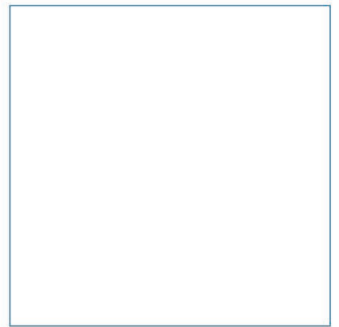
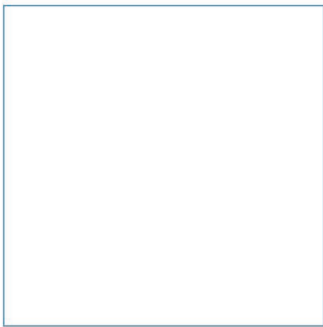
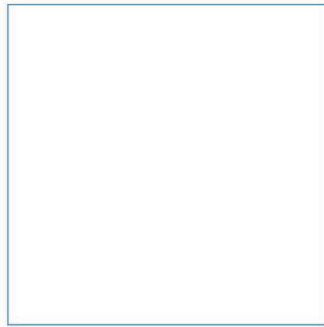


Associated British Ports

Immingham Eastern RoRo Terminal

Preliminary Environmental Information: Appendix 12.1 Phase 1 Desk Study

January 2022



Innovative Thinking - Sustainable Solutions

Immingham Eastern Ro-Ro Terminal


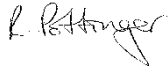

Phase 1 Geo-Environmental and Geotechnical Desk
Study

Associated British Ports

Project number: 60664611

05 November 2021

Quality information

Prepared by	Checked by	Verified by	Approved by
			
Beverly Okeke Graduate Environmental Engineer	Rachel Pottinger Principal Consultant	David Evans Associate Director	

Revision History

Revision	Revision date	Details	Authorized	Name	Position
01	05 November 2021	Issue 1 for Client Comment			

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Associated British Ports

Prepared by:

AECOM Limited
Royal Court, Basil Close
Chesterfield
Derbyshire
S41 7SL
United Kingdom

T: +44 (1246) 209221
aecom.com

AECOM Infrastructure & Environment UK Limited (“AECOM”) has prepared this Report for the sole use of **Associated British Ports** (“Client”) in accordance with the terms and conditions of appointment (**Project number: 60664611**) dated **05 November 2021**. No other warranty, expressed or implied, is made as to the professional advice included in this Report or any other services provided by AECOM. This Report may not be relied upon by any other party without the prior and express written agreement of AECOM.

Where any conclusions and recommendations contained in this Report are based upon information provided by others, it has been assumed that all relevant information has been provided by those parties and that such information is accurate. Any such information obtained by AECOM has not been independently verified by AECOM, unless otherwise stated in the Report. AECOM accepts no liability for any inaccurate conclusions, assumptions or actions taken resulting from any inaccurate information supplied to AECOM from others.

The methodology adopted and the sources of information used by AECOM in providing its services are outlined in this Report. The work described in this Report was undertaken between **September 2021** and **November 2021** and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances. AECOM disclaim any undertaking or obligation to advise any person of any change in any matter affecting the Report, which may come or be brought to AECOM’s attention after the date of the Report.

The site reconnaissance consisted of a general external inspection of the site aimed at identifying any obvious signs of geotechnical hazards and potential sources of ground contamination affecting the site. An environmental compliance audit and/or detailed structural inspection of existing buildings were outside the project brief. Similarly, the site visit excluded detailed consideration of the ecological or archaeological aspects of the site, and if such are believed to be of potential significance then it is recommended that specialist advice is sought.

Any risks identified in this Report are perceived risks, based on the information reviewed during the desk study and therefore partially based on conjecture from available information. The study is limited by the non-intrusive nature of the work and actual risks can only be assessed following a physical investigation of the site.

The opinions expressed in this report and the comments and recommendations given are based on a desk assessment of readily available information and an initial site reconnaissance by an AECOM Engineer. At this stage intrusive investigations have yet to be undertaken at site to establish actual ground and groundwater conditions and to provide data for an assessment of the geo-environmental status of the site.

Reference to historical Ordnance Survey (OS) maps and/or data provides invaluable information regarding the land use history of a site. However, it should be noted that historical evidence will be incomplete for the period pre-dating the first edition and between the release of successive maps and/or data.

Copyright

© This Report is the copyright of AECOM. Any unauthorised reproduction or usage by any person other than the addressee is strictly prohibited.

Table of Contents

1.	Introduction	8
1.1	Background.....	8
1.2	Objectives	8
1.3	Proposed Development	8
1.4	Scope of Work	8
1.5	Information Sources	8
2.	Site and Surrounding Area.....	10
2.1	Site Location	10
2.2	Site Description.....	10
2.3	Surrounding Land Use.....	10
3.	Site Reconnaissance	12
4.	Geological and Environmental Setting.....	15
4.1	Published Geology & Exploratory Records	15
4.1.1	Published Geology	15
4.1.2	Structural Geology	15
4.1.3	Historical Borehole Records	15
4.2	Soils and Soil Chemistry.....	17
4.3	Ground Subsidence and Stability	17
4.4	Mining and Mineral Extraction	17
4.5	Radon	17
4.6	Environmental Designations.....	18
4.7	Hydrogeology.....	18
4.7.1	Aquifer Classification	18
4.7.2	Groundwater Vulnerability	18
4.7.3	Groundwater Abstractions	18
4.7.4	Source Protection Zones	19
4.7.5	Nitrate Vulnerable Zones	19
4.8	Hydrology.....	19
4.8.1	Watercourses.....	19
4.8.2	Licensed Surface Water Abstractions.....	19
4.8.3	Artesian Aquifers.....	19
4.9	Summary of Environmental Site Sensitivity	20
5.	Historical & Planned Development	21
5.1	Historical Development of the Site and Surroundings.....	21
5.2	Planning Authority Records	22
5.3	Summary	23
6.	Previous Ground Investigations	24
6.1	19112 GD Pickles Ltd, 2020, Geoenvironmental Investigation Report	24
6.2	I19 Exploration Associates, 1980, British Transport Docks Board Immingham Dock – Eastern Jetty Final Report on Site Investigation S2552	25
6.3	I5 Ground Explorations Ltd, 1967, Report No.3722, Exploration of Ground Conditions at Immingham for British Transport Docks Boards.....	25
6.4	I5/I27 The British Transport Docks Board, 1965, Proposed Oil Jetties at Immingham, Lincolnshire, Report of Site Investigation	25
7.	Regulated Activities and Statutory Consultation	26
7.1	Utilities Summary.....	27
7.2	Unexploded Ordnance.....	29
7.2.1	Detailed UXO Threat Assessment Desk Top Study Summary	29
7.3	Summary	30
8.	Initial Conceptual Site Model (iCSM).....	32

8.1	Introduction	32
8.2	Assessment Framework	32
8.3	Potential Sources.....	32
8.4	Contaminants of Potential Concern (CoPC).....	33
8.5	Potential Receptors	34
8.6	Potential Pathways	35
9.	Environmental Risk Assessment	36
9.1	Risk Assessment Principles and Framework	36
9.2	LCRM Assessment of Risk	37
9.3	Preliminary Risk Assessment	38
9.4	Discussion of Risk to Receptors.....	41
9.4.1	Risk to Future Site Visitors	41
9.4.2	Risk to On-Site Workers (Within Future Buildings)	41
9.4.3	Risk to On-site Workers (Outdoors)	41
9.4.4	Risk to Offsite Human Health Receptors.....	41
9.4.5	Risk to Controlled Waters: Surface Water	42
9.4.6	Risk to Controlled Waters: Groundwater	42
9.4.7	Risk to Development Infrastructure	42
9.4.8	Risk to Construction Workers	43
9.4.9	Risk to Flora and Fauna	43
10.	Preliminary Geotechnical Appraisal	44
10.1	Geotechnical Risk Assessment	44
10.2	Preliminary Engineering Assessment.....	48
10.2.1	Foundations	48
10.2.2	Ground Floor Slabs	48
10.2.3	Excavations	48
10.2.4	Soakaways	48
11.	Conclusions	50
11.1	Environmental.....	50
11.2	Geotechnical.....	50
12.	Recommendations	52
13.	References.....	54
	Drawings	55
	Appendix A - AECOM Engineer Site Walkover Photographs	
	Appendix B - Groundsure Report	
	Appendix C – Historical Borehole Records	
	Appendix D – Utilities Report	
	Appendix E - Detailed UXO threat Assessment Desk Top Study	

Figures

Figure 1: Sub plots

Drawings

60664611/GI/001 Site Location Plan

Tables

Table 1: Summary of Current Surrounding Land Use	11
Table 2: Published Geology	15
Table 3: Historic Borehole Records.....	16
Table 4: Summary of Historical Development	21
Table 5: Summary of Historical On-Site Planning Applications.....	23
Table 6: Summary of Regulatory Information from Groundsure Report	26
Table 7: Recommended Risk Mitigation for a Medium Risk Site	29
Table 8: Likelihood of Risk	30
Table 9: Potential Sources	32
Table 10: Potential Sources of Contamination	33
Table 11: Potential Receptors	34
Table 12: Potential Pathways	35
Table 13: Severity of Risk.....	36
Table 14: Probability of Risk Occurring	37
Table 15: Level of Risk	37
Table 16: Conversion of LCRM Risk Categories.....	37
Table 17: Risk Evaluation of Potential Contaminant Linkages.....	39
Table 18: Scoring rational describing likelihood and consequences of geohazards	44
Table 19: Geohazard index ranges	44
Table 20: Summary of Risks	45

1. Introduction

1.1 Background

AECOM Ltd (hereafter referred to as “AECOM”) was commissioned by Associated British Ports (hereafter referred to as “ABP”) to undertake a Phase 1 geo-environmental and geotechnical assessment to support the planning application for the proposed development of a new roll-on/roll-off (Ro-Ro) facility within the Port of Immingham. The proposed development, which will be taken forward as a Nationally Significant Infrastructure Project (NSIP) will be known as the Immingham Eastern Ro-Ro Terminal.

1.2 Objectives

This Phase 1 report aims to identify potential contamination issues from current and historic land use, which may be related to on and off-site sources. This report also provides a preliminary assessment of the geotechnical factors which have the potential to affect a future development scheme. The report has been prepared to support submission of the planning application and marine license application addressing constraints related to ground conditions and contamination with respect to the proposed development.

1.3 Proposed Development

The proposed development is designed to service the embarkation and disembarkation of principally commercial and automotive traffic, possibly with a provision for a small element of passenger use during quieter periods.

The proposed development will involve marine works within the Humber Estuary and landside works on the existing port estate. The marine side development will comprise the construction of a new up to four-berth Ro-Ro jetty. On the landside, within the statutory port estate, ABP will make provision for an area of unit load/vehicle storage together with a number of terminal buildings. There will also be an internal site bridge which will cross over existing port infrastructure, including an ABP controlled railway track.

1.4 Scope of Work

The scope of work comprised the following:

- A review of the environmental setting of the site using publicly available resources such as Natural England’s ‘MAGIC’ and the British Geological Survey ‘GeolIndex’, including geology, hydrogeology, hydrology and statutory sensitive sites;
- Procurement of a Groundsure® Report to provide information on Regulatory Databases such as landfills and waste sites, neighbouring operational industrial facilities which are permitted, pollution incidents, etc.;
- A review of historical Ordnance Survey maps, provided with the Groundsure® Report, aimed at identifying the historic development of the site and potential environmental constraints/hazards;
- A site walkover of the accessible areas at the site to identify any potential hazards and inform the development of a preliminary Conceptual Site Model (CSM);
- Development of a preliminary Conceptual Site Model (CSM) for the current site, including identification of potential contamination sources, receptors, pathways and contaminant linkages;
- Preparation of this report.

1.5 Information Sources

The physical setting and environmental characteristics of the site have been assessed based on information gathered from the following sources:

- Groundsure® Report (GS-8247704) (Presented in Appendix B); (Ref. 1)
- BGS Solid and Drift for Partington (Sheet 81 (and including parts of Sheet 82 and 90)) 1:50,000; (Ref. 2)
- GeoIndex (onshore), British Geological Society (<https://www.bgs.ac.uk/map-viewers/geoindex-onshore/>); (Ref. 4)
- The Coal Authority, 2020, The Coal Authority Online Interactive Map;(<https://mapapps2.bgs.ac.uk/coalauthority/home.html>); (Ref. 5)
- MAGIC Map Application, DEFRA (<https://magic.defra.gov.uk/magicmap.aspx>); (Ref. 7)
- Environment Agency Website (www.environment-agency.gov.uk); (Ref. 8)
- Environment Agency Catchment Data Explorer (<https://environment.data.gov.uk/catchment-planning/>); (Ref. 9)
- North East Lincolnshire Council Planning Application Portal (Planning portal - NELC | NELC (nelincs.gov.uk)); (Ref. 10)
- Landmark Utilities Report (Ref: 285109404_1); (Ref. 11)
- Zetica UXO Risk Map Online (<https://zeticauxo.com/downloads-and-resources/risk-maps/>); (Ref. 12) and
- SafeLane Global Detailed Unexploded Ordnance Risk Assessment (Ref: 9048 RA) (Presented in Appendix D). (Ref. 13)

2. Site and Surrounding Area

2.1 Site Location

The location of the proposed Ro-Ro facility (hereafter referred to as the 'site') is located at the Port of Immingham. The site is centered on approximate National Grid Reference TA 20558 15316. A site location plan is presented as Drawing 60664611/GI/001. The surface area of the site is approximately 57.36 ha.

2.2 Site Description

The Port of Immingham lies immediately adjacent to the main deep-water shipping channel which serves the Humber Estuary. The Port comprises a number of discrete operational areas, with bulk commodities such as liquid fuels, solid fuels and ores, as well as Ro-Ro freight, being handled from in-river jetties. These include the Eastern and Western Jetties, the Immingham Oil Terminal (IOT), the Immingham Gas Terminal, Immingham Outer Harbour (IOH) and the Humber International Terminal (HIT). The residential town of Immingham lies approximately 500m to the south west of the site.

A site walkover was undertaken by an AECOM representative on the 21st October 2021. The site walkover photographs are presented in Appendix A. Further discussion is presented in Section 6. A site layout plan depicting the extent of the proposed development site is presented as Figure 1.3 in Volume 2 of the Preliminary Environmental Information Report.

The following summarises the proposed development at the site:

Marine Works

- An approach jetty from the shore;
- A linkspan with bankseat;
- Two floating pontoons with guide piles or articulated restraint arms;
- Two separate finger piers with two berths each, one either side with the stern ramps of the ships resting upon two floating pontoons;
- A capital dredge of the new berth pocket; and
- Disposal of dredged material at sea.

Landside Works

- The utilisation of existing cargo storage areas within ABP's port estate immediately adjacent to where the finger pier is attached to the land. These areas will be required to accommodate the throughput of the Ro-Ro cargo as it is either waiting to be embarked or awaiting pick-up after being disembarked;
- A number of terminal buildings will be constructed to provide appropriate facilities for lorry drivers and passengers. A small office, workshop and gatehouse may also be required; and
- An internal bridge will need to be constructed within the port estate to cross over an adjacent access road and ABP managed rail track.

2.3 Surrounding Land Use

Table 2.1 summarises the key features and current land use of the area surrounding the site. As previously stated, this is based on a review of desk-based sources, including aerial photography, and has been verified by AECOM during a site visit.

Table 2.1: Summary of Current Surrounding Land Use

Direction	Summary
North	The marine works are located with the Humber Estuary. To the north of the marine works lies a jetty with associated pipelines and mooring equipment. Beyond this the Humber Estuary continues for approximately 2.5km.
West	The majority of the Immingham Dock lies directly west of the proposed site. There are a number of industrial land uses located within this area including electrical sub stations, freight shipping companies, biofuels company, heating oil supplier and several unspecified warehouses and tanks. The town of Immingham is located approximately 500m west/ south west of the proposed development. The land beyond the town predominantly consists of agricultural fields.
South	The disused railway tracks are located along the southern border of the proposed site boundary, running from north west to south east. There are several industries located immediately south of the proposed site. These include shipping companies, waste management companies, manufacturing plants, power plants and electrical sub stations. The area south of this is predominantly dominated by agricultural fields. The nearest residential properties are on Queen's Road, approximately 150m south of the site. The A180 road lies approximately 2.3km south.
East	East of the proposed site (directly north of Sub Plot 2) are the associated petroleum terminals. Further east of the site consists of a few agricultural fields followed by the village of Stallingborough, located approximately 600m to the east/ south east. Beyond the village lies the Humber estuary which trends from the north west of the site to the south east.

3. Site Reconnaissance

A site walkover was undertaken by an AECOM engineer and ecologist on 21st October 2021, in the presence of two representatives from ABP and ABP's solicitor.

A summary of the observations made during the visit is provided as follows and a photographic record included as **Appendix A**.

ABP indicated that before the 1900s the site was a poorly drained salt marsh. The site was first developed in 1905/06 when works started on the Port of Immingham. However, the port was not fully operational until 1912. Historically, there were numerous railway sidings present across the site to aid the operation of the docks.

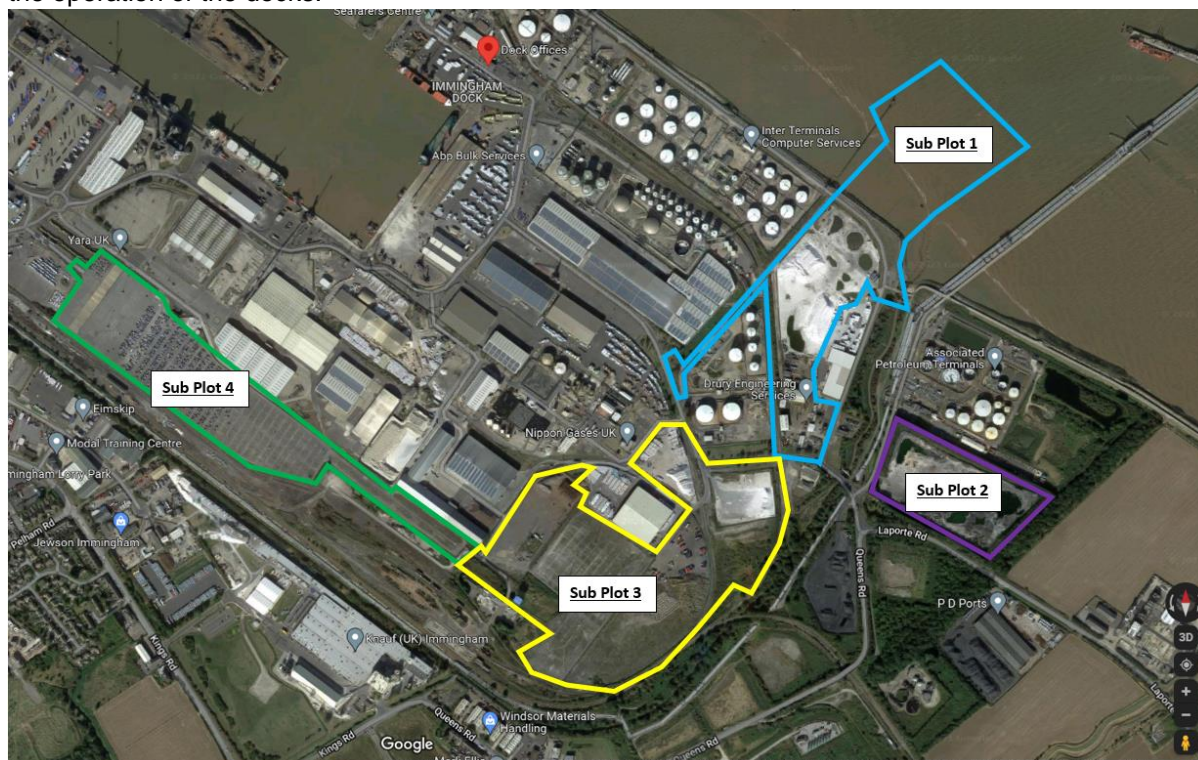


Figure 1 – Sub Plots

Observations from the site visit are split into 4 sub plots which are shown in **Figure 1**. Details of each sub plot are summarised here:

Sub Plot 1

- Sub Plot 1 is approximately 13.2 ha and is along the northern most part of the port. The northern section of the plot is within the Humber Estuary where the proposed terminal jetty will be. The remainder of the plot is landside and consists of a mixture of storage areas and warehouses.
- There is a vacant area between the Humber Estuary and the road, which includes a small area of hardstanding which is used as a car park, and a general waste skip.
- There are overground pipelines from the adjacent oil terminal which run along the coastline.
- Immediately east of the plot is a timber yard and warehouse which are outside the proposed development boundary.
- The central section of the plot is currently a storage yard for imported materials including pumice and blast furnace slag. The current ground surface is a mixture of made ground, bituminous macadam and gravel. Large ponds of rainwater were also noted in various areas across the site. The ABP representative indicated that this part of the site was previously used as a timber yard.

- The southern section of the plot was not accessible during the site visit as it is currently leased to Drury Engineering Services and PK Construction. Several intermediate bulk containers (IBCs), drums and gas cannisters were observed which appeared to be stored in a maintenance shed/yard type building. On the other side of the road which formed the eastern boundary of the plot were two large electrical substations.

Sub Plot 2

- Sub Plot 2 was not visited during the site reconnaissance. This area which is approximately 4.6ha and situated to the east of the port was previously a storage area for imported materials from the dock. Stockpiles of an unidentified material can be seen on the plot up until 2019 on Google Earth viewer.
- The plot is bounded to the north by an oil terminal leased from ABP to Associated Petroleum Terminals, to the east by agricultural land, to the south by Laporte Road and to the west by Queens Road and overground pipelines linking to the oil terminal.

Sub Plot 3

- Sub Plot 3 is approximately 16.8ha in area and is situated in the south east of the port. There are railway sidings within the eastern part of the plot and also running along the eastern boundary. The north eastern section of the plot consists of a square shaped storage yard which contained stockpiles of pumice at the time of the site visit. Hardstanding was not noted in this area.
- The storage yard in the north western section of the plot is used to store and bag aggregate. This section of the plot was covered in hardstanding.
- South of the railway sidings running through the north of the plot is a trailer yard with gravel surfacing. There was 1 no. 5,200L diesel tank and 1 no. gas oil tank (size unknown) in a concrete bund which was noted to be damaged. There were 3 no. IBCs littered around this area, containing household type waste (no liquids). There were also 2 no. old empty fuel tanks and an empty 'corrosive' labelled container discarded within this area.
- The south eastern section of the plot is mostly vacant land, surface is gravelly made ground with vegetation throughout. In the very south eastern point of the plot there is a culvert (service corridor) which goes below the site which contained the ports power and water supplies. The western section of the plot consists of two storage areas and an area of grassland. The larger of the two storage areas is used to store newly imported vehicles but was vacant at the time of the site visit. The second area is used as a storage area for timber imports. The ground surface on this section of the plot is hardstanding.

Sub Plot 4

- Sub Plot 4 is approximately 9ha and situated to the southern end of the port. This plot was not accessed during the site visit.
- Google Earth mapping indicates this area of the site has most recently been used as a storage area/car park for newly imported vehicles, and this was confirmed by the ABP representative.
- The plot is bounded to the north by Gresley Way and warehouses, to the east by Sub Plot 3, to the south by railway sidings and a storage area and to the west by car parks and trailer yards.

Overall Considerations

- The AECOM Engineer undertaking the site inspection was informed by the ABP representative during the inspection that no significant leaks/spills are known to have occurred anywhere within the red line boundary. However, there may have been small localised spills over the years. The representative did indicate that

there may be asbestos containing materials (ACMs) present on site relating mostly to lagging and past land use.

- No hazardous chemicals are known to be stored anywhere on site within the red line boundary (except for the 2 no. tanks in Sub Plot 3), as confirmed by the site representative.
- There do not appear to be any potential access issues regarding a potential future ground investigation. Most areas across the site were open and relatively level terrain with no overhead gantries or cables. Overground pipelines (from the neighbouring Oil Terminal) were noted along the coastline of Sub Plot 1.

4. Geological and Environmental Setting

The environmental setting of the site is of importance because the topography, geology, hydrogeology and hydrology of the site and the surrounding land are the main factors that influence the way in which contaminants which may be in the soil or groundwater can be transported on or off site, potentially impacting on identified receptors. Information has been sourced from the Groundsure® Report (GS-8247704) ^(Ref. 1) unless stated otherwise.

4.1 Published Geology & Exploratory Records

4.1.1 Published Geology

For the geological assessment of the site, the British Geological Survey (BGS) 1:50,000 Sheet 81 (and including parts of sheet 82 and 90) (Partington) ^(Ref. 2), the BGS GeoIndex Onshore Map Application ^(Ref. 4), BGS Geological Memoir ^(Ref. 4) and BGS Geology 1:10,000 maps included in the Groundsure® Report (GS-8247702) were reviewed. **Table 4.1** outlines the published geology beneath the site.

Table 4.1: Published Geology

Stratum	Expected Location	British Geological Survey (BGS) lithological description
Made Ground	Entire site. There are also some small areas of infilled ground indicated on mapping at the southern end of the site. This is congruent with the development history of the site.	Variable composition.
Tidal Flat Deposits - Clay and Silt	The majority of the site, apart from the bank of the Humber estuary.	Tidal flat deposits consist of unconsolidated sediment, mainly mud and/or sand. They may form the top surface of a deltaic deposit, which is normally a consolidated soft silty clay, with layers of sand, gravel and peat.
Beach and Tidal Flat Deposits (Undifferentiated) - Clay, Silt and Sand	Along the bank of the Humber estuary.	Composite of 'Beach deposits' and 'Tidal Flat Deposits'. Beach deposits comprise shingle, sand, silt and clay, which may be bedded or chaotic. Beach deposits may be in the form of dunes, sheets or banks.
Devensian Till	Entire site, underlying the Beach and Tidal Flat deposits.	No description given. Likely comprising a mixture of clay, sand, gravel, and boulders.
<u>Bedrock</u> : Burnham Chalk Formation	The north west trending arm of the site.	White, thinly bedded chalk with common tabular and discontinuous flint bands; sporadic marl seams.
<u>Bedrock</u> : Flamborough Chalk Formation – Chalk	The majority of the site, apart from the north west trending arm of the site.	White, well-bedded, flint-free chalk with common marl seams (typically one per meter). Common stylolitic surfaces and pyrite nodules.

4.1.2 Structural Geology

No faults are noted within the vicinity of the site.

4.1.3 Historical Borehole Records

The BGS GeoIndex (onshore) interactive mapping tool ^(Ref. 4) and Groundsure report indicates that there are eight No. historic boreholes located within the site boundary. Seven of these boreholes are labelled as confidential and, therefore, do not have accessible details. A summary of the details of the one borehole onsite and four relevant boreholes in the vicinity

outside of the site boundary are provided in **Table 4.2**. The borehole records are included in **Appendix C**.

Table 4.2: Historic Borehole Records

Reference	National Grid Reference	Approximate Distance from Site	Hole depth (m)	Date	Geology Encountered (base depth m bgl)
TA21NW10	520410, 415220	On-Site	31.09	1946	Made Ground (0.3) Soft Brown Warp (3.66) Soft Blue Warp (9.14) Peat (9.95) Marl Clay (15.24) Chalk and Gravel (22.86) Chalk (31.09)
TA21SW339	520170, 414890	60m S	47.55	1911	Red Warp (1.83) Blue Warp (7.01) Peat (7.62) Marl Clay (21.34) Sand and Gravel (22.86) Chalk Rock (47.55)
TA21SW249	520320, 414920	66m SE	64.77	1918	Descriptions start about 1.8m bgl Red Warp (3.35) Black Warp (10.97) Peat (11.28) Marl Clay (20.73) Sand and Gravel (24.08) Soft Loose Chalk (31.09) Firm Chalk (34.14) Hard Chalk (63.40)
TA11NE264	519850, 415160	74m SE	73.76	1911	Warp (7.19) Peat (7.62) Marl (17.37) Hard Marl (20.42) Clay (27.43) Red Clay (33.53) Chalk Rock (73.76)
TA21NW5	520300, 415320	38m S	60.96	1945	Made Ground (0.61) Soft Brown Warp (4.27) Soft Blue Warp (10.61) Boulder Clay with seams of Running Sand (17.68) Sand and Gravel (21.75) Boulder Clay (25.91) Black Gravel (27.43) Soft Dirty Chalk (30.48) White Chalk (60.96)

The available historic borehole logs provide no stratum descriptions other than those shown in **Table 4.2**. The boreholes indicate that warp (artificially induced alluvium) is likely present beneath the site to depths of 7-10m below ground level (bgl). Peat was also noted as present, in four of the historic borehole records, between 0.31m and 0.81m thick, at depths between 7 and 11m bgl. Varied strata were noted as underlying the peat and warp, comprised of marine deposits of marl, sand and gravel. Glacial deposits of Boulder Clay (Glacial Till) were noted in borehole TA21NW5, with clay deposits also noted in borehole TA11NE264. Rockhead is encountered at around 22 to 33m bgl and comprises chalk of an unknown thickness.

Groundwater strikes were not recorded on the historic borehole logs.

It should be noted that the information shown in the historic logs, which is often relatively old, incomplete and undertaken to now superseded standards, and in the British Geological Survey (BGS) mapping may not be entirely accurate and representative. Given the number of geological units and the watercourses present, the ground conditions including the rockhead level are anticipated to be relatively variable.

4.2 Soils and Soil Chemistry

The BGS estimated background soil chemistry concentrations for the development area where the proposed Ro-Ro facility is located are as follows:

Arsenic: 15 – 25 mg/kg;
Cadmium: 1.8 mg/kg;
Chromium: 90 – 120 mg/kg;
Lead: 100 mg/kg; and
Nickel: 30 – 45 mg/kg.

It should be noted that the frequency of sampling and testing for the BGS Estimated Soil Chemistry resource is very low (approximately 1 sample per km²).

4.3 Ground Subsidence and Stability

The following information on ground stability identified for the entire site is based on information provided in the Groundsure® Report (GS-8247704). The report classifies the hazard posed by running sands and compressible deposits as very low to moderate. The report also classifies the hazard posed by shrink swell clays and landslides as very low to low. The hazard posed by collapsible deposits and ground dissolution of soluble rocks are classified as negligible.

4.4 Mining and Mineral Extraction

The Groundsure® Report (GS-8247704) identified that the site is located within a coal mining area as defined by the Coal Authority. The Coal Authority Interactive Map Viewer ^(Ref. 5) confirms that the Humber Estuary is within a Coal Mining Reporting Area. However, the Interactive Map does not identify the site as being within a Development High Risk Area and, therefore, a separate Coal Mining Risk Assessment is not required. This was also confirmed through consultation with the Coal Authority who stated that the site is located outside the defined Development High Risk Area, therefore, there is no requirement to consider the coal mining legacy or to consult with the Coal Authority on subsequent planning. There are no known coal outcrops or underground workings within the proposed development area or within 1000m of the boundary.

No historical mineral extraction or non-coal mining records are present on site. The Groundsure® Report (GS-8247704) noted thirteen historical land uses which involved ground excavation at the surface, identified from Ordnance Survey mapping. There are a further twenty-six historical ground excavation records identified within 250m of the site boundary. These historical surface excavations are likely from industrial construction in the area.

In conclusion, the risk posed from quarrying, mining and landfills can be considered negligible.

4.5 Radon

The location of the proposed Ro-Ro facility is in an area where less than 1% of properties are affected by radon. The Groundsure® Report states that no radon protection measures are required (applicable in the construction of new dwellings or extensions). This data is supplied by the BGS.

This information is only relevant if the use of the site changes to a residential use in future.

4.6 Environmental Designations

The Humber Estuary is designated as a Site of Special Scientific Interest (SSSI) of 'mixed' interest including geological interest, Special Area of Conservation (SAC), Special Protection Area (SPA), and Ramsar site. The site also falls within a Nitrate Vulnerable Zone.

4.7 Hydrogeology

4.7.1 Aquifer Classification

The superficial geology (Tidal Flat Deposits) underlying the majority of the site footprint and the Devensian (Glacial) Till underlying the Tidal Flat Deposits across the site are classified as an Unproductive Aquifer. Unproductive Aquifers are defined by the Environment Agency as "... rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow".

The superficial geology (Beach and Tidal Flat Deposits (undifferentiated)) along the bank of the Humber estuary is classified as a Secondary Undifferentiated Aquifer. Secondary Undifferentiated Aquifers are classified by the Environment Agency as being "Assigned where it is not possible to attribute either category A or B to a rock type. In general, these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type".

The bedrock geology (Burnham Chalk Formation and Flamborough Chalk Formation) underlying the Devensian Till is classified as a Principal Aquifer. Principal Aquifers are defined by the Environment Agency as "Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers".

Due to the location of the proposed site close to the Humber Estuary, groundwater is likely to flow towards the estuary, but be tidally influenced.

4.7.2 Groundwater Vulnerability

The superficial aquifer associated with the Beach and Tidal Flat Deposits (Undifferentiated) is identified as being of high groundwater vulnerability in the Groundsure® Report (GS-8247704). This is due to the combined classification of a Productive Bedrock Aquifer and Productive Superficial Aquifer along the estuary bank. This indicates areas of the site which can easily transmit pollution to groundwater.

The groundwater vulnerability across the rest of the site is classified as low due to the combined classification of the unproductive superficial aquifer overlying the Principal bedrock aquifers. This indicates areas that provide greater protection from pollution to groundwater in the Principal Aquifers.

The majority of the site falls into the classification of very low to low risk of river and coastal flooding. An area of land in the north of the site closest to the River Humber is classified as medium risk of river and coastal flooding.

In the northern and north-eastern parts of the site, where a number of terminal buildings are to be constructed, the risk of groundwater flooding is classified as negligible to low risk. In the south most of the site is a moderate risk of groundwater flooding with some areas of negligible risk, low risk, and moderate – high risk.

4.7.3 Groundwater Abstractions

There are no groundwater abstractions located within the site boundary (Groundsure® Report (GS-8247704)).

In the wider area, there are eight (8) groundwater abstractions listed within 1km of the site. Two (2) of the abstractions are listed as active, operated by ABP and located 65m south east of the site and 130m north east of the site, while six (6) are listed as historical. The Groundsure

report describes the two active abstraction points as a 'Raw Water Supply'. ABP confirmed that they hold a licence from the Environment Agency to abstract groundwater for potable use from the active abstraction point located 65m south east. There are a further nine (9) groundwater abstractions listed between 1km – 2km of the site.

4.7.4 Source Protection Zones

According to the Groundsure® Report (GS-8247704), the south east corner of the site falls within Source Protection Zone (SPZ) SPZ 1 (Inner catchment) and is associated with an active Groundwater abstraction point located 63m south east of the site boundary. This is defined by the Environment Agency as being “50-day travel time of pollutant to source with a 50 m default radius”. A larger radius of the south east corner, surrounding the SPZ 1, lies within SPZ 2 (Outer catchment). This is defined by the Environment Agency as being “400 day travel time of pollutant to source. This has a 250 or 500 metres minimum radius around the source depending on the amount of water taken”. The remainder of the site lies within SPZ 3 (Total catchment) defined by the Environment Agency as being the “area around a supply source within which all groundwater ends up at the abstraction point. This is the point from where the water is taken. This could extend some distance from the source point”.

4.7.5 Nitrate Vulnerable Zones

According to DEFRA's MAGIC Map application ^(Ref. 7) and the Groundsure® Report (GS-8247704), the majority of site (landside) is classified as being within a Nitrate Vulnerable Zone.

4.8 Hydrology

4.8.1 Watercourses

The proposed development site is partially located within the Humber Estuary. This is referred to within the Groundsure® Report (GS-8247704) as the Humber Lower Transitional (ID: GB530402609201). The most current data from the Environment Agency Catchment Explorer (2019) ^(Ref. 9) designates the overall rating of the waterbody as 'moderate' with a moderate ecological status, and a chemical status of 'fail' based on priority hazardous substances Polybrominated diphenyl ethers (PBDE), Perfluorooctanesulfonic acid (PFOS), Polycyclic aromatic hydrocarbons (PAHs) and, mercury and its compounds.

The Groundsure® Report (GS-8247704) also states that the North Beck Drain river water body catchment (ID: GB104029067575) of the Becks Northern operational catchment lies 409m south of the proposed site development. It is recorded as a heavily modified water body (HMWB) due to coastal protection use, flood protection use, and navigational use. This means 'ecological potential' is applied rather than 'ecological status'. The current (2019) overall status of this waterbody is 'moderate', with ecological potential of 'moderate', and a chemical status of 'fail'. The reason for the 'fail' chemical status is based on priority hazardous substances PBDE and mercury and its compounds.

Within the Groundsure® Report there are three (3) unnamed surface water courses described as 'Inland river not influenced by normal tidal action' located onsite. These are located within Sub Plot 2 along its boundary. There are a further 37 unnamed watercourses of the same description within 250m of the site.

4.8.2 Licensed Surface Water Abstractions

There is one (1) surface water abstraction located 1,240m west of the site (Groundsure® Report (GS-8247704)). The abstraction is listed as historical and was operated by Immingham Town Council.

4.8.3 Artesian Aquifers

The site is located in an area which is susceptible to chalk artesian aquifers ^(Ref. 6). Therefore, there is the potential for artesian aquifers in the chalk bedrock, which could lead to potential blow wells that have implications on boreholes, piling and aquifer protection measures.

4.9 Summary of Environmental Site Sensitivity

The environmental sensitivity of the site is considered to be as follows with regards to:

- **Groundwater: Low to moderate sensitivity** – The bedrock underlying the site is designated as a Principal Aquifer associated with the Burnham Chalk Formation and Flamborough Chalk Formation. However, this is overlain by up to 34 m of low permeability Tidal Flat Deposits and Glacial Till (designated as an Unproductive aquifers) which are likely to afford significant protection to the underlying Principal Aquifer. There is an active groundwater abstraction 63m south east of the site with an associated source protection zone. SPZ1, SPZ 2 and, SPZ 3 are present within the site.
- **Surface water: High sensitivity** –The Humber Lower water body is located on site and has a WFD classification of 'moderate'. The Humber Estuary is also designated as a SSSI, SAC, SPA, and Ramsar site. However, there are no surface water abstractions within 1km of the site.
- **Land use: Low sensitivity** – The site is located in an area of commercial/ industrial land use. The town of Immingham is located approximately 300m south west of the proposed development.

5. Historical & Planned Development

The historical development of the site and the immediate surroundings has been assessed using historical Ordnance Survey (OS) maps dating from 1884-2021 obtained as part of the Groundsure® Report (GS-8247702).

Table 5.1 presents a summary of the main features present on site and within approximately 250m of the site boundary which may represent potential sources of contamination. Where dates are stated, these refer to the published date and as such do not necessarily refer to the exact date of existence of a particular feature. Development that may have occurred between map editions is recorded as occurring on the latter published map.

5.1 Historical Development of the Site and Surroundings

Table 5.1: Summary of Historical Development

Date	Scale	On Site Features	Key Off Site Features (<250m) *
1884-1888	1:2,500 1:10,560	A railway line crosses through the western extent of the site. Another railway line intersects through the east. An associated railway building is present. The rest of this site is undeveloped.	The Grimsby District Electric Light Railway crosses from the north west into the site.
1905-1910	1:2,500 1:10,560	No significant change.	No significant change.
1930-1932	1:2,500 1:10,560	Large increase in the number of railway sidings and railway buildings all over the site.	An 'Engine Shed' is located within 100m south of the site associated with the railway lines. A 'Store' related to the railway is located within 100m-250m west of the site. The Eastern Jetty Railway is present north west of the site within 250m. A sewage works (Grimsby R.D.C) is present 250 m east of the site. Several 'Coal Hoists' are noted approximately 300m north west of the site with associated railway tracks crossing into the site.
1938-1947	1:10,560	No significant change.	No significant change.
1951-1956	1:10,560	No significant change.	No significant change.
1964	1:2,500	The Grimsby District Electric Light Railway that runs through the north of the site is marked as 'disused'.	There are several circular tanks and a Depot present immediately north west of the site. 'Works' are present within 100m north west of the site. The jetty north west of the site within the Humber Estuary has been extended to within 100m of the proposed site.
1964-1969	1:2,500 1:10,560	There are several pipelines running through the centre of the site. A pipeline runs through the western site boundary from north east to south west. In the south west of the site (north of the confluence of railway tracks) an	An oil storage depot and chemical works with associated tanks is located just outside the site boundary in the centre of the site. Additional oil storage depots are located just outside the north west and north east site boundaries. An electrical substation is present just outside the eastern site boundary next to disused railway. A warehouse is present next to the electrical substation. The area formerly labelled as

		area formally labelled as a drain is now labelled as a pipeline.	'Works' are now labelled as chemical works present within 100m north west of the site. An electrical substation is present next to the chemical works. A chemical works is present within 250m west of the site.
1970-1971	1:2,500	No significant change.	North of the proposed development within the Humber Estuary there has been the development of a jetty (oil terminal).
1969-1972 1971-1973 1972 1972-1976	1:2,500 1:10,000	No significant change.	The 'Engine Shed' in the south of the site has been separated into an 'Engine Shed' and a 'Wagon Repair Shed'. A tank is noted between them. An electrical substation is shown immediately adjacent to the engine shed.
1973-1978 1975-1978 1976-1979 1979	1:2,500 1:10,000	No significant change.	No significant change.
1977-1982 1980	1:2,500	No significant change.	No significant change.
1979-1985 1980-1985 1984 1982-1985	1:2,500 1:10,000	No significant change. Some missing information on maps.	One 'Coal Hoist' is still noted with the associated railway appearing to be partially removed and disused.
1985-1988 1986 1988	1:2,500 1:10,000	No significant change.	A Depot is present within 100m south west of the site. A 'Works' is present 50m east of this Depot. The chemical works located 100m north west of the site are again labelled as 'Works'. A 'Gas Valve Compound' is noted at the north west boundary.
2001	1:10,000	No significant change.	No significant change.
2003	1:1,250	No significant change.	One of the tanks associated with the oil storage depot located just outside the site boundary in the centre of the site has been removed.
2010	1:10,000	No significant change.	The roundabout west of the site has been constructed. The Coal Hoist is no longer noted on mapping.
2021	1:10,000	No significant change.	The circular tanks associated with the oil storage depot to the north west of the site boundary are no longer present. The 'Works' 100m north west of the site are no longer noted on mapping.

*All distances are approximate.

5.2 Planning Authority Records

The Planning Application portal for North East Lincolnshire Council ^(Ref. 10) has been reviewed to provide information on historical planning applications submitted to the Local Authority

across the wider Immingham Dock site. A summary of historical planning applications is presented in **Table 5.2**.

Table 5.2: Summary of Historical On-Site Planning Applications

Date	Reference	Proposal	Decision
Nov 1992	HSC/DC/10	Application for Deemed Consent - Manufacture and storage of fertilizers and chemicals. Raw materials and intermediate products stored on site	Deemed Consent
Nov 1992	HSC/DC/11	Application for Deemed Consent - Handling and storage of agricultural fertilizers	Deemed Consent
Jun 2007	DC/1635/06/IMM	Extension to existing tank farm	Approved with Conditions
Mar 2008	DC/214/08/IMM	Construction of a carbon steel pipeline for bio-ethanol from Immingham Dock East Terminal to Moody Lane Grimsby	Approved with Conditions

Source: North East Lincolnshire Council

5.3 Summary

Based on the information reviewed, the potential for the underlying ground at the site to have been impacted as a result of historic activities is considered to be:

- **Moderate** with respect to historic on-site industrial activities. The site was first developed in 1905/06 when works started on the Port of Immingham. However, the port was not fully operational until 1912. The 1930 historical mapping depicts the development of railway lines across the site to supply the various commercial/industrial businesses across the wider site. The site is anticipated to be underlain by Made Ground of unknown composition associated with the historical development; and
- **High** with respect to historic and recent off-site activities. There are a variety of different historical and current industrial activities such as various unspecified depots, chemical works, oil storage depots, mining equipment, electrical substations, and unspecified works premises located close to the site.

This information is assessed further within the preliminary conceptual site model presented in **Section 8**.

6. Previous Ground Investigations

This section presents a summary of the results of the existing ground investigation data available for areas of Immingham Dock adjacent to the proposed development.

6.1 19112 GD Pickles Ltd, 2020, Geoenvironmental Investigation Report

The ground investigation was undertaken between 24th – 29th February 2020. The location of the exploratory holes were within Sub Plot 1 and Sub Plot 3. This comprised the completion of 6 no. cable percussion boreholes, 1no. rotary percussive borehole, and 15 no. machine excavated trial pits using a 9 tonne backhoe excavator. *In situ* CBR tests were undertaken in trial pits where ground conditions allowed. Monitoring wells were installed in 2 no. of the cable percussion boreholes (BH03 and BH05) to enable monitoring of groundwater level conditions.

The ground conditions are summarised as follows:

- A layer of Made Ground was found across the whole Site. Made Ground was recorded as variable and, in most areas, appeared to be imported construction /industrial waste likely dating back to when the land was originally reclaimed. The maximum depth of Made Ground was 5.0 m but generally between 0.8 m and 3.0 m in depth. Perched groundwater was recorded within the Made Ground.
- Below the Made Ground, natural strata of the Tidal Flat Deposits were recorded. The shallow soils often comprised a firm orange brown sandy CLAY and extended to depths of 3.0 m bgl. Soft grey Clays and Silts which are variably organic were recorded beneath the firm orange brown sandy Clay.
- The Boulder Clay was encountered from *circa* 10 m and comprised a stiff brown gravelly sandy CLAY. In RBH1 this was proven to 18.5 m bgl.
- Beneath the Boulder Clay dense SAND & GRAVEL was initially encountered followed by a thin layer of blowing sands. Below this the strata are interpreted in the ground investigation report to be the Chalk Gravels, Putty Chalk and hard White Chalk, the latter encountered at 28 m bgl.
- No notable groundwater table was encountered/recorded in Tidal Flat Deposits or the Boulder Clay.
- Groundwater under sub artesian pressure was encountered at 18 m bgl in RBH1.
- Surface water ponding occurred across the south, east and north of the wider site.

The chemical testing results are summarised as follows:

- Testing indicates that, except in 1 location (TP 24) in Yard 6 (west corner of Sub Plot 1), all contaminants were recorded at concentrations that did not exceed the corresponding GAC for a Commercial Land-use. Due to the nature of some of the fill materials this was unexpected.
- No asbestos containing materials were noted during the investigations. No asbestos was detected in the samples tested.
- The report concluded that based on the limited dataset available, there was no identified requirement for remediation. Contamination including asbestos may be present in areas not investigated.

6.2 I19 Exploration Associates, 1980, British Transport Docks Board Immingham Dock – Eastern Jetty Final Report on Site Investigation S2552

Four boreholes were constructed to depths between 34.5 m bgl and 40 m bgl. The ground conditions generally comprised interbedded clays, sand and gravel. One borehole (BH4) reported 5.0 m thickness of Made Ground comprising slag with silt, sand, and cobbles and boulders of clay.

6.3 I5 Ground Explorations Ltd, 1967, Report No.3722, Exploration of Ground Conditions at Immingham for British Transport Docks Boards

The site investigation was carried out in April 1967 to determine the ground conditions at Immingham for British Transport Docks Boards. The ground conditions are summarised here:

- Soft alluvial deposits containing peat were reported near to the surface. These were underlain by boulder clay, which in turn was underlain by interglacial deposits and then a second strata of boulder clay.
- The interglacial deposits were recorded as primarily comprising sandy clays and laminated clay, with a layer of sand or gravel beneath the upper boulder clay unit.
- The superficial deposits were underlain by chalk which was encountered at levels between -84 ft (25.6 m) bOD and -91ft (27.7 m) bOD.

6.4 I5/I27 The British Transport Docks Board, 1965, Proposed Oil Jetties at Immingham, Lincolnshire, Report of Site Investigation

A ground investigation was carried out, from 6th August to 11th September 1965, at Immingham Dock at Habrough Marsh (Site C) and South Killingholme (Site B) on the instruction of Rendel, Palmer & Tritton, consulting engineers to the British Transport Docks Board. The ground investigation was undertaken to support the proposed construction of an oil jetty at Immingham on the River Humber. A total of 17 boreholes were sunk to depths from 30 ft (9.1 m) bOD to 106 ft (32.3 m) bOD and the logs showed the following general strata sequence:

- Alluvium (very soft to soft organic silty clay);
- Laminated Clay (firm to stiff, laminated clay with pockets and partings of silt and fine sand);
- Boulder Clay (firm to hard, silty clay with fine to medium gravel including chalk fragments);
- Sand and gravel (loose to medium, dense, sand and gravel including chalk fragments; and
- Chalk (fissured white chalk).

7. Regulated Activities and Statutory Consultation

Regulated activities within 250 m of the site could, depending upon their nature, represent potential off-site sources of contamination. Whilst a 1 km search area was generally adopted; this section places emphasis on those activities present within 250 m.

Table 7.1 summarises pertinent regulatory information obtained from the Groundsure® Report (GS-8247704) for records of regulated potentially contaminative industrial activities within 250m of the site. Full details of all regulatory information are available within the Groundsure® Report (GS-8247704):

Table 7.1: Summary of Regulatory Information from Groundsure Report

Subject	No. of Records On-Site	No. of Records 0-50m	No. of Records 50-250m	Description of On-Site Records
Past Land use				
Historical Garages	0	0	3	-
Historical Energy Feature	0	5	13	-
Historical Tanks	1	34	92	<ul style="list-style-type: none"> Unspecified Tank (1996-1999)
Waste and Landfill				
Historical Landfill (EA/NRW Records)	2	0	0	<ul style="list-style-type: none"> Site Reference: 55/00/0062, 2000 Waste Type: Inert, Industrial Site Reference: 55/19/0166 Operator: British Transport Docks Board Waste Type: Inert, Industrial, Commercial, Household
Active or Recent Landfill	0	0	1	-
Historical Waste Sites	0	0	1	-
Licensed Waste Sites	2	0	5	<ul style="list-style-type: none"> Site Name: Sandstop Recycling Operator: Sandstop Quarries Ltd Type of Site: Inert & excavation Waste TS + treatment Size: 25000 tonnes Site Name: Immingham Dock Transfer Station Operator: Lockerbie Fred Type of Site: Special Waste Transfer Station Size: 25000 tonnes
Waste Exemptions	1	4	0	<ul style="list-style-type: none"> Reference: WEX236923, Not on a farm, Description: Spreading waste on non-agricultural land to confer benefit.
Current Industrial Land Use				
Licensed pollutant release (Part A(1))	0	0	30	-
Licensed pollutant release (Part A(2)/B))	2	0	3	<ul style="list-style-type: none"> Process: Coal & Coke Status: Current Permit
COMAH site	5	0	2	<ul style="list-style-type: none"> Company: Exolum Immingham Limited, Immingham East Terminal Operational Status: Current COMAH Site Tier: COMAH Upper Tier Operator Company: Exolum Immingham Limited, Immingham West Terminal Operational Status: Current COMAH Site Tier: COMAH Upper Tier Operator Company: Associated British Ports, Immingham Dock Operational Status: Current COMAH Site Tier: COMAH Upper Tier Operator

				<ul style="list-style-type: none"> Company: Associated British Ports, ABP Bulk Park Operational Status: Current COMAH Site Tier: COMAH Upper Tier Operator Company: Associated Petroleum Terminals (Immingham) Limited, Main Terminal Operational Status: Current COMAH Site Tier: COMAH Upper Tier Operator
Licensed Discharges to Controlled Waters	6	5	3	<ul style="list-style-type: none"> Only one discharge consent is currently active on site: Permit Number: PRNTS18163 Status: modified - (Water Resources Act (WRA) 91 schedule 10 - as amended by Environment Act (Env Act) 1995) Effluent Type: sewage & trade combined – unspecified Receiving Water: River Humber
Pollutant release to public sewer	0	0	4	-
Hazardous Substance/Storage	0	4	6	-
List 1 Dangerous Substances	1	0	2	<ul style="list-style-type: none"> Name: Hydro Agri Status: Active Authorised Substances: Mercury (other), Cadmium Receiving Water: River Humber
List 2 Dangerous Substances	1	1	4	<ul style="list-style-type: none"> Name: Hydro Agri Status: Active Authorised Substances: - Receiving Water: -
Pollution Incidents (EA/NRW)	1	0	0	<ul style="list-style-type: none"> Incident Date: 20/08/2001 Pollutant: Oils and Fuel Pollutant Description: Unidentified Oil Water Impact: Category 3 (Minor) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)
Pollution Inventory Substances	0	0	2	-
Pollution Inventory Waste Transfers	0	0	1	-

There are no records, noted in the Groundsure® Report, of historical landfill (BGS records), historical landfill (LA/mapping records), electricity cables, gas pipelines, sites determined as contaminated land, regulated explosive sites, radioactive substance authorisations, pollutant release to surface waters (red list), pollution inventory radioactive waste recorded within 250 m of the site.

7.1 Utilities Summary

A utilities report was obtained from Landmark (Ref: 285109404_1). The full report is included as **Appendix D**. A total of twenty utility companies were contacted. Ten utility companies provided responses that they may be affected by the proposed development. The list of affected utilities and a summary of their responses are included in **Table 7.2**. It should be noted that this list may not include all utilities present or those that have been decommissioned or added by site occupants.

Table 7.2: Affected Utilities

Utility	Category	Location of affected utility/ Response from provider	Date Issued
Anglian Water	Water, Sewerage	A decommissioned water line runs east to west between sub plot 1 and sub plot 3 and extends just south of sub plot 2.	19 th October 2021
Cadent Gas	Gas	A gas pipeline labelled as 'IP (Intermediate Pressure) mains' runs north to south through the centre of sub plot 4.	19 th October 2021
Environment Agency	Environmental Agency	The Environment Agency have not conducted a specific search of their records. They state that an environmental permit may be needed if work in, under, over or near to a main river flood or sea defence is intended.	19 th October 2021
Line search before U dig (LSBUD)	Other	LSBUD identified Cadent Gas and National Grid Gas Transmission as affected assets.	19 th October 2021
Network Rail	Rail	Within sub plot 3 and sub plot 4 network rail have identified: buried gas pipes from mileage, buried water main, buried foul water service, buried service and buried electrical cables.	19 th October 2021
North East Lincolnshire Council	Council	Service plans highlight sewers running just south of sub plot 2 and east of sub plot 3. The council advise that there might be electrical cables serving as highway apparatus which are not shown on electricity company records. Their records of underground apparatus are also not complete, and they advise to take reasonable care to identify and protect any additional apparatus discovered.	19 th October 2021
Northern Powergrid	Electric	The drawings provided depict underground power lines present within sub plot 1 and sub plot 3.	19 th October 2021
Openreach – [British Telecommunications]	Telecom	The drawings provided depict BT lines present within sub plot 2, sub plot 3 and sub plot 4.	19 th October 2021
Utility Assets	Electric	Utility Assets stated that they do not have any records of apparatus present within the site. They note that care should be taken when excavating around electricity cables in the event that not all cables present may be accurately shown.	19 th October 2021

Virgin Media	Telecom	Drawings provided depict a duct/ trench and its associated chambers/ poles present crossing east to west between sub plot 1 and sub plot 3. Another duct/ trench and its associated chambers/ poles	19 th October 2021
--------------	---------	---	-------------------------------

7.2 Unexploded Ordnance

According to regional unexploded ordnance (UXO) risk maps published by Zetica (Ref. 12), the site lies within a zone that experiences a low risk of UXO. It is estimated that no more than 15 unexploded bombs are likely to be present within an area of 1,000 acres.

A SafeLane Global UXO Report (GS-8247703) obtained on the recommendation of Groundsure has identified the risk of potential unexploded ordnance at the proposed site. The preliminary assessment resulted in a medium risk from German UXO. On the recommendation of SafeLane a Detailed UXO Threat Assessment Desk Top Study was commissioned for this site.

7.2.1 Detailed UXO Threat Assessment Desk Top Study Summary

The SafeLane Global Detailed UXO threat Assessment Desk Top Study is included as **Appendix E**.

Within the study, the risk was assessed to be medium based on the ‘German Air Delivered High Explosive (HE) bombs and Anti-Aircraft projectiles’ UXO type. This classification of medium risk has been derived from various potential sources of German air delivered UXO, such as the recordings of several bombing raids over the docks, reports of bombs dropped on railway sidings near the site, a lack of aerial photography of the site prior to 1950 when bomb damage would have been repaired, the possibility of unexploded bombs (UXB) falling into soft tidal mud and being obscured by mobile sediment or water, and the possibility of UXB coming to rest up to 15m away from its entry point due to the J curve effect in soft ground, ballast or mud.

This medium risk classification has also been derived from various potential sources of British or Allied UXO, such as the presence of several defensive positions and army camps, anti-aircraft defensive locations engaged in both WWI and WWII, and the possibility of UXO obscured by mobile tidal or marine sediment, thus, remaining undiscovered.

Recommended minimum mitigation measures have been proposed to support the proposed groundworks at the site and are detailed in **Table 7.3**. Additional measures to those proposed in **Table 7.3** include measures such as site specific explosive ordnance safety and awareness briefings to all personnel conducting intrusive works, site specific safety instruction and explosive ordnance disposal engineers. Further detail on these additional measures can be obtained within the full report in **Appendix E**.

Table 7.3: Recommended Risk Mitigation for a Medium Risk Site

Risk Level	Environment	Planned Site Activity	Recommendations
Medium	Land-based	Shallow Intrusive Works (e.g. excavations)	<ul style="list-style-type: none"> • UXO Safety & Awareness Briefing (Toolbox Brief (TBB)) • Site Specific Safety Instructions Training Course • Non-Intrusive (NI) Magnetometer Survey (Greenfield areas only) • Target Investigation (Required as a follow-on from NI magnetometer survey) • Search & Clear

Risk Level	Environment	Planned Site Activity	Recommendations
			<ul style="list-style-type: none"> Explosive Ordnance Disposal (EOD) Engineer Watching Brief (for brownfield areas unsuitable for NI magnetometer survey)
		Deep Intrusive Works (e.g. piling)	<ul style="list-style-type: none"> UXO Safety & Awareness Briefing (TBB) Site Specific Safety Instructions Training Course Intrusive Magnetometer Survey of pile/borehole positions
	Marine based	Shallow Intrusive Works (e.g. excavations)	<ul style="list-style-type: none"> UXO Safety & Awareness Briefing (TBB) Site Specific Safety Instructions Training Course NI Magnetometer UXO Survey NI 3D Seismic Investigation from the 2m contour
		Deep Intrusive Works (e.g. piling)	<ul style="list-style-type: none"> UXO Safety & Awareness Briefing (Toolbox Brief, TBB) Site Specific Safety Instructions Training Course Seismic Investigation: Further NI Survey over exact locations to identify and mitigate risk and geological assessment for further risk management

The risk of contamination assessed for the site is based on the likelihood that the site was contaminated, the risk of the contaminant item remaining, and the likelihood of, and potential consequences, should the item be struck during the proposed works. **Table 7.4** **Error! Reference source not found.** discusses the risk that each ordnance type presents to the scope of works for the project site.

Table 7.4: Likelihood of Risk

Type of Ordnance	Likelihood of Contamination	Likelihood of UXO remaining	Likelihood of encounter	Potential Consequence	Overall Risk Level
German High Explosive Bombs	Medium	Medium	Medium	Severe	Medium
German 1Kg Incendiary Bombs	Low	Low	Low	Severe	Low
Allied Anti-Aircraft Shells	Medium	Medium	Medium	Minor	Medium
British/Allied Small Arms	Medium	Low	Low	Not Significant	Low
Land Service Ammunition	Medium	Low	Low	Moderate	Low

7.3 Summary

Based on the information reviewed above and within the Groundsure® Report, the potential for contemporary registered or consented land use to pose a risk of contamination to the site is considered:

- Moderate** given that there is one historical tank, two historical landfills and two licensed waste sites identified as being on site.

- **High** with respect to historic and contemporary off-site activities given the number of tanks identified within the vicinity of the site.

This information is assessed further within the preliminary conceptual site model presented in **Section 8**.

8. Initial Conceptual Site Model (iCSM)

8.1 Introduction

This section is aimed at identifying possible risks, if any, arising from substances used or deposited on-site, or from other sources of land contamination. Both past and current potentially contaminative land uses have been considered.

8.2 Assessment Framework

Current legislation relating to contaminated land in the UK is contained within Part 2A of the Environmental Protection Act 1990, which was inserted by Section 57 of the Environment Act 1995 and by Section 86 of the Water Act 2003 and elaborated within the Contaminated Land (England) Regulations 2006 [S.I. 2006/1380] (amended 2012 [S.I. 2012/263]).

The “suitable for use” approach is adopted for the assessment of contaminated land. Remedial measures are only undertaken where unacceptable risks to human health or the environment are realised, taking into account the use (or proposed use) of the land in question and the environmental setting.

Current best practice recommends that the determination of health hazards due to contaminated land is based on the principle of risk assessment, as outlined in Part 2A of the Environmental Protection Act 1990.

The risk assessment process for the environmental contaminants is based on a source-pathway-receptor analysis. These terms can be defined as follows:

- Source: Hazardous substance that has the potential to cause adverse impacts;
- Pathway: Route whereby a hazardous substance may come into contact with the receptor. Examples include ingestion of contaminated soil and leaching of contaminants from soil into watercourses; and
- Receptor: Target that may be affected by contamination. Examples include human occupants/users of site, water resources (surface waters or groundwater), or structures.

For a risk to be present, there must be a viable contaminant linkage; i.e. a mechanism whereby a source impacts on a sensitive receptor via a pathway.

The following sections detail the conceptual site model, which has been developed for the site with the view to assessing the potential risks during construction and upon completion of the proposed development. The potential sources of contamination, potential receptors and potential pollutant pathways are identified and presented in **Table 8.1** to **Table 8.4**.

8.3 Potential Sources

This section highlights those former/current on-site and off-site activities that have been identified as potential sources of contamination. These activities may have in turn impacted on soil, soil leachate, and groundwater. A buffer of 1km has been considered for potential sources beyond the site boundary. However, only sources within 500m realistically pose the highest potential for any contamination to impact the site area.

Table 8.1: Potential Sources

Potential Source	Description
Made Ground	Made Ground is expected to be present within the majority of the footprint of the proposed development. This Made Ground may contain asbestos-containing materials and has the potential to contain metal, inorganic and/or organic contaminants. Leaks/spills of contaminants associated with vehicles used and

Potential Source	Description
	stored on site, hazardous materials used and stored on site and hazardous waste stored on site have the potential to have occurred, which may have migrated into the Made Ground.
Natural Strata	The natural strata consist of superficial Tidal Flat Deposits and a bedrock of Chalk. Free phase contamination may have migrated into the natural strata.
Soil Leachate	Potential contaminants may be leached from Made Ground and historical landfill sources at the site.
Groundwater	Shallow groundwater may be present within the Made Ground and potential contaminants may be present due to the historical industrial use of the site.
Ground Gas	Concentrations of ground gases (methane and carbon dioxide) could originate both from Made Ground and naturally from organic content within the underlying deposits. Methane also has the potential to be produced from the historical landfill sites. Carbon dioxide has the potential to be generated from the underlying Chalk deposits.
Off-site Sources	Possible migration of potential contaminants associated with the adjacent railway lines. Various historical and contemporary industries are present in the surrounding area which could be potential contamination sources.

8.4 Contaminants of Potential Concern (CoPC)

Table 8.2: Potential Sources of Contamination

Location	Potential Source	Potential Contaminants of Concern
On site	Made Ground of unknown source	Heavy metals, asbestos, sulphate (water soluble), sulphate (acid soluble), easily liberated sulphide, sulphur, pH, TPH, SVOCs including PAHs and VOCs. Ground gases such as carbon dioxide and methane.
On site	Current land uses including slag and pumice stockpiles, 1 no. 5,200L diesel tank and 1 no. gas oil tank (size unknown)	TPH, metals and sulphur
On site	Landfills	Heavy metals, asbestos, organic compounds. Ground gases such as carbon dioxide and methane.
Immediately south and historically on site	Railway and cuttings	Heavy metals, asbestos, TPH and PAHs.
Immediately west	Oil Storage Depots	Hydrocarbons, organic compounds, asbestos.
Immediately west	Chemical Works (fertiliser)	Heavy metals, acids, alkalis, ammonium salts, phosphates and superphosphates, organic chemicals, fuels, lubricating oils, PCBs, wastewater treatment chemicals (e.g. alum, sulphuric acid, ammonium hydroxide, asbestos).
Several located within 10m – 250m east, south and west	Electricity substations	PCBs
Onsite and several located within 50 –	Unspecified depot/works	Heavy metals, asbestos, sulphate (water soluble), sulphate (acid soluble), easily liberated sulphide,

250m east, south and west	sulphur, pH, TPH, SVOCs including PAHs and VOCs.
Approximately 250m east	Sewage works Heavy metals, Inorganic ions, organics, micro-organisms, treatment chemicals (alum, lime, polyelectrolytes, hydrochloric acid, sodium hydroxide, ferric chloride), asbestos.

TPH: Total Petroleum Hydrocarbons
 VOC: Volatile Organic Compounds
 SVOC: Semi-Volatile Organic Compounds
 PAH: Polycyclic Aromatic Hydrocarbons
 PCBs: Polychlorinated biphenyls

8.5 Potential Receptors

Table 8.3 lists the potential receptors at the site of the proposed development.

Table 8.3: Potential Receptors

Potential Receptor	Description
Future Site Visitors	Users of the site may be affected by the presence of elevated concentrations of certain determinands. However, the transient nature of some visitors will limit the exposure time.
Onsite workers	Workers at the site may be affected by the presence of elevated concentrations of certain determinands. These workers will have a longer-term exposure to potential contaminants at the site which may lead to chronic health conditions. The highest risk areas will be within the confined areas of the new buildings constructed. As the majority of the site will consist of parking and storage areas, there is only a very low risk to on site workers from outdoor inhalation.
Off-site Human Health Receptors	This includes residents, commercial and industrial buildings and occupiers of surrounding properties. The nearest residential properties identified are located approximately 200m south of the proposed site and therefore are not considered to be potential receptors. The nearest commercial/ industrial buildings are located immediately adjacent to the west of the proposed site within the wider Immingham Dock area.
Controlled Waters	This includes on-site and off-site water courses: <u>Surface Water</u> <ul style="list-style-type: none"> • Humber Estuary; and • Unnamed surface water courses (drains) identified within sub plot 2 which may be connected to other drains which discharge to the Humber Estuary. <u>Ground Water</u> <ul style="list-style-type: none"> • Superficial Secondary undifferentiated aquifers (Beach and Tidal Flat Deposits); • The Tidal Flat Deposits and Glacial Till are classified as unproductive strata and therefore not considered to be Controlled Waters receptor; and • Principal bedrock aquifers (Flamborough Chalk Formation and Burnham Chalk Formation) underlying the site, including a Source Protection Zone associated with a potable water abstraction approximately 65m south east of the site.
Development Infrastructure	Concrete is a receptor of chemical aggressivity in contaminated soils with a low pH and high sulphate concentrations. Plastic piped services and concrete foundations can be adversely affected by the presence of hydrocarbons, including phenolic compounds, where the integrity of the pipes can be compromised. This can lead to penetration of the pipes by mobile contaminants.
Flora & Fauna	On-site and off-site flora and fauna may be affected by the presence of elevated concentrations of certain determinands.

Construction Workers Exposures experienced by construction workers are much less than for future site users due to the limited period of exposure. However, construction workers are more likely to encounter potential contaminants during the construction works.

8.6 Potential Pathways

This section provides a summary of the potential pathways by which the identified sources may come into contact with receptors.

Table 8.4: Potential Pathways

Potential Pathway		Description
Soil Source Pathways Including the following sources: <ul style="list-style-type: none"> Made Ground Soil derived leachate 	Dermal Contact	Dermal contact with contaminated soils, soil derived dust and soil leachate.
	Direct Contact	Direct contact of building materials with contaminated soils and soil derived leachate.
	Ingestion	Direct or indirect ingestion of soil and soil derived dust.
	Inhalation	Inhalation of soil derived dust, organic vapours or ground generated gas.
	Plant Uptake	Uptake of contaminants via the roots.
Groundwater Source Pathways Including the following sources: <ul style="list-style-type: none"> Soil leachate Perched groundwater Deep groundwater 	Rainfall Infiltration & Vertical / Lateral migration via permeable strata and service conduits	Rainfall infiltration can generate and mobilise soil derived leachate which could impact on surface water following lateral migration and groundwater. Perched groundwater (if present) may also migrate vertically to groundwater in other, deeper aquifers.
	Lateral Migration through Aquifer	As well as being a receptor, aquifers allow lateral migration of contaminants through the permeable strata.
Surface Water Pathways Includes the following sources: <ul style="list-style-type: none"> Made Ground 	Surface Run-off	Entrainment of sediment in surface run off into drainage ditches on site which discharge to the Humber Estuary.
	Surface Water Drainage	Surface spills could migrate via surface run off to drainage which is discharged in to the Humber estuary.
Gas Pathways Including the following sources: <ul style="list-style-type: none"> Ground gas 	Vertical / Lateral Migration via permeable strata	Permeable strata, service trenches, historical landfills and areas of Made Ground may allow transportation of ground gases.

9. Environmental Risk Assessment

9.1 Risk Assessment Principles and Framework

Current best practice recommends that the determination of hazards due to contaminated land is based on the principle of risk assessment, as outlined in the Environment Agency guidance on Land Contamination Risk Management (LCRM), April 2021 ^(Ref. 13).

For a risk to be present, there must be a viable contaminant linkage; i.e. a mechanism whereby a source impacts on a sensitive receptor via a pathway. The potential contaminant linkages that have been identified for this site are presented in **Section 8**.

Assessments of risks associated with each of these contaminant linkages, following review of available information for the site is discussed in the following sections.

Using criteria broadly based on those presented in the Construction Industry Research and Information Association publication Research & Development (R&D) Publication 66, National House Building Council (NHBC)/Environment Agency/Chartered Institute of Environmental Health (CIEH) 2008, the magnitude of the risk associated with potential contamination at the site has been assessed. To do this an estimate is made of:

- The potential severity of the risk; and
- The likelihood of the risk occurring.

The severity of the risk is classified according to the criteria in **Table 9.1**.

Table 9.1: Severity of Risk

Severity	Description
High	<ul style="list-style-type: none"> • Acute risks to human health likely to result in “significant harm” (e.g. very high concentrations of contaminants/ground gases); • Catastrophic damage to buildings/property (e.g. by explosion, sites with high gassing potential, extensive VOC contamination); • Major pollution of controlled waters (e.g. surface watercourses or principal aquifers/source protection zones); and • Short term risk to a particular ecosystem.
Medium	<ul style="list-style-type: none"> • Chronic (long-term) risk to human health likely to result in “significant harm” (e.g. elevated concentration of contaminants/ground gases); • Pollution of sensitive controlled waters (e.g. surface watercourses or principal/secondary A aquifers); and • Significant effects on sensitive ecosystems or species.
Mild	<ul style="list-style-type: none"> • Pollution of non-sensitive waters (e.g. smaller surface watercourses or secondary B aquifers or unproductive strata); and • Significant damage to crops, buildings, structures or services (e.g. by explosion, sites with medium gassing potential, elevated concentrations of contaminants).
Minor	<ul style="list-style-type: none"> • Non-permanent human health effects (requirement for protective equipment during site works to mitigate health effects); • Damage to non-sensitive ecosystems or species; and • Minor (easily repairable) damage to buildings, structures or services (e.g. by explosion, sites with low gassing potential).

The probability of the risk occurring is classified according to the criteria given in **Table 9.2**.

Table 9.2: Probability of Risk Occurring

Probability	Explanation
High likelihood	Contaminant linkage may be present that appears very likely in the short term and risk is almost certain to occur in the long term, or there is evidence of harm to the receptor.
Likely	Contaminant linkage may be present, and it is probable that the risk will occur over the long term.
Low Likelihood	Contaminant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
Unlikely	Contaminant linkage may be present but the circumstances under which harm would occur even in the long term are improbable.

An overall evaluation of the level of risk is gained from a comparison of the severity and probability, as shown in **Table 9.3**.

Table 9.3: Level of Risk

		Severity			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very High	High	Moderate	Moderate / Low
	Likely	High	Moderate	Moderate / Low	Low
	Low Likelihood	Moderate	Moderate / Low	Low	Very Low
	Unlikely	Moderate / Low	Low	Very Low	Very low

9.2 LCRM Assessment of Risk

In October 2020 (updated April 2021), the UK government issued new guidance on the evaluation and management of contaminated land; LCRM ^(Ref. 13). Current contaminated land guidance LCRM (Environment Agency, 2021) categorises risk at Stage 1 Tier 1 as follows:

- Minimal or negligible;
- Tolerable or acceptable; and
- Unacceptable.

However, no framework for assessing the risk has been published to accompany the guidance, so the CIEH & NHBC R&D Publication 66 assessment framework constitutes best practice in this regard. To align the risk rankings in **Section 9.1** with the LCRM rankings and with the Part 2A definitions, the following matrix has been utilised. This conversion is presented in **Table 9.4**.

Table 9.4: Conversion of LCRM Risk Categories

R&D66 Level of Risk	Minimal/Negligible	Tolerable	Unacceptable
Very Low			
Low			
Moderate/Low			
Moderate			
High			
Very High			

This risk category spans both acceptable and unacceptable. This is intentional as it is this risk band that tends to have the greatest level of uncertainty associated with it. Acceptability will dependent on site-specific circumstances and level of confidence in the available evidence.

For a risk to be unacceptable, the contaminant linkage should be associated with at least a “medium” severity as defined in Table A4.3 in Annex 4 of R&D66 and the probability should (in the majority of cases) be at least “likely” as defined in Table A4.4 of R&D66.

These risk categories represent the level of risk as it is currently understood from the information available at this time.

9.3 Preliminary Risk Assessment

An evaluation of the potential risks associated with the identified sources at the location of the proposed development to the various receptors is discussed and presented in **Table 17** and **Section 9.4**. The level of risk is determined based on the current condition of the site, i.e. the effects of mitigation measures such as soil or groundwater treatment are not included but the level of risk takes into account the nature of the proposed development.

The evaluation includes an assessment of the significance of the potential contaminant linkages. Where it is considered that a particular contaminant linkage is not plausible in the context of the site and the proposed development, the overall risk is determined as being *Low*.

Table 9.5: Risk Evaluation of Potential Contaminant Linkages

Source	Pathway	Receptor	Potential Contaminant Linkage	Risk Evaluation			Potential Risk LC:RM	
				Severity	Probability	Risk		
Contaminants of potential concern within soil in Made Ground and natural strata	Direct Contact / Ingestion / Inhalation of vapours & dust	On-Site Human Health	Future Site Visitors (users of the Ro-Ro facility)	Y	Mild	Low likelihood	Low	Minimal / Negligible
			On-site Workers (Within future constructed buildings)	Y	Medium	Low likelihood	Moderate / Low	Tolerable
			On-site workers (Outdoors)	Y	Mild	Low likelihood	Low	Minimal / Negligible
			Construction / Maintenance Workers	Y	Mild	Likely	Moderate / Low	Minimal / Negligible
	Inhalation of Vapours / Dusts	Off-Site Human Health	Workers in the commercial/ industrial buildings located adjacent to the west site boundary	Y	Minor	Low likelihood	Very Low	Minimal / Negligible
	Surface run-off / Migration via site drainage	Controlled Waters	Surface Water: (Humber Estuary/ Drains on site)	Y	Medium	Likely	Moderate	Tolerable
	Infiltration / Vertical Migration		Groundwater: (Superficial Secondary Undifferentiated (Beach and Tidal Flat Deposits and Glacial Till))	Y	Mild	Low likelihood	Low	Minimal / Negligible
			Groundwater: (Principal bedrock aquifers (Flamborough Chalk Formation and Burnham Chalk Formation))	Y	Medium	Unlikely	Low	Minimal / Negligible
	Direct Contact	Development Infrastructure	Buildings to be constructed on site and associated foundations and infrastructure	Y	Mild	Likely	Moderate / Low	Tolerable
	Direct Contact / Uptake	Flora & Fauna	On site flora and fauna	Y	Minor	Likely	Low	Minimal / Negligible
Leachate and Groundwater contaminants from Made Ground and Natural Strata	Direct Contact / Ingestion / Inhalation of vapours	On-Site Human Health	Future Site Users / Visitors	Y	Mild	Low likelihood	Low	Minimal / Negligible
			On-site Workers (Within future constructed buildings)	Y	Medium	Low likelihood	Moderate / Low	Tolerable
			On-site workers (Outdoors)	Y	Minor	Low likelihood	Low	Minimal / Negligible
			Construction / Maintenance Workers	Y	Mild	Likely	Moderate / Low	Tolerable
	Lateral Migration	Controlled Waters	Surface Water: (Humber Estuary/ Drains on site)	Y	Medium	Likely	Moderate	Tolerable
	Preferential migration Through Surface Water Drainage			Y	Medium	Likely	Moderate	Tolerable

Vertical Migration		Groundwater: (Superficial Secondary Undifferentiated (Beach and Tidal Flat Deposits and Glacial Till))	Y	Mild	Likely	Moderate / Low	Minimal / Negligible	
		Groundwater: (Principal bedrock aquifers (Flamborough Chalk Formation and Burnham Chalk Formation))	Y	Medium	Low Likelihood	Moderate / Low	Tolerable	
	Direct Contact	Development Infrastructure	Buildings to be constructed on site and associated foundations and infrastructure	Y	Mild	Likely	Moderate / Low	Tolerable
	Infiltration / Off-site Migration	Off-Site Human Health	Workers in the commercial/ industrial buildings located adjacent to the west site boundary	Y	Mild	Unlikely	Very Low	Minimal / Negligible
	Direct Contact / Uptake	Flora & Fauna	Any on site flora and fauna	Y	Minor	High likelihood	Low	Minimal / Negligible
Ground Gas potentially produced by Made Ground, historical landfills, and naturally from organic content within the underlying deposits	Inhalation	On-Site Human Health	Future Site Visitors (users of the Ro-Ro facility)	Y	Minor	Low likelihood	Very Low	Minimal / Negligible
			On-site workers (Outdoors)	Y	Minor	Low likelihood	Very Low	Minimal / Negligible
	Inhalation / Migration & Explosion		On-site Workers (Within future constructed buildings)	Y	Medium	Likely	Moderate	Tolerable
			Construction / Maintenance Workers	Y	Medium	Likely	Moderate	Tolerable
	Migration & Explosion	Development Infrastructure	Buildings to be constructed on site and associated foundations and infrastructure	Y	Severe	Likely	High	Unacceptable
	Inhalation / Migration & Explosion	Off-Site Human Health	Off-site Receptors: Workers in the commercial/ industrial buildings located adjacent to the west site boundary	Y	Minor	Low likelihood	Very Low	Minimal / Negligible

9.4 Discussion of Risk to Receptors

9.4.1 Risk to Future Site Visitors

The risk to future site visitors is considered *Very Low to Low* for the three potential contaminant linkages identified in **Table 9.5**. These risks are considered as *Minimal/Negligible* using the LC:RM risk rating.

Future site users are unlikely to come into direct contact with the underlying soils as the majority of the site is currently covered in hardstanding and the future landside development will require a significant amount of hardstanding.

There is the potential for ground gas to be sourced from the Made Ground materials around the site. Pathways for gas migration may be present as the Made Ground is likely to comprise a variety of cohesive and granular materials, which will have a variety of permeabilities. The site is also underlain by organic rich soils which may be a source of ground gas.

Based on current layout plans, the passenger welfare facilities are to be located in the south east corner of Sub Plot 3. This is located within 40m of the historical landfill listed in **Table 7.1** (Ref: 55/00/0062, 2000), reported to contain inert and industrial waste. Due to the nature of the waste recorded within this landfill there is a low likelihood for ground gas generation. However, the presence of the landfill may still present a preferential pathway for ground gas and groundwater migration.

As the site will be used to service the embarkation and disembarkation of principally commercial and automotive traffic, possibly with provision for a small element of passenger use during quiet periods, most future site users will be transient in nature and, therefore, experience limited periods of exposure.

9.4.2 Risk to On-Site Workers (Within Future Buildings)

The risk to on-site workers within the future constructed buildings is considered *Moderate/Low* for the three potential contaminant linkages identified in **Table 9.5**. These risks are considered as *Tolerable* using the LC:RM risk rating.

This is due to increased exposure time a regular onsite worker would have to potential volatile contaminants compared to a transient site user or construction worker.

There are a few buildings proposed to be built at the site including welfare buildings for workers and passengers, and an office building. A workshop and gatehouse may also be required. Based on current layout plans) there are terminal buildings proposed to be built along the north west area of sub plot 3. This area borders land that has been identified to have had chemical works and oil storage as former and current land use (see **Table 5.1**) and a contaminant linkage via vapour inhalation may be present (see **Table 8.2**).

The risk from ground gas is considered Low for reasons outlined within **Section 9.4.1**.

9.4.3 Risk to On-site Workers (Outdoors)

The risk to on-site workers working outdoors is considered *Very Low to Low* for the three potential contaminant linkages identified in **Table 17**. These risks are considered as *Minimal/Negligible* using the LC:RM risk rating.

The risk to these workers is similar to the on-site workers described in **Section 9.4.2**. However, as these workers operate within open spaces the likelihood of the contaminant linkages of vapour inhalation and gas migration and explosion are reduced.

9.4.4 Risk to Offsite Human Health Receptors

The closest potential offsite human health receptors are the workers within the commercial / industrial buildings located immediately west of the site.

The risk to offsite receptors from direct contact, ingestion or inhalation of potential contaminants in Made Ground, natural soils, groundwater and leachate at the site is considered to be *Very Low*.

Any risks to local off-site receptors would be associated with off-site migration of contamination, for instance, in the form of wind-blown dust and organic vapours. Exposure via inhalation of dust is considered to be negligible for off-site receptors following development works, and as such there is not considered to be plausible contaminant linkage. The greatest potential for generation will be during the construction phase. Dust generation should be kept to a minimum in accordance with general best practice, as outlined in, for example, "Environmental Good Practice on Site", 3rd Edition, CIRIA Publication C692. Overall, the risks to off-site receptors from on-site soil derived dusts are considered to be *Very Low*, which is *Minimal/Negligible* under the LC:RM risk rating.

The level of risk considered for exposure of offsite receptors to ground gas is considered to be *Very Low* as it is considered unlikely that the proposed development at the site will change the existing ground conditions and not cause ground gas migration to these receptors.

Overall, the LC:RM risk rating to offsite receptors is considered to be *Minimal/Negligible*.

9.4.5 Risk to Controlled Waters: Surface Water

The risk from potential contaminants in Made Ground, natural soils, groundwater and leachate at the site to surface waters is considered to be *Moderate/Low to Moderate*. Overall, the LC:RM risk rating to surface waters is considered to be *Tolerable*.

The majority of the site will be covered by hardstanding, however some areas of soft ground exist which may allow infiltration of rainwater and thus the generation of soil leachate. Various potential pathways exist to surface water drains and the Humber Estuary, including surface water (overland) run-off, run-off in to surface water drains and then discharge in to the Humber Estuary and lateral migration of shallow or perched groundwater.

9.4.6 Risk to Controlled Waters: Groundwater

The risk from potential contaminants in Made Ground, natural soils, groundwater and leachate at the site to groundwater is considered to be *Low to Moderate/Low*. Overall, the LC:RM risk rating to groundwater is considered to be *Minimal/Negligible to Tolerable*.

The majority of the proposed site is underlain by a superficial Unproductive Aquifers (Tidal Flat Deposits and Glacial Till). A superficial Secondary Undifferentiated aquifer (Beach and Tidal Fla Deposits) are located along the bank of the Humber Estuary. Due to the Aquifer classifications, the severity of impact to them is considered mild. As the majority of the site is currently (and in the future development) covered in hardstanding, the likelihood of a contaminant linkage via vertical migration is lessened. However, there is the potential for future construction involving piling to create preferential pathways for migration of impacted groundwater into the Principal Aquifer. The potential risks associated with piling would be considered within a piling risk assessment with the appropriate mitigation implemented.

The proposed site is underlain by a Principal Aquifer at depth. The aquifer classification in addition to the presence of SPZ1, SPZ2 and SPZ3 on-site (associated with the groundwater abstraction point 63m south east of the site) would result in a medium to high severity of impact. However, the presence of approximately 17m of low permeability clay deposits (Tidal Flat Deposits and Glacial Till) across the proposed site is likely to restrict vertical migration of impacted groundwater, if present, reducing the likelihood and risk rating.

9.4.7 Risk to Development Infrastructure

The risk to development infrastructure for the three potential contaminant linkages identified in **Table 9.5** are *Moderate/Low to High*. These are risks are considered as *Tolerable to Unacceptable* using the LC:RM risk rating.

It is assumed that potential risks would be mitigated by using concrete and service pipes appropriate for any aggressive ground conditions identified at the site.

The gassing potential of the site will be assessed within a ground investigation prior to construction. It is anticipated that appropriate gas protection measures, where ground gas monitoring results indicate that protection is necessary, will be sufficient to mitigate the potential risk from ground gas.

9.4.8 Risk to Construction Workers

The risk to construction workers from direct contact, ingestion or inhalation of potential contaminants in Made Ground, natural soils, groundwater and leachate at the site is considered to be *Moderate/Low to Moderate*.

This assessment was made with the consideration that whilst construction workers might be expected to come into contact with soils, a site-specific risk assessment and the use of personal protective equipment will be a pre-requisite to them being on site. Therefore, construction workers should be protected from any potential contaminants. It is also considered that if construction workers did come into contact with a potential contaminant(s) at the site, they would experience limited periods of exposure. Taking the above into account, the risk of exposure from contaminated soils, leachate and groundwater to construction workers is considered *Tolerable* using the LC:RM risk rating.

There is potential for ground gas generation at the site due to the Made Ground present, organic content within the underlying deposits and the underlying Chalk deposits. The severity of ground gas risk at the site to construction / maintenance workers is considered *Medium* and the probability is considered *Likely*. Therefore, the risk to construction workers from inhalation of ground gas and risk of explosion due to the build-up of ground gas in enclosed spaces is considered to be *Tolerable*. However, it is recommended that entry into excavations or any other enclosed space on a construction site should comply with confined space legislation and be assessed prior to entry.

Before construction works start, a health and safety risk assessment should be carried out in accordance with current health and safety regulations. This assessment should cover potential risks to both construction staff and the local population. Based on the findings of this risk assessment, appropriate mitigation measures should be implemented during the course of the earthworks.

9.4.9 Risk to Flora and Fauna

The risks to flora and fauna on the site have been classified as low. The majority of the site is likely to be covered in hardstanding in future which will remove the pathway to on-site flora. The Humber Estuary is designated as an ecologically sensitive site, however, potentially adverse effects that are identified through investigation will be able to be mitigated through a site specific Environmental Management Plan.

10. Preliminary Geotechnical Appraisal

10.1 Geotechnical Risk Assessment

A number of geotechnical hazards have been identified for the site. In order to quantify the risks associated with the proposed works, a preliminary geotechnical risk assessment has been conducted. To do this, an estimate is made of:

- the potential severity of the risk (consequence); and
- the likelihood of the risk occurring.

The likelihood and consequence of the risk are classified according to the criteria in **Table 10.1** below:

Table 10.1: Scoring rational describing likelihood and consequences of geohazards

Likelihood		Consequence	
1	Improbable Extremely unlikely to occur in relevant period	1	Insignificant Unlikely to have impact on works.
2	Remote Unlikely to occur in relevant period	2	Marginal Minor first aid incident or requiring routine maintenance repair.
3	Occasional Likely to occur in relevant period	3	Serious Lost time, injury or illness; minor damage to property/ infrastructure or significant environmental effect.
4	Probable Likely to occur several times in relevant period	4	Critical Major injury, major damage to property/infrastructure, or major environmental effect.
5	Frequent Likely regular occurrence in relevant period	5	Catastrophic Death or major loss; total systems failure

An overall evaluation of the level of risk is gained from a comparison of the severity and probability, as shown in **Table 10.2** below:

Table 10.2: Geohazard index ranges

Index = Likelihood x Consequence (See also CIRIA SP125).

16-25	Very High Risk	Unacceptable. Re-examine activities to provide lower risk.
9-15	High risk	Further mitigation measures required and/or alter method of work. Seek approval from all stakeholders if risk cannot be reduced.
6-8	Medium Risk	Tolerable only if further mitigation is not reasonably practical and there is need to continue activity with identified controls.
1-5	Low Risk	Broadly acceptable if all reasonably practicable control measures in place.

A geotechnical risk register for the proposed works at Immingham Eastern Ro-Ro Terminal has been developed; identifying the risks associated with the current condition of the site and typical construction risks relating to the proposed improvement options. The geotechnical risk register is a live document and will need to be updated as risks are identified in subsequent stages of the scheme.

The geotechnical risks associated with the proposed works are summarised in **Table 20**:

Table 10.3: Summary of Risks

Risk Number	Hazard	Risk	Risk before Mitigation			Mitigation	Risk after Mitigation		
			L	C	I		L	C	I
GEO 001	Unidentified services	Delays or changes to proposed works. Injury or death of site operatives. Damage as a result of works which results in commercial compensation and delays. Increased cost and delay to divert or lower services.	3	5	15	Obtain up to date service plans and records. Service providers contacted before mobilisation and known services marked out. Site to be scanned using Cable Avoidance Tool (CAT) and Ground Penetrating Radar (GPR) before ground works, and hand dug investigation where necessary. Design proposed scheme to minimise impact on existing services. Continued vigilance during work.	1	5	5
GEO 002	Slope instability along field embankments, ditches and cuttings	Propagation of slope failure into third party land, resulting in cost to client for compensation for damages. Slope failure of railway embankment.	2	5	10	Avoid works undercutting slopes. Where unavoidable, use temporary stabilising structures and provide continuous slope monitoring for signs of instability. Suitable ground investigation and geotechnical analysis prior to works. Earth retaining structures to be considered as necessary.	1	5	5
GEO 003	Unexploded ordnance	Potential UXO related to historical military activity. Injury or death of site operatives. Delays to works.	3	5	15	Review of specialist UXO desk study obtained to further clarify the risk at the site and specify appropriate mitigation for ground investigation and construction. Continued vigilance during and excavation works. Use of CAT and GPR scanning.	1	5	5
GEO 004	Made Ground, Beach Deposits, Tidal Flat Deposits and Peat	Any existing artificial and superficial deposit in its current state is unlikely to provide a suitable founding stratum for structural foundations and potentially unsuitable for pavement. Made Ground is anticipated across the site due to its historical and current industrial land use.	3	3	9	The extent of and potentially highly variable thickness of existing weak and compressible materials or soils, should be assessed during a ground investigation and foundations should be placed on a suitable bearing stratum below any weak and compressible soil. It may require excavation and replacement, or treatment for new hardstanding areas. Deep foundations may be required.	1	3	3

Risk Number	Hazard	Risk	Risk before Mitigation			Mitigation	Risk after Mitigation		
			L	C	I		L	C	I
GEO 005	Hard rock / boulders / buried structures	Delays or changes to proposed works / scheme. Piling obstruction. Scheme design alterations to avoid underground structures.	3	3	9	Suitable ground investigation. Live assessment of ground excavatability. Provision for a pneumatic breaker /suitable plant on site during excavation. Obtain drawings and information related to current and previous structures for consideration in permanent and temporary works design. Design proposed scheme to minimise impact from existing obstructions and/or break out and remove.	1	3	3
GEO 006	Unforeseen ground conditions	Inadequate or uneconomic design. Delays or changes to proposed temporary & permanent works. Failure of works. Excessive cost of works.	3	4	12	Suitable ground investigation. Inspection of ground and material during construction to ensure conditions are the same or better than expected. Redesign of temporary and permanent works where necessary.	1	3	3
GEO 007	Differential Settlement of weak compressible soils (Made Ground, clay and peat)	Differential settlement leading to damage to buildings and/or foundations.	2	3	6	Ground investigation to identify underlying ground conditions and design appropriate foundation solutions.	1	3	3
GEO 008	Groundwater Flooding due to shallow groundwater	Additional costs and delays to site works. Flooding of excavations during construction or ground investigation. Flooding of unprotected basements.	3	3	9	An investigation into the groundwater levels including tidal and seasonal variation is recommended prior to commencement of any detailed earthworks or foundation design. Appropriate dewatering equipment on site. Consideration in permanent and temporary works design.	1	3	3
GEO 009	Groundwater Flooding due to blow wells from Chalk Artesian Aquifers	Additional costs and delays to site works. Flooding of excavations during construction or ground investigation. Flooding of unprotected basements.	3	3	9	Suitable ground investigation. An investigation into the groundwater levels including tidal and seasonal variation is recommended prior to commencement of any detailed earthworks or foundation design. Appropriate dewatering equipment on site.	1	3	3

Risk Number	Hazard	Risk	Risk before Mitigation			Mitigation	Risk after Mitigation		
			L	C	I		L	C	I
						Consideration in permanent and temporary works design.			
GEO 010	Shrink and Swell associated with tree removal	Increase or decrease in soil water pressure caused by removal or presence of trees causes change in soil volume. This could lead to differential settlement or subsidence of shallow foundations and pavement construction.	2	3	6	Consideration of retention of trees and impact on shallow foundations or the reverse. Consider deeper foundations to impact mitigation. Root confining planters may be prudent near areas of new landscaping and pavement construction. Where trees are to be removed, retained or planted as part of the proposed development assessment should be undertaken to determine the risk they may cause via shrink/heave of soils as a result of their presence/absence. This should be informed by intrusive ground investigation to determine the characteristics of the site soils and how susceptible they are to changes in pore water pressure.	1	3	3
GEO 011	Acid or sulphate bearing soil & groundwater.	Chemical attack on buried concrete, steel or geosynthetic.	2	3	6	Geochemical laboratory testing on samples taken during ground investigation and analysis of results. Suitable specification of permanent works undertaken.	1	3	3

10.2 Preliminary Engineering Assessment

10.2.1 Foundations

Subject to detailed design, for lightly loaded structures with no concern for excessive total and differential settlement, the underlying superficial deposits may be suitable for the use of traditional spread foundations founded within the formation. However, this is subject to assessment of ground conditions following a ground investigation as superficial materials are described as soft in the historical boreholes. However, bearing resistance of foundation stratum of the proposed structures will need to be considered for suitability of any spread foundations. Foundation design will consider both total and differential settlement. Shallow foundations will also consider the shrinking and swelling potential of the strata present.

Areas of deeper Made Ground/artificial ground are known to be present as Warp is noted to extend to 7-10 m bgl, and will require further detailed investigation. In particular, the suitability of soft superficial deposits and Peat will be considered, which are potentially located at founding level. In general, foundations should be located within natural ground beneath any fill, Made Ground, soft highly compressible soil, and below the depth of effect of variations due to vegetation, seasonal and climatic change. Remedial measures in these areas may be required.

Similarly, footings should be taken deeper than the minimum depth specified, where structures are located within influencing distance of any existing or future trees. In these circumstances reference should be made to Chapter 4.2 of NHBC's Standards (2011).

The construction of both bored and driven piles would be technically feasible at this site. However, the suitability of driven piles should be considered from an environmental/nuisance issue. Piles may encounter a variety of obstructions including boulders within the Glacial Till, obstructions from existing or historical underground structures and foundations, variable rock head level and variable properties of rock. All of these potential features should be taken into consideration.

If contamination is identified on the site, a piling risk assessment should be carried out during the detailed design stage in accordance with the Environment Agency Guidance, *"Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention"* and *"Piling in Layered Ground: risks to groundwater and archaeology – Since Report SC0200074/SR"*

10.2.2 Ground Floor Slabs

Ground bearing floor slabs are thought to be suitable but are dependent on the thickness and consistency of the Made Ground and the floor loading. The potential use of ground bearing floor slabs should be determined following the ground investigation.

10.2.3 Excavations

Where excavations for foundations, earthworks, and drainage are required, stability of excavated areas should be considered. Close or continuous support will be required for any manned entry to excavations.

Due to the groundwater regime being unknown, shallow groundwater is likely to be encountered and may require groundwater control during excavation. Groundwater may also be subject to tidal influence. Detailed information regarding the groundwater regime will be available following the ground investigation and subsequent monitoring.

10.2.4 Soakaways

The ground conditions may be unsuitable for the use of pit soakaways due to the general presence of cohesive, low permeability strata with limited infiltration. The available historic ground investigation indicates that suitable granular deposits are unlikely to be located at the surface. Intrusive ground investigation should include permeability testing to determine the suitability of the ground for infiltration-based drainage solutions and SUDS if required in the

proposed development. If unsuitable, surface water run-off should be directed to the main drainage subject to appropriate consent to discharge.

11. Conclusions

ABP intend to develop a new Ro-Ro facility designed to service the embarkation and disembarkation of principally commercial and automotive traffic, possibly with provision for a small element of passenger use during quiet periods. The proposed development, which will be taken forward as a Nationally Significant Infrastructure Project (NSIP) will be known as the Immingham Eastern Ro-Ro Terminal.

From the historical OS maps, the site and surrounding area has had significant industrial use. Satellite mapping observations made during the site walkover indicate that Made Ground is likely to be present across the proposed site. This is anticipated to be underlain by Tidal Flat Deposits and Chalk deposits.

11.1 Environmental

It is considered, based on the information obtained, that geo-environmental risks range between very *Low* and *High*. Potential sources of contamination relating to both onsite, off-site, historical and current land uses have been identified and potential linkages to human health (on-site and off-site commercial/industrial workers) and surface waters (unnamed drains and Humber Estuary) may be present.

However, the underlying superficial deposits are classified as Unproductive or Secondary Undifferentiated Aquifers from which there are no potable water abstractions within 1km of the site. In addition, although the chalk bedrock at depth is classified as a Principal Aquifer and there is a Source Protection Zone I associated with a potable water abstraction 63m south east of the site, it is afforded protection from approximately 17m of low permeability Tidal Flat Deposits and Glacial Till.

The Made Ground, natural deposits and historical landfills may also be a potential source of ground gas at the site.

The Detailed UXO threat Assessment Desk Top Study was commissioned provided the site with a medium risk classification. Recommended minimum mitigation measures have been proposed within the UXO report to support the proposed groundworks at the site and have been summarised in **Section 7.1.1**.

11.2 Geotechnical

Key geotechnical findings as part of this desk study include:

- Made Ground and Artificial Ground is anticipated across the entire site, previously recorded to 7 – 10m bgl. There are also some small areas of infilled ground indicated on mapping at the southern end of the site. This is congruent with the development history of the site.
- Superficial deposits are reported to cover the site and likely comprise Beach and Tidal Flat Deposits, which are underlain by glacial deposits.
- The bedrock anticipated to underlie the majority of the site is the Flamborough Chalk Formation, apart from the north west arm of the site which is the Burnham Chalk Formation.

The key geotechnical hazards identified include:

- There is a risk of slope instability along ditches and cuttings.
- The site is potentially underlain by significant depths of soft/compressible cohesive deposits, which pose a risk of total or differential settlement of foundations.
- Numerous utilities are present across the site, therefore striking underground services during ground investigation or construction is of concern.

- Any existing Made Ground in its current state is unlikely to provide a suitable founding stratum for structural foundations and potentially unsuitable for pavement.
- The groundwater level is likely shallow and under tidal influence. This may affect temporary and permanent works.

The potential geotechnical risks that have been identified have been assessed by the preliminary risk assessment as being very low to medium, with the majority being low risk following appropriate mitigation.

12. Recommendations

At this stage, and subject to supporting information required for the engineering design, it is recommended that ground investigation works are undertaken across the footprint of the proposed development. The ground investigation would be required to determine the presence of any geo-environmental and/or geotechnical issues that require mitigation to allow the proposal to proceed and to assist in discharging anticipated planning conditions that are likely to be set by North East Lincolnshire Council.

Prior to the ground investigation, service providers would be contacted before mobilisation and known services marked out. The site would also be scanned using Cable Avoidance Tool (CAT) and Ground Penetrating Radar (GPR) before ground works, and hand dug investigation where necessary. In addition to this, drawings and information related to current and previous structures would be obtained.

The ground investigation would include the following:

- Investigate the nature and extent of Made Ground across the site;
- Investigate the nature of the underlying natural superficial deposits, where present, including determination of in-situ soil properties;
- Investigate depths to the weathered and competent bedrock;
- Investigate bedrock materials (dependent on proposed structure loadings) to determine an adequate founding stratum;
- Obtain soil and groundwater samples for chemical testing and geotechnical testing;
- Install gas and groundwater monitoring wells and undertake monitoring of ground gas concentrations and groundwater levels; and
- Undertake a range of suitable soil, leachate, and groundwater chemical tests, including BRE sulfate tests.

Any ground investigation would be expected to comprise cable percussion boreholes, rotary core drilling and machine-dug trial pits.

As the site has classified as medium risk for UXO recommended minimum mitigation measures have been proposed to support the proposed groundworks at the site. These measures include:

Landside Works and Marine Works

- UXO Safety & Awareness Briefing (Toolbox Brief, TBB); and
- Site Specific Safety Instructions (SSSIs) Training Course.

Landside Works

- Non-Intrusive (NI) Magnetometer Survey (Greenfield areas only);
- Target Investigation (Required as a follow-on from NI magnetometer survey);
- Search & Clear;
- Explosive Ordnance Disposal (EOD) Engineer Watching Brief (for brownfield areas unsuitable for NI magnetometer survey); and
- Intrusive Magnetometer Survey of pile/borehole positions.

Marine Works

- Non-Intrusive Magnetometer UXO Survey;
- Non-Intrusive 3D Seismic Investigation from the 2m contour; and

- Seismic Investigation: Further Non-Intrusive Survey over exact locations to identify and mitigate risk and geological assessment for further risk management.

Following the ground investigation, an interpretative report comprising human health, controlled waters and ground gas risk assessments should be undertaken to fully assess the levels of contamination across the site, to identify mitigation measures where required and make recommendations to allow the redevelopment of the site. This report would also review the geotechnical conditions based on the ground investigation results and provide outline guidance on the need for ground improvement and advice on foundation options, typical allowable bearing pressures and potential settlement ranges for the ground conditions.

The site investigation and interpretive report would be used to assist in discharging planning conditions.

13. References

1. Groundsure® Report (GS-8247704)
2. BGS Geology 1:50,000 Solid & Drift, Sheet 81 (and including parts of sheet 82 and 90) (Patrinton)
3. BGS, 2020, BGS GeolIndex Onshore Map Application. Available at: <http://mapapps2.bgs.ac.uk/geoindex/home.html> [Online, accessed October 2021].
4. BGS, 1994, Geology of the country around Grimsby and Patrington : memoir for 1:50000 geological sheets 90 and 91 and 81 and 82 (England & Wales).
5. The Coal Authority, 2020, The Coal Authority Online Interactive Map. Available at: <https://mapapps2.bgs.ac.uk/coalauthority/home.html> [Online, accessed October 2021].
6. BGS. The Chalk Aquifer System of Lincolnshire. Research Report RR/06/03.
7. DEFRA MAGIC Map Application. Available at: <https://magic.defra.gov.uk/MagicMap.aspx> [Online, accessed October 2021]
8. Environment Agency Website. Available at: www.environment-agency.gov.uk [Online, accessed October 2021]
9. Environment Agency, 2021, Environment Agency Catchment Data Explorer. Available: <https://environment.data.gov.uk/catchment-planning/> [Online, accessed October 2021].
10. North East Lincolnshire Council, 2021, North East Lincolnshire Council Planning Application Portal. Available: [Planning portal - NELC | NELC \(nelincs.gov.uk\)](http://nelincs.gov.uk) [Online, accessed October 2021].
11. Landmark Utilities Report (Ref: 285109404_1)
12. Zetica UXO Risk Map Online. Available: <https://zeticauxo.com/downloads-and-resources/risk-maps/> [Online, accessed October 2021].
13. Environment Agency guidance on Land Contamination Risk Management (LCRM), April 2021

Drawings



Plot Date : 18 January 2022 14:30:54
 File Name : C:\USERS\SIMON.WATSON\DESKTOP\PROJECT\SUGAR\60664611-GI-001

© Crown copyright and
 database rights 2022.
 Ordnance Survey 0100031673

Drawing Title
**ASSOCIATED BRITISH PORTS
 IMMINGHAM EASTERN RO-RO TUNNEL
 SITE LOCATION PLAN**

Purpose of issue		
FOR INFORMATION		
Drawn SDW	Checked BO	Approved DE
Date	Scale @ A4 1:50,000	Rev -
Drawing Number 60664611/GI/001		



Appendix A - AECOM Engineer Site Walkover Photographs


AECOM		PHOTOGRAPHIC LOG	
Client Name: Associated British Ports		Site Location: Project Sugar – Port of Immingham	Project No. 60664611
Photo No. 1	Date: 21/10/2021		
Direction Photo Taken:			
North			
Description			
Sub Plot 1 – Looking north towards Humber Estuary/Proposed Terminal Jetty			

Photo No. 2	Date: 21/10/2021		
Direction Photo Taken:			
West			
Description			
Sub Plot 1 – Looking west towards the port.			

Client Name: Associated British Ports

Site Location: Project Sugar – Port of Immingham

Project No. 60664611

Photo No. 3

Date:
21/10/2021

Direction Photo Taken:

West

Description

Sub Plot 1 - Section of vegetated land between road and northern storage yard.



Photo No. 4

Date:
21/10/2021

Direction Photo Taken:

North

Description

Sub Plot 1 – Northern storage yard containing stockpiles of blast furnace slag. Ponding present of recent rainfall.



Client Name: Associated British Ports

Site Location: Project Sugar – Port of Immingham

Project No. 60664611

Photo No. 5
Date: 21/10/2021

Direction Photo Taken:

South

Description

Sub Plot 1 – Rainwater ponding in centre of northern storage yard. Stockpiles of pumice in the background.



Photo No. 6
Date: 21/10/2021

Direction Photo Taken:

West

Description

Sub Plot 1 – Abandoned (empty) IBCs in northern storage yard.



Client Name: Associated British Ports

Site Location: Project Sugar – Port of Immingham

Project No. 60664611

Photo No. 7 **Date: 21/10/2021**

Direction Photo Taken:

South West

Description

Sub Plot 1 – Stockpile of pumice in northern storage yard.



Photo No. 8 **Date: 21/10/2021**

Direction Photo Taken:

South West

Description

Sub Plot 1 – Surface water ponding between two pumice stockpiles in the northern storage yard.



Client Name: Associated British Ports

Site Location: Project Sugar – Port of Immingham

Project No. 60664611

Photo No. 9
Date: 21/10/2021

Direction Photo Taken:

N/A

Description

Sub Plot 1 – Condition of hard standing across the northern storage yard.



Photo No. 10
Date: 21/10/2021

Direction Photo Taken:

North

Description

Sub Plot 1 – Abandoned rusty/empty drum in northern storage yard.



Client Name: Associated British Ports

Site Location: Project Sugar – Port of Immingham

Project No. 60664611

Photo No. 11 **Date:** 21/10/2021

Direction Photo Taken:

West

Description

Sub Plot 1 – Land leased to third party and could not be accessed. Suspected maintenance shed containing gas cylinders, IBCs and drums.



Photo No. 12 **Date:** 21/10/2021

Direction Photo Taken:

West

Description

Sub Plot 1 – Machinery and plant on leased land.



Client Name: Associated British Ports

Site Location: Project Sugar – Port of Immingham

Project No.
60664611

Photo No.
13

Date:
21/10/2021

Direction Photo Taken:

West

Description

Sub Plot 1 – Trestles stored on leased land.



Photo No.
14

Date:
21/10/2021

Direction Photo Taken:

East

Description

Sub Plot 1 – Large electricity substations situated immediately east of proposed site.



Client Name: Associated British Ports

Site Location: Project Sugar – Port of Immingham

Project No. 60664611

Photo No. 15 **Date:** 21/10/2021

Direction Photo Taken:

North West

Description

Sub Plot 1 - Railway that runs parallel to Sub Plot 1 western boundary.



Photo No. 16 **Date:** 21/10/2021

Direction Photo Taken:

East

Description

Sub Plot 1 – General waste skip situated on hard standing in north east corner of Sub Plot 1.



Client Name: Associated British Ports

Site Location: Project Sugar – Port of Immingham

Project No. 60664611

Photo No. 17 **Date: 21/10/2021**

Direction Photo Taken:

South

Description

Sub Plot 3 – Aggregate stockpile situated in north western storage yard.



Photo No. 18 **Date: 21/10/2021**

Direction Photo Taken:

South

Description

Sub Plot 3 – Trailer yard in the centre of the plot.



Client Name: Associated British Ports

Site Location: Project Sugar – Port of Immingham

Project No. 60664611

Photo No. 19 **Date:** 21/10/2021

Direction Photo Taken:

West

Description

Sub Plot 3 – 2 no. storage tanks (diesel and oil) situated in centre of trailer yard. Contained in concrete bund which appears to be damaged.



Photo No. 20 **Date:** 21/10/2021

Direction Photo Taken:

East

Description

Sub Plot 3 – Empty corrosive container, situated in trailer yard amongst old tires and empty fuel tanks.



Client Name: Associated British Ports

Site Location: Project Sugar – Port of Immingham

Project No. 60664611

Photo No. 21 **Date:** 21/10/2021

Direction Photo Taken:

North West

Description

Sub Plot 3 – Overgrown grassland further south than trailer yard. Abandoned machinery.



Photo No. 22 **Date:** 21/10/2021

Direction Photo Taken:

South

Description

Sub Plot 3 – Fence boundary separating the storage area used for imported vehicles (west) and the vegetated land (east).



Client Name: Associated British Ports

Site Location: Project Sugar – Port of Immingham

Project No. 60664611

Photo No. 23 **Date:** 21/10/2021

Direction Photo Taken:

North

Description

Sub Plot 3 – Stockpile towards southern end of vegetated area. Rubbish and rubble present.



Photo No. 24 **Date:** 21/10/2021

Direction Photo Taken:

South East

Description

Sub Plot 3 – Service duct / culvert below site (bringing power and water to the site).



Client Name: Associated British Ports

Site Location: Project Sugar – Port of Immingham

Project No. 60664611

Photo No. 25 **Date:** 21/10/2021

Direction Photo Taken:

South West

Description

Sub Plot 3 – Storage area in the north eastern corner. Looking south west towards other storage area (aggregate stockpile).



Photo No. 26 **Date:** 21/10/2021

Direction Photo Taken:

North

Description

Sub Plot 3 – Storage area in north eastern corner. Stockpile of pumice partially visible.



Client Name: Associated British Ports

Site Location: Project Sugar – Port of Immingham

Project No. 60664611

Photo No. 27
Date: 21/10/2021

Direction Photo Taken:

North East

Description

Sub Plot 3 – Storage area in north eastern corner. Stockpile of pumice.



Appendix B - Groundsure Report

Appendix C – Historical Borehole Records

Appendix D – Utilities Report

Appendix E - Detailed UXO threat Assessment Desk Top Study

