surface water and groundwater resources will be addressed as part of Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.;
- Operation and maintenance:
 - Impact 1: Loss of agricultural land from operation of underground cables has been scoped out on the basis that that this impact has been appropriately considered and mitigated (where applicable);
 - Impact 2: Routine maintenance effects on sterilisation of minerals and loss of agricultural land; and
 - Impact 3: Transboundary effects on geology, ground conditions and land quality.
- Decommissioning:
 - Impact 1: Risks posed to sensitive surface water and groundwater resources will be addressed as part of Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk; and
- Cumulative:
 - Impact 1: Risks posed to sensitive surface water and groundwater resources will be addressed as part of Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk. No impacts have been scoped out for construction or decommissioning.

Realistic Worst-Case Scenario

- 23.5.3 The final design of the Project will be confirmed through detailed engineering design studies that will be undertaken post-consent to enable the commencement of construction. In order to provide a precautionary but robust impact assessment at this stage of the development process, realistic worst-case scenarios have been defined in terms of the potential effects that may arise. This approach to EIA, referred to as the Rochdale Envelope, is common practice for developments of this nature, as set out in the Planning Inspectorate (The Inspectorate) Advice Note Nine (2018). The Rochdale Envelope for a project outlines the realistic worst-case scenario for each individual impact, so that it can be safely assumed that all lesser options will have less impact. Further details are provided in Volume 1, Chapter 6: EIA Methodology.
- 23.5.4 The following section identifies the MDS in environmental terms, defined by the project design envelope.

Table 23.24: Maximum design scenario for Geology and Ground Conditions for the Project alone

Potential effect	Maximum adverse scenario assessed	Justification
Construction		
<p>Onshore ECC Impact to soil quality, resource and function; impact to potential mineral resource; potential to excavate through contaminated sites (yet unidentified sources)</p>	<p>For the assessment presented in this chapter, the onshore ECC represents an indicative corridor of 300m, requiring a typical working width of approximately 80m and 80km in length. Cables will be installed directly or in ducts, with installation undertaken in sections. The cables will be installed in one trench per circuit (maximum of 4 trenches for up to 4 circuits), with each trench up to 5 m wide and up to 3 m deep.</p> <p>The assessment considers construction of up to six transition joint bay (TJBs) with a maximum construction area of 42,000m².</p> <p>Haul road will be approximately 6.8m in width and will extend the along each open trenched section of the onshore ECC, with distinct access points to reduce construction traffic on local roads.</p> <p>72 no. temporary compound locations (primary and secondary) along the ECC route. Indicative maximum logistics compounds area of up to 300m x 150m.</p>	<p>The MDS includes the maximum corridor width, within which the final onshore ECC will be located and so represents the greatest area of land disturbance.</p> <p>The maximum area of TJB has been used.</p> <p>The maximum number of cable trenches and cable depth has been used.</p>
<p>OnSS Impact to soil quality, resource and function; impact to potential mineral resource; potential to excavate through contaminated sites (yet unidentified sources)</p>	<p>The OnSS includes the footprint of the substation infrastructure and development platform (including landscaping). The indicative temporary working area of the OnSS is expected to be 270,000m².</p> <p>Three potential substation locations at two National Grid connection nodes are currently included in the assessment.</p> <p>One logistics compound work area is included (at each OnSS location) to accommodate offices, welfare facilities, car parking, workshops and</p>	<p>Disturbance to existing ground conditions will result from the OnSS construction and so a maximum construction footprint has been assumed.</p>

Potential effect	Maximum adverse scenario assessed	Justification
	<p>storage areas. Indicative maximum area of 300m x 150m is assumed for the substation logistic compound.</p> <p>The maximum permanent footprint of the OnSS considered is the AIS OnSS with an area of 92,700m². In the absence of detailed design of the OnSS, it has been assumed the entire permanent footprint of the OnSS will be constructed of impermeable material.</p>	
<p>Trenchless technique Impact to soil quality, resource and function; impact to potential mineral resource; potential to excavate through contaminated sites (yet unidentified sources)</p>	<p>Trenchless crossings expected at several locations such as landfall, flood defences, main roads, railways and some utility crossings. Trenchless crossings would require compounds that would be located at either end of the crossing.</p> <p>Trenchless technique compounds anticipated to be 150m x 30m in size.</p>	<p>Trenchless techniques present a risk of indirectly contaminating surface soils from drilling fluids and the movement of excavated earth/ sediments.</p>
<p>Landfall Impact to soil quality, resource and function; impact to potential mineral resource; potential to excavate through contaminated sites (yet unidentified sources)</p>	<p>Trenchless technique will be for up to 6 bores (one per circuit plus one spare) will be used from landfall to cross the coastal flood defence line.</p>	<p>The MDS includes the maximum number of cables anticipated at landfall and therefore, the maximum working corridor required.</p>
Operation and Maintenance		
<p>Increase in contamination risk</p>	<p>Routine maintenance of the OnSS.</p>	<p>The MDS for contamination risk at the OnSS.</p>
Decommissioning		

Potential effect	Maximum adverse scenario assessed	Justification
<p>Onshore Impacts on soil quality, resource and function</p>	<p>Buried cables would be de-energized with the ends sealed and left in place to avoid ground disturbance.</p> <p>Removal of the OnSS including areas of hardstanding and the removal of TJBs.</p> <p>Any final decommissioning methodology will adhere to industry best practice, rules and regulations at the time of decommissioning.</p>	<p>The onshore export cable remaining in situ provides potential lateral pathways for contamination which could indirectly affect soil and ground conditions.</p> <p>Removal of all OnSS infrastructure represents greatest disturbance.</p>

Embedded Mitigation

23.5.5 Mitigation measures that were identified and adopted as part of the evolution of the project design (embedded into the project design) and that are relevant to geology and ground conditions are listed in Table 23.25. General mitigation measures, which would apply to all parts of the Project, are set out first. Mitigation measures that would apply specifically to geology and ground conditions issues associated with the landfall, onshore corridor cable and substation, would be secured through the relevant management plans and DCO requirements.

Table 23.25: Embedded mitigation relating to geology and ground conditions

Project phase	Mitigation measures embedded into the project design
General	
Site Selection	The Project has undergone a site selection process which has involved incorporating environmental considerations in collaboration with the engineering design requirements. Land take will be reduced as far as practicable. Reinstatement of land to its original use will be undertaken as far as practical following the completion of the construction works.
Project Design	Careful routing of the onshore ECC and design of key crossing points to avoid key areas of sensitivity.
Environmental Permit	Subject to any disapplication of the relevant legislation within the DCO (which would be discussed with the relevant statutory consultees), consent would be required for the works (e.g. drilling, crossing, culverting, passing under or through) affecting the sea defence structures, main rivers, non-main and ordinary watercourses in accordance with Environmental Permitting (England and Wales) Regulations 2016 and the requirements of Environment Agency. The conditions of the consents would be specified to ensure that construction does not result in significant alteration to the ground conditions and land use.
Construction	
Code of Construction Practice (CoCP)	An CoCP will be submitted as part of the DCO application. The CoCP will include measures to control the potential impacts to ground conditions and land use. Outline documents are provided (document reference 8.1).
Pollution Prevention	Construction practices will incorporate measures to prevent pollution. Areas at risk of spillage, such as vehicle maintenance areas and hazardous substance stores (including fuel, oils, drilling fluids and chemicals) will be bunded and carefully sited to minimise the risk of hazardous substances entering drainage systems or local watercourses. Additionally, the bunded areas will have impermeable bases to limit the potential for migration of contaminants into groundwater following any leakage/spillage. Bunds used to store fuel, oil etc. will have a 110% capacity. A Pollution Prevention and Emergency Incident Response Plan (PPEIRP) will be prepared and held on all construction sites to follow in the event of an environmental emergency.

Project phase	Mitigation measures embedded into the project design
Best Practice	<p>All construction work will be undertaken in accordance with the CoCP, and good practice guidance including, but not limited to:</p> <ul style="list-style-type: none"> ▪ Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors CIRIA (C532) (CIRIA 2001); ▪ CIRIA – SuDS Manual (C753) (CIRIA, 2015b); <ul style="list-style-type: none"> ▪ No discharge to main river watercourses will occur without permission from the Environment Agency (SuDS Manual); ▪ Wheel washers and dust suppression measures to be used as appropriate to prevent the migration of pollutants (SuDS Manual); ▪ Regular cleaning of roads of any construction waste and dirt to be carried out (SuDS Manual); ▪ DEFRA Construction Code of Practice for the Sustainable Use of Soil on Construction Sites (2009); and ▪ Good Practice Guide for Handling Soils in Mineral Workings (Institute of Quarrying, 2021).
Contaminated land	<ul style="list-style-type: none"> ▪ In order to mitigate the potential impacts associated with excavation of potentially contaminative material: <ul style="list-style-type: none"> ▪ Should areas of potential concern occur in close proximity to the Project, the onshore ECC will be micro-sited where possible to maintain a 25m buffer; ▪ The CoCP will identify the procedures to be followed should an area of contamination be encountered. Areas where these materials are found will be photographed and annotated on a site drawing. Where necessary, works on site at that location will cease until any identified contamination has been assessed in accordance with the Part IIA of the EPA and the Contaminated Land (England) Regulations 2006. This assessment will be undertaken by a competent person in accordance with the LCRM guidance (Environment Agency 2021). ▪ Construction workers will follow good site practice and hygiene rules; ▪ Personal protective equipment (PPE), including nitrile gloves, protective overalls, safety goggles and face mask will be worn where appropriate, especially by those workers who are likely to be coming into contact with soil or water, such as those carrying out hand digging activities; and

Project phase	Mitigation measures embedded into the project design
	<ul style="list-style-type: none"> ▪ Adopt appropriate safe working practices that consider the potential for hazardous ground gases ingress and accumulation in confined spaces. The use of gas protection measures, such as impermeable membranes and ventilation, may be required if any permanent structures are to be in proximity to identified sources of ground gases such as a landfill site. ▪ All works will be carried out in accordance with BS5930: 1999 (The Code of Practice for Site Investigations) and BS10175:2001 (Investigation of Potentially Contaminated Sites): <ul style="list-style-type: none"> ▪ Use of the waste hierarchy to determine the most sustainable option for all surplus soils that are generated on site; ▪ Re-instatement of topsoil; ▪ Inclusion of excavated subsoil that is suitable for use within the design as landscaping material at the converter substation to minimise offsite movements; ▪ Segregation of waste subsoil for offsite management from subsoil suitable for reinstatement on site; ▪ Identification of suitable local schemes that are suitable for offsite reuse or recycling of surplus subsoil; ▪ Any wastes found to be hazardous, will be stockpiled or stored separately from any non- hazardous stockpiles. Appropriate action will be taken in accordance with the Hazardous Waste (England and Wales) Regulations 2005; and ▪ Use of a Site Waste Management Plan to monitor wastes arisings and ensure adherence to duty of care and wastes legislation on site and also the anticipation of sustainable waste management practices by maximising waste prevention, reuse and recycling for material destined for offsite waste management. This will actively discourage sending waste to landfill.
Operation and Maintenance	
General	<p>Operational practices will incorporate measures to prevent pollution and should contamination be encountered to deal with it, including emergency spill response procedures, clean up and control of any potentially contaminated surface water runoff.</p> <p>Best practice will be undertaken to excavate, handle and replace without impacting soil quality significantly.</p>
Decommissioning	
General	Decommissioning practices will incorporate measures like the construction phase, to prevent pollution. These measures will include

Project phase	Mitigation measures embedded into the project design
	emergency spill response procedures, control of surface water and clean up and remediation of any contaminated soils. Exposed cable ducts will be sealed with an appropriate water proofing material to mitigate flood risk or creation of preferential flow pathways.
	A decommissioning plan will be required, to include protection of the soils and ground conditions, based on guidance that will be appropriate at the time of decommissioning.

23.6 Assessment Methodology

- 23.6.1 This section sets out the scope and methodology for the geology and ground conditions assessment of the Project.
- 23.6.2 There are no published guidelines or criteria for assessing and evaluating effects on ground conditions and land use within the context of an EIA. In the absence of this, the assessment is based on a methodology derived from the Institute of Environmental Management and Assessment (IEMA) guidance, Design Manual for Roads and Bridges (2019) and the Land Contamination Risk Management (LCRM).
- 23.6.3 Professional judgement and a qualitative risk assessment methodology have been used to assess the findings in relation to each of these criteria to give an assessment of significance for each potential impact. Once the degree of impact and sensitivity has been assessed these are then combined to determine the likelihood of each potential overall effect occurring.
- 23.6.4 This approach provides a mechanism for identifying the areas where site specific mitigation measures will be required, in addition to embedded mitigation, and for identifying mitigation measures appropriate to the risk presented by the development proposals. This approach also allows effort to be focused on reducing risk where the greatest benefit may result.
- 23.6.5 Volume 1, Chapter 6 EIA Methodology details the general impact assessment method, and the following sections describe more specifically the methodology used to assess the potential impacts of the Project on geology and ground conditions.

Assessment Criteria and Assignment of Significance

- 23.6.6 The approach for determining the significance of effects is a two-stage process that involves defining the sensitivity of the receptors and the magnitude of the impacts on those receptors. This section describes the criteria applied in this chapter to assign values to the sensitivity of receptors and the magnitude of potential impacts.
- 23.6.7 The sensitivity of the receiving environment (i.e., the baseline quality of the receiving environment) is defined as its ability to absorb an effect without a detectable change and can be considered through a combination of professional judgement and a set of pre-defined criteria which is set out in Table 23.27. Receptors in the receiving environment only need to meet one of the defined criteria to be categorised at the associated level of sensitivity.

- 23.6.8 It should be noted that the sensitivity criteria adopted for land quality relating to contamination was based on the tolerance of the site to change i.e. that known contaminated sites will be more sensitive to the ground-breaking aspects of development, during the construction phase, than those areas where no contamination is present.
- 23.6.9 The potential magnitude of impact would depend upon whether the potential effect would cause a fundamental, material or detectable change. In addition, the timing, scale, size and duration of the potential effect resulting from the Project are also determining factors. The criteria that have been used to assess the magnitude of impact are defined in Table 23.26.
- 23.6.10 This approach uses the term “beneficial” for an advantageous or positive effect on an environmental resource or receptor or “adverse”, for a detrimental or negative effect on an environmental resource or receptor.

Table 23.26: Impact magnitude definitions

Magnitude	Description/reason
Major	Fundamental loss (long term or permanent loss of geological feature and/or, over an area of more than 20ha or loss of soil-related features) of resource and/or quality and integrity of resource; likely to cause exceedance of statutory objectives and/or breaches of legislation; severe damage to key characteristics, features or elements. Contamination - significant contamination identified, contamination heavily restricts future use of land (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major long-term improvement of attribute quality (Beneficial).
Moderate	Loss of resource (partial loss of geological feature and/or over an area of between 5 and 20ha or loss of soil-related features) but not adversely affecting the overall integrity; partial loss of/damage to key characteristics, features or elements with/without exceedance of statutory objectives or with/without breaches of legislation. Contamination – Significant contamination could be present. Control/remediation measures are required to reduce risks to human health/make land suitable for intended use (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Minor	Permanent, irreversible loss over less than 5ha or a temporary, reversible loss of one or more soil functions or soil volumes and/or some measurable change in geological feature attributes, quality or vulnerability; reversible or minor loss of, or alteration to, one (maybe more) key characteristics, features or elements. Contamination - Significant contamination is unlikely with a low risk to receptors. Best practice measures can be implemented to minimise risks (Adverse).
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).

Magnitude	Description/reason
Negligible	No discernible loss or detrimental alteration to one or more characteristics, features or elements; impact of insufficient magnitude to affect the overall use/integrity. Contamination – no risks identified, no requirement for control measures to reduce risks to receptors or to make land suitable for intended use (Adverse).
	Very minor or no benefit to or positive addition of one or more characteristics, features or elements; impact of insufficient magnitude to affect the use/integrity (Beneficial).

23.6.11 The sensitivity/importance of the receptor is defined in Table 23.27.

Table 23.27: Sensitivity/importance of the environment

Receptor sensitivity/ importance	Definition
Major	<p>Geology</p> <ul style="list-style-type: none"> ▪ UNESCO Geoparks, (SSSI or GCR sites with internationally important geomorphological or geological features; ▪ Special Area of Conservation (SAC), SSSI or GCR with nationally important geomorphological or geological features. <p>Soils</p> <ul style="list-style-type: none"> ▪ Soils supporting protected features within a European site and/ or UK designated site (e.g., UNESCO Geoparks, SPA, SAC SSSI or Areas of Outstanding Natural Beauty (AONB), Special Landscape Area, and GCR); ▪ ALC Classes 1, 2 and 3a- Excellent to Good Quality agricultural land; and/ or ▪ Important surface mineral reserves that would be sterilised (i.e. without future access). <p>Contamination</p> <ul style="list-style-type: none"> ▪ Presence of regulatory determined contaminated land (Part 2A EPA designated); ▪ VE construction workers.
Moderate	<p>Geology</p> <ul style="list-style-type: none"> ▪ Regionally Important Geological Site (RIGS) or Local Geological Sites (LoGS). <p>Soils</p> <ul style="list-style-type: none"> ▪ Soils supporting protected or valued non-statutory designated sites (e.g., Local Nature Reserves (LNR), Local Geological Site's, Sites of Nature Conservation Importance); and/or ▪ ALC Classes 3b Moderate Land capable of producing a moderate range of crops; ▪ Surface mineral reserves that would remain accessible for extraction. <p>Contamination</p>

Receptor sensitivity/ importance	Definition
	<ul style="list-style-type: none"> ▪ Areas of potential concern identified by Local Authority under their statutory investigation of contaminated land (under Part 2A; EPA 1990).
Minor	<p>Geology</p> <ul style="list-style-type: none"> ▪ Locally important sites (e.g., non designated geological exposures, former quarry's/mining sites). <p>Soils</p> <ul style="list-style-type: none"> ▪ Soils supporting valued features within non-designated notable or priority habitats/landscapes. Agricultural soils; ▪ ALC Classes 4 and 5 Poor to Very Poor Quality– Improved grassland and rough grazing or Urban soils; ▪ Surface mineral reserves that would remain accessible for extraction. <p>Contamination</p> <ul style="list-style-type: none"> ▪ Areas of previously developed land with no areas of potential concern relating to contaminated land identified.
Negligible	<p>Geology</p> <ul style="list-style-type: none"> ▪ Common geological features of limited use for knowledge/study; <p>Soils</p> <ul style="list-style-type: none"> ▪ As for low sensitivity, but with only indirect, tenuous, and unproven links between sources of impact and soil functions; <p>Contamination</p> <ul style="list-style-type: none"> ▪ No areas of previously developed land with no areas of potential concern relating to contaminated land identified.

23.6.12 The sensitivity of the receiving environment together with the magnitude of the impact determines the significance of the effect, which can be categorised into level of significance as identified in Table 23.28.

23.6.13 The table provides a guide to assist in decision making. However, it should not be considered as a substitute for professional judgment and interpretation. In some cases, the potential sensitivity of the receiving environment or the magnitude of potential impact cannot be quantified with certainty and, therefore, professional judgement remains the most robust method for identifying the predicted significance of a potential effect.

23.6.14 Effects of '**major**' and '**moderate**' significance are considered to be 'significant' in terms of the EIA Regulations. The broad definitions of the terms used are set out in Volume 1, Chapter 5: EIA Methodology. A statement of residual effects, following consideration of any further specific mitigation measures where identified, is then given.

23.6.15 Assessment of the significance of potential effects is described in Table 23.28.

Table 23.28: Matrix to determine effect significance

		Magnitude of impact			
		<i>Negligible</i>	<i>Minor</i>	<i>Moderate</i>	<i>Major</i>
Sensitivity of receptor	<i>Negligible</i>	Negligible (Not significant)	Negligible (Not significant)	Minor (Not significant)	Minor (Not significant)
	<i>Minor</i>	Negligible (Not significant)	Minor (Not significant)	Minor (Not significant)	Moderate (Significant)
	<i>Moderate</i>	Minor (Not significant)	Minor (Not significant)	Moderate (Significant)	Major (Significant)
	<i>Major</i>	Minor (Not significant)	Moderate (Significant)	Major (Significant)	Major (Significant)

Assumptions and Limitations

- 23.6.16 This preliminary assessment is based on design information and publicly available data obtained from the Environment Agency, Natural England and commercial data supply companies, as well as additional information supplied from stakeholders during the scoping and consultation stages.
- 23.6.17 Overall, a moderate to high level of certainty has been applied to the study. The information accessible in order to complete the assessment is considered sufficient to establish the comprehensive baseline within the Project onshore geology and ground conditions study area, therefore, there are no data limitations that would affect the conclusions of this assessment.
- 23.6.18 The Maximum Design Scenario (MDS) identified in section 23.5 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These scenarios have been selected from the details provided in the Project Description (Volume 3, Chapter 1). Effects of greater significance are not predicted to arise should any other development scenario to that assessed here be taken forward in the final design scheme, within the assessed boundaries.
- 23.6.19 A full assessment will be undertaken as part of the EIA and will be reported in the ES that will be submitted with the DCO application.

23.7 Impact Assessment

Construction

23.7.1 This section presents the assessment of impacts arising from the construction phase of the Project.

Impact 1 and 2: Short term risks to construction workers and offsite human receptors during development of onshore ECC and associated infrastructure, including the OnSS

23.7.2 The impacts to human health from the construction stages of the Project were considered in the context of existing identified contaminated sources and how the Project is likely to interact with these, based on significant pollution linkages.

23.7.3 The excavation of cable trenches, earthworks and the movement and stockpiling of soils have the potential to mobilise existing ground contamination (where present). This could result in impacts to human health through dermal contact, inhalation and ingestion of contaminants.

23.7.4 An assessment has been undertaken for the study area to identify potential presence of contaminants within soils and geology. The study has identified that the majority of the land within the study area is agricultural land and unacceptable risks from contamination are not anticipated.

23.7.5 The baseline data as set out in section 23.4 has indicated that localised areas within the study area with a potentially contaminative past use may be present. This includes the historic landfill areas mapped within the study area for five sections; WM1, WM2, WM4, WM5, WM13, and A2. These historic landfills are thought to be small scale, isolated areas within farmland, and of inert nature with very low risk.

23.7.6 Within all other study areas there are no identified sources of potential contamination.

23.7.7 Micro-siting as part of the design and embedded mitigation will avoid, where possible positioning the Onshore ECC and construction haul roads within the mapped landfill and will employ an appropriate buffer zone. The incurrence of contaminated land is predicted to be minor but where areas of potential contamination cannot be avoided, targeted ground investigations would be undertaken.

23.7.8 If it does occur that contamination is likely to be associated with previous farming practices such as usage of pesticides and fertilizers, small spillages and leakages of fuel or oil and deposition of waste materials. If disturbed during construction works, there is a possibility that sources of contamination could be mobilised causing potential harm to construction workers and/or human receptors.

23.7.9 The construction environmental management plan (CEMP) will set out procedures to be followed should sources of contamination (e.g., buried asbestos) are discovered during construction phase works. If unexpected contamination is encountered or suspected, the works would cease in that area and assessment by a suitably qualified land contamination specialist would be made to determine appropriate actions. Soil (soil vapour/ groundwater) samples would be collected and analysed. The risks associated with contamination would be assessed. When required, a remediation strategy would be designed and agreed with the Environment Agency and Lincolnshire County Council before implementation.

- 23.7.10 Potential impacts to construction workers can be managed directly via appropriate controls and construction management practices. Embedded mitigation, as described in Table 23.25, will control the impacts associated with any potential ground contamination.
- 23.7.11 The sensitivity of construction workers is considered to be major, the magnitude of impact is assessment as negligible, and the resulting significance of the effect is **minor adverse**. This is not significant in EIA terms.

Impact 3: Construction phase impacts upon soil/land quality

Onshore ECC Infrastructure

- 23.7.12 The soils within the onshore ECC infrastructure, are generally loamy and clayey soils that are not considered to generally exhibit characteristics which indicate they have a high susceptibility to damage or degradation. The soils are however mapped as ALC Grade 1, 2 or 3 (excellent to good quality soils), which are classified as Best and Most Versatile soils (BMV). As all of the study area is mapped as Grade 1, 2 or 3 and therefore BMV agricultural land, a worst-case scenario will be assumed, and the sensitivity of the soil resource and function is determined as major.
- 23.7.13 Site clearance and preparation works for installation of the onshore export cables, cable joint bays and the preparation of access routes have the potential to impact the soil and land quality. Potential impacts identified include:
- Over compaction of agricultural and amenity soils caused by the use of heavy machinery onsite;
 - Over compaction of agricultural and amenity soils caused by storage of construction equipment at the site;
 - Structural deterioration of soil materials during excavation, soil handling, storage and replacement;
 - Erosion and loss of soils during soil handling, storage and replacement; and
 - Homogenisation and loss of characteristic horizons during excavation, storage and replacement.
- 23.7.14 These direct impacts on soil quality can also have potential indirect impacts on soil fertility and drainage.
- 23.7.15 The onshore ECCs through areas of predominantly agricultural land. Construction will involve the temporary stripping and storage of topsoil and subsoil to excavate trenches to the required width and depth to install cable circuits. Whilst there will be a short term, temporary impact upon agricultural land during the construction phase, the reinstatement of land above the buried cable will allow agricultural cultivation to re-commence once the cable has been installed. Field drainage will be reinstated and the indicative minimum burial depth (from ground surface to the top of the cable ducting), will allow cultivation of land.
- 23.7.16 The construction methodology chosen will ensure that the direct impacts on soil resulting from excavation will be limited spatially to the onshore ECC and temporally to a one-off process of excavation, storage and replacement.

- 23.7.17 The potential for long-term impacts on soil resulting from the construction works is assessed as negligible, although careful soil handling will be required in order to preserve soil, structure, texture and avoid compaction within sensitive locations such as productive arable fields or high-quality pasture.
- 23.7.18 Mitigation to ensure soils are protected during the development process will be undertaken and will be managed through planning and regulatory control and operation of best practice site management techniques. The principles that will be adopted to manage potential impacts upon soil during construction within the onshore ECC will be set out in the outline Soil Management Plan (SMP) (document reference 8.1.3). The SMP provides details of mitigation measures and best practice handling techniques to safeguard soil resources by ensuring their protection, conservation and appropriate reinstatement during the construction of the onshore works.
- 23.7.19 Given the features affected, i.e., agricultural soils, roadsides and amenity land, plus the limited and temporary nature of the works, there will not be considerable, permanent/irreversible changes over the majority of the soils. It is therefore assessed as a negligible magnitude of impact across the study area.
- 23.7.20 Given the major sensitivity and the negligible magnitude of impact for soil grades within all sections, the overall significance of the impacts on physical parameters of soil quality is **minor adverse** and therefore not significant in EIA terms.

OnSS Search Areas

- 23.7.21 The soils within the three OnSS search areas are generally loamy and clayey soils that are not considered to generally exhibit characteristics which indicate they have a high susceptibility to damage or degradation. The soils are however mapped as ALC Grade 1 or 3 (excellent to good quality soils), which are classified as BMV soils. As all of the study area is mapped as Grade 1 or 3 and therefore BMV agricultural land, a worst-case scenario will be assumed, and the sensitivity of the soil resource and function is determined as major.
- 23.7.22 The clearance and preparation of the OnSS, will involve similar construction machinery and processes to installation of the onshore ECC and therefore similar impacts are anticipated in terms of the physical parameters of soil quality within the OnSS.
- 23.7.23 The principles that will be adopted to manage potential impacts upon soil during construction within the OnSS will be set out in the outline SMP, provided as part of the outline CoCP. The SMP provides details of mitigation measures and best practice handling techniques to safeguard soil resources by ensuring their protection, conservation and appropriate reinstatement during the construction of the onshore works.
- 23.7.24 Given the features affected, i.e., agricultural soils, roadsides and amenity land; plus the limited and temporary nature of the works, there will not be considerable, permanent/irreversible changes over the majority of the soils. It is therefore assessed as a negligible magnitude of impact across the study area.
- 23.7.25 Given the major sensitivity and the negligible magnitude of impact for soil grades within the OnSS search areas, the overall significance of the impacts on physical parameters of soil quality is **minor adverse** and therefore not significant in EIA terms.

23.7.26 There is potential for localised mobilisation of bulk materials such as concrete or entrainment of stockpiled material from excavations during OnSS construction to result in watercourses or drainage ditches becoming restricted or blocked. This could impact flow regimes and could result in an increase in localised land contamination. However, through strict management protocols set out in within the outline CoCP the potential impact would be mitigated, and the magnitude of the impact is assessed as negligible, and the sensitivity is major resulting in an effect of **minor adverse** and therefore significant in EIA terms.

Trenchless Crossings and TJBs

23.7.27 The clearance and preparation of the trenchless crossings and TJB sites will involve similar construction machinery and processes to installation of the onshore ECC and therefore similar impacts to those described in paragraphs 23.7.13, are anticipated as for the onshore ECC works.

23.7.28 Implementation of the embedded mitigation measures and the measures proposed within the outline SMP would ensure that the potential for incidents detrimental to land quality occurring is localised and would reduce the magnitude of the impact of any such incidents.

23.7.29 The impact on geology and ground conditions from the trenchless techniques would be direct (shore works only) or indirect (via onshore watercourses discharging to the coast) and of an intermittent nature and of short duration.

23.7.30 The potential impact would arise from the drilling activity and could lead to bentonite and or drilling fluids/ hydraulic fluids being released into the soils and or groundwater. In consideration of pollution prevention measures, these techniques would be managed effectively with a negligible magnitude of impact and located away from sensitive receptors.

23.7.31 Based on the proposed construction methodology (as set out in Volume 1, Chapter 3: Project Description), impacts are likely to be associated with localised excavation and therefore the magnitude has been assessed as negligible. The sensitivity of the receptors, the soils are considered to have a major sensitivity. The effect would therefore be **minor adverse**, which is not significant in EIA terms.

Impact 4: Sterilisation of mineral deposits

23.7.32 As noted in the baseline environment for the onshore ECC the study area does not overlie areas of minerals safeguarded by Lincolnshire County Council. A search of the Lincolnshire County Council planning website has not shown any extant planning permissions for mineral extraction in these areas.

23.7.33 The published information indicates that in this region the deposits are widespread. Deposits further north within similar geologies have been quarried, however within the study area deposits have not been quarried or mined on any significant scale are unlikely to be of economic value. It is considered that the construction of the ECC and proposed OnSS locations will not lead to sterilisation of mineral resources.

23.7.34 The sensitivity of mineral resources has been assessed as negligible and the magnitude deemed to be negligible. The effect would therefore be **negligible**, which is not significant in EIA terms.

Impact 5: Designated Sites

- 23.7.35 The Chapel Point – Wolla Bank Site SSSI & GCR and the Lincolnshire Coast Submerged Forest LGS are present within the landfall study area sections for LN1 and WM1 study areas. These sites are situated adjacent to each other along the coastal beach and shoreline between Chapel St Leonards and Sutton-on-Sea.
- 23.7.36 The submerged landscape of the Lincolnshire coast was once visible for many miles along the foreshore between Mablethorpe and Skegness, however, is now much reduced in extent and rarely exposed beneath the encroaching sea levels and beach nourishment materials.
- 23.7.37 The presence of the Project within a designated geological site has the potential to damage or have an adverse impact to the features of the designated site. As the designated sites do not overlap, the Project will likely only directly affect one of the designated sites, this direct impact will likely occur where the construction compound is situated, and the trenchless technique used.
- 23.7.38 Trenchless techniques will be used to install the onshore cable from a temporary construction compound (TCC) on landfall situated on the beach to a compound on the western site of Roman Bank Road. The designated sites are linear features along the coastline that do not overlap. The extent of the submerged forest within the landfall study area will be confirmed by the project's Ground Investigation campaign following this PEIR. For the Application the location of the trenchless punch out will be confirmed and will look to avoid this feature.
- 23.7.39 Where the boundary of the Project is within or in very close proximity to the designated sites control of working areas and marking out of the site boundary would be employed to avoid or reduce disturbance to these areas from construction plant and activities.
- 23.7.40 The controls which would be adopted at site in accordance with best practice would ensure that the potential magnitude of impact on the designated SSSI/GCR and LGS is negligible, and the sensitivity has been assessed as major thus the significance of effect is **minor adverse**. No additional mitigation, over and above best practice, is required.

Impact 6: Agricultural Drainage

- 23.7.41 There is also potential during construction that a temporary impact on field drainage and irrigation systems could occur, which can lead to a reduction in productivity and other farming practices.
- 23.7.42 Soil types found within the PEIR boundary and at the landfall are mostly freely draining loamy and clayey soils. Existing field drains are expected to be made of ceramic or plastic pipes. Duct installation requires the excavation of the cable trench and stockpiling of soils and has the potential to cause an adverse impact to the field drainage systems. As such, it is likely that the drains would be impacted by any excavation works through agricultural fields.
- 23.7.43 The embedded mitigation measures, described in Section 23.6, contain a commitment to develop a SMP, which would include replacement of field drainage systems following initial restoration of the land.

23.7.44 When accounting for the embedded mitigation proposed, the impacts would be localised, short-term and reversible following the construction phase, and therefore of minor magnitude. As the sensitivity of the receptor is considered to be moderate, the resultant level of effect would be **minor** that is not significant in EIA terms.

Operations and Maintenance

Impact 1 and 2: Ingress and accumulation of hazardous ground gases, structures and services laid in direct contact with contaminated soils and groundwater

23.7.45 The design of the ECCs have considered contaminated land and the layout will be designed to avoid any areas of potential contamination. The distance from potentially contamination sources and the impermeable nature of the clay bedrock geology across the ECC minimises the risk of potential pathways and precludes the need for gas mitigation.

23.7.46 Closed landfills are present within the study area; however, none are considered to pose an impact to the Project, due to nature of material accepted, age of infilling and the proposed works associated with the Project. The embedded mitigation sets out measures should unexpected contamination be identified.

23.7.47 Potential sources for contamination will be referenced during the design phase ensuring selection of appropriate materials that provide adequate protection from contaminated soils and/or groundwater.

23.7.48 The sensitivity of the receptor is minor, and the magnitude is deemed to be negligible. The effect would therefore be **negligible**, which is not significant in EIA terms.

Impact 3: Operational impacts on geology/ground conditions and associated longer term risks to human and environmental receptors

23.7.49 Significant ground disturbance is considered unlikely during the operation phase. Contractors appointed to carry out repair and/or maintenance activities using existing access infrastructure. Contractors would be required to adopt appropriate working methods and control measures such as mitigation and best practice measures set out as part of the CoCP.

23.7.50 Any possible impacts will be kept to a minimum. It is considered that the effects on geology and ground conditions of the maintenance and repairs at the landfall and along the onshore ECC will not be significant.

23.7.51 The sensitivity of the receptor is minor, and the magnitude is deemed to be negligible. The effect would therefore be **negligible**, which is not significant in EIA terms.

Impact 4: Agricultural Drainage

23.7.52 Potential impacts regarding the Project on the land use of agricultural drainage systems are only considered to occur at the construction phase. During the operational phase, once the landfall, ECC, OnSS and ancillary infrastructure are already in place, the impacts on agricultural drainage will have already occurred, been mitigated and reinstated. The land-take of the Project is unlikely to interfere with drainage post-construction mitigation and reinstatement as the infrastructure would be stationary. Further impacts on flood risk and hydrology are considered in Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk.

- 23.7.53 The embedded mitigation measures, described in Section 23.5, contain a commitment to develop a CEMP, which would include replacement of field drainage systems following initial restoration of the land.
- 23.7.54 When accounting for the embedded mitigation proposed, the impacts would be localised, short-term and reversible following the construction phase, and therefore, at the operational phase, these impacts would be considered to be of a negligible magnitude. As the sensitivity of the receptor is considered to be moderate, the resultant level of effect would be **minor adverse**, which is not significant in EIA terms.

Decommissioning

Impact 1 and 2: Short term risks to construction workers and offsite human receptors during decommissioning of onshore ECC and associated infrastructure

- 23.7.55 During decommissioning phase, the risks to construction workers and offsite human receptors impacts on geology and ground conditions will be similar to those assessed for the construction phase. Good practice measures (similar to those identified within the outline CoCP) would be employed during decommissioning. A decommissioning plan that will be secured through the DCO would be agreed with statutory authorities at the time of decommissioning.
- 23.7.56 The sensitivity of the receptor is major, and the magnitude is deemed to be negligible. The effect would therefore be **minor adverse**, which is not significant in EIA terms.

23.8 Cumulative Impact Assessment

- 23.8.1 This cumulative impact assessment for geology and ground conditions has been undertaken in accordance with the methodology provided in Volume 1, Annex 5.2: Cumulative Impact Assessment Methodology.
- 23.8.2 The projects and plans selected as relevant to the assessment of impacts to geology and ground conditions are based upon an initial screening exercise undertaken on a long list. Each project, plan or activity has been considered and scoped in or out on the basis of effect-receptor pathway, data confidence and the temporal and spatial scales involved. For the purposes of assessing the impact of the Project on geology and ground conditions in the region, the cumulative effect assessment technical note submitted through the EIA Evidence Plan and forming Volume 1, Annex 5.2 of this PEIR screened in a number of projects and plans.
- 23.8.3 The greatest potential for cumulative effects arises when the construction phase of another development overlaps with the construction phase of the Project. Cumulative effects are considered to have the potential to be significant only where such an overlap may exist, as activities that could be potentially detrimental to the ground conditions and land use environment are greatly reduced during the operational phase of developments (e.g., excavation works, substation construction etc.).
- 23.8.4 Therefore, potential cumulative effects to geology and the soils environment between the Project and other proposed or consented developments are considered plausible only where the development footprint of both developments overlap during construction.

- 23.8.5 The short list in Volume 1, Appendix 5.2: Onshore Cumulative Impact Assessment at PEIR stage has identified several projects which may cause cumulative impacts; however, all of these are deemed too far away from the boundaries of the Project to be considered for specific consideration for geology and ground conditions. The list will be updated and reviewed at the next stage to ascertain whether there has been any change to this position.
- 23.8.6 It is considered that geographic separation between developments, results in the absence of a cumulative effect to geology and the soils environment. Based on geographic separation between the Project and other proposed or consented developments located within a 250m radius, the majority of other projects have been scoped out of the cumulative assessment.

23.9 Inter-Relationships

- 23.9.1 This chapter has considered the effect of the onshore elements of the Project on geology and ground conditions in relation to the proposed onshore infrastructure. Effects on land use are considered in Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk..
- 23.9.2 The potential for effects of the Project to result in consequential effects on other receptors would be controlled by the measures set out in this chapter. The effects identified within this chapter are predicted to be minor or negligible adverse. None of these effects would be significant in EIA terms. Given the localised nature of the effects, there is not considered to be potential for significant inter-related effects on any offshore receptors.
- 23.9.3 There are not considered to be any significant inter-related effects between offshore and onshore parts of the Project in terms of geology and ground conditions.

23.10 Transboundary Effects

- 23.10.1 Based upon the nature of the site, and the baseline ground conditions as identified by this initial assessment, it is considered that any impacts, if present, will be localised. It is therefore judged that there will not be any transboundary impacts relating to geology and ground conditions.
- 23.10.2 Transboundary effects were agreed by The Inspectorate to be scoped out of the assessment. Therefore, this impact will be scoped out from further consideration within the EIA.

23.11 Conclusions

- 23.11.1 The potential geology and ground conditions receptors in the study area comprise soils, geology and construction workers who may be exposed to ground contamination. These receptors vary in their environmental sensitivity from negligible to major.
- 23.11.2 The assessed magnitude of the various identified impacts of the Project on geology and ground conditions ranges from minor to negligible (adverse). Overall, through the implementation of mitigation measures, including those specified in the outline CoCP, it is considered that the likely overall effect of the Project on ground conditions and land use throughout the construction, operation and decommissioning of the Project is not significant in EIA terms.

Table 23.29 Summary of Residual Effects

Description of effect	Effect	Additional mitigation measures	Residual impact
Construction			
Impact 1: Short term risks to construction workers during development of onshore ECC and associated infrastructure, including the OnSS;	Minor adverse	None (CoCP already part of the Project)	No significant adverse residual effects
Impact 2: Risks to offsite human receptors, such as occupants of residential properties bordering the onshore ECC			
Impact3: Construction phase impacts upon soil/land quality	Onshore ECC - Minor adverse	None (CoCP already part of the Project)	No significant adverse residual effects
	OnSS Search Areas – Minor adverse	None (CoCP already part of the Project)	No significant adverse residual effects
	Trenchless Crossing and TJB - Minor adverse	None (CoCP already part of the Project)	No significant adverse residual effects
Impact 4: Sterilisation of mineral deposits	Negligible	None required	No significant adverse residual effects
Impact 5: Designated Sites	Minor adverse	None (CoCP already part of the Project)	No significant adverse residual effects
Impact 6: Agricultural Drainage	Minor adverse	Not Applicable – no additional mitigation identified	No significant adverse residual effects
Operation and Maintenance			

Description of effect	Effect	Additional mitigation measures	Residual impact
Impact 1: Ingress and accumulation of hazardous ground gases	Negligible	None (CoCP already part of the Project)	No significant adverse residual effects
Impact 2: Structures and services laid in direct contact with contaminated soils and groundwater			
Impact 3: Operational impacts on geology/ground conditions and associated longer term risks to human and environmental receptors	Negligible	None (CoCP already part of the Project)	No significant adverse residual effects
Impact 4: Agricultural Drainage	Minor	Not Applicable – no additional mitigation identified	No significant adverse residual effects
Decommissioning			
Impact 1: Risks to offsite human receptors, such as occupants of residential properties bordering the onshore ECC	Minor adverse	None (CoCP already part of the Project)	No significant adverse residual effects
Cumulative			
None identified.			

23.12 References

Department for Environmental Food & Rural Affairs (2009), 'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites' https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/716510/pb13298-code-of-practice-090910.pdf [Accessed: October 2022]

Department for Environmental Food & Rural Affairs (2012), 'Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance'

DECC (2011a) Overarching National Policy Statement for Energy (EN-1). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf [Accessed: Oct 2022]

DECC (2011b) National Policy Statement for Renewable Energy Infrastructure (EN-3). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47856/1940-nps-renewable-energy-en3.pdf [Accessed: Oct 2022]

DECC (2011c) National Policy Statement for Electricity Networks Infrastructure (EN-5). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47858/1942-national-policy-statement-electricity-networks.pdf [Accessed: Oct 2022]

DESNZ (2023a) Draft Overarching National Policy Statement for Energy (EN-1). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147380/NPS_EN-1.pdf [Accessed: Mar 2023]

DESNZ (2023b) Draft National Policy Statement for Renewable Energy Infrastructure (EN-3). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147382/NPS_EN-3.pdf [Accessed: Mar 2023]

DESNZ (2023c) Draft National Policy Statement for Electricity Networks Infrastructure (EN-5). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147384/NPS_EN-5.pdf [Accessed: Mar 2023] Environment Agency Guidance: Land contamination risk management (LCRM), <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm> [Accessed online: October 2022]

Institute of Environmental Management & Assessment (2022), 'A New Perspective on Land and Soil in Environmental Impact Assessment' https://s3.eu-west-2.amazonaws.com/iema.net/documents/knowledge/policy/impact-assessment/J35787_IEMA_Land_and_Soils_Guidance.pdf [Accessed online: October 2022]

Rudland, D.J., Lancefield, R.M., Mayell, P.N (2001), 'Contaminated Land Risk Assessment: A Guide to Good Practice (C552)', CIRIA, 2001.

Standards for Highways (2019), 'Sustainability & Environment Appraisal. LA 109 Geology and Soils, Rev 0'

The Planning Inspectorate (2018) Rochdale Envelope. Available at: <https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-nine-rochdale-envelope/> [Accessed: Oct 2022]

The Planning Inspectorate (2022), 'Scoping Opinion: Proposed Outer Dowsing Offshore Wind Farm'

The UK Government (2021), 'National Planning Policy Framework'