HyNet North West

ENVIRONMENTAL STATEMENT – (VOLUME III)

Appendix 11.6 Ground Investigation Report

HyNet Carbon Dioxide Pipeline DCO

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 – Regulations 5(2)(a)

Document Reference Number D.6.3.11.6

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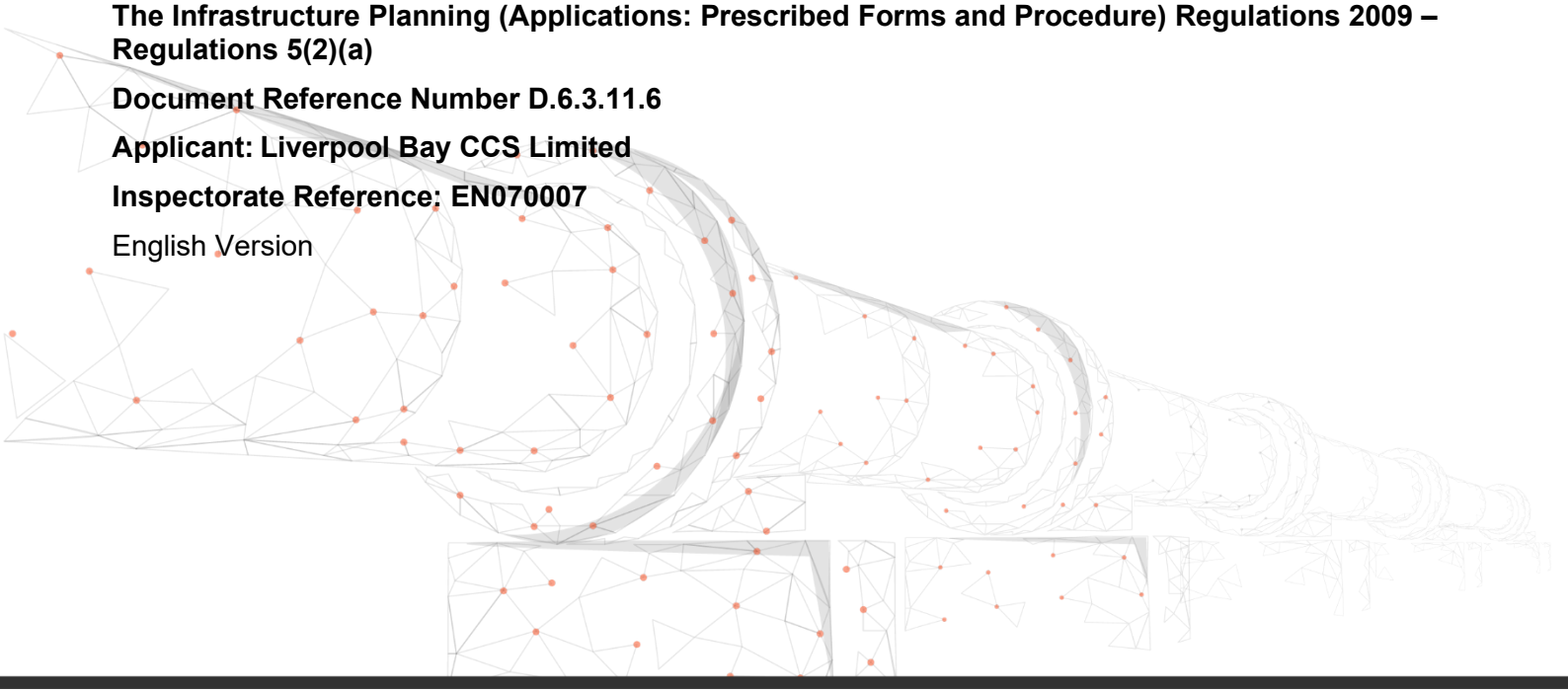

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TABLE OF CONTENTS

1. INTRODUCTION

1.1.1. It should be noted that this technical appendix was produced during the development of the Preliminary Design of the DCO Proposed Development. Therefore, the design information presented herein is indicative, and may be different to the final Preliminary Design (including the pipeline alignments and other construction layers) which is described in **Chapter 3 – Description of the DCO Proposed Development (Volume II).** It should also be noted that the terminology may not align with that presented in the **Glossary (Document reference**: **D.1.7**).

1.1.2. However, this technical appendix remains applicable to informing the Environmental Impact Assessment and any associated limitations or assumptions are discussed in **Chapter 11- Land and Soils (Volume II)**.

LBA CCS TRANSPORT AND STORAGE PROJECT

ONSHORE PIPELINES

LBA CCS Transport and Storage Project Ground Investigations - Geoenvironmental Interpretive Report

Validity Status	Revision Number	Date	Description	Prepared	Checked	Approved	Approved Eni UK
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Appendix A – Guidelines on Use of Report	Fugro	BM	SW
Appendix B – Drawings	CH	SW	SW
Appendix C - Geochemical Laboratory Testing Data	JB	JH/SW	SW
Appendix D - Geoenvironmental Insitu Testing Data	CH	JH/SW	SW
Appendix E - Fugro Generic Assessment Criteria (GACs)	CH	JH/SW	SW
Appendix F - Water Quality Standards	CH	JH/SW	SW
Appendix G - Gas and Groundwater Monitoring Data	CH	JH/SW	SW

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Appendices

In the PDF version of the report some of the appendices are saved as attached files these can normally be found by clicking on the symbol of a paperclip, normally located on the left hand side in most PDF readers.

Tables in the Main Text

Tables in the Appendices

1. Introduction

1.1 Overview

On the instructions of Eni UK Limited (ENI), Fugro GeoServices Limited (FGSL) have completed a geoenvironmental interpretative report for their site at Liverpool Bay for its Carbon Capture Storage (CCS) Transport and Storage (T&S) Project.

The project is being developed in parallel with and as part of the HyNet Northwest full-chain hydrogen and CCS industrial decarbonisation project (the HyNet Project) which is designed to transform a region of the UK into the world's first low carbon industrial cluster by 2030.

This report uses the information obtained from the recent ground investigation reported in the Laboratory Report (Fugro 2022) and Interpretative Report (Fugro 2022). The purpose of this report is to provide geoenvironmental interpretation of the data presented within these reports and should be read in conjunction with these to gain a full understanding of both the site and the presented interpretation.

1.2 Proposed Development

An overview of the Liverpool Bay project is presented in Figure 1.1 taken from ENI's project specification 104900BLSC80011.

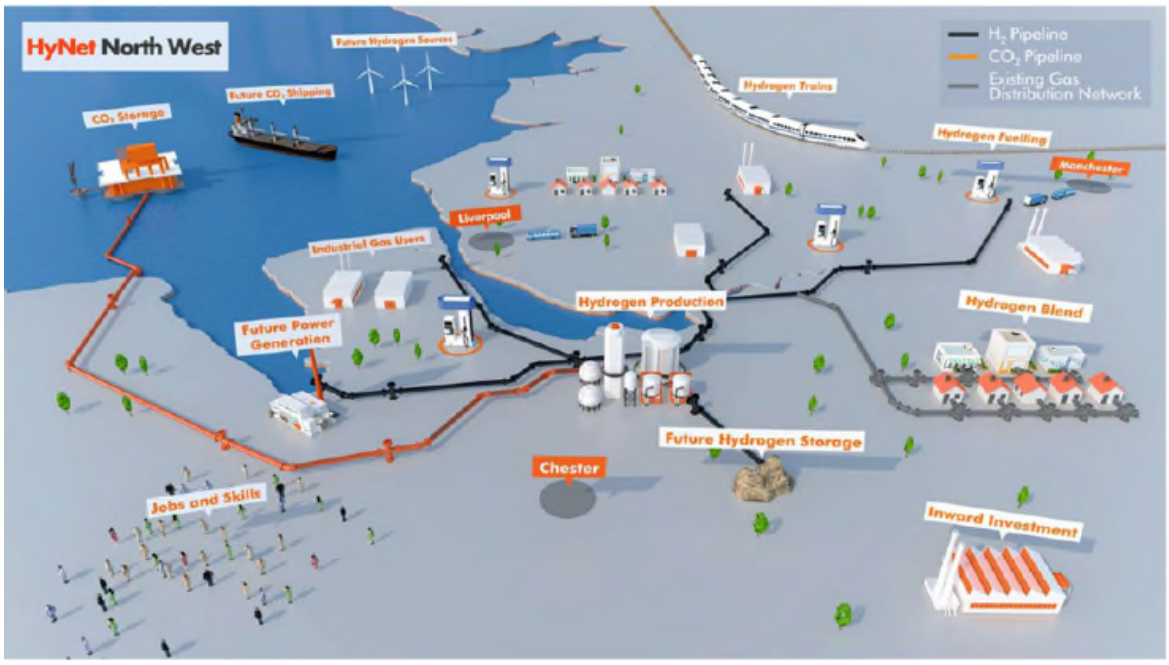

Figure 1.1: Liverpool Bay Facilities Overview

The orange pipeline onshore is the focus of this appraisal. The Liverpool Bay project includes;

- A new onshore pipeline (36" diameter and approximately 33 km long) to transport CO_2 from the emitters at Stanlow to Connah's Quay (CQY);

- A 20" diameter section of pipe northeast of Stanlow;
- Repurposing of the existing onshore 24" diameter Point of Ayr (PoA) to CQY natural gas line to carry CO_2 in the opposite direction;
- Development of the onshore assets at PoA to provide onshore compression, which will be expanded in later phases;
- Repurposing of existing sub-sea natural gas pipelines for CO_2 service. In later years pipelines will be replaced as required for expansion;
- Development of the Douglas, Hamilton Main, Hamilton North and Lennox platforms, in an incremental manner for CO_2 sequestration service;
- Development of the Hamilton Main, Hamilton North and Lennox reservoirs for CO_2 storage.

1.3 Reporting

This report aims to develop an understanding of the potential contaminants that may impact the site to generate a geoenvironmental risk assessment. Guidelines on the limitations of the use of the report and the data provided within it are given in Appendix A.

Due to the length of the route, it has been split up into sections as summarised in Table 1.1. The division of the route was undertaken by WSP to assist in the management of the available information, except for Sections 7 and 8 these have been created by Fugro for ease of reporting. The investigation work associated with these sections was not part of the original scope of works and were included when the investigation continued at the beginning of 2022. These Block Valve Stations (BVS's) and Above Ground Installation (AGI) at the Point of Ayr (PoA) Terminal were designed to allow maintenance work along the section of existing pipe between the Flint AGI and PoA. Geoenvironmental assessments for these locations have been undertaken and are discussed further in later sections.

Table 1.1: Sections of the pipeline

Section	Route	From	To	Chainage [m]
1	GtS	Grinsome Road AGI	Stanlow AGI	0 – 3,750
2	StF	Stanlow AGI	A41 crossing	0 – 8,100
3		A41 crossing	A548 crossing	8,100 – 14,250
4		A548 crossing	A550 crossing	14,250 – 20,850
5		A550 crossing	B5126 crossing	20,850 – 29,150
6		B5126 crossing	Flint AGI	29,150 – 31,800
7	-	Block Valve Stations 1-4. (Coed-y-Cra BVS, Cornist Lane BVS, Pentre Halkyn BVS, Babell BVS)		-
8	PoA	Point of Ayr site.		-

1.4 Preliminary Construction Methodology

The new pipeline has some above ground structures associated with it, as summarised in Table 1.2 and several crossings of existing road, rail, waterway and utility infrastructure, presented in Appendix B.1, summarised in Table 1.3.

Construction techniques associated with the pipeline are likely to be a combination of trench and trenchless techniques (the latter mainly for crossings). For the BVS's and AGI's permanent hardstanding for above ground pipework and small low-rise buildings for telemetry equipment will be required. During construction temporary compounds will be required, so location of these will need to be considered with regards to the impact on human health in the short term.

Table 1.2: Table of Structures Associated with Routes, Sections and Chainage

Route	Section	Structure	Chainage (m approx.)
GtS	1	Grinsome Road AGI	0
StF	2	Stanlow AGI	0
		Rockbank BVS	6,850
	3	Mollington BVS	11,000
	5	Aston Hill BVS	21,455
		Northhop Hall AGI	28,131
	6	Flint AGI	31,782
-	7	Coed-y-Cra BVS1	No chainage provided
		Cornist Lane BVS2	No chainage provided
		Pentre Halkyn BVS3	No chainage provided
		Babell BVS4	No chainage provided
PoA	8	Point of Ayr AGI	No chainage provided

Table 1.3: Table of Major Infrastructure Crossings

No.	Pipeline	Crossing	Notes
TRS-01	20''	Ince Railway	Main railway line and spur
TRS-02	20''	A5117	Adjacent to service station
TRS-03	20''	Pipelines	Cadent gas
TRS-04	20''	Pipelines	BPA, Shell
TRS-05	20''	A5117	Stanlow refinery entrance
TRS-06	36''	A5117	Stanlow refinery entrance
TRS-07	36''	Pipelines	BPA, Shell, UU
TRS-08	36''	M56	
TRS-09	36''	River Gowy	
TRS-10	36''	Pipelines	BPA, Shell

No.	Pipeline	Crossing	Notes
TRS-11	36''	Picton Lane	
TRS-12	36''	Pipelines	Exolum, MOD
TRS-13	36''	Pipelines	National grid gas
TRS-14	36''	M53	
TRS-15	36''	Wervin Road	
TRS-16	36''	Pipelines	Exolum, MOD
TRS-17	36''	Shropshire Union Canal	
TRS-18	36''	A41 (Liverpool Road)	
TRS-19	36''	Pipelines	Cadent gas, UU
TRS-20	36''	Mollington Railway	
TRS-21	36''	Station Road	
TRS-22	36''	Townfield Lane	
TRS-23	36''	Overwood Lane	
TRS-24	36''	A540	
TRS-25	36''	Hermitage Road	
TRS-26	36''	Chester Millenium Greenway	
TRS-27	36''	A548 (Sealand Road)	
TRS-28	36''	River Dee	
TRS-29	36''	North Wales Coast Railway	
TRS-30	36''	Chester Road	East crossing
TRS-31	36''	Chester Road	West crossing - short
TRS-32	36''	Chester Road	West crossing - long
TRS-33	36''	Mancot Lane	
TRS-34	36''	A550 (Gladstone Way)	
TRS-35	36''	Aston Hall Playground	
TRS-36	36''	Borderlands Railway	
TRS-37	36''	A494 (Aston Expressway)	
TRS-38	36''	Church Lane	
TRS-39	36''	Holywell Road	
TRS-40	36''	Green Lane	
TRS-41	36''	Northop Hall Ancient Woodland	
TRS-42	36''	Connah's Quay Road	
TRS-43	36''	Northop Brook	

1.5 Sources of Information

Table 1.4 details additional sources of information which were provided by the client. Relevant information from these has been summarised within this report, should further detail be required it is recommended users of this document are directed towards the original source.

Table 1.4: Previous Reports

Report	Author	Date	Section	Document I.D.
DCO	WSP	June 2022	Sections 1 to 6	70070865-11850(2)
Geological Desktop Study	Eni	July 2021	Sections 1 to 6	1025H0BLRV80010
Preliminary Environmental Information Report (PIER) Volume II	Hynet Northwest	Feb 2022	Sections 1 to 6	D.0.9.2
TCPA	WSP	May 2022	Sections 7 to 8	11900

1.6 Environmental Assessment Framework

The Land Contamination: Risk Management (LCRM) Guidance (EA, April 2021) outlines how to assess if there is unacceptable risk and to recommend which options are the most suitable to manage the risk through the implementation of remediation, if necessary. The guidance is based upon The Model Procedures for the Management of Land Contamination, CLR 11 (EA, 2004), and was originally developed to provide a technical framework for applying a risk management process when dealing with land potentially affected by contamination. The scope, framework and purpose remain the same, despite being archived in March 2014 (EA, 2004).

The process involves identifying, deciding on, and taking appropriate action to deal with land contamination in a way that is consistent with government policies and legislation within the UK. Environmental assessors use a Source-Pathway-Receptor (SPR) style Conceptual Site Model (CSM) when determining the risk posed by a potentially contaminated site. For potential risk to arise each stage of the SPR linkage must be present, plausible, and significant.

Our approach follows the framework provided in the new guidance, the stages and tiers of which can be briefly summarised as follows:

Stage 1 Risk Assessment (RA)

- Tier 1: Preliminary Risk Assessment (PRA, can include Exploratory Investigation)
- Tier 2: Site Investigation and Generic Quantitative Risk Assessment (GQRA)
- Tier 3: Detailed Quantitative Risk Assessment (DQRA)

Stage 2 Options Appraisal (OA)

Decide if sufficient up to date information is available.

- Tier 1: Identify feasible remediation options.
- Tier 2: Detailed evaluation of options.
- Tier 3: Selection of final remediation option.

Stage 3 Remediation Strategy (RS)

- Tier 1: Develop a Remediation Strategy.
- Tier 2: Remediation and Verification.
- Tier 3: Long term monitoring and maintenance (if required).

Based on the above, under the LCRM guidance this would be considered to be an exploratory investigation forming part of the Tier 1 Preliminary Risk Assessment.

2. The Site Setting

2.1 Site Location and Description

The site is located in the northwest of England, running between Chester and Ellesmere Port into Wales near Deeside then up to Point of Ayr. The new section of pipeline route covers approximately 35 km from Elton to Flint as seen in Figure 2.1. The first section of 20" pipe starts at Grinsome Road (Grid Ref. 346913, 376149) heading west to Stanlow (Grid Ref. 344628, 374925). This is where the 36" pipe starts and this continues to just outside Flint at (Grid Ref. 325218, 370893). At this point it connects into some existing pipework which finishes at Point of Ayr (Grid Ref. 312266, 383977). Along this latter section three additional Block Valve Stations (BVS's) will be added to assist with maintenance.

Figure 2.1: Location Overview; Green is 36 inch Pipeline Route; Blue is an outline for proposed Section 7 and 8 and; Pink is the Alcohol Site to Grinsome Road AGI

A general location plan and detailed location maps of the sections in which boreholes were undertaken are present in Appendix B.1.

2.2 Geology

As part of a Geological Desktop Study (Soil Engineering, 2021) four cross sections detailing the chainages along the route and expected geology were provided. Based on this information and the desk study a summary of the geology along the route, has been split into Superficial and Bedrock deposits, and presented in Table 2.1 and Table 2.2 respectively.

Table 2.1: Superficial Geology

Epoch	Strata
Holocene	MADE GROUND
	Tidal Flat Deposits – clay, silt and sand
Quaternary	Glacio-fluvial Deposits, Devensian – clay, sand and gravel
	Glacial Till Deposits – diamicton; unsorted sediments with gravel in a fine mud matrix
	Wind Blown Deposits, often forming dunes - sand
	Peat – gravel, sand and peat

Table 2.2: Bedrock Geology

Period	Group/Subgroup	Formation
Early Triassic	N/A	Kinnerton Sandstone Fm
	Sherwood Sandstone Group (SSG)	Chester Fm
Carboniferous (Westphalian)	Warwickshire Group (WAWK)	Etruria Fm
Carboniferous (Bolsovian)	Pennine Coal Measures Group (PCM)	Hollin Rock Fm
Carboniferous (Duckmantian – Bolsovian)	Pennine Coal Measures Group (PCM)	Pennine Middle Coal Measures Fm
Carboniferous (Langsettian)	Pennine Coal Measures Group (PCM)	Pennine Lower Coal Measures Fm
Carboniferous (Yeadonian)	Craven Group (CRAV)	Bowland Shale Fm

2.3 Coal Mining Review

As part of the Geological Desk Study, Soil Engineering (2021) a Consultant Coal Mining Report was obtained Table 2.3 summarises, by section, the risks posed along the proposed route from past coal mining activities which could impact; foundation design, infrastructure. Exploratory holes were located near/in areas of concern and it is understood that Eni have undertaken an additional assessment of risk from mining, associated with section 5.

Consideration of the impact of the potential for mine gases or water in high risk areas particularly if located near structures may require further investigation, to that undertaken in this report, either in the form of a more detailed Coal Mining Risk Assessment (CMRA) and/or additional ground investigation.

2.4 Radon Assessment

The United Kingdom Health Security Agency (UKHSA), UK Radon interactive mapping service (UKHSA, 2022) divides the country up into 1km^2 grid squares, shaded to correspond to the highest potential risk posed by Radon within that area. This grid works on the principle that the darker the square the higher the potential risk. Table 2.4 summarises the potential risks posed from Radon within each section of the route. A map extract is available in Appendix B.1 (Figure B.1).

Table 2.3: Coal Mining Risk Summary, Soil Engineering (2021)

Section	Solid Geology Strata	CA Reporting Area / CA DHRA	Recorded Workings (type)
Section 1	Chester Formation, Wilmslow Sandstone Formation, Kinnerton Sandstone Formation	Not in Coal mining reporting area	None recorded
Section 2	Chester Formation, Kinnerton Sandstone Formation	Not in Coal mining reporting area	None recorded
Section 3	Kinnerton Sandstone Formation	Not in Coal mining reporting area	None Recorded
Section 4	Kinnerton Sandstone Formation Etruria Formation Pennine Lower Coal Measures Formation Pennine Middle Coal Measures Formation	South eastern area within Coal Mining Reporting Area, with local Development High Risk Areas	Shafts and underground workings,
Section 5	Pennine Middle Coal Measures, Pennine Lower Coal Measures	In Coal Mining Reporting Area, with local Development High Risk Areas	Shafts and underground workings,
Section 6	Pennine Middle Coal Measures, Pennine Lower Coal Measures	In Coal Mining Reporting Area, with local Development High Risk Areas	Shafts and underground workings,
Section 7	Pennine Middle Coal Measures, Bowlands Sandstone Formation	In Coal Mining Reporting Area, with local Development High Risk Areas	Shafts and underground workings,
Section 8	Pennine Middle Coal Measures,	In Coal Mining Reporting Area, with local Development High Risk Areas	Shafts and underground workings,

The BRE Digest (BR211, 2015) provides details on protection requirements for future end users from the effects of Radon gas within structures and underground spaces. Within the report underground spaces are identified as basements or occupied spaces. It is recommended that consideration should be given to whether similar protection measures will be required for any underground access chambers particularly where person-entry is required.

If a structure is located in an area, which requires some form of protection measures it is recommended that a site specific Radon risk report is produced to determine the level of protection required to ensure that it is the most cost effective. For buildings requiring radon protection, design and verification works will be required. Further investigation to create a more detailed Radon specific assessment is recommended between Sections 4 and 6 due to the potential Radon risks identified BRE Digest, BR211 (2015).

Where structures are located in an area where methane from coalfields or gases from landfills are present, then methane protection will take precedence as these will exceed those required for Radon. In this case reference should be made to BRE Report BR414 (2001).

Table 2.4: Radon Summary

Section	UK Radon Map (Potential Risk)	BRE211(2015): (Shaded Squares)	Indicative Protection Measure [1]
Section 1	1-3% - in north-eastern portion, Majority of section below 1%.	Clear grid squares	No Protection measures
Section 2	Below 1%	Clear grid squares	No Protection measures
Section 3	Southern area indicated as 1-3%, majority of section below 1%	Clear grid squares	No Protection measures
Section 4	Western area, around the River Dee varies between 5-10%, 10-30% and 30%+.	Mix of lightly shaded and darkly shaded grid squares, depending on location	Depending on shading, either Basic or Full protection measures will be required for future buildings.
Section 5	Majority of the section between 10-30% and 30%+ potential risk.	Darkly shaded grid squares	Full Protection measures will be required for any buildings in this zone
Section 6	Majority of the section between 10-30% and 30%+ potential risk.	Darkly shaded grid squares	Full Protection measures will be required for any buildings in this zone
Section 7	Majority of the section between 10-30% and 30%+ potential risk.	Darkly shaded grid squares	Full Protection measures will be required for any buildings in this zone
Section 8	Majority of the section between 10-30% and 30%+ potential risk.	Darkly shaded grid squares	Full Protection measures will be required for any buildings in this zone
[1] is "Based on maps from "BRE Digest BR211".			

2.5 Hydrogeology

WSP (2022) provided for each section along the route, the hydrogeological classifications for the associated geological units. These have been split into Superficial and Bedrock units and are summarised in Table 2.5 and Table 2.6, respectively.

There are no recorded groundwater abstraction points within 2km of the site boundary between Sections 1 to 8, or within 500m of a Source Protection Zone (SPZ). However, it should be noted that in Section 4 at approximate coordinates (334428, 366441) a small section of the New Build Infrastructure Boundary lies within a SPZ 3 (total catchment) adjacent to the River Dee, north of Hawarden Airport.

Table 2.5: Drift Aquifer Summary

Section	Drift Strata	Environment Agency Aquifer Classification
Section 1	Tidal Flat Deposits	Secondary Aquifer - Undifferentiated
	Glacial Till Deposits	Secondary Aquifer - Undifferentiated
Section 2	Tidal Flat Deposits	Secondary Aquifer - Undifferentiated
	Glacial Till Deposits	Secondary Aquifer - Undifferentiated
	Wind Blown Deposits	Secondary Aquifer - A
	Glaciofluvial Deposits, Devensian (GFDUD)	Secondary Aquifer - A
	Peat	Unproductive
Section 3	Tidal Flat Deposits	Secondary Aquifer - Undifferentiated
	Glacial Till Deposits	Secondary Aquifer - Undifferentiated
	Glaciofluvial Deposits, Devensian (GFDUD)	Secondary Aquifer - A
Section 4	Tidal Flat Deposits	Secondary Aquifer - Undifferentiated
	Glacial Till Deposits	Secondary Aquifer - Undifferentiated
Section 5	Glacial Till Deposits	Secondary Aquifer - Undifferentiated
	Head Deposits	Secondary Aquifer - Undifferentiated
	Glaciofluvial Deposits, Devensian (GFDUD)	Secondary Aquifer - A
Section 6	Glacial Till Deposits	Secondary Aquifer - Undifferentiated
	Glaciofluvial Deposits, Devensian (GFDUD)	Secondary Aquifer - A
Section 7	Glacial Till Deposits	Secondary Aquifer - Undifferentiated
	Glaciofluvial Deposits, Devensian (GFDUD)	Secondary Aquifer - A
	Head	Secondary Aquifer - Undifferentiated
Section 8	Tidal Flat Deposits	Unproductive
	Wind Blown Deposits	Secondary Aquifer - A

Table 2.6: Solid Geology Aquifer Summary

Sections	Solid Geology Strata	Environment Agency Aquifer Classification
Section 1	Kinnerton Formation	Principal Aquifer
	Chester Formation	Principal Aquifer
Section 2	Chester Formation	Principal Aquifer
	Wilmslow Formation	Principal Aquifer
Section 3	Chester Formation	Principal Aquifer
	Kinnerton Formation	Principal Aquifer
Section 4	Kinnerton Formation	Principal Aquifer
	Etruria Formation	Secondary Aquifer - A
	Pennine Coal Measures, Middle and Lower	Secondary Aquifer - A
Section 5	Hollins Rock	Secondary Aquifer - A
	Pennine Middle Coal Measures	Secondary Aquifer - A
	Pennine Lower Coal Measures	Secondary Aquifer - A
	Bowlands Shale Formation	Secondary Aquifer - Undifferentiated
Section 6	Pennine Middle Coal Measures	Secondary Aquifer - A
	Pennine Lower Coal Measures	Secondary Aquifer - A
	Bowlands Shale Formation	Secondary Aquifer - Undifferentiated
Section 7	Bowlands Shale Formation	Secondary Aquifer - Undifferentiated
Section 8	Pennine Middle Coal Measures	Secondary Aquifer - A
	Pennine Lower Coal Measures	Secondary Aquifer - A

2.6 Hydrology

Numerous surface water courses from drainage ditches to major rivers are along the route. To assess the potential for surface water contamination, for each section, the nearest downgradient surface water features and features crossing the site are presented in Table 2.7.

Table 2.7: Nearest Downgradient Surface Water Feature Summary

Sections	Nearest Downgradient Surface Water Features	Comments	Surface Water Abstractions
Section 1	Field Drains Ponds adjacent to route	Northern part is in a lowland area approximately 5m AOD crossed by field drains.	None identified.
Section 2	River Gowy Stanney Mill Brook Shropshire Union Canal Field Drains	All three features cross route perpendicular to site and lowland areas intersected by field drains.	Abstraction from Shropshire Union Canal and River Gowy
Section 3	Shropshire Union Canal Backford Brook Finchetts Gutter	Aligns with NE part of Section 3. Crosses route perpendicular to site. Crosses route perpendicular to site.	Abstraction from Shropshire Union Canal
Section 4	Finchetts Gutter River Dee Broughton Brook, Sandycroft Drain	Crosses route perpendicular to site. Crosses route perpendicular to site. Cross route perpendicular to site and aligns with central part of Section 4.	None identified.
Section 5	Wepre Brook, Alltami Brook	Cross route perpendicular to site.	None identified.
Section 6	Northop Brook	Crosses route perpendicular to site.	None identified.
Section 7	BVS1: None Identified within 250m. BVS2: None Identified within 250m. BVS3: Nant Y Flint stream	- - 150m west of BVS3	None identified.
Section 8	Welsh Channel Dee Estuary Artificial ponds and drainage channels.	Sea adjacent to the north west. Adjacent to the east. On site and From 20m distance.	None identified.

2.7 Previous Investigation

As part of DCO Phase 1 report WSP (2022) for Sections 1 to 6 no additional geoenvironmental investigation reports were obtained associated with proposed structure locations or existing identified sources of contamination.

In the TCPA desk study WSP (2022) which covered Section 7 and 8 an existing geoenvironmental report was obtained for a former colliery site located to the south of the Point of Ayr terminal.

3. Historical Setting

3.1 Site History

Prior to the investigation works carried out by Fugro in 2021/2022 a Phase 1 Baseline report was produced, WSP, (2022). As part of this report various sources of information were reviewed including Groundsure reports, historical maps, various relevant websites, discussions with local authorities and a site walkover. Some of this information has been summarised in Table 3.1 to highlight the most pertinent information which would impact on the quantitative assessment. It is recommended that if full details, including reviewing maps, are required then these reports are referenced directly. Potential contaminative historical land uses are highlighted in bold type.

Table 3.1: Summary of Site History

Section	On-Site	Off-Site
1	Rail land from 1890s; **Industrial Works** from 1960s; Stanlow **Oil Refinery** from 1990s to present.	Motorway service area including **fuel station** adjacent to the [N/E/S/W] from 1980s to present.
2	A5117 constructed in 1938; River Gowy realigned by 1954; M56 and M53 had both been constructed by 1983.	Chorlton **Quarry** and Church Farm **Sand Pit** (1898-1968);, located within 50m and 100m of the proposed Pipeline respectively.
3	Agricultural land intersected with Shropshire Union Canal, Backford Brook and various ponds. Railway Line, replaced with cycling route 2001.	Church Farm **Sand Pit** (1898-1968) within 50m.
4	Eastern part of section: Agricultural land intersected by rail line. Western part of section: Surface **workings** (clay pits and brickworks), coal **mines** and associated **shafts** until the 1950s.	**Engineering Works** 50m north from 1940s.
5	**Clay pit and brick works** on site from 1869 – 1970s. Old **Colliery** on site and adjacent to east. Two disused **shafts**, (historical collieries), intercept the centre of the proposed section to the southeast of Northop Hall in 1991.	Surface and underground **mining** (sand / clay / gravel pits, brickworks, shafts, collieries and associated spoil heaps) and a reservoir are located at Aston, Ewloe Green and Northop Hall. By 1950 many of the ground workings are now identified as 'disused' or 'old'. Reservoir 60m north at Old Aston Hill, Ewloe in 1910; Industrial works including **chemical and tarmacadam works** 200m north in Queensferry from 1900s, by 1990s marked as Depots. Rail Line dismantled in 1970; **Fuel station** on the A55 within 30m of the pipeline is constructed from 1991 onwards. A55 North Wales Expressway dated from 1981. Possible relic **landfill** site dated 1991 50m north.

Section	On-Site	Off-Site
		Brickworks and **Quarry** 50m south from 1898 to 2001.
6	**Sand Pit** between 1909 and 1953 adjacent to Tros-y-mynydd.	**Sand Pit** adjacent to east at Little Leadbrook Farm 1950s – 1990s. Agricultural land intersected by Northop Brook, ponds, footpaths and roads.
7	BVS1 – **Old Quarry** on-site, by 1871 the site is shown as agricultural land. BVS2 – Agricultural land. BVS3 – Agricultural land / minor development.	BVS 1 – Possible old **mining features** such as a lead shaft from 250m distance. BVS2 – **Mining features** including lead shafts and clay pits from 120m distance. BVS3 – Predominately agricultural land within 250m.
8	Point of Ayr **Colliery** in the south, expanded in the 1950s closed in 1996. Underground and surface **ground workings** and a **refuse / slag heap** from 1899. Armed Forces **firing practice** 1914 – 1946. Coast between Talacre and Gronant, 'The Warren', **demolition** residues (demolished circa 1985). Point of Ayr **Gas Terminal** constructed by 1994 to present.	Agricultural land intersected by footpaths roads and railway. No significant potential contaminating uses identified within 250m.

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3.2 Background Soil Chemistry

The background soil chemistry has been collated from UKSO (2022) to aid assessment of Generic Quantitative Risk Assessment for the revised conceptual site model (Section 13). Based on the preliminary conceptual site model (CSM) produced by WSP - Volume II (2022), the background readings have been screened against critical concentration screening values for public open space (POS) – park. The background concentrations were screened against the most conservative criteria and none of the published background soil metal concentrations exceeded the GAC.

Table 3.2: Background Soil Chemistry

Analyte	Critical Concentration C_C	Section 1	Section 2	Section 3	Section 4	Section 5	Section 6	Section 7	Section 8	Readings Exceeding GAC Concentrations?
Arsenic	170	12.05	10.36	10.54	12.09	13.57	29.25	13.57	13.57	No
Cadmium	532	0.34	0.32	0.31	0.34	0.43	0.70	0.43	0.43	No
Chromium III	33000	46.73	65.35	69.42	64.38	62.35	70.75	62.35	62.35	No
Copper	44000	25.26	16.36	15.12	17.52	19.15	31.36	19.15	19.15	No
Lead	1300	73.91	61.51	71.68	94.05	160.17	532.00	160.17	160.17	No
Nickel	3400	16.34	17.39	18.34	19.48	19.22	35.55	19.22	19.22	No
Selenium	1800	0.36	0.19	0.21	0.3	0.41	0.64	0.41	0.41	No

Reference – background readings taken from UKSO (2022) interactive map.

3.3 Landfill & Waste

Registered and historical landfill and waste sites within 250m of the pipeline are summarised in Table 3.3. The Ince Power Station should be considered for further investigation as a potential source for contamination. There were no recorded landfill sites, registered nor historical, for Sections 6 or 7.

Table 3.3: Landfill and Waste Summary

Section	Registered Landfill Site	Historical Landfill Site
Section 1	Moor Lane (taking special waste) 195m southeast	Ince Power Station, Ash Road 9m west. Kemira Growhow Landfill Site Ince, 172m east.
Section 2	Gowy landfill boundary located approximately 50m to the south. The landfill is reported to have a >25,000T capacity excluding inert waste.	Spring Bank Farm (north of Hob Lane) to the east. Thornton Green Lane, 57m southwest.
Section 3	-	Land off Station Road (west of railway and north of Newbuild Infrastructure Boundary) in Mollington, adjacent to pipeline. Seahill Road, Sealand, 250m northwest.
Section 4	-	Refuse tip 90m southeast of the western extent.
Section 5	Old Aston Hill approximately 232m northeast landfill type A6 (taking other/unspecified wastes).	Newbridge Farm located centrally and land off Gladstone Way at the eastern extents. Upper Aston Hill Lane 105m southwest, land at rear of transport yard 180m north, Sea View Farm 200m north.
Section 6	-	-
Section 7	-	-
Section 8	-	Refuse tip 203m southeast. Currently an active licenced waste site for metal recycling, operated by Delyn Metals Ltd

4. Preliminary Conceptual Site Model

4.1 Methodology

Utilising the method outlined in Section 1.6 the historical information from WSP (2022) reports have been assessed and a Conceptual Site Model (CSM) has been produced. This CSM follows the Source-Pathway-Receptor model outlined within Land Contamination Risk Management (2021) and forms a Stage 1 Risk Assessment.

The risk assessment utilises the Source-Pathway-Receptor approach as outlined within the guidance, these are defined as the following.

- **Source** – a contaminant or pollutant that is in, on or under the land and that has the potential to cause harm or pollution. Sources can also be defined as the origin of a hazard, such as pollutants and contaminants.
- **Pathway** – a route by which a receptor is or could be affected by a contaminant.
- **Receptor** – something that could be adversely affected by a contaminant, for example a person, controlled waters, an organism, an ecosystem, or Part 2A receptors such as buildings, crops or animals.

The over-riding principle of the source-pathway receptor model is to identify any potential contaminant linkages to assess the overall risk. The risks are assessed based on their potential severity and the probability of occurring, in an approach based on the guidance within the UK CIRIA report C552 (2001). For the CSM the grading for the severity of the risk and the probability of occurring are detailed respectively in Table 4.1and Table 4.2.

Table 4.1: Severity of the Risk

Grading	Classification
Severe	Acute risks to Human Health Major pollution of Controlled Waters (Surface Waters or Aquifers)
Moderate	Chronic (long term) risks to human health; Pollution of sensitive controlled waters (surface waters and aquifers)
Low	Pollution of non-sensitive water resources
Minor	Requirement for PPE and specialist equipment during site works to mitigate health effects. Damage to non-sensitive ecosystems or species.
Nominal	Risks are around the day to day life levels (Human health).

Table 4.2: Probability of Risk Occurrence

Likelihood	Classification
High Likelihood	Contaminant linkage may be present, and risk is almost certain to occur in the longer term with evidence that it will impact and cause harm to the receptor.
Likely	Contaminant linkage may be present and it is probable that the risk will occur over the long term.

Likelihood	Classification
Low Likelihood	Contaminant linkages may be present and there is the possibility of the risk occurring, although there is no certainty that it will do so.
Unlikely	Contaminant linkage may be present but circumstance under which harm would occur are improbable.

The overall evaluation of the level of risk is determined from the comparison of the severity of the risk and the probability of occurrence. This is presented in Table 4.3.

Table 4.3: Comparison of Severity and Risk

		Severity				
		Severe	Moderate	Low	Minor	Nominal
Probability	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Likelihood	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
	Low Likelihood	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk
	Unlikely	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk	Nominal Risk

Table 4.4below provides a Qualitative description of the typical consequences and potential actions required for each risk once identified.

Table 4.4: Qualitative Risk Assessment – Classification of Consequence

Classification	Definition
Very High Risk	Severe harm to the receptor, which could already be occurring, or a high likelihood of severe harm arising to a receptor. Will require immediate remedial works and mitigations measures to be completed.
High Risk	Harm is likely to arise to receptor and is likely to be severe unless appropriate remedial action and mitigation measures are undertaken. Remedial works may be required in the short term but may also be required over the longer term.
Moderate Risk	Possible harm could arise to a receptor, but unlikely to be severe. Har is likely to be mild with the possibility that some remedial works may be required in the longer term.
Moderate / Low Risk	Possible that harm could arise to a receptor, but where a combination of likelihood and consequence result in a risk that is above low, but not sufficient to be to be classified as moderate. Limited further targeted investigation works may be required to clarify the risk, if necessary, remediation works are likely to be limited in extent.
Low Risk	Possible that harm could arise to a receptor. Such harm, at worst, would normally be mild.
Very Low Risk	Low Likelihood that harm could arise to a receptor. Such harm is unlikely to be any worse than mild and for a short time.
Nominal Risk	Very low likelihood of harm occurring, very unlikely to occur. No remedial measures to be required.

4.2 Preliminary Conceptual Site Model

Table 4.5 presents the Preliminary Conceptual Site Model provided by WSP (2022) this will be used as the basis for the review of the findings from the investigation and will be revised based on these.

Table 4.5: Preliminary Conceptual Site Model

Potential Contaminant Source	Pathway	Receptor	Severity of Risk	Probability of Risk	Qualitative Review
Contamination within Made Ground or natural soils associated with current or historic industrial/commercial land use including oil refineries, fertilisers plants, landfills, collieries, railway embankments. Historical mineral workings and infilled land (coal, lead, lime, sand and gravel). Various historic and current/active industrial trades. Historical military land use. Isolated electrical substations and/or diesel-powered generators and associated tanks (e.g., supplying rural domestic/farm demands).	Dermal contact, ingestion and inhalation of dusts and/or fibres	Construction workers during construction phase and decommissioning phase. Maintenance workers/ pipeline workers during the operational phase. Neighbouring site users/ members of the public nearby during the construction phase	Medium	Low	MODERATE / LOW RISK Numerous areas of potential contamination sources have been identified within the Scoping Boundary of the Proposed Development. A ground investigation targeting the identified sources should be undertaken to qualify and quantify potential risks to future site users during operation. This data should be utilised to produce the risk assessment and method statements for construction workers during the construction phase. Future site maintenance workers should undertake risk assessments and use appropriate PPE and mitigation procedures before undertaking maintenance on the pipeline. Prior the construction phase a suitable Remediation Strategy (if required) to detail the removal and disposal of any soil/ groundwater and a Construction Environmental Management Plan (CEMP) should detail the mitigation measures to prevent neighbouring site users from exposure to potential contamination via direct contact, ingestion or inhalation.
	Inhalation of hazardous ground gases/vapours.	Construction workers during construction phase and decommissioning phase. Future site users (maintenance workers of pipeline). Neighbouring site users (if contamination is mobilised during the construction phase)	Medium	Low	

Potential Contaminant Source	Pathway	Receptor	Severity of Risk	Probability of Risk	Qualitative Review
Contamination within Made Ground or natural soils associated with current or historic industrial/commercial land use including oil refineries, fertilisers plants, landfills, collieries, railway embankments. Historical mineral workings and infilled land (coal, lead, lime, sand and gravel). Various historic and current/active industrial trades. Historical military land use. Isolated electrical substations and/or diesel-powered generators and associated tanks (e.g., supplying rural domestic/farm demands).	Overland flow. Lateral migration within on-site surface water features. Leaching of contaminants through the unsaturated zone and subsequent impact on groundwater. Impact to groundwater via poor quality drainage. Vertical migration to underlying superficial and bedrock aquifers. Baseflow contribution of groundwater to surface water features. Migration along pipeline once installed.	Underlying groundwater (aquifer sensitivity identified within each chapter). On and off-site surface water features (identified for each section within relevant chapters); and Flora and fauna within identified environmentally sensitive sites (i.e., SSSIs).	Medium	Low	MODERATE / LOW RISK Numerous sensitive controlled waters receptors have been identified including sensitive superficial and bedrock deposits, unnamed streams, surface waters courses and ponds. A targeted ground investigation to establish the baseline groundwater and immediately adjacent surface water course conditions prior to the construction of the Proposed Development should be undertaken. Should significant existing groundwater or surface impact be identified then suitable remediation and mitigation measures will be required during construction (within the remediation strategy and CEMP) and operation (within the design of drainage and pipeline trench design) to prevent the mobilisation and migration of this impact. As the pipeline could act as a preferential pathway an assessment of the long-term effects on the local water regime should be undertaken using the ground investigation data. The CEMP should detail the proposed dewatering methods and mitigation measures for prevention of construction drainage or spillages from impacting nearby water courses or the groundwater.
	Direct contact with corrosive substances (e.g., sulphates and hydrocarbons) in the soil and shallow groundwater; and Accumulation of hazardous gases within structures (explosive risk).	Pipeline buildings and infrastructure during the operational phase.	Medium	Low	MODERATE / LOW RISK There is potential for contaminants within Made Ground / natural strata that could impact the proposed below ground infrastructure. The ground investigation should include analysis of an appropriate selection of samples, both targeted and to provide general coverage, for potential contaminants which could be corrosive to infrastructure i.e., sulphate and hydrocarbons.

Potential Contaminant Source	Pathway	Receptor	Severity of Risk	Probability of Risk	Qualitative Review
Hazardous gases including methane/ carbon dioxide from landfills, mine workings, infilled colliery pits, sand pits, clay pits etc Radon Naturally occurring organic rich peat deposits.	Inhalation of hazardous ground gases/vapours.	Future site users (within buildings) Neighbouring site users during construction where construction processes could cause gas migration	Severe	Low	MODERATE RISK There are several sources of ground gas including former mine workings, landfills, infilled colliery pits etc and there are naturally occurring Peat deposits and infilled quarries which could also present a ground gas source. The ground investigation should include the provision of gas wells and appropriate monitoring if an identified source of ground gas is within 50m of the Proposed Development route. The results of the ground gas monitoring should be used to inform the design of gas protection measures or remedial works. The pipeline should be considered as a pathway at the design stage to allow appropriate mitigation measures to be included. It is noted that Radon protection measures are required in Sections 4-6. These should be incorporated within permanent structures proposed for these Sections.

5. Summary of Investigation Works

5.1 Introduction

The following section summarises the current intrusive investigations (Fugro, 2022). All logs, *insitu* testing, laboratory testing and survey data is presented in these reports and should be referred to if further detail is required.

5.2 Intrusive Investigation

The final scope of intrusive works was modified where necessary to accommodate the site conditions encountered as the investigation progressed.

Due to access issues the site work was undertaken in two phases as follows;

1. Phase one; between 04 October 2021 and 23 December 2021;
2. Phase two; between 21 January 2022 and 13 April 2022.

Table 5.1: provides a summary of the investigation works carried out.

Table 5.1: Scope of Completed Works

Works Performed	Totals and Details
Inspection Pits [1]	57
Trial Pits	61
Cable Percussion	24
Cone Penetration Testing	50
Sonic drilling	16
Rotary Coring	13
Sonic drilling with rotary follow-on	5
Soil Head Space; Photo-ionisation detection tests	211
Soakaway	7
Thermal Testing	Yes
Installation of groundwater monitoring standpipes	2
Installation of ground gas monitoring standpipes	13
Geotechnical laboratory testing	Reported in the laboratory report
Geoenvironmental laboratory testing	Reported in the laboratory report
Post fieldwork monitoring	Reported in the laboratory report
Notes: 1 - Refers to locations which were terminated in the Inspection Pit	

5.3 Investigation Aims

A specification for the ground investigation ENI, (2021) was provided to Fugro for tendering.

The locations of the exploratory holes along the new proposed pipeline routes were placed at approximately 500m centres. This was to provide a good overview of the site conditions along the route. Geoenvironmental testing was scheduled at every location within 0.20m bgl of ground level and where Made Ground was encountered this was then sampled until natural ground was reached.

The considerations taken into account for the ground investigation were as follows:

- Infrastructure crossings such as
  - Roads
  - Railways
  - Rivers
- Location of AGI / BVS infrastructure
- Historic features such as sandpits along/near to the route where these may or may not have been infilled
- Historic mining along the route

Once on-site locations took into account the nature of the ground being crossed, removing trees / woodland to reach a ground investigation location was not considered appropriate at this stage, so positions were moved on the ground to cause least impact both to the environment and the landowner. Access to some areas was also not straightforward or could not be gained, due to livestock or other items and so positions were placed as close as reasonable or cancelled to be considered for a later phase of investigation.

The choice of borehole or trial pit came down to the location – whether in an area that was to be trenched, or at locations of potential trenchless crossings or above ground infrastructure (BVS / AGI) were to be constructed in the latter case a borehole was implemented.

Some of the groundwater monitoring locations were installed to understand the groundwater regime associated with the crossings so as to assess its impact on the proposed construction techniques (such as tidal effects associated with the River Dee). Gas monitoring was implemented as an addition or at locations where mining or infilling had occurred previously.

With regards to groundwater testing originally this was to focus on pH, and sulfate concerns associated with aggressive ground conditions for concrete. Where visual or olfactory effects of contamination could be identified a full suite of testing of groundwaters was carried out.

6. Ground Conditions

6.1 Introduction

The following section provides a summary of the ground conditions associated with the proposed route. This has been based on an interpretation of the geological maps produced by the British Geological Survey (BGS, 2022) and the exploratory hole logs from the intrusive investigations.

The soil profiles shown are based on analysed CPT data, visual descriptions of recovered samples, and the laboratory testing results.

6.2 Ground Conditions by Section

6.2.1 Section 1

The ground conditions associated with Section 1 of the route are summarised in Table 6.1. Made Ground was encountered at only one location which is situated close to the entrance of a field off the B5132. This was identified as anthropogenic due to the presence of granite in the gravel and a slight bitumous odour at 0.85m bgl.

Majority of this section comprises of Topsoil overlying the Tidal Flat Deposits, identified above the Glacial Till Deposits. Generally, the various stratum become shallower towards the southwest with the Glacial Till Deposits coming close to surface around Chainage GtS_1000m.

6.2.2 Section 2

Table 6.2 summarises the ground conditions associated with Section 2. Throughout Section 2; near surface stratum predominantly comprises of Topsoil with a maximum thickness of 0.60m bgl.

Made Ground is encountered at a few locations of note is the first at the location of the Stanlow AGI (LB_21_01_BH) where Tarmacadam is overlying sand and gravel, with a layer of cobbles to 1.20m bgl. The other is associated with Rockbank BVS (LB_21_21_BH) where 1.50m bgl of mainly clayey gravelly sand was encountered.

The natural ground conditions vary considerably withing Section 2 as the pipeline moves in a westerly direction it crosses Glacial Till Deposits, Blown Sand Deposits, Peat and Tidal Flat Deposits, which seem to be associated with an infilled valley as bedrock is present near the surface in (LB_21_01_BH) then further west in (LB_21_101_TP).

Table 6.1: Section 1 Summary of Ground Conditions

Section 1	From [m BGL]	To [m BGL]	Location(s)	Description
Topsoil	0.00	0.60	LB_21_202_BH LB_21_202_CPT LB_21_203_BH LB_21_203_CPT LB_21_205_TP LB_21_206_BH LB_21_206_CPT LB_21_207_CPT LB_21_208_TP LB_21_210_BH LB_21_212_CPT LB_21_213_BH LB_21_213_CPT LB_21_214_CPT	TOPSOIL. Soft dark grey to dark brown CLAY with varying proportions of silt, sand, gravel and rootlets
Made Ground	0.00	0.90	LB_21_210_CPT	MADE GROUND. (Soft) grey slightly sandy gravelly CLAY becoming slightly clayey sandy GRAVEL with depth. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mudstone.
Tidal Flat Deposits (TFD)	0.10	13.00	LB_21_202_BH LB_21_202_CPT LB_21_203_BH LB_21_203_CPT LB_21_212_CPT LB_21_213_BH LB_21_213_CPT LB_21_214_CPT	Interbedded soft CLAY with varying proportions of sand and silt with PEAT layers (H5 to H9) and lenses of SAND.
Glacio-fluvial Deposits (undiff.)	8.60	12.74	LB_21_203_BH LB_21_213_BH	Interbedded grey SAND and GRAVEL lenses within Glacial Till Deposits.
Glacial Till Deposits	0.30	14.60	LB_21_202_BH LB_21_203_BH LB_21_205_TP LB_21_206_BH LB_21_206_CPT LB_21_207_CPT LB_21_208_TP LB_21_210_BH LB_21_210_CPT LB_21_213_BH	Stiff reddish brown slightly sandy slightly gravelly CLAY. Sand is fine. Gravel is angular and subangular fine and medium of mixed lithologies including mudstone, siltstone and sandstone. With lenses of Sand at various levels. Sand is generally fine to medium.

Table 6.2: Section 2 Summary of Ground Conditions

Section 2	From [m BGL]	To [m BGL]	Location(s)	Description
Topsoil	0.00	0.60	LB_21_02_BH LB_21_03_TP LB_21_04_TP LB_21_05_BH LB_21_06_BH LB_21_08_BH LB_21_08_CPT LB_21_09_CPT LB_21_10_CPT LB_21_11_BH LB_21_11_CPT LB_21_12_BH LB_21_13_BH LB_21_14_TP LB_21_16_BH LB_21_17_CPT LB_21_18_BH LB_21_19_BH LB_21_20_BH LB_21_20_CPT LB_21_20_TP LB_21_21_CPT LB_21_22_TP LB_21_101_TP LB_21_102_CPT LB_21_102_TP LB_21_112_BH LB_21_113_TP LB_21_114_TP LB_21_115_TP LB_21_118_CPT LB_21_119_CPT LB_21_120_CPT LB_21_124_BH	Dark brown/grey sandy CLAY. Sand is fine to coarse with varying proportions of rootlets. In some locations slightly gravelly. Gravel is subangular to rounded, fine to coarse.
Made Ground	0.00	0.15	LB_21_01_BH	MADE GROUND: TARMACADAM
	0.00	0.80	LB_21_07_BH LB_21_21_BH	MADE GROUND. Dark brown slightly gravelly sandy CLAY. Sand is fine and medium. Gravel is angular fine and medium of sandstone and flint, occasional fragments of medium gravel sized brick and concrete.
	0.15	1.50	LB_21_01_BH LB_21_21_BH LB_21_21_CPT LB_21_118_CPT LB_21_119_CPT	MADE GROUND. Light brown mottled orange slightly clayey gravelly SAND. Sand is fine and medium. Gravel is angular to subrounded fine to coarse of sandstone and mudstone.
Tidal Flat Deposits (TFD)	0.30	6.72	LB_21_11_BH LB_21_11_CPT LB_21_114_TP LB_21_115_TP	Soft bluish grey slightly gravelly sandy CLAY with rare pockets (<5mm x 25mm) of plastic amorphous dark brown peat. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of flint and mudstone. Slight organic odour. Lenses of brown to grey clayey SAND and GRAVEL are encountered near the top and base of this unit. Sand is fine to coarse. Gravel is angular to subrounded of mudstone and basalt.
	1.20	5.76	LB_21_11_BH LB_21_114_TP	Spongy to Plastic black pseudo-fibrous PEAT occasionally with gravel. Gravel is angular to rounded fine to coarse of mudstone and sandstone. Organic odour.
Wind Blown Deposits	0.00	14.76	LB_21_07_BH LB_21_08_BH LB_21_08_CPT LB_21_09_CPT LB_21_114_BH LB_21_114_TP	Brown clayey SAND. Sand is fine to coarse. Lenses of CLAY were identified within the Inspection pit and possibly at depth within some of the CPT's.

Section 2	From [m BGL]	To [m BGL]	Location(s)	Description
Peat	0.10	10.00	LB_21_10_CPT LB_21_12_BH LB_21_118_CPT LB_21_119_CPT LB_21_120_CPT	Black strongly decomposed PEAT with possible lenses of organic CLAY and SAND. Occasionally gravelly near surface, gravel is angular and subangular of sandstone. Organic odour throughout.
Glacio-fluvial Deposits (undiff.)	0.30	8.80	LB_21_19_BH	Loose brown SAND. Sand is fine to coarse.
Glacial Till Deposits	0.10	17.61	LB_21_02_BH LB_21_03_TP LB_21_04_TP LB_21_05_BH LB_21_06_BH LB_21_07_BH LB_21_10_CPT LB_21_11_BH LB_21_12_BH LB_21_13_BH LB_21_14_TP LB_21_16_BH LB_21_17_CPT LB_21_18_BH LB_21_22_TP LB_21_101_TP LB_21_102_CPT LB_21_102_TP LB_21_112_BH LB_21_113_TP LB_21_114_BH LB_21_114_TP LB_21_115_TP LB_21_118_CPT LB_21_119_CPT LB_21_120_CPT LB_21_124_BH	Firm to very stiff reddish brown slightly gravelly sandy CLAY. Sand is fine and medium. Gravel is subangular and subrounded fine of sandstone. Lenses of SAND and Gravel with varying proportions of each other and cobbles were encountered at various depths throughout this unit. Sand was generally fine to coarse. Gravel was angular to rounded fine to coarse. Low cobble and boulder content was also identified throughout these units.
Chester Formation	0.30	0.80	LB_21_20_TP	Soft brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of quartzite and sandstone. Residual soil.
	0.30	10.10	LB_21_01_BH LB_21_07_BH LB_21_08_BH LB_21_19_BH LB_21_20_BH LB_21_20_CPT LB_21_20_TP LB_21_21_BH LB_21_112_BH LB_21_113_TP	Light brownish orange slightly gravelly slightly clayey SAND. Sand is fine and medium. Gravel is subangular and subrounded fine of sandstone. Residual soil.
	1.20	24.50	LB_21_01_BH LB_21_02_BH LB_21_05_BH LB_21_06_BH LB_21_08_BH LB_21_19_BH LB_21_20_BH LB_21_21_BH LB_21_101_TP LB_21_102_TP LB_21_102_CPT LB_21_113_TP	Extremely weak and very weak reddish brown fine and medium grained SANDSTONE.

6.2.3 Section 3

Made Ground was only encountered at one location in Section 3 (LB_21_39_TP) to a maximum thickness of 0.30mbgl. Topsoil is encountered at all other locations within Section 3 comprising of clay with varying proportions of sand and gravel.

The underlying superficial deposits in this section comprise predominantly of Glacial Till Deposits before dropping down, at the end of the section onto the Tidal Flat Deposits associated with the River Dee. Generally, the till was identified as a clay with lenses of sand and gravel throughout. The Tidal Flat Deposits, within Section 3 are predominantly sands with varying proportions of clay and gravel.

No bedrock was encountered in this section and the ground conditions are summarised in Table 6.3.

6.2.4 Section 4

Table 6.4 summarises the ground conditions associated with Section 4. The maximum thickness of Made Ground associated with this was 0.85m bgl in LB_21_56_BH which was located close to a field entrance and comprised of sandy clay with varying proportions of gravel. A further two locations; LB_21_47_BH and LB_21_49_BH had a silty sand with gravel associated with them.

The superficial deposits, Tidal Flat Deposits, comprised predominantly of sand with varying proportions of clay and gravel. Lenses of clay and gravel were also identified throughout the unit and on the southern side of the River Dee, lenses of Peat were encountered at various depths. Glacial Till Deposits were encountered at a greater depth at the start of this section but was encountered at shallower depths towards the end. It comprised of clay with lenses of sand and gravel at various depths.

Table 6.3: Section 3 Summary of Ground Conditions

Section 3	From [m BGL]	To [m BGL]	Location(s)	Description
Topsoil	0.00	0.40	LB_21_26_TP LB_21_27_BH LB_21_27_CPT LB_21_28_CPT LB_21_29_CPT LB_21_30_BH LB_21_31_TP LB_21_32_BH LB_21_32_CPT LB_21_33_BH LB_21_33_CPT LB_21_34_CPT LB_21_35_TP LB_21_36_TP LB_21_37_TP LB_21_38_BH LB_21_38_CPT LB_21_40_TP LB_21_41_CPT LB_21_96_CPT LB_21_96_TP LB_21_97_TP LB_21_98_TP LB_21_99_BH LB_21_100_CPT LB_21_121_BH LB_21_122_BH LB_21_123_BH	Topsoil. Soft dark grey/brown Clay with varying proportions of sand and gravel. Sand is fine to coarse. Gravel is fine to coarse.
Made Ground	0.00	0.30	LB_21_39_TP	MADE GROUND. (Soft) dark grey slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse quartzite, ceramic and plastic.
Tidal Flat Deposits (TFD)	0.30	10.09	LB_21_39_TP LB_21_40_TP LB_21_41_CPT	Light brown slightly gravelly clayey SAND. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of shells.
Glacial Till Deposits	0.30	20.50	LB_21_26_TP LB_21_27_BH LB_21_27_CPT LB_21_28_CPT LB_21_29_CPT LB_21_30_BH LB_21_31_TP LB_21_32_BH LB_21_32_CPT LB_21_33_BH LB_21_33_CPT LB_21_34_CPT LB_21_35_TP LB_21_36_TP LB_21_37_TP LB_21_38_BH LB_21_38_CPT LB_21_39_TP LB_21_96_CPT LB_21_96_TP LB_21_97_TP LB_21_100_CPT LB_21_121_BH LB_21_122_BH LB_21_123_BH	Firm to very stiff reddish brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed lithologies including flint, quartzite and mudstone.
	0.30	16.70	LB_21_28_CPT LB_21_29_CPT LB_21_32_BH LB_21_32_CPT LB_21_33_CPT LB_21_96_CPT LB_21_100_CPT LB_21_121_BH	Lenses of light brown mottled orange gravelly slightly clayey SAND encountered at various depths throughout the Glacial Till Deposits. Sand is fine and medium. Gravel is subangular and subrounded fine to coarse of mixed lithologies including sandstone, mudstone and flint.
	4.80	7.50	LB_21_32_BH	Lense of medium dense brownish grey very sandy GRAVEL. Sand is fine to coarse. Gravel is angular to subrounded fine and medium rarely coarse of mixed lithologies including siltstone, sandstone, mudstone and quartzite.

Table 6.4: Section 4 Summary of Ground Conditions

Section 4	From [m BGL]	To [m BGL]	Location(s)	Description
Topsoil	0.00	0.50	LB_21_42_TP LB_21_43_TP LB_21_44_BH LB_21_44_CPT LB_21_45_BH LB_21_46_BH LB_21_50_TP LB_21_51_BH LB_21_52_BH LB_21_53_TP LB_21_54_BH LB_21_54_CPT LB_21_55_BH LB_21_55_CPT LB_21_56_BH LB_21_110_BH	Topsoil. Soft dark grey/brown Clay with varying proportions of sand and gravel. Sand is fine to coarse. Gravel is fine to coarse.
Made Ground	0.30	0.85	LB_21_56_BH	Firm brown and light brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular and subangular fine and medium of coal.
	0.00	0.80	LB_21_47_BH LB_21_49_BH	Dark brown silty SAND with varying proportions of gravel. Sand is fine to coarse, gravel is angular to subrounded fine to coarse of brick, slate and limestone.
Tidal Flat Deposits (TFD)	0.20	18.15	LB_21_42_TP LB_21_43_TP LB_21_44_BH LB_21_44_CPT LB_21_45_BH LB_21_46_BH LB_21_47_BH LB_21_49_BH LB_21_50_TP LB_21_51_BH LB_21_52_BH LB_21_53_TP LB_21_54_BH LB_21_54_CPT LB_21_55_BH LB_21_55_CPT LB_21_56_BH	Light brown SAND with varying proportions of clay, silt and gravel. Sand is fine to coarse; gravel is angular to rounded fine to coarse. Lenses of CLAY with varying proportions of silt, sand and gravel, GRAVEL and dark brown/black strongly to moderately decomposed pseudo-fibrous PEAT. Organic odour. Sand is fine to coarse, gravel is angular to rounded fine to coarse of flint, quartz, granite, mudstone quartzite, flint and granite charcoal.
Glacial Till Deposits	0.30	31.17	LB_21_44_BH LB_21_44_CPT LB_21_45_BH LB_21_46_BH LB_21_47_BH LB_21_49_BH LB_21_51_BH LB_21_52_BH LB_21_54_BH LB_21_54_CPT LB_21_55_BH LB_21_55_CPT LB_21_56_BH LB_21_110_BH	Firm and very stiff brown CLAY with varying proportions of sand and gravel. Sand is fine and medium. Gravel is subangular and subrounded fine to coarse of mixed lithologies including mudstone, sandstone and flint. Lenses of brown SAND and slightly clayey sand GRAVEL are also identified throughout. Sand is fine to coarse. Gravel is subangular and subrounded fine to coarse of mixed lithologies including quartzite, quartz, mudstone and flint.

6.2.5 Section 5

Section 5 contained the thickest sequence of Made Ground as summarised in Table 6.5. Based on information provided by WSP (2022) the exploratory holes LB_21_109_BH and LB_21_109_TP were located at the site of a former landfill. 4.50m bgl was identified comprising of clay with varying proportions of sand and gravel. Plastic, brick, glass, timber, ash slag and concrete formed part of this material. 2.80m of Made Ground was also encountered at LB_21_63_BH, this was associated with a former sand pit which may have been infilled during the construction of the A494.

Superficial deposits in this section comprise of undifferentiated Glaciofluvial Deposits overlying Glacial Till Deposits. The Glaciofluvial Deposits are predominantly formed of sand with varying proportions of clay, silt and gravel and lenses of clay, silt and gravel throughout. The Glacial Till Deposits composition is as identified in previous sections.

Bedrock is identified closer to surface at several locations within Section 5. Of note is Northop Hall AGI, where the Hollin Rock Formation, which comprised of a weathered sandstone is encountered at 0.30m bgl in LB_21_105_TP. The Pennine Middle and Lower Coal Measures were encountered at minimum depths of 2.20m bgl and 7.50m bgl respectively.

6.2.6 Section 6

No Made Ground was encountered in the exploratory holes associated with Section 6, as indicated in Table 6.6. Topsoil is proven to a maximum depth of 0.30m bgl comprising of clay with varying proportions of sand and gravel.

Associated superficial deposits mainly comprised of Glacial Till Deposits, with a small amount of Head Deposits identified in LB_21_79_TP. This comprised of a sandy clayey gravel with a low cobble and boulder content.

Bedrock was only encountered in LB_21_77_BH, comprising of weathered mudstones for the Pennine Middle Coal Measures.

6.2.7 Section 7

Section 7 comprised of 4 small investigations at BVS locations along the line of the existing pipeline between the Flint AGI and Point of Ayr. This will allow for maintenance points for dealing with issues along the pipe. Since the completion of the investigation one of these locations has been removed, but results will be discussed here for completeness.

Made Ground was only encountered in one of the exploratory holes LB_21_306_TP, which comprised of cobbles over a layer of Terram at a depth of 0.30m bgl. The remainder of the locations encountered Topsoil over Glacial Till Deposits, as summarised in Table 6.7.

Table 6.5: Section 5 Summary of Ground Conditions

Section 5	From [m BGL]	To [m BGL]	Location(s)	Description
Topsoil	0.00	0.40	LB_21_58_TP LB_21_59_BH LB_21_59_CPT LB_21_60_BH LB_21_60_CPT LB_21_60A_CPT LB_21_61_CPT LB_21_62_CPT LB_21_64_BH LB_21_65_BH LB_21_65_CPT LB_21_66_TP LB_21_70_TP LB_21_73_BH LB_21_73_CPT LB_21_74_BH LB_21_74_CPT LB_21_75_TP LB_21_76_TP LB_21_77_CPT LB_21_91_TP LB_21_92_CPT LB_21_93_CPT LB_21_93_TP LB_21_94_TP LB_21_95_BH LB_21_103_BH LB_21_107_TP LB_21_109_BH	TOPSOIL. Brown or Dark grey CLAY with varying proportions of sand and gravel. Sand is generally fine to medium, occasionally fine to coarse. Gravel is subangular to subrounded fine to coarse of flint, quartzite, mudstone and sandstone.
Made Ground	0.00	1.00	LB_21_69_TP LB_21_106_TP	MADE GROUND. Grass over friable dark grey slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed lithologies including quartzite, brick, plastic, wood and glass. Low cobble content comprising of brick and concrete
	0.00	2.80	LB_21_58_TP LB_21_63_BH LB_21_64_BH LB_21_64_CPT	MADE GROUND. Grey and brown SAND, with varying proportions of clay and gravel occasionally recovered as GRAVEL with varying proportions of clay and sand. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of sandstone, mudstone, concrete, brick, chert, asphalt and concrete
	0.50	0.70	LB_21_64_CPT	CONCRETE. Non-reinforced in a gravel matrix. GRAVEL is angular to subangular coarse concrete
	0.00	4.50	LB_21_109_BH LB_21_109_TP	MADE GROUND grey/black/brown CLAY with varying proportions of sand and gravel. Sand is fine to coarse sometimes with an ash content. Gravel is angular to subrounded fine to coarse quartzite, brick, plastic, glass slate, wood, slag and concrete. Low cobble content of sandstone, slate and quartzite
Glaciofluvial Deposits, Devensian (GFDUD)	0.10	12.80	LB_21_60_BH LB_21_60_CPT LB_21_60A_CPT LB_21_61_CPT LB_21_62_CPT LB_21_63_BH LB_21_64_BH LB_21_64_CPT LB_21_65_BH LB_21_65_CPT	Brown SAND with varying proportions of clay, silt and gravel and lenses of soft to stiff CLAY, SILT and GRAVEL. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed lithologies including quartzite, sandstone, mudstone and flint.

Section 5	From [m BGL]	To [m BGL]	Location(s)	Description
Glacial Till Deposits	0.00	21.57	LB_21_58_TP LB_21_59_BH LB_21_59_CPT LB_21_64_BH LB_21_64_CPT LB_21_65_BH LB_21_65_CPT LB_21_66_TP LB_21_69_TP LB_21_70_TP LB_21_73_BH LB_21_73_CPT LB_21_74_BH LB_21_74_CPT LB_21_75_TP LB_21_76_TP LB_21_77_CPT LB_21_91_TP LB_21_92_CPT LB_21_92_TP LB_21_92A_TP LB_21_93_CPT LB_21_93_TP LB_21_94_TP LB_21_95_BH LB_21_103_BH LB_21_106_TP LB_21_107_TP	Stiff light brown mottled grey and orange CLAY with varying proportions of sand and gravel. Sand is fine and medium. Gravel is subangular and subrounded fine and medium of mixed lithologies including sandstone, mudstone, charcoal and flint. Low cobble and boulder content was encountered comprising of mudstone and quartzite. Lenses of grey gravelly slightly clayey SAND with low boulder content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of sandstone and mudstone. Boulders (<200mm x 300mm x 400mm) are subangular and subrounded of moderately weak sandstone throughout the unit along with greyish brown slightly clayey sandy GRAVEL with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded medium and coarse of mixed lithologies including mudstone, sandstone, flint and shale. Cobbles (<65mm x 80mm x 90mm) are very weak subangular of sandstone.
Hollin Rock Formation	0.90	3.00	LB_21_103_BH LB_21_107_TP	Light brown SANDSTONE. Recovered as slightly sandy clayey gravel. Sand is fine to coarse. Gravel is angular and subangular of sandstone.
	0.30	1.90	LB_21_105_TP LB_21_106_TP LB_21_107_TP	Light brown SANDSTONE. Recovered as gravel and cobbles. Gravel is fine to coarse angular and subangular of sandstone. Cobbles (<85mm x 110mm x 270mm) are of very weak sandstone. Slightly to moderately weathered.
Pennine Middle Coal Measures Formation	2.20	20.65	LB_21_63_BH LB_21_64_BH LB_21_64_CPT LB_21_69_TP LB_21_73_BH LB_21_74_BH LB_21_74_CPT LB_21_109_TP	Very stiff light brownish grey slightly sandy slightly gravelly CLAY with low cobble content. Cobbles (<30mm x 60mm x 65mm) are subangular of very weak mudstone and siltstone.
	12.30	22.05	LB_21_63_BH LB_21_64_BH	Medium dense brown slightly gravelly SAND. Sand is fine and medium. Gravel is angular and subangular of fine mudstone, siltstone and coal.
	4.40	12.30	LB_21_64_BH LB_21_74_BH	Medium dense becoming dense brown and grey sandy GRAVEL. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed lithologies predominantly sandstone, siltstone and mudstone.
	2.80	21.00	LB_21_69_TP LB_21_73_BH LB_21_109_BH LB_21_109_TP	Extremely weak grey and dark grey MUDSTONE. Slightly weathered. Fractures undetermined. Fracture spacing undetermined.
	3.00	12.63	LB_21_73_BH LB_21_103_BH	Very weak thinly laminated brown, rarely mottled grey fine grained micaceous SANDSTONE with rare brown nodules (<10mm x 10mm x 15mm) of strong ironstone. Partially weathered. Fractures are inclined 0

Section 5	From [m BGL]	To [m BGL]	Location(s)	Description
				degrees, rarely 5 and 90 degrees, very closely spaced, planar, rough, tight, locally open (<1mm) infilled with orangish dark red soft clay (<1mm), with orange and reddish orange staining.
Pennine Lower Coal Measures Formation	7.60	25.50	LB_21_59_CPT LB_21_60_BH LB_21_60A_CPT LB_21_61_CPT LB_21_62_CPT LB_21_95_BH	Firm light grey gravelly CLAY. Gravel is subangular of extremely weak and very weak fragments (<5mm x 5mm x 10mm) of light grey mudstone. Highly weathered.
	7.50	17.52	LB_21_60_BH LB_21_95_BH	Very weak and weak black COAL. Recovered as non intact angular and subangular fragments (<10mm x 20mm x 20mm). Slightly weathered.
	18.17	18.60	LB_21_60_BH	Strong black carbonaceous SHALE. Recovered as non intact angular to subrounded fragments (<5mm x 25mm x 40mm) with frequent very soft grey clay. Slightly weathered.
	19.80	24.77	LB_21_60_BH	Extremely weak and very weak light grey MUDSTONE. Highly fractured producing non intact core. Recovered as angular and subangular fragments (<10mm x 10mm x 25mm) of extremely weak and very weak light grey mudstone with occasional subangular fragments (<15mm x 20mm x 20mm) of strong brown ironstone with frequent firm grey clay. Fractures undetermined. Fracture spacing undetermined.
	21.10	21.63	LB_21_60_BH	Very weak light grey brecciated fine grained SANDSTONE within a matrix of soft to firm light grey clay with occasional quartz veins, with occasional black coal veins. Partially weathered. Fractures undetermined. Fracture spacing undetermined.

Table 6.6: Section 6 Summary of Ground Conditions

Section 6	From [m BGL]	To [m BGL]	Location(s)	Description
Topsoil	0.00	0.30	LB_21_77_BH LB_21_78_BH LB_21_78_CPT LB_21_79_TP LB_21_80_TP LB_21_81_BH LB_21_81_CPT LB_21_83_TP LB_21_83A_TP LB_21_83B_TP LB_21_84_TP LB_21_85_BH LB_21_86_CPT LB_21_87_TP LB_21_88_BH LB_21_89_TP LB_21_90_CPT	Dark grey/brown CLAY with varying proportions of sand and gravel. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of quartzite, mudstone, flint, clinker and sandstone.
Glacial Till Deposits	0.20	15.20	LB_21_77_BH LB_21_78_BH LB_21_78_CPT LB_21_80_TP LB_21_81_BH LB_21_81_CPT LB_21_82_TP LB_21_83_TP LB_21_83A_TP LB_21_83B_TP LB_21_84_TP LB_21_85_BH LB_21_86_CPT LB_21_87_TP LB_21_88_BH LB_21_89_TP LB_21_90_CPT	Firm reddish brown slightly gravelly sandy CLAY with occasional lenses (<5mm x 5mm) of light brown fine sand. Sand is fine to coarse. Gravel is subrounded fine to coarse of flint and mudstone.
	0.70	11.09	LB_21_78_CPT LB_21_81_BH LB_21_81_CPT LB_21_82_TP LB_21_87_TP LB_21_90_CPT	Reddish brown slightly gravelly clayey SAND with low cobble and boulder content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of sandstone. Cobbles (<70mm x 110mm x 140mm) are subangular to rounded of medium strong sandstone. Boulders (<200mm x 250mm x 280mm) are subangular to rounded of medium strong sandstone.
	3.20	7.40	LB_21_81_BH	Dense brown slightly sandy GRAVEL. Gravel is subrounded fine to coarse of mixed lithologies including flint, mudstone, quartzite and rare quartz.
Head	0.30	2.00	LB_21_79_TP	Very dense brown sandy GRAVEL. Sand is fine to coarse. Gravel is subangular and subrounded of mixed lithologies including flint, sandstone and quartzite.
Pennine Middle Coal Measures Formation	6.80	10.50	LB_21_77_BH	Interbedded gravelly CLAY's and MUDSTONEs. Gravel is angular to subangular fine to coarse of extremely weak mudstone and rare coal.

Table 6.7: Section 7 Summary of Ground Conditions

Section 7	Stratum	From [mBGL]	To [mBGL]	Location(s)	Description
BVS1	Topsoil	0.00	0.30	LB_21_309_TP LB_21_310_TP LB_21_311_TP	Dark brown sandy CLAY with occasional gravel. Sand is fine to medium. Gravel is subrounded and rounded fine to coarse of limestone.
	Glacial Till Deposits	0.20	2.30	LB_21_309_TP LB_21_310_TP	Firm dark orangish brown slightly gravelly slightly sandy CLAY. Sand is fine and medium. Gravel is angular to rounded fine to coarse of mixed lithologies including sandstone and mudstone.
		0.30	2.00	LB_21_311_TP	Brown gravelly locally clayey SAND with a low and medium cobble and boulder content. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of limestone and rarely slate. Cobbles (<30mm x 55mm x 60mm) are fine to coarse subangular to rounded of limestone and rarely slate. Boulders (<200mm x 200mm x 400mm) are of limestone.
BVS2	Topsoil	0.00	0.30	LB_21_306_TP LB_21_307_TP LB_21_308_TP	Dark brown slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of sandstone, limestone quartzite and granite.
	Made Ground	0.10	0.30	LB_21_306_TP	MADE GROUND. COBBLES are subrounded of sandstone and limestone placed on Terram (old access to field).
	Glacial Till Deposits	0.30	1.90	LB_21_306_TP	Brown slightly gravelly clayey SAND with medium cobble and boulder content below 0.90m bgl. Sand is fine to coarse. Gravel is subangular and subrounded fine to coarse of mixed lithologies including sandstone, limestone and granite. Cobbles are subangular and subrounded of mixed lithologies including sandstone, granite and limestone. Boulders (<400mm) are subangular and subrounded of mixed lithologies including limestone, granite and sandstone.
		0.30	1.60	LB_21_307_TP LB_21_308_TP	Stiff to very stiff dark brown slightly sandy slightly gravelly CLAY. Sand is fine and medium. Gravel is subangular to rounded fine to coarse of mixed lithologies including sandstone quartz and mudstone.

Section 7	Stratum	From [mBGL]	To [mBGL]	Location(s)	Description
		0.70	1.00	LB_21_307_TP	Dark orangish brown slightly clayey SAND and GRAVEL. Sand is fine to coarse. Gravel is angular to subrounded fine and medium of quartz flint and slate.
		1.00	1.80	LB_21_307_TP	Firm slightly gravelly sandy SILT. Sand is fine to coarse mainly fine. Gravel is angular to rounded fine and medium of sandstone limestone quartz mudstone and slate.
		1.80	2.00	LB_21_307_TP	Orange slightly gravelly SAND. Sand is fine to coarse. Gravel is angular to rounded fine of sandstone limestone and mudstone.
BVS3	Topsoil	0.00	0.40	LB_21_303_TP LB_21_304_TP LB_21_305_TP	Dark brown slightly gravelly clayey SAND. Sand is fine to coarse. Gravel is subangular and subrounded fine to coarse of sandstone, limestone and flint.
	Glacial Till Deposits	0.40	1.20	LB_21_303_TP LB_21_304_TP LB_21_305_TP	Brown yellowish grey slightly gravelly clayey to very clayey SAND. Sand is fine to coarse. Gravel is subangular and subrounded fine to coarse of mixed lithologies of sandstone, quartzite and granite.
		0.80	2.70	LB_21_303_TP LB_21_304_TP LB_21_305_TP	Firm and stiff brown yellow and grey slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular and subrounded fine to coarse of mixed lithologies including sandstone limestone and mudstone.
		2.00	2.70	LB_21_305_TP	Light brown grey and dark brown sandy clayey locally very clayey GRAVEL with low cobble and boulder content. Sand is fine to coarse. Gravel is subangular and subrounded fine to coarse of mudstone and occasionally sandstone. Cobbles (<50mm x 50mm x 150mm) are subangular of sandstone and mudstone. Boulders (<300mm) are subrounded of sandstone.

Section 7	Stratum	From [mBGL]	To [mBGL]	Location(s)	Description
BVS4	Topsoil	0.00	0.40	LB_21_301_TP LB_21_302_TP	Dark brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular and subrounded fine to coarse of mixed lithologies including sandstone, limestone and flint. Cobbles are subangular and subrounded of sandstone and limestone.
	Glacial Till Deposits	0.40	1.50	LB_21_301_TP LB_21_302_TP	Firm and stiff yellowish brown and grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular and subrounded fine to coarse of mixed lithologies including sandstone, limestone, quartzite and coal. Cobbles are subangular and subrounded of sandstone and granite
		1.20	2.30	LB_21_302_TP	Brown grey very gravelly slightly clayey SAND. Sand is fine to coarse. Gravel is subangular and subrounded fine to coarse of mixed lithologies including sandstone, limestone and quartzite.

6.2.8 Section 8

Section 8 is associated with Eni's Point of Ayr Gas Terminal. Made Ground was encountered in all the exploratory holes to a maximum depth of 1.20m bgl, as summarised in Table 6.8. At most locations this comprised of gravel with varying proportions of sand and fragments of man-made detritus. In LB_21_160_BH and LB_21_161_BH a layer of clay was encountered at the base of the associated Made Ground (0.90-1.20m bgl).

Below the superficial deposits of Tidal Flat Deposits which generally comprised of either a clay or silt, which became a sand with depth.

Bedrock was not encountered within this section.

Table 6.8: Section 8 Summary of Ground Conditions

Section 8	From [m BGL]	To [m BGL]	Location(s)	Description
Made Ground	0.00	0.60	LB_21_162_IP LB_21_163_IP LB_21_164_IP	SAND and GRAVEL locally with a low cobble content. Sand is fine to coarse. Gravel is angular and subangular fine to coarse of coal, limestone, brick, slag and occasional concrete porcelain and glass. Cobbles are subangular of limestone and concrete.
	0.20	0.90	LB_21_160_BH LB_21_161_BH	Light grey sandy GRAVEL with low cobble content. Sand is fine to coarse. Gravel is angular fine to coarse of limestone. Cobbles (<100mm) are angular of limestone.
	0.90	1.20	LB_21_160_BH LB_21_161_BH	(Soft and firm) dark greyish brown sandy very gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine and medium of limestone
Tidal Flat Deposits	1.20	5.50	LB_21_160_BH LB_21_161_BH	Very soft to firm locally slightly sandy SILT / CLAY. Sand is fine.
			LB_21_160_BH LB_21_161_BH	Grey slightly sandy SILT. Sand is fine.
	3.90	15.00	LB_21_160_BH LB_21_161_BH	Loose and medium dense brownish grey and light brown slightly silty/clayey SAND with rare shell fragments and locally with extremely closely and closely spaced thick laminations of dark grey clay. Sand is fine and medium.

6.3 Visual and Olfactory Evidence of Contamination

During the investigations, the supervising environmental consultant made the following observations: Organic odours concurrent with the observation of peat in natural ground and a slight bituminous odour at the base of the Made Ground in LB_21_210_CPT at 0.9m depth. No other odours indicative of contamination (e.g. hydrocarbon odours) were identified during the investigations.

In addition, no visual evidence of Asbestos containing material were noted.

6.3.1 Soil Headspace Screening

Out of 211 soil samples subject to headspace testing, the majority of the samples recorded a measurement below the instrument limit of detection of 0.1ppm. Of the concentrations measured above 0.1ppm, the highest was 455ppm in LB_21_01_BH, which is considered elevated. This was the only elevated soil headspace reading, the next detection was 4ppm in LB_21_20_BH at 0.80m bgl and not considered significant.

7. Installations and Monitoring

7.1 Overview

On completion of drilling the following were installed:

- Two slotted 50 mm diameter standpipes;
- Thirteen slotted 50 mm diameter standpipes with gas taps;
- Twelve digital data loggers.

Full details of the installations are on the borehole logs in the Appendices of previous Fugro Laboratory Report (2022) and Table 7.1 below summarises the stratum exposed within the response zone for the monitoring installations.

Table 7.1: Monitoring Installation Details

Section	Hole ID	Base of borehole [mbgl]	Response Zone [mbgl]		Stratum at response zone
2 Pipeline	LB_21_05_BH	16.00	13.50	16.5	Chester Formation
	LB_21_114_BH	8.00	5.50	8.50	Glacial Till Deposits
	LB_21_16_BH	12.00	2.00	12.00	Glacial Till Deposits
	LB_21_19_BH	9.00	2.00	8.00	Glaciofluvial Deposits, Devensian (GFDUD)
2 Stanlow	LB_21_01_BH	14.50	3.50	12.50	Chester Formation
	LB_21_02_BH	10.00	7.50	10.50	Chester Formation
3 Pipeline	LB_21_123_BH	14.50	10.00	14.50	Glacial Till Deposits
4 Pipeline	LB_21_110_BH	8.00	1.00	8.00	Glacial Till Deposits Tidal Flat Deposits
	LB_21_44_BH	18.00	15.00	18.00	Tidal Flat Deposits
	LB_21_47_BH	8.00	2.00	8.00	Glacial Till Deposits
	LB_21_55_BH	8.00	6.00	8.00	
5 Pipeline	LB_21_109_BH	5.20	3.00	5.20	Made Ground / Pennine Middle Coal Measures Formation
	LB_21_63_BH	10.00	3.50	10.00	Glaciofluvial Deposits, Devensian (GFDUD) / Pennine Middle Coal Measures Formation
	LB_21_64_BH	16.00	13.50	16.50	Pennine Middle Coal Measures Formation
8 Point of Ayr	LB_21_160_BH	15.00	4.00	15.00	Tidal Flat Deposits

7.2 Groundwater Monitoring

Groundwater level observations were made using:

- Interface probe to record presence and thickness of light non aqueous phase liquid and dense non aqueous phase liquid (LNAPL/DNAPL);
- Manual readings using water level dip tape;
- Digital water pressure data loggers (Divers).

Digital water pressure data loggers (Divers) have been installed to continuously monitor water pressures. The diver data can be viewed on Fugro's GAIA Monitoring website which the client, Eni, has direct access.

The diver data was downloaded, as of 23rd June 2022, from the source and graphical interpretations are presented in Appendix G.3. The graphs are divided by their Section area; however Sections 1, 6 and 7 do not have divers installed.

7.2.1 Visual and Olfactory Evidence of Contamination – Groundwater

Section 2, Stanlow Oil Refinery had 2 groundwater samples taken of which LB_21_01_BH noted a 'paint/ hydrocarbon odour', the sample having a 'slight hydrocarbon sheen' on the surface which was not thick enough to be detected by the interface probe – assumed less than 1mm thick or discontinuous. There were no other observations recorded.

7.3 Groundwater Sampling

A total of 13 groundwater samples were carried out with one sample completed: 15th March 2022, and the remaining 12 samples taken during the fieldwork between 28th and 30th March 2022. Water sampling records are presented in the Factual Laboratory Report (Fugro, 2022). Geoenvironmental laboratory testing of the water samples is summarised in Section 11.

7.4 Ground Gas

Four ground gas monitoring visits were undertaken between 6th December 2021 and 13th April 2022. The field data sheets are presented in the Factual Laboratory Report (Fugro, 2022) and the results are summarised in Appendix G.1 or discussed in Section 12.3; Table 12.2.

7.5 Results

High PID readings were recorded at LB_21_01_BH at Section 2 within the Stanlow refinery area. The elevated PID readings are reflected through their EPH levels which could be caused by the activities within the local environment; possible fire-fighting foam within the refinery area.

Evidence of water development and sampling can be viewed in the diver data by the drop in groundwater level between 28-30th March 2022. Some drops in the water level, particularly in Section 5 Pipeline, could be attributed to ongoing works in the area e.g. drainage, pump tests, however Fugro does not have proof outside of these dates.

8. Geoenvironmental Laboratory Testing

8.1 Overview

The geoenvironmental laboratory testing programme was determined and scheduled by Eni and laboratory tests were undertaken at Derwentside Environmental Testing Services (DETS) Limited (UKAS 2139). The laboratories' UKAS accreditation certificates are presented in Appendix J of the Factual report by Fugro (2022).

8.2 Summary of Geoenvironmental Laboratory Testing

Analytical testing suites specific to the project, together with guidance notes on geoenvironmental testing, are detailed in the Fugro Interpretative Report (2022). The number of analytical testing suites undertaken are listed in Table 8.1.

Table 8.1: Summary of Geoenvironmental Laboratory Tests Undertaken

Analytical Suite/Group	Number of Analyses
Suite Ec	173
Waste Acceptance Criteria – Suite H	6
Suite F – Water Suite	7
BRE SD1 – Water Suite	12
TOC (Water)	12
COD (Water)	12
BOD (Water)	12

DETS provided details of any deviating samples and the reasons for any deviations which are provided in Appendix H of the Fugro Laboratory Report (2022).

8.3 Results for Soil Analysis

8.3.1 Asbestos

70 samples of Made Ground were subject to asbestos screening and the result was No Asbestos Detected (NAD). The results of this analysis are presented in Table 8.2.

Asbestos was not detected in any of the 103 samples of natural ground, all of the asbestos testing is summarised by Section with associated ground conditions in Appendix E.

Table 8.2: Summary of Asbestos in Made Ground

Section	Hole ID	Depth	Asbestos Detected Yes/No
GtS_1_Grinsome Road AGI	LB_21_202_CPT	0.1	No
GtS_1_Pipeline	LB_21_203_CPT	0.1	No
	LB_21_205_TP	0.2	No
	LB_21_208_TP	0.2	No
	LB_21_210_CPT	0.6	No
StF_2_Pipeline	LB_21_04_TP	0.1	No
	LB_21_113_TP	0.2	No
	LB_21_119_CPT	0.2	No
	LB_21_20_TP	0.2	No
	LB_21_19_BH	0.25	No
	LB_21_114_TP	0.4	No
	LB_21_118_CPT	0.4	No
	LB_21_07_BH	0.7	No
StF_2_Rockbank BVS	LB_21_101_TP	0.3	No
	LB_21_102_TP	0.3	No
	LB_21_21_BH	0.9	No
StF_2_Stanlow AGI	LB_21_01_BH	0.15	No
StF_3_Mollington BVS	LB_21_98_TP	0.2	No
StF_3_Pipeline	LB_21_26_TP	0.2	No
	LB_21_36_TP	0.2	No
	LB_21_39_TP	0.2	No
	LB_21_40_TP	0.2	No
	LB_21_96_TP	0.2	No
	LB_21_97_TP	0.2	No
StF_4_Pipeline	LB_21_42_TP	0.2	No
	LB_21_43_TP	0.2	No
	LB_21_50_TP	0.2	No
	LB_21_46_BH	0.3	No
	LB_21_47_BH	0.3	No
	LB_21_49_BH	0.3	No
StF_5_Aston Hall BVS	LB_21_93_TP	0.2	No
	LB_21_94_TP	0.2	No
StF_5_Northop Hall AGI	LB_21_105_TP	0.2	No
StF_5_Pipeline	LB_21_107_TP	0.2	No
	LB_21_61_CPT	0.2	No
	LB_21_69_TP	0.2	No

Section	Hole ID	Depth	Asbestos Detected Yes/No
StF_5_Pipeline	LB_21_70_TP	0.2	No
	LB_21_75_TP	0.2	No
	LB_21_76_TP	0.2	No
	LB_21_91_TP	0.2	No
	LB_21_106_TP	0.3	No
	LB_21_58_TP	0.4	No
	LB_21_63_BH	0.7	No
	LB_21_69_TP	0.9	No
	LB_21_109_BH	0.95	No
	LB_21_63_BH	1.1	No
	LB_21_109_TP	1.4	No
	LB_21_109_BH	4	No
StF_6_Flint AGI	LB_21_84_TP	0.2	No
	LB_21_87_TP	0.2	No
StF_6_Pipeline	LB_21_79_TP	0.2	No
	LB_21_80_TP	0.2	No
	LB_21_83_TP	0.2	No
	LB_21_89_TP	0.2	No
Separate Phase_7_Pipeline	LB_21_309_TP	0.1	No
	LB_21_301_TP	0.3	No
	LB_21_302_TP	0.3	No
Separate Phase_8_Point of Ayr	LB_21_162_IP	0	No
	LB_21_163_IP	0	No
	LB_21_164_IP	0	No
	LB_21_160_BH	0.2	No
	LB_21_161_BH	0.2	No
	LB_21_162_IP	0.3	No
	LB_21_163_IP	0.3	No
	LB_21_164_IP	0.3	No
	LB_21_160_BH	0.4	No
	LB_21_161_BH	0.4	No
	LB_21_160_BH	0.9	No
	LB_21_161_BH	0.9	No

8.3.2 Organics - PAH / TPH

Concentrations of PAHs were generally low, with the highest concentration detected in a sample from Section 5 Pipeline; LB_21_63_BH at 1.10-1.20m (9.8 mg/kg total PAH).

Petroleum Hydrocarbon (TPH or EPH) concentrations were mostly below the Laboratory's Limit of Detection (LOD) of 10mg/kg. The highest concentration was detected in Section 4 Pipeline; LB_21_47_BH at 0.3m (147mg/kg Made Ground,).

8.3.3 Metals

Arsenic concentrations ranged from the LOD to a maximum of 41mg/kg (LB_21_109_TP at 3.9m, Section 5 Pipeline in the coal measures). The highest arsenic concentration in Made Ground was 27mg/kg (Section 5 Pipeline; LB_21_58_TP at 0.4m,).

Cadmium concentrations in Made Ground were all low with 34 out of 35 samples <1mg/kg. 140 out of 145 samples of natural ground detected cadmium <1mg/kg and the highest concentration in natural ground was 2.5mg/kg (LB_21_303_TP at 0.5m, Section 7 Pipeline).

Chromium III concentrations in Made Ground and natural ground samples were all <100mg/kg. Chromium VI was not detected when tested for.

In 35 Made Ground samples, copper concentrations did not exceed 60mg/kg. The highest copper concentration detected was 104mg/kg (Section 4 Pipeline; LB_21_44_BH at 0.3m, in the Tidal Flat Deposits).

The highest lead concentration was detected in a sample of natural ground (Section 7 Pipeline in the Glacial Till Deposits; LB_21_303_TP at 0.5m, 422mg/kg which is considered elevated) whilst the maximum lead concentration in Made Ground was 280mg/kg, which is a relatively low concentration for Made Ground.

Mercury concentrations in Made Ground and natural ground were all <1mg/kg, nickel concentrations were all below 50mg/kg, selenium concentrations were all <2mg/kg and zinc concentrations did not exceed 380mg/kg (Made Ground and natural ground).

8.3.4 pH and SO_4

Representative samples of strata from across the site, were tested in order to determine their pH value and Soluble Sulphate (SO_4) levels to determine the risk they pose to any future buried concrete structures. Testing and classification was completed in line with the BRE guidance, notably BRE Special Digest 1: Concrete in Aggressive Grounds (2005). For natural strata a greenfield setting has been assumed, for Made Ground a brownfield setting has been assumed. Ground water has been assumed as mobile in all locations however further investigation is required to confirm actual ground water conditions.

Results of the Geochemical Laboratory Testing and the assessment of the Design Sulphate Class (DS) the Aggressive Chemical Environment for Concrete Class (ACEC Class) are provided in Appendix C.

Made Ground results for ACEC Class are AC-1d; Topsoil results for ACEC Class are AC-1d to AC-2z; Tidal Flat Deposits results for ACEC Class vary from AC-1 to AC-4 varying lithologies (Peat, Clay and Sand). For a full assessment further testing will be required for Made Ground, Topsoil, Tidal Flat Deposits, and the Bed Rock. Within the Glacial Till Deposits the results for ACEC Class are predominantly AC-1d, however in LB_21_99_BH at 16.50m BGL the ACEC Class is recorded as AC-3, protection measures are recommended within this horizon.

8.3.5 Organic Matter

Made Ground samples ranged between <1% and 25% soil organic matter with 22 out of 25 samples detecting less than 10%.

Organic matter concentrations measured in Section 2 Pipeline; LB_21_118_CPT and Section 5 Pipeline; LB_21_109_TP and LB_21_58_TP were between 15% and 25% which may have waste disposal consequences for disposal of these materials (Section 14).

8.3.6 Quality Assurance

Some of the laboratory holding times were exceeded for some of the soil laboratory tests e.g. LB_21_210_CPT (lab report 21-27110) and this may affect the validity of some of the results.

8.3.7 Discussion - Soil

Indicators of potential soil contamination, primarily sporadic incidences of Made Ground, were identified across the entire route. Corresponding laboratory analysis of Made Ground samples confirmed the general absence of contamination and no detections for the presence of asbestos in soil.

The sample of Made Ground with the bituminous odour (LB_21_210_CPT) returned TPH concentrations <LOD and a low total PAH concentration of 0.29mg/kg.

The high soil headspace reading in LB_21_01_BH requires further targeted investigation.

Further details are presented in Appendix E, where comparison to GAC's for Parks and Open Spaces has been undertaken.

8.4 Environmental Laboratory Testing - Groundwater

A single round of groundwater sampling was undertaken between 15th and 30th March 2022. The original purpose of the water samples was for geotechnical comparison for concrete classification. During sampling, the operator noticed odours in some of the wells and these are summarised in Table 8.3 and the testing suite was increased. Further details are presented below.

In addition, at the client's request, samples LB_21_11_BH and LB_21_203_BH were taken during drilling.

A total of 7 samples of groundwater were tested for an extended suite of determinants including metals and PAHs and 5 more samples tested for sulphate, BOD, COD and TOC. Results are summarised in Appendix F.2.

Table 8.3: Water Sampling description summary (Appendix G.2)

Section	Borehole Location ID	Odour / sample description
Section 2 – Stanlow AGI	LB_21_01_BH	Very cloudy, orangish brown. Strong paint/ hydrocarbon odour. Slight sheen, not thick enough to detect by interface probe.
	LB_21_02_BH	Vey cloudy, light orangey brown. No odour.
Section 2 – Pipeline	LB_21_05_BH	Very cloudy, light brownish orange. Slight brackish odour.
	LB_21_19_BH	Strong eggy smell, light brown in colour due to sediment load.
	LB_21_114_BH	Very cloudy, orangey brown. No odour.
Section 4 – Pipeline (A458)	LB_21_44_BH	Slightly cloudy, yellowish white tinge. Slightly brackish with eggy odour.
	LB_21_55_BH	Very cloudy, light brownish orange. No odour.
	LB_21_110_BH	Very cloudy, light orangish brown, high sandy sediment lode. No odour.
Section 5 - Pipeline	LB_21_63_BH	Very cloudy, greyish brown. No odour.
	LB_21_64_BH	Very cloudy, dark greyish brown. No odour.
	LB_21_109_BH	Very cloudy, murky greyish brown. No odour.
Separate Phase_8_Point of Ayr	LB_21_160_BH	Very cloudy, dark greyish brown, high silty sediment lode. No odour.

8.5 Groundwater Results

8.5.1 pH and Inorganic Compounds

The pH values ranged between 4.6 units (LB_21_11_BH, Section 2 Pipeline, Tidal Flat Deposits) and 7.8 units (LB_21_160_BH, Separate Phase 8 Point of Ayr, Tidal Flat Deposits). Except for the sample from LB_21_11_BH, groundwater was slightly alkaline to alkaline. The sample from LB_21_11_BH was slightly acidic.

Cyanide was not detected above the laboratory limit of detection (LOD).

Nitrate concentrations ranged from <1mg/l to 8mg/l in 11 out of 12 samples with a maximum of 105mg/l detected in well LB_21_02_BH, Section 2 Stanlow AGI, Chester Formation. Ammoniacal nitrogen results were all <2mg/l.

10 out of 12 samples tested for chloride detected between 9mg/l and 176mg/l with the highest concentrations in two samples (LB_21_160_BH, Separate Phase_8_Point of Ayr, Tidal Flat Deposits at 418mg/l and LB_21_44_BH, Section 4 pipeline, Tidal Flat Deposits at 1448mg/l).

Biochemical oxygen demand (BOD) values were between <LOD and 16mg/l in 10 out of 12 groundwater samples. The highest values were in sample LB_21_01_BH, Section 2 Stanlow AGI (220mg/l) and LB_21_160_BH, Separate Phase 8 Point of Ayr, Tidal Flat Deposits (224mg/l).

Chemical Oxygen Demand (COD) values ranged between 3mg/l and 201mg/l in 9 out of 12 samples. The highest values were 676mg/l (LB_21_160_BH, Separate Phase_8_Point of Ayr, Tidal Flat Deposits), 2605mg/l in LB_21_01_BH, Section 2 Stanlow AGI and 2815mg/l in sample LB_21_114_BH (Section 2 pipeline, Glacial Till Deposits).

8.5.2 Metals

Arsenic concentrations ranged between 0.5µg/l and 5.3µg/l – the highest concentration was in LB_21_160_BH, Separate Phase 8 Point of Ayr, Tidal Flat Deposits.

Concentrations of boron ranged from 20µg/l to 734µg/l – the highest concentration was in LB_21_44_BH, Section 4 Pipeline, Tidal Flat Deposits.

Cadmium and mercury concentrations were all <1µg/l and chromium, copper and lead concentrations were all <5µg/l.

Out of 7 samples tested for nickel, 5 were <3µg/l. The remaining two samples recorded 17.6µg/l and 32µg/l (samples LB_21_203_BH, Section 1 Pipeline, Tidal Flat Deposits and LB_21_11_BH, Section 2 Pipeline, Tidal Flat Deposits respectively).

Magnesium concentrations were <50mg/l except for a sample from LB_21_44_BH, Section 4 Pipeline, Tidal Flat Deposits which detected 109mg/l.

All of the zinc concentrations were <500µg/l out of seven samples.

Chloride concentrations were <250mg/l in 10 out of 12 samples. Samples LB_21_160_BH and LB_21_44_BH detected concentrations of 418mg/l and 1448mg/l respectively.

8.5.3 Organics – Phenol, Petroleum Hydrocarbon and PAH Compounds

Monohydric phenols were not detected in the seven samples tested.

Out of seven samples tested for Petroleum Hydrocarbons (as EPH>C10-40), three samples were below the LOD of 10µg/l. The highest concentrations were detected in LB_21_01_BH, Section 2 Stanlow AGI, 552µg/l and LB_21_160_BH, Separate Phase 8 Point of Ayr, Tidal Flat Deposits, 1434µg/l.

PAH compounds were not detected in 4 out of 7 samples. The three detections ranged between 0.1µg/l and 2.1µg/l and the significance of these results is presented further in Section 11.

8.5.4 Discussion - Groundwater

Of most significance are the detections of Petroleum Hydrocarbons in groundwater samples LB_21_01_BH, LB_21_05_BH, LB_21_11_BH and LB_21_160_BH. Additional samples will be required to confirm the results.

The highest chloride concentration is noted to be close to the tidal part of the River Dee and reflective of saline intrusion and not considered significant.

The significance of the results is discussed in Section 11.

9. Generic Quantitative Risk Assessments (GQRA)

9.1 Methodology

This section contains the generic Quantitative Risk Assessments for Human health and controlled waters in accordance with the guidance outlined within Land Contamination Risk Management (2020) and forms part of a Stage 1 Risk Assessment. The generic Quantitative Risk Assessment used the site specific information acquired during the ground investigation to estimate the risks posed to a site.

The risk assessment utilises the Source-Pathway-Receptor approach as outlined within the guidance, as explained in Section 4.1.

This methodology has been used to complete the Risk Assessments and is key in the revision of the Conceptual Site Model. Contamination screening was undertaken on samples recovered from the site to assess the risks posed to human health and controlled waters.

9.1.1 Pathways:-

When considering the proposed end use, and without considering treatment, removal or protection measures, there are some potential plausible pathways available. Pathways are defined in Land Contamination Risk management as "a route by which a receptor is or could be affected by a contaminant". From the ground investigation and proposed development plan, the following pathways have been identified.

- ingestion, inhalation, dermal contact for human health receptors
- infiltration and contaminant migration through permeable strata such as the unsaturated zone for groundwater
- a secondary pathway from groundwater contamination to surface water
- migration of ground gases and vapours such as permanent gases, landfill gas and volatile hydrocarbons into buildings
- direct contact and uptake by plants

In addition, the CLEA Risk Assessment Model for Human Health, there are 3 exposure mediums considered for on site receptors, comprising ingestion of soil containing contaminants, inhalation of contaminated dust/vapours and dermal contact, with up to 10. exposure pathways considered, as shown below.

- Ingestion of soil and indoor dust
- Consumption of homegrown produce and attached soil
- Dermal contact (indoor)
- Dermal contact (outdoor)
- Inhalation of dust (indoor)
- Inhalation of dust (outdoor)
- Inhalation of vapour (indoor)
- Inhalation of vapour (outdoor)

- Oral background intake
- Inhalation background intake.

Where the future site has hard cover and below new structures, the majority of these pathways will not be available.

When considering the potential pathways for leachate migration, where either hard cover and/or future surface water drainage systems are present, the potential effects of surface infiltration or contaminated surface water runoff will be greatly reduced. Similarly, when considering the construction work force, exposure pathways through direct contact, ingestion and dust inhalation will be available during part of the construction process, and therefore adequate PPE should be provided to protect the work force during this period.

9.1.2 Receptors:-

Within the CLEA Risk Assessment Model for Human Health, the potential receptors are assessed initially on site end use, followed by a delineation of age category (i.e. child or adult), with default settings for Residential, Allotment and Public Open Space (Park) end uses based on a child aged 0 to 6 years, Public Open Space (Residential) based on a child aged 3 to 9 and Commercial end uses based upon a working exposure period of up to 49 years (i.e. 16 to 65).

Key generic assumptions for Residential and Public Open Space (Residential) are based upon a typical residential property, consisting of a two-storey small, terraced house, with private garden, and a Commercial end use based upon a typical commercial or light industrial property, consisting of a three-storey office building (pre-1970). No buildings are anticipated for Allotment or Public Open Space (Park) end uses. Within the CLEA Risk Assessment Model for Human Health there are 6 no. generic end use categories presently in use detailed below

1) Residential - with home grown produce,

2) Residential - without home grown produce,

3) Allotments,

4) Commercial

5) Public Open Space – Residential,

6) Public Open Space - Park

Therefore, for the Stage 1 Risk Assessment, the end use categories have been selected as follows.

4) Commercial – for all service buildings and ancillary pipe infrastructure along the route

6) Public Open Space – Park – for the route of the pipe, excluding any service buildings and ancillary infrastructure.

Soil Organic Matter (SOM) is a percentage representation of the organic matter present in the materials sampled. SOM is used as an aid in determining the correct GAC to assess the screening results to. Typically, GACs include different Critical Concentrations for different analytes depending on the SOM percentage. The typical SOM divisions are 1%, 2.5% and 6% with a best fit approach being utilised when determining the assessment criteria.

9.1.3 Controlled Waters Screening Methodology

Potential risks to groundwater and surface water from dissolved contaminants in groundwater have been assessed by screening against a hierarchy of generic water quality standards (WQS).

The WQS are protective of the environmental quality of surface waters (EQS) or of human health (via Drinking Water Standards (DWS)). Results above the WQS do not necessarily indicate significant contamination but may require further assessment.

The screening criteria are selected from the following list with EQS and UK DWS typically considered in the first instance:

- EQS – derived from toxicity data, noting chronic effects after long-term exposure or at sensitive life stages of target aquatic species. The EQS quoted are based on The Water Framework Directive (Standards and Classification) Directions (England and Wales), 2015.
- UK DWS – derived from the Water Supply (Water Quality) Regulations 2018.
- World Health Organisation Guidelines (WHO Health) protect health and derive from the World Health Organisation Guidelines for Drinking Water Quality, 4th edition, 2017.

10. Generic Quantitative Risk Assessment (Human Health)

All of the contaminant concentrations detected in soil were below the GAC for Public Open Space (Park) as shown in Appendix E. Contaminant concentrations were therefore all below the less sensitive Commercial GAC Screening.

In the absence of an identified source of contaminants, there are no contaminant linkages identified from soil. This assessment is provided within the limitations of the study (Section 15).

11. Generic Quantitative Risk Assessment (Controlled Waters)

Concentrations of the PAHs Benzo(a)pyrene were above the WQS in samples LB_21_01_BH and LB_21_05_BH and Benzo(b)fluoranthene in LB_21_01_BH only.

Only total petroleum hydrocarbons were tested in waters and speciated results are required to make an assessment. That said, it is likely that concentrations in samples LB_21_01_BH, LB_21_05_BH, LB_21_11_BH and LB_21_160_BH would exceed WQS from one or more TPH fractions. Additional samples will be required to confirm the results.

Concentrations of chloride exceeded the WQS in two samples LB_21_160_BH and LB_21_44_BH and as mentioned previously the highest chloride concentration is noted to be close to the tidal part of the River Dee and reflective of saline intrusion and not considered significant.

Sample LB_21_19_BH, Section 2, Stanlow, results were below the WQS but it was noted in the field sheets during sampling that the sample had a 'strong paint/ hydrocarbon odour', the sample itself having a 'slight sheen' on the surface.

Based on the above, it is apparent that some of the groundwater samples detected concentrations of contaminants above the WQS. Additional water sampling will be required to confirm the results and make a more robust assessment.

12. Preliminary Ground Gas Risk Assessment

12.1 Methodology

The data obtained from the gas monitoring completed following the site investigation works has been assessed in line with the current process outlined within BS8485:2015+A1:2019. From the data obtained, an empirical, semi-quantitative method was selected. Guidance from CIRIA C665:2007 was also used to assist with the risk assessment.

The principle of the assessment is a Gas Screening Value or GSV which are calculated for both Carbon Dioxide (CO2) and Methane (CH4). This is generated by the following simplified formula:

GSV= (Peak Gas/100) X Peak Flow.

The GSV values will be assessed against the Characteristic Gas Situation (CS) thresholds as outlined within Table 2 in BS8485:2015+A1:2019. This has been summarised in Table 12.1.

Table 12.1: Characteristics Gas Situation Classification Table

CS	Hazard Potential	Site Characteristics (GSV) (L/Hr)	Additional Factors
CS1	Very Low	<0.07	Typically <1% CH_4 and <5% CO_2 concentrations, otherwise upgrade to CS2
CS2	Low	0.07 to <0.7	Typically measured flow rate of <70 L/Hr, otherwise upgrade to CS3
CS3	Low / Moderate	0.7 to <3.5	
CS4	Moderate	3.5 to <15	
CS5	High	15 to <70	
CS6	Very High	>70	

12.2 Results

Results are summarised in Table 12.2, and is formed of a total of 30 ground gas measurements.

This report will not form a comprehensive ground gas risk assessment due to the limited data available. Data is limited due to the monitoring wells being multi-purpose as opposed to well installations targeted at ground gas assessment. Only one of the monitoring well installations had a length of unsaturated well screen over 0.5m in length (LB_21_16_BH). As a result, the ground gas measurements are largely reading headspace in the upper plain pipe (sealed) section of the monitoring wells.

12.2.1 Barometric Pressure

Atmospheric pressure ranged from 1001mb (low pressure, recorded 06/12/2021) to 1042 (high pressure, recorded 18/03/2022). Monitoring events with pressure <1008mb were on five days - 06/12/2021, 10/03/2022, 05/04/2022 and 12/04/2022.

12.2.2 Gas Flow

Measurements ranged from -2 l/hr (negative flow into the well) to 13.8 l/hr (positive flow out of the well). The flow readings may represent variations in pressure due to groundwater variations in the plain (sealed) top section of the well pipe.

12.2.3 Methane

22 out of 30 measurements of methane were below the instrument level of detection of 0.1% by volume.

Monitoring wells LB_21_01_BH (Section 2) and LB_21_64_BH (Section 5) detected methane concentrations between 0.2% and 0.7%. The highest methane reading was a single reading of 5.2% measured in monitoring well LB_21_109_BH (Section 5) on 14/12/2021.

12.2.4 Volatile Organic Compounds (VOC)

VOCs were measured using a PID meter and the majority of readings were 0ppm or less than 10ppm and not considered elevated.

Slightly elevated readings between 10ppm and 20ppm were measured in monitoring wells LB_21_63_BH and LB_21_64_BH (Section 5), and LB_21_110_BH (Section 4) and LB_21_114_BH (Section 2).

The highest PID readings were measured in monitoring well LB_21_01_BH (Section 2). VOC concentrations in the well headspace ranged from 175ppm to 272ppm between 14/03/2022 and 22/03/2022. These concentrations are considered elevated and indicative of a source of hydrocarbon / solvent contamination. The concentrations detected in LB_21_01_BH are coincident with the highest detection of petroleum hydrocarbons in groundwater.

12.2.5 Other Determinands

Oxygen concentrations ranged from 15% to 21% and 25 out of 30 readings were above 19% which is indicative of the entrainment of atmospheric air into the well during measurement.

Carbon dioxide concentrations ranged from 0.1% (the instrument level of detection) to 4.4% for 28 out of 30 readings. The highest reading was 6.7%, measured in LB_21_109_BH (Section 5) on 14/12/2021 which is the same monitoring event as the highest methane reading for the same well.

Carbon monoxide and hydrogen sulphide concentrations were low and less than 5ppm for all of the 30 readings.

12.3 Ground Gas Discussion

The results of the preliminary ground gas assessment were affected by the monitoring well installations which resulted in most of the ground gas measurements being representative of the gas in the well headspace as opposed to measuring gas concentrations in the unsaturated zone. However, the following conclusions can be drawn from the results:

- The results indicate that much of the route has a low gas risk.
- The elevated PID readings in well LB_21_01_BH (Section 2) will require further, targeted investigation.
- LB_21_109_BH (Section 5) had an elevated methane level identified during one of the monitoring visits and is associated with a former infilled quarry. This is located along the pipe route and could be a potential source for migratory methane along the pipe. It is recommended that some further investigation is carried out in this area focused on the Made Ground to assess the volumes of gas being produced.
- The locations of the proposed above ground structures along the route are unlikely to require gas protection measures, however radon protection as outlined in Section 2.4 may be required.
- No ground gas installations were placed in section 1 due to high groundwater levels
- Section 6 and 7 have not had any gas monitoring installations installed due to the presence of the Glacial Till or Fluvioglacial Deposits. Should unexpected Made Ground be encountered, which could be a potential source for ground gas, dependent on the amount this can either be excavated out or may require some additional investigation work to determine the impact on the route.

Table 12.2: Gas Monitoring Data Summary

Section	Location ID	Date	Barometric Pressure (mb)	Depth to Water	Well Response Zone (m)	CO ppm	H2S ppm	VOC ppm	Methane %	CO2 %	Oxygen %	Flow l/hr	Comment
Section 2	LB_21_01_BH	14/03/2022	1011	0.90	3.50 - 12.50	1	0	185	0.4	0.1	21	0	Groundwater level above slotted section
Section 2	LB_21_01_BH	18/03/2022	1042	1.17	3.50 - 12.50	1	0	272	0.6	0.4	20.5	2.1	Groundwater level above slotted section
Section 2	LB_21_01_BH	22/03/2022	1030	1.22	3.50 - 12.50	1	0	175	0.3	0.5	20.2	0	Groundwater level above slotted section
Section 2	LB_21_02_BH	16/12/2021	1036	4.10	7.50 - 10.50	4	3	0	0	0.3	20.1	0	Groundwater level above slotted section
Section 2	LB_21_02_BH	20/12/2021	1026	0.00	7.50 - 10.50	3	2	0	0.1	0.4	19.8	0	Groundwater level above slotted section
Section 2	LB_21_114_BH	14/12/2021	1024	0.72	5.50 - 8.50	0.1	0	20	0	0.1	20.3	0	Groundwater level above slotted section
Section 2	LB_21_114_BH	06/12/2021	1001	0.60	5.50 - 8.50	2	0	0	0	0.2	20.2	0	Groundwater level above slotted section
Section 2	LB_21_16_BH	13/04/2022	1013	9.16	2.00 - 12.00	1	0	1	0	1.6	16.5	-2	None
Section 2	LB_21_19_BH	13/04/2022	1015	0.58	2.00 - 8.00	3	0	2	0	0.4	20.4	0.2	Groundwater level above slotted section
Section 3	LB_21_123_BH	13/04/2022	1012	1.51	10.00 - 14.50	0	0	1	0	0.1	20.8	13.8	Groundwater level above slotted section
Section 4	LB_21_110_BH	07/03/2022	1021	0.04	1.00 - 8.00	0	0	0	0.1	0.2	20.6	0.5	Well Flooded
Section 4	LB_21_110_BH	14/03/2022	1022	0.10	1.00 - 8.00	0	0	1	0.1	0.2	20.8	0	Well Flooded

Section	Location ID	Date	Barometric Pressure (mb)	Depth to Water	Well Response Zone (m)	CO ppm	H2S ppm	VOC ppm	Methane %	CO2 %	Oxygen %	Flow l/hr	Comment
Section 4	LB_21_110_BH	24/03/2022	1029	0.03	1.00 - 8.00	2	1	19	0.1	0.3	20.4	-0.2	Well Flooded
Section 4	LB_21_110_BH	30/03/2022	1012	0.14	1.00 - 8.00	0	0	0	0	0.4	20.6	7	Well Flooded
Section 4	LB_21_47_BH	12/04/2022	1004	2.47	2.00 - 8.00	0.1	0	0	0	0.1	21.1	-	Less than 0.5m unsaturated response zone
Section 4	LB_21_55_BH	06/12/2021	1003	1.21	6.00 - 8.00	3	0	0	0	1.4	19.4	0	Groundwater level above slotted section
Section 4	LB_21_55_BH	14/12/2021	1021	1.01	6.00 - 8.00	2	0	0	0	1.4	19.3	0	Groundwater level above slotted section
Section 5	LB_21_109_BH	06/12/2021	1001	2.30	3.00 - 5.20	2	0	0	0.7	0.9	19.9	0	Groundwater level above slotted section
Section 5	LB_21_109_BH	14/12/2021	1018	1.43	3.00 - 5.20	2	0	0	5.2	6.7	15.2	0.3	Groundwater level above slotted section
Section 5	LB_21_63_BH	14/03/2022	1013	3.87	3.50 - 10.00	0	0	1	0.1	2.0	20.3	0	Less than 0.5m unsaturated response zone
Section 5	LB_21_63_BH	25/03/2022	1022	3.66	3.50 - 10.00	0	0	12	0	2.4	17.2	-0.1	Less than 0.5m unsaturated response zone
Section 5	LB_21_63_BH	28/03/2022	1015	4.07	3.50 - 10.00	0	0	0	0	2.6	17.3	0	0.57m unsaturated response zone
Section 5	LB_21_63_BH	10/03/2022	1004	3.32	3.50 - 10.00	0	1	11	0.1	4.4	16.3	0	Groundwater level above slotted section
Section 5	LB_21_64_BH	10/03/2022	1003	6.09	13.50 -16.50	3	0	1	0.2	0.2	20.7	0	Groundwater level above slotted section

Section	Location ID	Date	Barometric Pressure (mb)	Depth to Water	Well Response Zone (m)	CO ppm	H2S ppm	VOC ppm	Methane %	CO2 %	Oxygen %	Flow l/hr	Comment
Section 5	LB_21_64_BH	14/03/2022	1013	6.06	13.50 -16.50	4	0	2	0.1	0.2	20.8	0	Groundwater level above slotted section
Section 5	LB_21_64_BH	25/03/2022	1022	6.26	13.50 -16.50	2	0	15	0.2	0.2	20.3	0	Groundwater level above slotted section
Section 5	LB_21_64_BH	28/03/2022	1012	6.18	13.50 -16.50	0	0	0	0	0.2	20.6	4.4	Groundwater level above slotted section
Section 8	LB_21_160_BH	30/03/2022	1011	1.53	4.00 - 15.00	0	0	0	0	0.1	20.9	0	Groundwater level above slotted section
Section 8	LB_21_160_BH	05/04/2022	1006	1.25	4.00 - 15.00	0	0	0	0	0.2	20.8	12.3	Groundwater level above slotted section
Section 8	LB_21_160_BH	12/04/2022	1002	1.79	4.00 - 15.00	0.6	0	0	0	0.6	20.4	-	Groundwater level above slotted section

13. Revised Conceptual Site Model

Following the results of the intrusive investigation works, the Conceptual Site Model (CSM) has been revised. This revision includes both the preliminary information and the results of all the completed site works. The revised CSM has been prepared in line with the guidance outlined in Land Contamination Risk Management (2020), and forms part of the generic quantitative risk assessment.

It summarises the various contaminant sources, plausible migration pathways and potentially sensitive receptors identified for this site, assuming no remediation, additional protection measures and/or removal of the sources of contamination takes place. More details on the assessment approach and how the risks are categorised is available in Section 4.

Table 13.1: Revised Conceptual Site Model

Section	Potential Contaminant Source	Pathway	Receptor	Severity of Risk	Probability of Risk	Qualitative Review	RISK
1	On Site: Contamination within Made Ground or natural soils associated with current or historic industrial facilities, oil refinery, railway embankments. Off Site: Fuel Station, landfill (vapour, gas).	Human Health: Direct contact, inhalation, ingestion. Aquifer: Leaching / lateral migration. Surface Water: lateral migration. Structures: direct contact / gas ingress through permeable unsaturated strata.	Human Health: Construction /maintenance workers, adjacent users/residents. Aquifer: Superficial: Secondary - Undifferentiated (TFD/GT). **Bedrock: Principal (Kinnerton Fm, Chester Fm).** Surface Water: Field Drains, Pond.	Human Health: Moderate. Aquifer: Moderate. Surface Water: Low. Structures: Severe.	Human Health: Likely (acute/construction workers). Aquifer: Low likelihood. Surface water: Low likelihood. Structures: Low likelihood.	Geoenvironmental testing indicates that soil contamination at the existing exploratory holes is below the relevant GAC and no exceedances were identified. Insufficient information to assess controlled waters but potential risks identified at Stanlow refinery, further investigation is recommended. This data should be utilised to produce the risk assessment and method statements for construction workers during the construction phase, to ensure appropriate hazard control measures e.g. control of vapour/gas in confined spaces, use of PPE. Future site maintenance workers should undertake risk assessments and use appropriate PPE and mitigation procedures before undertaking maintenance on the pipeline. Prior to the construction phase a Construction Phase Environmental Plan (CEMP) should detail the mitigation measures to prevent neighbouring site users from exposure to potential contamination via direct contact, ingestion or inhalation. Any future structures should be assessed against local potential ground gas sources and appropriate additional investigation / protection measures installed.	L / M
2	On site: Oil Refinery, high soil headspace. Off Site: Historical mineral workings, infilled land (quarry / sand pit), landfill.	Human Health: Direct contact, inhalation, ingestion. Aquifer: Leaching / lateral migration. Surface Water: lateral migration. Structures: direct contact / gas ingress through	Aquifer: Superficial: Secondary A (WB, GFD), Secondary Undifferentiated - (GT), Unproductive (Peat). **Bedrock: Principal (Chester**	Human Health: Moderate. Aquifer: Moderate. Surface Water: Low. Structures: Severe.	Human Health: Likely (acute/construction workers). Aquifer: Low likelihood. Surface water: Low likelihood.	Geoenvironmental testing indicates that soil contamination at the existing exploratory holes is below the relevant GAC and no exceedances were identified. Potential risk identified to controlled waters from the detection of hydrocarbons in groundwater at the Stanlow refinery further investigation is recommended. This data should be utilised to produce the risk assessment and method statements for construction workers during the construction phase, to ensure appropriate hazard control measures e.g. control of vapour/gas in confined spaces, use of PPE. Future site maintenance workers should undertake risk	L / M

Section	Potential Contaminant Source	Pathway	Receptor	Severity of Risk	Probability of Risk	Qualitative Review	RISK
		permeable unsaturated strata.	**Fm, Wilmslow Fm).** Surface Water: River Gowy, Stanney Mill Brook, Shropshire Union Canal, Field Drains, SW abstractions. Structures: Pipeline / ancilliary structures.		Structures: Low likelihood.	assessments and use appropriate PPE and mitigation procedures before undertaking maintenance on the pipeline. Prior to the construction phase a Construction Phase Environmental Plan (CEMP) should detail the mitigation measures to prevent neighbouring site users from exposure to potential contamination via direct contact, ingestion or inhalation. Any future structures should be assessed against local potential ground gas sources and appropriate additional investigation / protection measures installed.	
3	On Site: Former rail land. Off Site: Historical mineral workings and infilled land (Sand Pit, gas).	Human Health: Direct contact, inhalation, ingestion. Aquifer: Leaching / lateral migration. Surface Water: lateral migration. Structures: direct contact / gas ingress through permeable unsaturated strata.	Human Health: Construction /maintenance workers, adjacent users/residents. Aquifer: Superficial: Secondary A (GFD), Secondary - Undifferentiated (TFD/GT). **Bedrock: Principal**	Human Health: Moderate. Aquifer: Moderate. Surface Water: Low.	Human Health: Likely (acute/construction workers). Aquifer: Low likelihood. Surface water: Low likelihood.	Geoenvironmental testing indicates that soil contamination at the existing exploratory holes is below the relevant GAC and no exceedances were identified. Low potential risk to controlled waters due to an absence of potential sources. This data should be utilised to produce the risk assessment and method statements for construction workers during the construction phase, to ensure appropriate hazard control measures e.g. control of vapour/gas in confined spaces, use of PPE. Future site maintenance workers should undertake risk assessments and use appropriate PPE and mitigation procedures before undertaking maintenance on the pipeline. Prior to the construction phase a Construction Phase Environmental Plan (CEMP) should detail the mitigation measures to prevent neighbouring site users from exposure to potential contamination via direct contact, ingestion or inhalation.	L / M

Section	Potential Contaminant Source	Pathway	Receptor	Severity of Risk	Probability of Risk	Qualitative Review	RISK
			(Kinnerton Fm, Chester Fm). Surface Water: Shropshire Union Canal, Backford Brook, Finchetts Gutter, SW abstraction. Structures: Pipeline / ancilliary structures.				
4	On Site: Surface workings (clay pit / brickworks), landfill (gas). Off Site: Engineering Works, refuse tip.	Human Health: Direct contact, inhalation, ingestion. Aquifer: Leaching / lateral migration. Surface Water: lateral migration. Structures: direct contact / gas ingress through permeable unsaturated strata.	Human Health: Construction /maintenance workers, adjacent users/residents. Aquifer: Superficial: Secondary - Undifferentiated (TFD/GT). **Solid: Principal (Kinnerton Fm)**, Secondary A (Etruria Fm,	Human Health: Moderate. Aquifer: Moderate. Surface Water: Low. Structures: Severe.	Human Health: Likely (acute/construction workers). Aquifer: Low likelihood. Surface water: Low likelihood. Structures: Low likelihood.	Geoenvironmental testing indicates that soil contamination at the existing exploratory holes is below the relevant GAC and no exceedances were identified. Low potential risk to controlled waters due to an absence of potential sources and no significant contamination detected in groundwater (1 round of sampling). This data should be utilised to produce the risk assessment and method statements for construction workers during the construction phase, to ensure appropriate hazard control measures e.g. control of vapour/gas in confined spaces, use of PPE. Future site maintenance workers should undertake risk assessments and use appropriate PPE and mitigation procedures before undertaking maintenance on the pipeline. Prior to the construction phase a Construction Phase Environmental Plan (CEMP) should detail the mitigation measures to prevent neighbouring site users from exposure to potential contamination via direct contact, ingestion or inhalation. Any future structures should be assessed against local potential ground gas sources and appropriate additional investigation /	L / M

Section	Potential Contaminant Source	Pathway	Receptor	Severity of Risk	Probability of Risk	Qualitative Review	RISK
			Coal). Surface Water: Finchetts Gutter, River Dee, Broughton Brook, Sandycroft Drain. Structures: Pipeline / ancilliary structures.			protection measures installed. Radon Protection measures required for new buildings: assessed on a location by location basis.	
5	On site: Colliery, shafts, Surface workings (clay pit / brickworks), landfills (gas). Off Site: Collieries, mineral workings, chemical works, fuel station, landfills.	Human Health: Direct contact, inhalation, ingestion. Aquifer: Leaching / lateral migration. Surface Water: lateral migration. Structures: direct contact / gas ingress through permeable unsaturated strata.	Aquifer: Superficial: Secondary A (GFD), Secondary - Undifferentiated (GT/Head). Solid: Secondary A (Hollins, CM, Bowlands Fm). Surface Water: Wepre Brook, Alltami Brook Structures: Pipeline /	Human Health: Moderate. Aquifer: Low. Surface Water: Low. Structures: Severe.	Human Health: Likely (acute/construction workers). Aquifer: Low likelihood. Surface water: Low likelihood. Structures: Low likelihood.	Geoenvironmental testing indicates that soil contamination at the existing exploratory holes is below the relevant GAC and no exceedances were identified. Low potential risk to controlled waters due to an absence of potential sources and lower groundwater sensitivity. This data should be utilised to produce the risk assessment and method statements for construction workers during the construction phase, to ensure appropriate hazard control measures e.g. control of vapour/gas in confined spaces, use of PPE. Future site maintenance workers should undertake risk assessments and use appropriate PPE and mitigation procedures before undertaking maintenance on the pipeline. Prior to the construction phase a Construction Phase Environmental Plan (CEMP) should detail the mitigation measures to prevent neighbouring site users from exposure to potential contamination via direct contact, ingestion or inhalation. Any future structures should be assessed against local potential ground gas sources and appropriate additional investigation / protection measures installed. Radon Protection measures required for new buildings: assessed on a location by location basis.	L / M

Section	Potential Contaminant Source	Pathway	Receptor	Severity of Risk	Probability of Risk	Qualitative Review	RISK
			ancilliary structures.				
6	On Site: Sand pit. Off Site: Sand pit (gas).	Human Health: Direct contact, inhalation, ingestion. Aquifer: Leaching / lateral migration. Surface Water: lateral migration. Structures: direct contact / gas ingress through permeable unsaturated strata.	Human Health: Construction /maintenance workers, adjacent users/residents. Aquifer: Superficial: Secondary A (GFD), Secondary - Undifferentiated (GT). Solid: Secondary A (Coal, Bowlands Fm). Surface Water: Northop Brook Structures: Pipeline / ancilliary structures.	Human Health: Moderate. Aquifer: Low. Surface Water: Low. Structures: Severe.	Human Health: Likely (acute/construction workers). Aquifer: Low likelihood. Surface water: Low likelihood. Structures: Low likelihood.	Geoenvironmental testing indicates that soil contamination at the existing exploratory holes is below the relevant GAC and no exceedances were identified. Low potential risk to controlled waters due to an absence of potential sources and lower groundwater sensitivity. This data should be utilised to produce the risk assessment and method statements for construction workers during the construction phase, to ensure appropriate hazard control measures e.g. control of vapour/gas in confined spaces, use of PPE. Future site maintenance workers should undertake risk assessments and use appropriate PPE and mitigation procedures before undertaking maintenance on the pipeline. Prior to the construction phase a Construction Phase Environmental Plan (CEMP) should detail the mitigation measures to prevent neighbouring site users from exposure to potential contamination via direct contact, ingestion or inhalation. Any future structures should be assessed against local potential ground gas sources and appropriate additional investigation / protection measures installed. Radon Protection measures required for new buildings: assessed on a location by location basis.	L / M
7	On Site: Infilled Quarry. Off Site: coal and lead mining features (gas).	Human Health: Direct contact, inhalation, ingestion. Aquifer: Leaching	Human Health: Construction /maintenance workers,	Human Health: Moderate. Aquifer: Moderate.	Human Health: Likely (acute/construction	Geoenvironmental testing indicates that soil contamination at the existing exploratory holes is below the relevant GAC and no exceedances were identified. Low potential risk to controlled waters due to an absence of potential sources.	L / M

Section	Potential Contaminant Source	Pathway	Receptor	Severity of Risk	Probability of Risk	Qualitative Review	RISK
		/ lateral migration. Surface Water: lateral migration. Structures: direct contact / gas ingress through permeable unsaturated strata.	adjacent users/residents. Superficial: Secondary A (GFD), Secondary - Undifferentiated (GT). **Bedrock: Principal (Cefn Mawr & Loggerhead Limestone),** Secondary A (Gwespyr SS), Secondary Undifferentiated (Bowland Shale) Surface Water: Nant Y Flint stream.	Surface Water: Low. Structures: Severe.	workers). Aquifer: Low likelihood. Surface water: Low likelihood. Structures: Low likelihood.	This data should be utilised to produce the risk assessment and method statements for construction workers during the construction phase, to ensure appropriate hazard control measures e.g. control of vapour/gas in confined spaces, use of PPE. Future site maintenance workers should undertake risk assessments and use appropriate PPE and mitigation procedures before undertaking maintenance on the pipeline. Prior to the construction phase a Construction Phase Environmental Plan (CEMP) should detail the mitigation measures to prevent neighbouring site users from exposure to potential contamination via direct contact, ingestion or inhalation. Any future structures should be assessed against local potential ground gas sources and appropriate additional investigation / protection measures installed. Radon Protection measures required for new buildings: assessed on a location by location basis.	
8	On Site: Colliery, Surface workings (refuse/slag heap) - gas. Military firing range. Off Site: Former refuse tip now	Human Health: Direct contact, inhalation, ingestion. Aquifer: Leaching / lateral migration. Surface Water: lateral migration.	Human Health: Construction /maintenance workers, adjacent users/residents. Superficial:	Human Health: Moderate. Aquifer: Moderate. Surface Water: Low.	Human Health: Likely (acute/construction workers). Aquifer: Low likelihood.	Geoenvironmental testing indicates that soil contamination at the existing exploratory holes is below the relevant GAC and no exceedances were identified. Insufficient information to assess controlled waters but potential risks identified. This data should be utilised to produce the risk assessment and method statements for construction workers during the construction phase, to ensure appropriate hazard control measures e.g. control of vapour/gas in confined spaces, use of	L / M

Section	Potential Contaminant Source	Pathway	Receptor	Severity of Risk	Probability of Risk	Qualitative Review	RISK
	metal recycling yard.	Structures: direct contact / gas ingress through permeable unsaturated strata.	Secondary A (WB), Unproductive (TFD). Solid: Secondary A (Coal) Surface Water: Welsh Channel, Dee Estuary, Artificial ponds, drainage channels. Structures: Pipeline / ancilliary structures.	Structures: Severe.	Surface water: Low likelihood. Structures: Low likelihood.	PPE. Future site maintenance workers should undertake risk assessments and use appropriate PPE and mitigation procedures before undertaking maintenance on the pipeline. Prior to the construction phase a Construction Phase Environmental Plan (CEMP) should detail the mitigation measures to prevent neighbouring site users from exposure to potential contamination via direct contact, ingestion or inhalation. Any future structures should be assessed against local potential ground gas sources and appropriate additional investigation / protection measures installed. Radon Protection measures required for new buildings: assessed on a location by location basis.	
Key: L / M = Low to Moderate Risk							

14. Waste Assessment and Classification

14.1 Waste Classification Overview

Through the ground investigation stage and the construction process for this project waste materials, predominantly soil and stone, will be generated. This waste material will comprise of predominately natural strata with some surface Made Ground and topsoil materials also requiring disposal or re-use elsewhere.

Note: Only an initial hazard assessment with recommendations for further assessment can be given at this stage.

Environment Agency Technical Guidance WM3 Ver.1.2 (2021) entitled 'Guidance on the classification and assessment of waste' has been utilised to categorise the correct European Waste Category (EWC) code. The wastes are presented in the List of Wastes Directive (LoWD, 2014/955/EU) and grouped according to generic industry, process or waste type. Some of these wastes are hazardous without further assessment (absolute entries) or are 'mirror' entries that require further assessment as to hazardous properties to determine whether the waste is hazardous, this can be done via a hazard assessment. Mirror wastes within the LoWD are either hazardous (denoted by a code ending with an asterisk (*)) or non-hazardous.

Certain contaminants (e.g. asbestos, diesel) have prescribed concentration thresholds that if breached will render the waste material to be classified as 'hazardous'. In the initial testing of the samples the concentrations of plausible contaminants within the soil, usually pre-defined from the desk-study, along with those determinands which are required for defining the waste type. Results of this assessment should help to determine the likely fate of the soil (re-use elsewhere, treatment at a facility, or disposal in landfill) and whether the material is hazardous or not. Usually within the Construction and Demolition industry these soil wastes would be within Chapter 17 under;

17 05 03* soil and stones containing hazardous substances, or;

17 05 04 soil and stones other than those mentioned in 17 05 03*

Depending on the results of the Hazard Assessment, advice can be given as to the likely options available for a given waste, and if any further testing or assessment will be necessary before collection from site, as this is the 'producer's responsibility'. Hazardous waste will likely require Waste Acceptance Criteria (WAC) testing and after 'pre-treatment' or off-site treatment. Non-hazardous waste should be reused or recycled wherever possible, however if the waste is set to be re-used then additional documentation may be required.

Uncontaminated naturally occurring materials are usually classified as inert waste and several lines of evidence may be used to confirm the classification; evidence can include geo-environmental investigation findings and chemical laboratory testing where appropriate,

although the receiver is not obligated to accept the waste and they may have their own criteria to fulfil before accepting materials.

14.2 Physical Appearance of the Waste

Made Ground materials with hydrocarbon odours and / or the visual presence of hydrocarbons (as oil staining or separate phase hydrocarbons) would need to undergo a separate hazardous waste assessment to determine the most appropriate disposal route. This applies to materials represented by sample LB_21_01_BH at 0.15m (Section 2 Stanlow AGI, elevated PID reading).

Other contaminated made ground is likely to be encountered at these locations that requires further waste assessment.

The majority of the made ground contained no visual or olfactory evidence of significant contamination. No visible fragments of asbestos were reported as seen during the site investigation and sample preparation. Asbestos fibres were not detected in any of the samples.

The made ground overlies predominately natural and uncontaminated superficial and solid geology materials.

The excavations across the route will be a mixture of made ground, topsoil and underlying natural strata (superficial and solid geology).

14.3 Chemical Composition of the Waste

A total of 111 basic characterisation test suites were undertaken on soils and four samples (two samples of made ground and two samples of natural soil) were also scheduled for landfill WAC analysis as detailed in the Laboratory Report (2022).

Made Ground: None of the samples detected the presence of asbestos. An initial waste classification is presented in Table 14.1 and identifies the need for further assessment.

Natural Ground: Some of the natural ground has been contaminated and requires further assessment prior to disposal. It could be assumed that where hydrocarbons have been detected in groundwater then natural ground may be contaminated on excavation. Therefore at locations:

- LB_21_01_BH – Stanlow Oil Refinery
- LB_21_160_BH – Point of Ayr

Additional samples of natural ground will need to be taken and tested for the contaminants of concern prior to disposal or reuse.

Table 14.1: Made Ground Contaminant Summary

Section Ref.	Hole ID	Depth	Material Type	Description	Initial Waste Classification
GtS_1_Pipeline	LB_21_210_CPT	0.60	Made Ground	Slight bituminous odour at the base of the Made Ground.	TBC
StF_2_Pipeline	LB_21_07_BH	0.70	Made Ground	No significant contamination.	Non-hazardous
StF_2_Rockbank BVS	LB_21_21_BH	0.90	Made Ground	No significant contamination.	Non-hazardous
StF_2_Stanlow AGI	LB_21_01_BH	0.15	Made Ground	Elevated soil headspace reading (455ppm). Materials require a hazardous waste assessment.	Potentially Hazardous
StF_3_Pipeline	LB_21_39_TP	0.20	Made Ground	No significant contamination.	Non-hazardous
StF_4_Pipeline	LB_21_47_BH	0.30	Made Ground	TPH Detected in Soil – requires further waste assessment.	TBC
StF_4_Pipeline	LB_21_49_BH	0.30	Made Ground	Slightly elevated lead and zinc.	Non-hazardous
StF_5_Pipeline	LB_21_106_TP	0.30	Made Ground	No significant contamination.	Non-hazardous
StF_5_Pipeline	LB_21_109_TP	0.95	Made Ground	Sample contains organic material (8.9% TOC).	TBC
StF_5_Pipeline	LB_21_109_TP	1.40	Made Ground	No significant contamination. Leachable contaminants within inert WAC limits. Note: MG is 3.6m depth, requires further assessment.	Non-hazardous*
StF_5_Pipeline	LB_21_58_TP	0.40	Made Ground	Made Ground contains asphalt fragments but no significant contamination detected. Waste receiver to confirm acceptance.	TBC
StF_5_Pipeline	LB_21_69_TP	0.20	Made Ground	No significant contamination.	Non-hazardous
StF_5_Pipeline	LB_21_69_TP	0.90	Made Ground	No significant contamination.	Non-hazardous
Separate Phase_8_Point of Ayr	LB_21_160_BH	0.20	Made Ground	No significant contamination.	Non-hazardous
Separate Phase_8_Point of Ayr	LB_21_160_BH	0.40	Made Ground	Low concentrations TPH detected.	Non-hazardous
Separate Phase_8_Point of Ayr	LB_21_160_BH	0.90	Made Ground	Low concentrations TPH detected.	Non-hazardous

Section Ref.	Hole ID	Depth	Material Type	Description	Initial Waste Classification
Separate Phase_8_Point of Ayr	LB_21_161_BH	0.20	Made Ground	No significant contamination.	Non-hazardous
Separate Phase_8_Point of Ayr	LB_21_161_BH	0.40	Made Ground	No significant contamination.	Non-hazardous
Separate Phase_8_Point of Ayr	LB_21_161_BH	0.90	Made Ground	No significant contamination.	Non-hazardous
Separate Phase_8_Point of Ayr	LB_21_162_IP	0.00	Made Ground	No significant contamination.	Non-hazardous
Separate Phase_8_Point of Ayr	LB_21_162_IP	0.30	Made Ground	No significant contamination.	Non-hazardous
Separate Phase_8_Point of Ayr	LB_21_163_IP	0.00	Made Ground	No significant contamination. MG depth not proved.	Non-hazardous
Separate Phase_8_Point of Ayr	LB_21_163_IP	0.30	Made Ground	No significant contamination. MG depth not proved.	Non-hazardous
Separate Phase_8_Point of Ayr	LB_21_164_IP	0.00	Made Ground	No significant contamination. MG depth not proved.	Non-hazardous
Separate Phase_8_Point of Ayr	LB_21_164_IP	0.30	Made Ground	No significant contamination. MG depth not proved.	Non-hazardous

Notes:
TBC: Waste Classification is To Be Confirmed through separate sampling and testing (insufficient information).
Non-hazardous*: Made Ground is unlikely to be classified as inert without further assessment.
Potentially Hazardous: Materials require further assessment before classification.

On the basis of the above and the other ground information collected it should be assumed that Made Ground and some of the natural arisings from the Stanlow Oil Refinery would be classified as hazardous waste from hydrocarbon contamination, until proved otherwise through detailed waste assessment.

The limitations of this preliminary assessment have been identified in the table above and further testing will be required throughout the construction phase prior to disposal.

15. Conclusions and Recommendations

15.1 Conclusions

Soil – no concentrations were recorded above the GAC, and soil contamination risk to end users is not thought to be significant. Asbestos not detected in any soil sample.

Groundwater – LB_21_01_BH, LB_21_ 05_BH, LB_21_11_BH and LB_21_160_BH identified hydrocarbon contamination that may be a risk to controlled waters / buildings and structures / human health during construction (vapours), additional monitoring, sampling and risk assessment is required in those areas.

Ground Gas - high VOC results measured in LB_21_01_BH associated with the Stanlow Oil Refinery need further assessment. For bulk gases, high groundwater levels meant very little unsaturated zone was monitored, and the monitoring wells were not designed for ground gas, resulting in inconclusive results.

15.2 Recommendations

The following sections highlight areas where it is considered additional ground investigation or further monitoring is required.

15.2.1 Stanlow

LB_21_01_BH, Section 2 (chainage 0m) within the Stanlow Refinery area: elevated PID readings and TPH concentrations are indicative of contamination entering groundwater. It is possible that fire-fighting foams used within the refinery area may have contaminated groundwater with Perfluorooctane sulfonate (PFOS), Perfluorooctanoic acid (PFOA) and Per and polyfluorinated alkyl substances (PFAS). It is recommended that additional ground investigation is carried out in the area to further refine our understanding of ground conditions and extent of the contamination. This could comprise of 4-6 Window sample holes with appropriate gas and water standpipes located around the current location.

15.2.2 M56

LB_21_05_BH (36" pipeline chainage 1600m) is marginally exceeding the WQS for hydrocarbons. Although, this exceedance is not considered significant it is recommended that, in the first instance, an additional groundwater sample is taken from the existing installation. If this indicates the present of hydrocarbons again, then additional investigation may be required in the area to determine source and extent.

15.2.3 River Gowy

LB_21_11_BH (36" Pipeline Chainage 3200m) may have recorded elevated levels of TPH due drilling fluids present at the time of sampling (as this was done whilst drilling) or potentially associated with the peat. If required additional investigation including appropriate water sampling could be considered to confirm.

15.2.4 Gladstone Way

LB_21_109_BH at chainage 21000m (36" pipeline), Gladstone way requires further investigation due to the high gas levels recorded. It is recommended that a further review of the potential sources and some additional investigation work, comprising of 4-6 Window Sample holes and installations are undertaken to determine if the gassing in the area requires additional remediation measures to prevent migration along the pipeline.

15.2.5 Alltami Brook

LB_21_108_BH was never performed due to access limitations at the time, this is near to Alltami Brook, chainage 26200m (36" pipeline) ground investigation is still required in this area as it is believed to have been associated with, coal workings including open cast activities and could be a potential source for gas.

15.2.6 Point of Ayr Gas Terminal

Elevated TPH readings at borehole LB_21_160_BH (within Point of Ayr Gas Terminal) indicate that some additional ground investigation is recommended for Point of Ayr to identify the source and improve our understanding of ground conditions. 4-6 Window samples with associated installations should be sufficient.

15.2.7 AGI's and BVS's

During the investigation the location of the AGI's and BVS's were still being assessed. It is recommended that once these are finalised the new locations are reviewed in conjunction with the existing investigation data to determine if further investigation is required.

15.2.8 Groundwater sampling

It is recommended that 2 further groundwater sampling visits are undertaken at the monitoring wells that have been installed to date. This can be included within the additional GI works that have been proposed above.

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Appendix A

Guidelines on Use of Report

Appendix A Contents

A.1 Limitations and Use of Data

This report (the 'Report') was prepared as part of the services (the 'Services') provided by Fugro GeoServices Limited ('Fugro') for its client (the 'Client') under the terms of the relevant contract between the two parties (the 'Contract'). The Services were performed by Fugro based on requirements of the Client set out in the Contract or otherwise made known by the Client to Fugro at the time.

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Appendix B

Drawings

Appendix B Contents

B.1 Plans and Map Sections

Radon Map

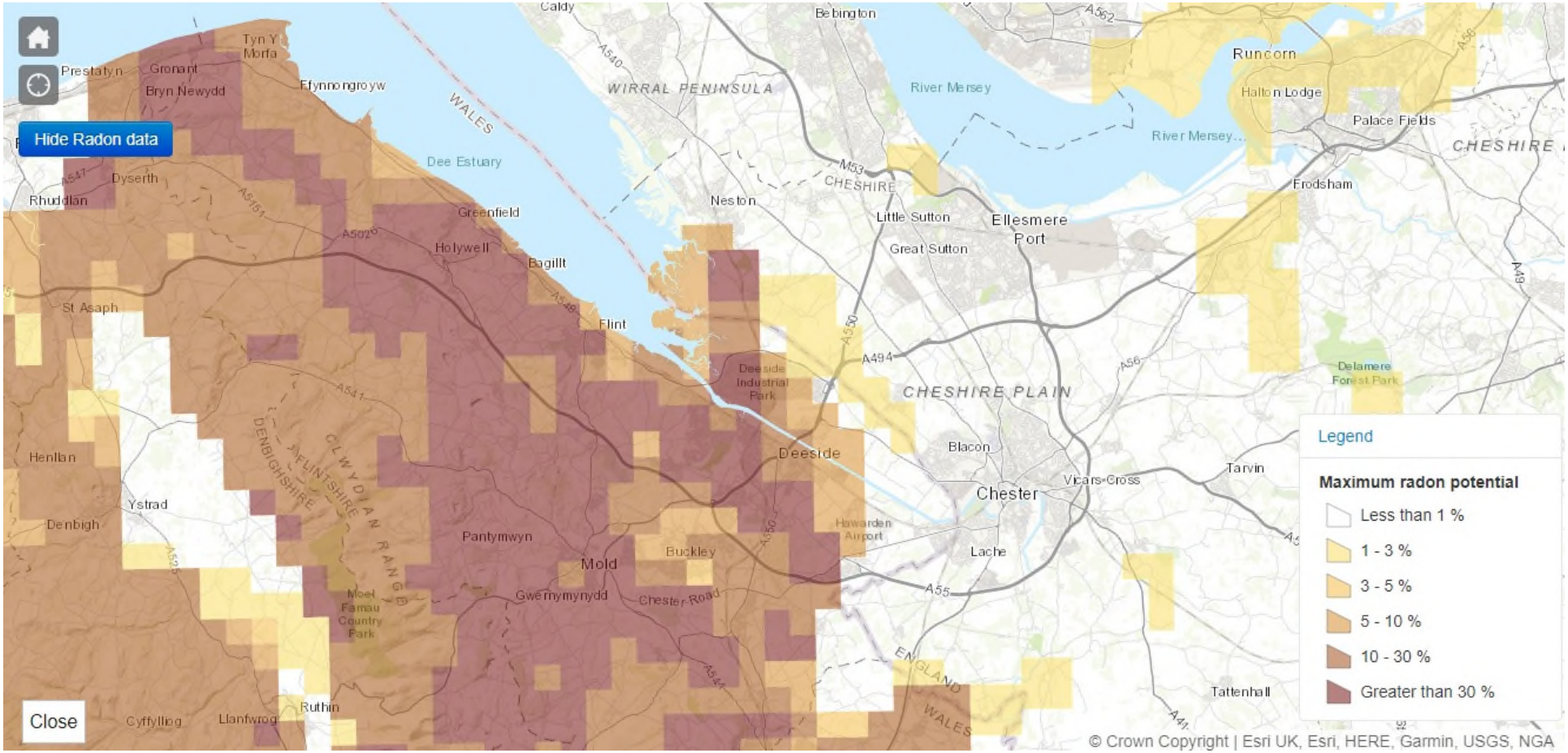


Figure B.1: Radon Map for Site area (UKHSA, 2022)

Appendix C

Geochemical Laboratory Testing Data

Appendix C Contents

C.1 Section 1; Concrete Classification

Table C.1: Concrete Classification Section 1

Strata	Locations	pH values		SO4 Values (mg/l)		Design SO_4 Class	ACEC Class
		Min	Max	Min	Max		
Topsoil	LB_21_210_BH	7.23		25.85		DS-1	AC-1d
Tidal Flat Deposits (TFD) - Clay	LB_21_202_CPT LB_21_213_CPT	7.63	8.2	12.77	222.54	DS-1	AC-1d
Tidal Flat Deposits (TFD) - Peat	LB_21_203_CPT	4.66		517.16		DS-2	AC-3z
Glacial Till Deposits	LB_21_206_CPT LB_21_208_TP LB_21_205_TP LB_21_207_CPT LB_21_206_BH	6.93	8.20	22.50	78.81	DS-1	AC-1d
Chester Formation	LB_21_210_BH	7.6		34.80		DS-1	AC-1d

C.2 Section 2; Concrete Classification

Table C.2: Concrete Classification Section 2

Strata	Locations	pH values		SO4 Values (mg/l)		Design SO_4 Class	ACEC Class
		Min	Max	Min	Max		
Made Ground	LB_21_210_BH	7.41		11.50		DS-1	AC-1d
Topsoil	LB_21_12_BH	4.50		115.73		DS-1	AC-2z
Tidal Flat Deposits (TFD) - Clay	LB_21_11_BH LB_21_115_TP	5.56	7.71	10.20	135.36	DS-1	AC-1d
Tidal Flat Deposits (TFD) - Sand	LB_21_11_BH	3.06		2087.7		DS-3	AC-4
Tidal Flat Deposits (TFD) - Peat	LB_21_114_TP LB_21_11_BH LB_21_12_BH	4.66	6.78	36.15	2326.28	DS-3	AC-4
Wind Blown Deposits	LB_21_08_BH LB_21_114_BH	7.63	7.77	6.94	7.44	DS-1	AC-1d
Glacial Till Deposits	LB_21_22_TP LB_21_18_BH LB_21_06_BH LB_21_02_BH LB_21_04_TP LB_21_102_TP LB_21_06_BH LB_21_05_BH LB_21_112_BH LB_21_05_BH LB_21_14_TP LB_21_03_TP LB_21_13_BH	6.60	8.72	10.31	309.59	DS-1	AC-1d
Chester Formation	LB_21_08_BH LB_21_02_BH LB_21_113_TP LB_21_20_TP LB_21_07_BH LB_21_21_BH LB_21_101_TP	7.01	8.91	10.64	130.86	DS-1	AC-1d

C.3 Section 3; Concrete Classification

Table C.3: Concrete Classification Section 3

Strata	Locations	pH values		SO4 Values (mg/l)		Design SO_4 Class	ACEC Class
		Min	Max	Min	Max		
Tidal Flat Deposits (TFD) - Sand	LB_21_40_TP	8.66		10.26		DS-1	AC-1
Glacial Till Deposits	LB_21_38_BH LB_21_40_TP LB_21_32_BH LB_21_30_BH LB_21_98_TP LB_21_99_BH LB_21_97_TP LB_21_39_TP LB_21_31_TP LB_21_33_BH LB_21_36_TP LB_21_35_TP LB_21_96_TP LB_21_26_TP	7.18	8.66	10.26	1731.24	Generally, DS -1 DS – 3 at LB_21_99_BH	Generally, AC-1 AC – 3 at LB_21_99_BH

C.4 Section 4; Concrete Classification

Table C.4: Concrete Classification Section 4

Strata	Locations	pH values		SO4 Values (mg/l)		Design SO_4 Class	ACEC Class
		Min	Max	Min	Max		
Tidal Flat Deposits (TFD) - Clay	LB_21_53_TP LB_21_44_BH LB_21_54_BH	6.65	8.34	11.58	3267.09	DS-1 / DS-4	AC-1d / AC-4
Tidal Flat Deposits (TFD) - Sand	LB_21_43_TP LB_21_44_BH LB_21_55_BH LB_21_44_BH LB_21_42_TP	7.97	8.41	26.21	290.40	DS - 1	AC-1d
Tidal Flat Deposits (TFD) - Peat	LB_21_51_BH LB_21_50_TP LB_21_55_BH	6.70	7.74	39.22	3233.67	DS-1 / DS-4	AC -1d / AC-4
Glacial Till Deposits	LB_21_55_BH LB_21_56_BH LB_21_51_BH LB_21_52_BH LB_21_110_BH LB_21_54_BH	7.88	9.08	25.64	247.89	DS – 1	AC - 1

C.5 Section 5; Concrete Classification

Table C.5: Concrete Classification Section 5

Strata	Locations	pH values		SO4 Values (mg/l)		Design SO_4 Class	ACEC Class
		Min	Max	Min	Max		
Made Ground	LB_21_109_BH	7.61		21.96		DS - 1	AC-1d
Glaciofluvial Deposits , Devensian	LB_21_60_BH LB_21_64_BH	7.69	7.75	7.91	63.08	DS-1	AC-1d
Glacial Till Deposits	LB_21_66_TP LB_21_74_BH LB_21_95_BH LB_21_59_BH LB_21_92A_TP LB_21_73_BH LB_21_70_TP LB_21_75_TP LB_21_58_TP LB_21_76_TP LB_21_59_BH LB_21_94_TP	5.98	9.18	3.53	125.33	DS-1	AC-1d
Hollin Rock Formation	LB_21_105_TP	7.44		2.10		DS-1	AC-1d
Pennine Middle Coal Measures Formation	LB_21_69_TP LB_21_103_BH LB_21_109_BH LB_21_74_BH LB_21_73_BH	7.37	8.05	8.98	89.04	DS-1	AC-1d

C.6 Section 6; Concrete Classification

Table C.6: Concrete Classification Section 6

Strata	Locations	pH values		SO4 Values (mg/l)		Design SO_4 Class	ACEC Class
		Min	Max	Min	Max		
Head Deposits	LB_21_79_TP	7.86		12.36		DS-1	AC-1d
Glacial Till Deposits	LB_21_89_TP LB_21_88_BH LB_21_87_TP LB_21_78_BH LB_21_81_BH LB_21_85_BH LB_21_77_BH LB_21_82_TP LB_21_80_TP LB_21_84_TP LB_21_83B_TP	7.42	8.47	6.52	109.33	DS-1	AC-1d

C.7 Section 7; Concrete Classification

Table C.7: Concrete Classification Section 7

Strata	Locations	pH values		SO4 Values (mg/l)		Design SO_4 Class	ACEC Class
		Min	Max	Min	Max		
Glacial Till Deposits	LB_21_307_TP LB_21_302_TP LB_21_309_TP LB_21_305_TP LB_21_311_TP LB_21_304_TP LB_21_306_TP LB_21_310_TP LB_21_308_TP LB_21_301_TP	6.37	8.16	7.44	17.13	DS-1	AC-1d

C.8 Section 8; Concrete Classification

Table C.8: Concrete Classification Section 8

Strata	Locations	pH values		SO4 Values (mg/l)		Design SO_4 Class	ACEC Class
		Min	Max	Min	Max		
Made Ground	LB_21_160_BH LB_21_161_BH	7.68	8.86	9.97	28.64	DS-1	AC-1d
Tidal Flat Deposits (TFD) - Clay	LB_21_160_BH	8.06		31.63		DS-1	AC-1d
Tidal Flat Deposits (TFD) - Sand	LB_21_160_BH LB_21_161_BH	6.72	9.04	117.67	1164.09	DS-1 / DS-2	AC-1s / AC-2
Tidal Flat Deposits (TFD) - Silt	LB_21_161_BH	6.76		530.62		DS-2	AC-2

Appendix D

Geoenvironmental Insitu Testing Data

Appendix D Contents

D.1 YSI Calibration Certificates

D.2 PID Calibration Certificates

The PID Calibration certificates below are;

- 257740 certifies Tiger PID: T-118424, and;
- 257741 certifies Tiger PID: T-118425.

Appendix E

Fugro Generic Assessment Criteria (GACs)

Appendix E Contents

E.1 Generic Assessment Criteria (GACs)

E.1.1 Generic Metals

Table E.1: Generic Assessment Criteria; Generic Metals

		Critical Conc. (C_C) mg/kg						
	Analyte	Residential with Homegrown Produce	Residential without Home Grown Produce	Allotment	Commercial	Public Open Space Residential	Public Open Space - Park	Note
Generic Metals	Arsenic	37	40	43	640	79	170	1
	Cadmium	11	85	1.9	190	120	532	1
	Chromium III	910	910	18000	8600	1500	33000	1
	Chromium VI	6	6	1.8	33	7.7	220	1
	Copper	2400	7100	520	68000	12000	44000	1
	Lead	200	310	80	1100	630	1300	
	Mercury	40	56	19	1100	120	240	1
	Nickel	180	180	230	980	230	3400	1
	Selenium	250	430	88	12000	1100	1800	1
	Zinc	3700	400000	620	7300000	81000	170000	1
	Cyanide	34(3)						

E.1.2 Polycyclic Aromatic Hydrocarbons (PAHs)

Table E.2: Generic Assessment Criteria; PAHs

Analyte	Critical Conc. (C_C) mg/kg																		Note TOC x 1.72 = SOM
	Residential with Homegrown Produce			Residential without Home Grown Produce			Allotment			Commercial			Public Open Space Residential			Public Open Space - Park			
SOM	1%	2.5%	6%	1%	2.5%	6%	1%	2.5%	6%	1%	2.5%	6%	1%	2.5%	6%	1%	2.5%	6%	
Acenaphthene	210	510	1100	3000	4700	6000	34	85	200	84000	97000	100000	15000	15000	15000	29000	30000	30000	1
Acenaphthylene	170	420	920	2900	4600	6000	28	69	160	83000	97000	100000	15000	15000	15000	29000	30000	30000	1
Anthracene	2400	5400	11000	31000	35000	37000	380	950	2200	520000	540000	540000	74000	74000	74000	150000	150000	150000	1
Benzo(a)anthracene	7.2	11	13	11	14	15	2.9	6.5	13	170	170	180	29	29	29	49	56	62	1
Benzo(a)pyrene	2.2	2.7	3	3.2	3.2	3.2	0.97	2	3.5	35	35	36	5.7	5.7	5.7	11	12	13	1
Benzo(b)fluoranthene	2.6	3.3	3.7	3.9	4	4	0.99	2.1	3.9	44	44	45	7.1	7.2	7.2	13	15	16	1
Benzo(ghi)perylene	320	340	350	360	360	360	290	470	640	3900	4000	4000	640	640	640	1400	1500	1600	1
Benzo(k)fluoranthene	77	93	100	110	110	110	37	75	130	1200	1200	1200	190	190	190	370	410	440	1
Chrysene	15	22	27	30	31	32	4.1	9.4	19	350	350	350	57	57	57	93	110	120	1
Dibenz(ah)anthracene	0.24	0.28	0.3	0.31	0.32	0.32	0.14	0.27	0.43	3.5	3.6	3.6	0.57	0.57	0.58	1.1	1.3	1.4	1
Fluoranthene	280	560	890	1500	1600	1600	52	130	290	23000	23000	23000	3100	3100	3100	6300	6300	6400	1
Fluorene	170	400	860	2800	3800	4500	27	67	160	63000	68000	71000	9900	9900	9900	23000	20000	20000	1
Indeno(123cd)pyrene	27	36	41	45	46	46	9.5	21	39	500	510	510	82	82	82	150	170	180	1
Naphthalene	2.3	5.6	13	2.3	5.6	13	4.1	10	24	190	460	1100	4900	4900	4900	1200	1900	3000	1
Phenanthrene	95	220	440	130	1500	1500	15	38	90	220000	22000	23000	3100	3100	3100	6200	6200	6300	1
Pyrene	620	1200	2000	3700	3800	3800	110	270	620	54000	54000	54000	7400	7400	7400	15000	15000	15000	1

E.1.3 Total Petroleum Hydrocarbons (TPHs)

Table E.3: Generic Assessment Criteria; TPHs

		Critical Conc. (C_C) mg/kg																	
	Analyte	Residential with Homegrown Produce			Residential without Home Grown Produce			Allotment			Commercial			Public Open Space Residential			Public Open Space - Park			Note TOC x 1.72 = SOM
	SOM	1%	2.5%	6%	1%	2.5%	6%	1%	2.5%	6%	1%	2.5%	6%	1%	2.5%	6%	1%	2.5%	6%	
TPH's	Speciated TPHs (Ali/Aro)																			1
	Aliphatic C_5-C_6	42	78	160	42	78	160	730	1700	3900	3200	5900	12000	570000	590000	600000	95000	130000	180000	1
	Aliphatic C_6-C_8	100	230	530	100	230	530	2300	5600	13000	7800	17000	40000	60000	610000	620000	150000	220000	320000	1
	Aliphatic C_8-C_{10}	27	65	150	27	65	150	320	770	1700	2000	4800	11000	13000	13000	13000	14000	18000	21000	1
	Aliphatic C_{10}-C_{12}	130	330	760	130	330	770	2200	4400	7300	9700	23000	47000	13000	13000	13000	21000	23000	24000	1
	Aliphatic C_{12}-C_{16}	1100	2400	4300	1100	2400	4400	11000	13000	13000	59000	82000	90000	13000	13000	13000	25000	25000	26000	1
	Aliphatic C_{16}-C_{35}	65000	92000	110000	65000	92000	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	1
	Aliphatic C_{35}-C_{44}	65000	92000	110000	65000	92000	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	1
	Aromatics C_5-C_7	70	140	300	370	690	1400	13	27	57	26000	46000	86000	56000	56000	56000	76000	84000	92000	1
	Aromatics C_7-C_8	130	290	660	860	1800	3900	22	51	120	56000	110000	180000	56000	56000	56000	87000	95000	100000	1
	Aromatics C_8-C_{10}	34	83	190	47	110	270	8.6	21	51	3500	8100	17000	5000	5000	5000	7200	8500	9300	1
	Aromatics C_{10}-C_{12}	74	180	380	250	590	1200	13	31	74	16000	28000	36000	5000	5000	5000	9200	9700	10000	1
	Aromatics C_{12}-C_{16}	140	330	660	1800	2300	2500	23	57	130	36000	37000	38000	5100	5100	5000	10000	10000	10000	1
	Aromatics C_{16}-C_{21}	260	540	930	1900	1900	1900	46	110	260	28000	28000	28000	3800	3800	3800	7600	7700	7800	1
	Aromatics C_{21}-C_{35}	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	1
	Aromatics C_{35}-C_{44}	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	1
	Ali/Aro C_{44}-C_{70} Total	1600	1800	1900	1900	1900	1900	1200	2100	3000	28000	28000	28000	3800	3800	3800	7800	7800	7900	1
	MBTE																			

E.2 Fugro Generic Assessment Criteria (GACs)

E.2.1 Section 1 Grinsome AGI

E.2.1.1 Metal Screening Summary

Table E.4: Grinsome Road AGI Generic Metal Screening Summary

Geology		Topsoil		Tidal Flat Deposits	
No. of Samples		1		4	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C
Arsenic	170	11.9	No	16.5	No
Cadmium	532	0.4	No	0.1	No
Chromium III	33000	24.2	No	32.9	No
Chromium VI	220	0.0	No	0.0	No
Copper	44000	25.2	No	22.8	No
Lead	1300	50.1	No	25.6	No
Mercury	240	0.1	No	0.0	No
Nickel	3400	17.1	No	29.9	No
Selenium	1800	0.1	No	0.5	No
Zinc	170000	79.2	No	70.7	No
Cyanide	34	0.6	No	0.0	No

(1) = LQM/CIEH S4UL's – Commercial, (2) = CL:AIRE C4SLs – Commercial, (3) = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit

E.2.1.2 PAHs and TPHs Screening Summary

Table E.5: Grinsome Road AGI PAHs and TPHs Screening Summary

Geology		Topsoil		Tidal Flat Deposits	
No. of Samples		1		4	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Speciated PAHs					
Acenaphthene	30000	<0.01	No	<0.01	No
Acenaphthylene	30000	<0.01	No	0.02	No
Anthracene	150000	<0.01	No	<0.01	No
Benzo(a)anthracene	62	0.02	No	0.45	No
Benzo(a)pyrene	13	0.01	No	0.02	No
Benzo(b)fluoranthene	16	0.01	No	<0.01	No
Benzo(ghi)perylene	1600	<0.01	No	0.01	No
Benzo(k)fluoranthene	440	0.01	No	0.01	No
Chrysene	120	<0.01	No	0.06	No
Dibenz(ah)anthracene	1.4	<0.01	No	0.01	No
Fluoranthene	6400	0.03	No	0.14	No
Fluorene	20000	<0.01	No	0.03	No
Indeno(123cd)pyrene	180	<0.01	No	0.08	No
Naphthalene	3000	<0.01	No	0.03	No
Phenanthrene	6300	0.02	No	0.15	No
Pyrene	15000	0.03	No	0.12	No
Speciated TPHs (Ali/Aro)					
Aliphatic C_5-C_6	180000	0.01	No	0.01	No
Aliphatic C_6-C_8	320000	0.01	No	0.01	No
Aliphatic C_8-C_{10}	21000	0.01	No	0.01	No
Aliphatic C_{10}-C_{12}	24000	<0.01	No	<0.01	No
Aliphatic C_{12}-C_{16}	26000	<0.01	No	<0.01	No
Aliphatic C_{16}-C_{21}	490000	<0.01	No	<0.01	No
Aliphatic C_{21}-C_{35}	490000	<0.01	No	<0.01	No
Aliphatic C_{35}-C_{44}	490000	<0.01	No	<0.01	No
Aliphatic C_{10}-C_{44}	490000	<0.01	No	<0.01	No
Aromatics C_5-C_7	92000	0.01	No	0.01	No
Aromatics C_7-C_8	100000	0.01	No	0.01	No
Aromatics C_8-C_{10}	9300	0.01	No	<0.01	No
Aromatics C_{10}-C_{12}	10000	<0.01	No	<0.01	No

Geology		Topsoil		Tidal Flat Deposits	
No. of Samples		1		4	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Aromatics C_{12}-C_{16}	10000	<0.01	No	<0.01	No
Aromatics C_{16}-C_{21}	7800	<0.01	No	<0.01	No
Aromatics C_{21}-C_{35}	7900	<0.01	No	<0.01	No
Aromatics C_{35}-C_{44}	7900	<0.01	No	<0.01	No
Aromatics C_{10}-C_{44}	7900	<0.01	No	<0.01	No
Ali/Aro C_{10}-C_{44} Total		<0.01	No	<0.01	No
MBTE		0.01	No	0.01	No
C_5-C_{10} Gasoline Range Organiser (GRO)	25000	0.10	No	0.1	No
[1] = LQM/CIEH S4UL's – POS Park – 2.5% SOM, [2] = CL:AIRE C4SLs – POS Park – 2.5% SOM, [3] = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit SOM:					

E.2.1.3 Asbestos Screening

Table E.6: Grinsome Road AGI Asbestos Screening Summary

Strata	Locations	Depth (m)	Results
Topsoil/Made Ground	LB_21_202_CPT	0.1	NAD
Tidal Flat Deposits	LB_21_202_CPT LB_21_212_CPT LB_21_213_CPT LB_21_214_CPT	0.5 – 0.9	NAD
Notes: NAD – No Asbestos Detected			

E.2.2 Section 1 Pipeline

E.2.2.1 Metal Screening Summary

Table E.7: Section 1 Pipeline Generic Metal Screening Summary

Geology		Topsoil		Made Ground		Tidal Flat Deposits	
No. of Samples		3		1		7	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C
Arsenic	170	17.6	No	6.6	No	17.8	No
Cadmium	532	0.32	No	0.5	No	0.2	No
Chromium III	33000	41.2	No	21.7	No	36.9	No
Chromium VI	220	0.0	No	0.0	No	0.0	No
Copper	44000	49.5	No	21.1	No	43.0	No
Lead	1300	81.1	No	27.6	No	28.0	No
Mercury	240	0.1	No	0.1	No	0.0	No
Nickel	3400	34.6	No	11.9	No	35.8	No
Selenium	1800	0.2	No	0.2	No	1.1	No
Zinc	170000	95.1	No	72.1	No	90.0	No
Cyanide	34	0.6	No	0.4	No	0.2	No

(1) = LQM/CIEH S4UL's – Commercial, (2) = CL:AIRE C4SLs – Commercial, (3) = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit

E.2.2.2 PAHs and TPHs Screening Summary

Table E.8: Section 1 Pipeline PAHs and TPHs Screening Summary

Geology		Topsoil		Made Ground		Shallow drift deposits	
No. of Samples		3		1		7	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Speciated PAHs							
Acenaphthene	30000	<0.01	No	<0.01	No	<0.01	No
Acenaphthylene	30000	<0.01	No	<0.01	No	<0.01	No
Anthracene	150000	<0.01	No	<0.01	No	0.01	No
Benzo(a)anthracene	62	0.03	No	0.03	No	0.07	No
Benzo(a)pyrene	13	0.02	No	0.03	No	0.05	No
Benzo(b)fluoranthene	16	0.03	No	0.04	No	<0.01	No
Benzo(ghi)perylene	1600	<0.01	No	<0.01	No	<0.01	No
Benzo(k)fluoranthene	440	0.01	No	0.02	No	<0.01	No
Chrysene	120	0.02	No	0.05	No	0.02	No
Dibenz(ah)anthracene	1.4	<0.01	No	<0.01	No	0.02	No
Fluoranthene	6400	0.03	No	0.08	No	0.02	No
Fluorene	20000	0.01	No	<0.01	No	<0.01	No
Indeno(123cd)pyrene	180	<0.01	No	<0.01	No	0.03	No
Naphthalene	3000	<0.01	No	<0.01	No	<0.01	No
Phenanthrene	6300	0.02	No	0.04	No	0.01	No
Pyrene	15000	0.03	No	0.08	No	0.02	No

Geology		Topsoil		Made Ground		Shallow drift deposits	
No. of Samples		3		1		7	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Speciated TPHs (Ali/Aro)							
Aliphatic C_5-C_6	180000	0.01	No	0.01	No	0.01	No
Aliphatic C_6-C_8	320000	0.01	No	0.01	No	0.01	No
Aliphatic C_8-C_{10}	21000	0.01	No	0.01	No	0.01	No
Aliphatic C_{10}-C_{12}	24000	<0.01	No	<0.01	No	<0.01	No
Aliphatic C_{12}-C_{16}	26000	<0.01	No	<0.01	No	<0.01	No
Aliphatic C_{16}-C_{21}	490000	<0.01	No	<0.01	No	<0.01	No
Aliphatic C_{21}-C_{35}	490000	<0.01	No	<0.01	No	15.24	No
Aliphatic C_{35}-C_{44}	490000	<0.01	No	<0.01	No	<0.01	No
Aliphatic C_{10}-C_{44}	490000	<0.01	No	<0.01	No	<0.01	No
Aromatics C_5-C_7	92000	0.01	No	0.01	No	0.01	No
Aromatics C_7-C_8	100000	0.01	No	0.01	No	0.01	No
Aromatics C_8-C_{10}	9300	0.01	No	0.01	No	0.01	No
Aromatics C_{10}-C_{12}	10000	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{12}-C_{16}	10000	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{16}-C_{21}	7800	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{21}-C_{35}	7900	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{35}-C_{44}	7900	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{10}-C_{44}	7900	<0.01	No	<0.01	No	<0.01	No
Ali/Aro C_{10}-C_{44} Total		<0.01	<0.01	<0.01	No	15.32	No

Geology		Topsoil		Made Ground		Shallow drift deposits	
No. of Samples		3		1		7	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
MBTE		0.01	0.01	0.01	No	0.01	No
C_5-C_{10} Gasoline Range Organiser (GRO)	25000	0.10	0.10	0.10	No	0.10	No
[1] = LQM/CIEH S4UL's – POS Park – 2.5% SOM, [2] = CL:AIRE C4SLs – POS Park – 2.5% SOM, [3] = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit SOM:							

E.2.2.3 Asbestos Screening

Table E.9: Section 1 Pipeline Asbestos Screening Summary

Strata	Locations	Depth (m)	Results
Topsoil	LB_21_203_CPT LB_21_205_TP LB_21_208_TP	0.1 - 0.2	NAD
Made Ground	LB_21_210_CPT	0.6	NAD
Tidal Flat Deposits	LB_21_202_BH LB_21_203_BH LB_21_203_CPT LB_21_213_BH	0.4 – 1.0	NAD
Glacial Till Deposits	LB_21_206_BH LB_21_207_CPT	0.6 – 0.9	NAD
Notes: NAD – No Asbestos Detected			

E.2.3 Section 2 Pipeline

E.2.3.1 Metal Screening Summary

Table E.10: Section 2 Pipeline Generic Metal Screening Summary

Geology		Topsoil		Made Ground		Tidal Flat Deposits		Glaciofluvial Deposits, Devensian		Glacial Till Deposits		Windblown Deposits		Peat		Chester Formation	
No. of Samples		6		2		6		2		14		2		3		2	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Arsenic	170	10.4	No	8.6	No	22.4	No	8.5	No	9.1	No	1.2	No	19.1	No	3.3	No
Cadmium	532	0.2	No	0.4	No	0.3	No	0.3	No	0.2	No	0.0	No	0.2	No	0.1	No
Chloride		-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.9	No
Chromium III	33000	20.8	No	21.5	No	35.9	No	27.8	No	38.8	No	4.2	No	14.8	No	13.2	No
Chromium VI	220	0.0	No	0.0	No	0.0	No	0.0	No	0.0	No	0.0	No	0.0	No	0.0	No
Copper	44000	26.6	No	18.4	No	33.8	No	20.2	No	26.9	No	7.0	No	15.4	No	9.2	No
Fluoride		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.3	No
Lead	1300	36.7	No	28.0	No	23.4	No	34.0	No	57.7	No	4.3	No	10.0	No	5.9	No
Mercury	240	0.2	No	0.0	No	0.1	No	0.0	No	0.02	No	0.0	No	0.1	No	0.0	No
Nickel	3400	12.4	No	17.9	No	25.4	No	28.1	No	39.6	No	3.3	No	11.4	No	10.5	No
Selenium	1800	0.1	No	0.2	No	0.9	No	0.3	No	0.2	No	0.0	No	0.7	No	0.1	No
Zinc	170000	48.9	No	77.5	No	43.8	No	66.1	No	218.4	No	7.8	No	25.2	No	25.5	No
Cyanide	34	0.8	No	0.5	No	1.44	No	4.9	No	0.3	No	0.0	No	0.5	No	0.0	No

(1) = LQM/CIEH S4UL's – Commercial, (2) = CL:AIRE C4SLs – Commercial, (3) = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit

E.2.3.2 PAHs and TPHs Screening Summary

Table E.11: Section 2 Pipeline PAHs and TPHs Screening Summary

Geology		Topsoil		Made Ground		Tidal Flat Deposits		Glaciofluvial Deposits, Devensian		Glacial Till Deposits		Windblown Deposits		Peat		Chester Formation	
No. of Samples		6		2		6		2		14		2		3		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Speciated PAHs																	
Acenaphthene	30000	<0.01	No	0.05	No	<0.01	No	<0.01	No	0.06	No	<0.01	No	<0.01	No	<0.01	No
Acenaphthylene	30000	<0.01	No	0.02	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No
Anthracene	150000	<0.01	No	0.13	No	0.03	No	<0.01	No	0.03	No	<0.01	No	0.01	No	<0.01	No
Benzo(a)anthracene	62	0.37	No	0.14	No	0.25	No	<0.01	No	0.03	No	0.02	No	0.03	No	0.02	No
Benzo(a)pyrene	13	0.03	No	0.08	No	0.07	No	<0.01	No	0.01	No	0.01	No	0.03	No	<0.01	No
Benzo(b)fluoranthene	16	0.02	No	0.11	No	0.03	No	<0.01	No	0.03	No	0.02	No	0.02	No	<0.01	No
Benzo(ghi)perylene	1600	0.01	No	<0.01	No	<0.01	No	<0.01	No	0.01	No	<0.01	No	<0.01	No	<0.01	No
Benzo(k)fluoranthene	440	<0.01	No	0.05	No	0.02	No	<0.01	No	0.01	No	0.01	No	0.02	No	<0.01	No
Chrysene	120	0.04	No	0.16	No	0.02	No	<0.01	No	0.04	No	0.01	No	0.03	No	0.01	No
Dibenz(ah)anthracene	1.4	0.01	No	<0.01	No	0.02	No	<0.01	No	0.01	No	<0.01	No	<0.01	No	0.02	No
Fluoranthene	6400	0.06	No	0.53	No	0.15	No	<0.01	No	0.13	No	0.01	No	0.04	No	<0.01	No
Fluorene	20000	<0.01	No	0.06	No	<0.01	No	<0.01	No	0.04	No	0.01	No	0.01	No	<0.01	No
Indeno(123cd)pyrene	180	0.01	No	0.01	No	0.03	No	<0.01	No	0.01	No	0.01	No	<0.01	No	0.02	No
Naphthalene	3000	<0.01	No	0.02	No	0.01	No	<0.01	No	<0.01	No	<0.01	No	0.01	No	<0.01	No
Phenanthrene	6300	0.05	No	0.62	No	0.03	No	<0.01	No	0.07	No	0.01	No	0.04	No	<0.01	No
Pyrene	15000	0.06	No	0.42	No	0.03	No	<0.01	No	0.09	No	0.01	No	0.03	No	<0.01	No
Speciated TPHs (Ali/Aro)																	
Aliphatic C_5-C_6	180000	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No
Aliphatic C_6-C_8	320000	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No
Aliphatic C_8-C_{10}	21000	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No
Aliphatic C_{10}-C_{12}	24000	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No
Aliphatic C_{12}-C_{16}	26000	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No
Aliphatic C_{16}-C_{21}	490000	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No
Aliphatic C_{21}-C_{35}	490000	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No
Aliphatic C_{35}-C_{44}	490000	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No
Aliphatic C_{10}-C_{44}	490000	<0.01	No	<0.01	No	1.10	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No

Geology		Topsoil		Made Ground		Tidal Flat Deposits		Glaciofluvial Deposits, Devensian		Glacial Till Deposits		Windblown Deposits		Peat		Chester Formation	
No. of Samples		6		2		6		2		14		2		3		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Aromatics C_5-C_7	92000	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No
Aromatics C_7-C_8	100000	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No
Aromatics C_8-C_{10}	9300	0.01	No	0.01	No	0.01	No	0.01	No	0.14	No	0.01	No	0.01	No	0.01	No
Aromatics C_{10}-C_{12}	10000	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{12}-C_{16}	10000	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{16}-C_{21}	7800	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{21}-C_{35}	7900	<0.01	No	<0.01	No	2.33	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{35}-C_{44}	7900	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{10}-C_{44}	7900	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No
Ali/Aro C_{10}-C_{44} Total		<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No
MBTE		0.01	No	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No
C_5-C_{10} Gasoline Range Organiser (GRO)	25000	0.10	No	0.10	No	0.10	No	0.10	No	0.10	No	0.10	No	0.10	No	0.10	No

[1] = LQM/CIEH S4UL's – POS Park – 2.5% SOM, [2] = CL:AIRE C4SLs – POS Park – 2.5% SOM, [3] = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit SOM:

E.2.3.3 Asbestos Screening

Table E.12: Section 2 Pipeline Asbestos Screening Summary

Strata	Locations						Depth (m)	Results
Topsoil	LB_21_04_TP	LB_21_19_BH	LB_21_20_TP	LB_21_119_CPT	LB_21_113_TP	LB_21_114_TP	0.1 - 0.4	NAD
Made Ground	LB_21_07_BH	LB_21_118_CPT					0.4 – 0.7	NAD
Tidal Flat Deposits	LB_21_11_BH	LB_21_115_TP	LB_21_115_TP	LB_21_12_BH	LB_21_11_BH	LB_21_12_BH	0.3 – 1.1	NAD
Glaciofluvial Deposits , Devensian	LB_21_16_BH	LB_21_16_BH					0.3 – 1.1	NAD
Glacial Till Deposits	LB_21_03_TP LB_21_112_BH LB_21_112_BH	LB_21_13_BH LB_21_18_BH LB_21_05_BH	LB_21_112_BH LB_21_112_BH LB_21_124_BH	LB_21_124_BH LB_21_22_TP	LB_21_06_BH LB_21_114_BH	LB_21_17_CPT	0.3 – 1.5	NAD
Wind Blown Deposits	LB_21_08_BH	LB_21_114_BH					0.65 – 0.8	NAD
Peat	LB_21_10_CPT	LB_21_119_CPT	LB_21_120_CPT				0.4 – 0.7	NAD
Chester Formation	LB_21_20_BH						0.8	NAD
Notes: NAD – No Asbestos Detected								

E.2.4 Section 2 Rockbank BVS

E.2.4.1 Metal Screening Summary

Table E.13: Section 2 Rockbank BVS Generic Metal Screening Summary

Geology		Topsoil		Made Ground	
No. of Samples		2		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C
Arsenic	170	6.0	No	6.6	No
Cadmium	532	0.2	No	0.1	No
Chromium III	33000	26.7	No	19.2	No
Chromium VI	220	0	No	0	No
Copper	44000	20.3	No	13.5	No
Lead	1300	31.5	No	8.3	No
Mercury	240	0.1	No	0.1	No
Nickel	3400	15.5	No	16.9	No
Selenium	1800	0.1	No	0.1	No
Zinc	170000	57.4	No	30.1	No
Cyanide	34	0.7	No	0.0	No

(1) = LQM/CIEH S4UL's – Commercial, (2) = CL:AIRE C4SLs – Commercial, (3) = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit

E.2.4.2 PAHs and TPHs Screening Summary

Table E.14: Section 2 Rockbank BVS PAHs and TPHs Screening Summary

Geology		Topsoil		Made Ground	
No. of Samples		2		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Speciated PAHs					
Acenaphthene	30000	<0.01	No	<0.01	No
Acenaphthylene	30000	<0.01	No	<0.01	No
Anthracene	150000	<0.01	No	<0.01	No
Benzo(a)anthracene	62	0.02	No	0.04	No
Benzo(a)pyrene	13	0.01	No	0.02	No
Benzo(b)fluoranthene	16	0.01	No	0.02	No
Benzo(ghi)perylene	1600	<0.01	No	0.01	No
Benzo(k)fluoranthene	440	0.01	No	0.01	No
Chrysene	120	0.01	No	0.02	No
Dibenz(ah)anthracene	1.4	<0.01	No	<0.01	No
Fluoranthene	6400	0.01	No	0.03	No
Fluorene	20000	<0.01	No	<0.01	No
Indeno(123cd)pyrene	180	<0.01	No	0.01	No
Naphthalene	3000	<0.01	No	<0.01	No
Phenanthrene	6300	<0.01	No	0.02	No
Pyrene	15000	0.01	No	0.03	No
Speciated TPHs (Ali/Aro)					
Aliphatic C_5-C_6	180000	0.01	No	0.01	No
Aliphatic C_6-C_8	320000	0.01	No	0.01	No
Aliphatic C_8-C_{10}	21000	0.01	No	0.01	No
Aliphatic C_{10}-C_{12}	24000	<0.01	No	<0.01	No
Aliphatic C_{12}-C_{16}	26000	<0.01	No	<0.01	No
Aliphatic C_{16}-C_{21}	490000	<0.01	No	<0.01	No
Aliphatic C_{21}-C_{35}	490000	<0.01	No	<0.01	No
Aliphatic C_{35}-C_{44}	490000	<0.01	No	<0.01	No
Aliphatic C_{10}-C_{44}	490000	<0.01	No	<0.01	No
Aromatics C_5-C_7	92000	0.01	No	0.01	No
Aromatics C_7-C_8	100000	0.01	No	0.01	No
Aromatics C_8-C_{10}	9300	0.01	No	0.01	No
Aromatics C_{10}-C_{12}	10000	<0.01	No	<0.01	No

Geology		Topsoil		Made Ground	
No. of Samples		2		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Aromatics C_{12}-C_{16}	10000	<0.01	No	<0.01	No
Aromatics C_{16}-C_{21}	7800	<0.01	No	<0.01	No
Aromatics C_{21}-C_{35}	7900	<0.01	No	<0.01	No
Aromatics C_{35}-C_{44}	7900	<0.01	No	<0.01	No
Aromatics C_{10}-C_{44}	7900	<0.01	No	<0.01	No
Ali/Aro C_{10}-C_{44} Total		<0.01	No	<0.01	No
MBTE		0.01	No	0.01	No
C_5-C_{10} Gasoline Range Organiser (GRO)	25000	0.10	No	0.10	No
(1) = LQM/CIEH S4UL's – POS Park – 2.5% SOM, (2) = CL:AIRE C4SLs – POS Park – 2.5% SOM, (3) = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit SOM:					

E.2.4.3 Asbestos Screening

Table E.15: Section 2 Rockbank BVS Asbestos Screening Summary

Strata	Locations	Depth (m)	Results
Topsoil	LB_21_102_TP LB_21_101_TP	0.3	NAD
Made Ground	LB_21_21_BH	0.9	NAD
Notes: NAD – No Asbestos Detected			

E.2.5 Section 2 Stanlow

E.2.5.1 Metal Screening Summary

Table E.16: Section 2 Stanlow AGI Generic Metal Screening Summary

Geology		Made Ground		Tidal Flat Deposits		Glacial Till Deposits	
No. of Samples		1		1		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C
Arsenic	170	6.6	No	1.4	No	5.0	No
Cadmium	532	1.1	No	0.1	No	0.0	No
Chromium III	33000	17.3	No	3.8	No	16.6	No
Chromium VI	220	0.0	No	0	No	0.0	No
Copper	44000	27.7	No	50.3	No	13.1	No
Lead	1300	106.1	No	12.7	No	9.6	No
Mercury	240	0.1	No	0.0	No	0.0	No
Nickel	3400	17.0	No	6.2	No	12.6	No
Selenium	1800	0.3	No	0.1	No	0.2	No
Zinc	170000	140.5	No	42.0	No	33.4	No
Cyanide	34	0.2	No	0.0	No	0.3	No

(1) = LQM/CIEH S4UL's – Commercial, (2) = CL:AIRE C4SLs – Commercial, (3) = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit

E.2.5.2 PAHs and TPHs Screening Summary

Table E.17: Section 2 Stanlow AGI PAHs and TPHs Screening Summary

Geology		Made Ground		Tidal Flat Deposits		Glacial Till Deposits	
No. of Samples		1		1		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Speciated PAHs							
Acenaphthene	29000	<0.01	No	<0.01	No	<0.01	No
Acenaphthylene	29000	<0.01	No	<0.01	No	<0.01	No
Anthracene	150000	<0.01	No	<0.01	No	<0.01	No
Benzo(a)anthracene	49	0.03	No	0.01	No	0.02	No
Benzo(a)pyrene	11	0.01	No	<0.01	No	0.01	No
Benzo(b)fluoranthene	13	0.03	No	0.01	No	0.01	No
Benzo(ghi)perylene	1400	0.01	No	<0.01	No	<0.01	No
Benzo(k)fluoranthene	370	0.02	No	<0.01	No	0.01	No
Chrysene	93	0.02	No	0.01	No	0.01	No
Dibenz(ah)anthracene	1.1	0.01	No	0.01	No	0.01	No
Fluoranthene	6300	0.03	No	0.01	No	0.02	No
Fluorene	23000	<0.01	No	<0.01	No	0.01	No
Indeno(123cd)pyrene	150	0.02	No	<0.01	No	0.01	No
Naphthalene	1200	<0.01	No	<0.01	No	<0.01	No
Phenanthrene	6200	0.01	No	<0.01	No	0.02	No
Pyrene	15000	0.03	No	<0.01	No	0.01	No
Speciated TPHs (Ali/Aro)							
Aliphatic C_5-C_6	95000	0.01	No	0.01	No	0.01	No
Aliphatic C_6-C_8	150000	0.01	No	0.01	No	0.01	No
Aliphatic C_8-C_{10}	14000	0.01	No	0.01	No	0.01	No
Aliphatic C_{10}-C_{12}	21000	<0.01	No	<0.01	No	<0.01	No
Aliphatic C_{12}-C_{16}	25000	<0.01	No	<0.01	No	<0.01	No
Aliphatic C_{16}-C_{21}	450000	<0.01	No	<0.01	No	<0.01	No
Aliphatic C_{21}-C_{35}	450000	<0.01	No	<0.01	No	<0.01	No
Aliphatic C_{35}-C_{44}	76000	<0.01	No	<0.01	No	<0.01	No
Aliphatic C_{10}-C_{44}	87000	<0.01	No	<0.01	No	<0.01	No
Aromatics C_5-C_7	7200	0.01	No	0.01	No	0.01	No
Aromatics C_7-C_8	9200	0.01	No	0.01	No	0.01	No
Aromatics C_8-C_{10}	10000	0.01	No	0.01	No	0.01	No
Aromatics C_{10}-C_{12}	7600	<0.01	No	<0.01	No	<0.01	No

Geology		Made Ground		Tidal Flat Deposits		Glacial Till Deposits	
No. of Samples		1		1		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Aromatics C_{12}-C_{16}	7800	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{16}-C_{21}	7800	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{21}-C_{35}	7800	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{35}-C_{44}	95000	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{10}-C_{44}	150000	<0.01	No	<0.01	No	<0.01	No
Ali/Aro C_{10}-C_{44} Total	14000	<0.01	No	<0.01	No	<0.01	No
MBTE		0.01	No	0.01	No	0.01	No
C_5-C_{10} Gasoline Range Organiser (GRO)	25000	0.10	No	0.10	No	0.10	No
[1] = LQM/CIEH S4UL's – POS Park – 2.5% SOM, [2] = CL:AIRE C4SLs – POS Park – 2.5% SOM, [3] = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit SOM:							

E.2.5.3 Asbestos Screening

Table E.18: Section 2 Stanlow AGI Asebestos Screening Summary

Strata	Locations	Depth (m)	Results
Made Ground	LB_21_01_BH	0.15	NAD
Tidal Flat Deposits	LB_21_01_BH	0.4	NAD
Glacial Till Deposits	LB_21_02_BH	0.8	NAD
Notes: NAD – No Asbestos Detected			

E.2.6 Section 3 Mollington BVS

E.2.6.1 Metal Screening Summary

Table E.19: Section 3 Mollington BVS Generic Metal Screening Summary

Geology		Topsoil		Glacial Till Deposits	
No. of Samples		1		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C
Arsenic	170	7.9	No	4.8	No
Cadmium	532	0.2	No	0.0	No
Chromium III	33000	22.14	No	21.1	No
Chromium VI	220	0.0	No	0.0	No
Copper	44000	18.8	No	9.9	No
Lead	1300	59.7	No	10.3	No
Mercury	240	0.1	No	0.0	No
Nickel	3400	16.4	No	11.0	No
Selenium	1800	0.1	No	0.0	No
Zinc	170000	52.8	No	22.5	No
Cyanide	34	0.4	No	0.0	No

(1) = LQM/CIEH S4UL's – Commercial, (2) = CL:AIRE C4SLs – Commercial, (3) = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit

E.2.6.2 PAHs and TPHs Screening Summary

Table E.20: Section 3 Mollington BVS PAHs and TPHs Screening Summary

Geology		Topsoil		Glacial Till Deposits	
No. of Samples		1		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Speciated PAHs					
Acenaphthene	30000	<0.01	No	<0.01	No
Acenaphthylene	30000	<0.01	No	<0.01	No
Anthracene	150000	<0.01	No	<0.01	No
Benzo(a)anthracene	62	0.03	No	0.02	No
Benzo(a)pyrene	13	0.01	No	<0.01	No
Benzo(b)fluoranthene	16	0.03	No	<0.01	No
Benzo(ghi)perylene	1600	0.01	No	<0.01	No
Benzo(k)fluoranthene	440	0.02	No	<0.01	No
Chrysene	120	0.01	No	0.01	No
Dibenz(ah)anthracene	1.4	0.02	No	0.02	No
Fluoranthene	6400	0.04	No	<0.01	No
Fluorene	20000	<0.01	No	<0.01	No
Indeno(123cd)pyrene	180	0.03	No	0.01	No
Naphthalene	3000	<0.01	No	<0.01	No
Phenanthrene	6300	0.02	No	<0.01	No
Pyrene	15000	0.03	No	<0.01	No
Speciated TPHs (Ali/Aro)					
Aliphatic C_5-C_6	180000	0.01	No	0.01	No
Aliphatic C_6-C_8	320000	0.01	No	0.01	No
Aliphatic C_8-C_{10}	21000	0.01	No	0.01	No
Aliphatic C_{10}-C_{12}	24000	<0.01	No	<0.01	No
Aliphatic C_{12}-C_{16}	26000	<0.01	No	<0.01	No
Aliphatic C_{16}-C_{21}	490000	<0.01	No	<0.01	No
Aliphatic C_{21}-C_{35}	490000	<0.01	No	<0.01	No
Aliphatic C_{35}-C_{44}	490000	<0.01	No	<0.01	No
Aliphatic C_{10}-C_{44}	490000	<0.01	No	<0.01	No
Aromatics C_5-C_7	92000	0.01	No	0.01	No
Aromatics C_7-C_8	100000	0.01	No	0.01	No
Aromatics C_8-C_{10}	9300	0.01	No	0.01	No
Aromatics C_{10}-C_{12}	10000	<0.01	No	<0.01	No

Geology		Topsoil		Glacial Till Deposits	
No. of Samples		1		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Aromatics C_{12}-C_{16}	10000	<0.01	No	<0.01	No
Aromatics C_{16}-C_{21}	7800	<0.01	No	<0.01	No
Aromatics C_{21}-C_{35}	7900	<0.01	No	<0.01	No
Aromatics C_{35}-C_{44}	7900	<0.01	No	<0.01	No
Aromatics C_{10}-C_{44}	7900	<0.01	No	<0.01	No
Ali/Aro C_{10}-C_{44} Total		<0.01	No	<0.01	No
MBTE		0.01	No	0.01	No
C_5-C_{10} Gasoline Range Organiser (GRO)	25000	0.1	No	0.1	No
(1) = LQM/CIEH S4UL's – POS Park – 2.5% SOM, (2) = CL:AIRE C4SLs – POS Park – 2.5% SOM, (3) = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit SOM:					

E.2.6.3 Asbestos Screening

Table E.21: Section 3 Mollington BVS Asbestos Screening Summary

Strata	Locations	Depth (m)	Results
Topsoil	LB_21_98_TP	0.2	NAD
Glacial Till Deposits	LB_21_99_BH	0.7	NAD
Notes: NAD – No Asbestos Detected			

E.2.7 Section 3 Pipeline

E.2.7.1 Metal Screening Summary

Table E.22: Section 3 Pipeline Generic Metal Screening Summary

Geology		Topsoil		Made Ground		Glacial Till Deposits	
No. of Samples		5		1		16	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C
Arsenic	170	8.5	No	13.5	No	8.8	No
Cadmium	532	0.3	No	0.2	No	0.2	No
Chromium III	33000	26.9	No	18.0	No	37.4	No
Chromium VI	220	0.0	No	0.0	No	0.0	No
Copper	44000	23.0	No	25.6	No	28.3	No
Lead	1300	74.7	No	40.9	No	43.5	No
Mercury	240	0.2	No	0.1	No	0.1	No
Nickel	3400	26.2	No	19.4	No	40.3	No
Selenium	1800	0.5	No	2.6	No	0.7	No
Zinc	170000	64.7	No	0.3	No	58.4	No
Cyanide	34	0.3	No	0.31	No	0.4	No

[1] = LQM/CIEH S4UL's – Commercial, [2] = CL:AIRE C4SLs – Commercial, [3] = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit

E.2.7.2 PAHs and TPHs Screening Summary

Table E.23: Section 3 Pipeline PAHs and TPHs Screening Summary

Geology		Topsoil		Made Ground		Glacial Till Deposits	
No. of Samples		5		1		16	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Speciated PAHs							
Acenaphthene	30000	0.01	No	<0.01	No	<0.01	No
Acenaphthylene	30000	<0.01	No	<0.01	No	<0.01	No
Anthracene	150000	0.02	No	0.01	No	0.04	No
Benzo(a)anthracene	62	0.09	No	0.03	No	0.02	No
Benzo(a)pyrene	13	0.09	No	0.03	No	0.01	No
Benzo(b)fluoranthene	16	0.11	No	0.05	No	0.03	No
Benzo(ghi)perylene	1600	0.04	No	0.02	No	0.01	No
Benzo(k)fluoranthene	440	0.04	No	0.05	No	0.02	No
Chrysene	120	0.10	No	0.03	No	0.02	No
Dibenz(ah)anthracene	1.4	0.02	No	<0.01	No	0.02	No
Fluoranthene	6400	0.12	No	0.06	No	0.03	No
Fluorene	20000	0.01	No	<0.01	No	0.01	No
Indeno(123cd)pyrene	180	0.05	No	0.02	No	0.02	No
Naphthalene	3000	<0.01	No	<0.01	No	0.01	No
Phenanthrene	6300	0.10	No	0.03	No	0.03	No
Pyrene	15000	0.05	No	0.06	No	0.02	No
Speciated TPHs (Ali/Aro)							
Aliphatic C_5-C_6	180000	0.01	No	0.01	No	0.01	No
Aliphatic C_6-C_8	320000	0.01	No	0.01	No	0.01	No
Aliphatic C_8-C_{10}	21000	0.01	No	0.01	No	0.01	No
Aliphatic C_{10}-C_{12}	24000	<0.01	No	<0.01	No	2.10	No
Aliphatic C_{12}-C_{16}	26000	<0.01	No	<0.01	No	0.85	No
Aliphatic C_{16}-C_{21}	490000	<0.01	No	<0.01	No	0.11	No
Aliphatic C_{21}-C_{35}	490000	<0.01	No	<0.01	No	11.4	No
Aliphatic C_{35}-C_{44}	490000	<0.01	No	<0.01	No	2.6	No
Aliphatic C_{10}-C_{44}	490000	<0.01	No	<0.01	No	<0.01	No
Aromatics C_5-C_7	92000	0.01	No	0.01	No	0.01	No
Aromatics C_7-C_8	100000	0.01	No	0.01	No	0.01	No
Aromatics C_8-C_{10}	9300	0.01	No	0.01	No	0.01	No
Aromatics C_{10}-C_{12}	10000	<0.01	No	<0.01	No	<0.01	No

Geology		Topsoil		Made Ground		Glacial Till Deposits	
No. of Samples		5		1		16	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Aromatics C_{12}-C_{16}	10000	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{16}-C_{21}	7800	<0.01	No	<0.01	No	0.27	No
Aromatics C_{21}-C_{35}	7900	<0.01	No	<0.01	No	2.04	No
Aromatics C_{35}-C_{44}	7900	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{10}-C_{44}	7900	<0.01	No	<0.01	No	<0.01	No
Ali/Aro C_{10}-C_{44} Total		<0.01	No	<0.01	No	19.44	No
MBTE		0.01	No	0.01	No	0.01	No
C_5-C_{10} Gasoline Range Organiser (GRO)	25000	0.1	No	0.1	No	0.1	No
[1] = LQM/CIEH S4UL's – POS Park – 2.5% SOM, [2] = CL:AIRE C4SLs – POS Park – 2.5% SOM, [3] = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit SOM:							

E.2.7.3 Asbestos Screening

Table E.24: Section 3 Pipeline Asbestos Screening Summary

Strata	Locations				Depth (m)	Results
Topsoil	LB_21_40_TP LB_21_26_TP	LB_21_36_TP	LB_21_96_TP	LB_21_97_TP	0.2	NAD
Made Ground	LB_21_39_TP				0.2	NAD
Glacial Till Deposits	LB_21_121_BH LB_21_122_BH LB_21_123_BH LB_21_123_BH	LB_21_27_BH LB_21_32_BH LB_21_33_BH LB_21_34_CPT	LB_21_35_TP LB_21_37_TP LB_21_121_BH LB_21_122_BH	LB_21_30_BH LB_21_31_TP LB_21_38_BH LB_21_38_CPT	0.8	NAD
Notes: NAD – No Asbestos Detected						

E.2.8 Section 4 A458

E.2.8.1 Metal Screening Summary

Table E.25: Section 4 A458 Generic Metal Screening Summary

Geology		Topsoil		Made Ground		Tidal Flat Deposits		Glacial Till Deposits	
No. of Samples		4		2		14		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C
Arsenic	170	10.9	No	12.2	No	14.0	No	10.6	No
Cadmium	532	0.4	No	0.7	No	1.4	No	0.2	No
Chromium III	33000	23.0	No	15.9	No	74.3	No	26.6	No
Chromium VI	220	0.0	No	0.0	No	0.0	No	0.0	No
Copper	44000	27.7	No	30.4	No	104.1	No	26.5	No
Lead	1300	52.9	No	279.9	No	64.6	No	14.8	No
Mercury	240	0.1	No	0.0	No	0.4	No	0.1	No
Nickel	3400	17.1	No	47.4	No	28.4	No	30.1	No
Selenium	1800	0.1	No	0.9	No	0.33	No	0.4	No
Zinc	170000	80.2	No	236.0	No	222.5	No	52.5	No
Cyanide	34	0.7	No	0.2	No	2.9	No	0.0	No

[1] = LQM/CIEH S4UL's – Commercial, [2] = CL:AIRE C4SLs – Commercial, [3] = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit

E.2.8.2 PAHs and TPHs Screening Summary

Table E.26: Section 4 A458 PAHs and TPHs Screening Summary

Geology		Topsoil		Made Ground		Tidal Flat Deposits		Glacial Till Deposits	
No. of Samples		4		2		14		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Speciated PAHs									
Acenaphthene	30000	<0.0	No	<0.0	No	0.01	No	<0.01	No
Acenaphthylene	30000	<0.0	No	<0.0	No	<0.01	No	<0.01	No
Anthracene	150000	<0.0	No	0.1	No	0.02	No	<0.01	No
Benzo(a)anthracene	62	0.1	No	0.4	No	0.02	No	<0.01	No
Benzo(a)pyrene	13	0.2	No	0.4	No	0.02	No	<0.01	No
Benzo(b)fluoranthene	16	0.2	No	0.6	No	0.23	No	<0.01	No
Benzo(ghi)perylene	1600	0.2	No	0.3	No	0.12	No	<0.01	No
Benzo(k)fluoranthene	440	0.1	No	0.3	No	0.08	No	<0.01	No
Chrysene	120	0.1	No	0.6	No	0.15	No	<0.01	No
Dibenz(ah)anthracene	1.4	<0.0	No	0.1	No	0.04	No	0.01	No
Fluoranthene	6400	0.2	No	1.0	No	0.19	No	<0.01	No
Fluorene	20000	<0.0	No	<0.0	No	0.01	No	<0.01	No
Indeno(123cd)pyrene	180	0.1	No	0.3	No	0.11	No	0.02	No
Naphthalene	3000	<0.0	No	<0.0	No	0.04	No	<0.01	No
Phenanthrene	6300	0.1	No	0.3	No	0.02	No	<0.01	No
Pyrene	15000	0.2	No	0.9	No	0.01	No	<0.01	No

Geology		Topsoil		Made Ground		Tidal Flat Deposits		Glacial Till Deposits	
No. of Samples		4		2		14		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Speciated TPHs (Ali/Aro)									
Aliphatic C_5-C_6	180000	<0.0	No	<0.0	No	0.01	No	0.01	No
Aliphatic C_6-C_8	320000	<0.0	No	<0.0	No	0.01	No	0.01	No
Aliphatic C_8-C_{10}	21000	<0.0	No	<0.0	No	0.01	No	0.01	No
Aliphatic C_{10}-C_{12}	24000	0.1	No	<0.0	No	<0.01	No	<0.01	No
Aliphatic C_{12}-C_{16}	26000	<0.0	No	<0.0	No	<0.01	No	<0.01	No
Aliphatic C_{16}-C_{21}	490000	<0.0	No	0.2	No	<0.01	No	<0.01	No
Aliphatic C_{21}-C_{35}	490000	<0.0	No	26.2	No	<0.01	No	<0.01	No
Aliphatic C_{35}-C_{40}	490000	<0.0	No	7.5	No	<0.01	No	<0.01	No
Aliphatic C_{10}-C_{44}	490000	<0.0	No	33.8	No	<0.01	No	0.04	No
Aromatics C_5-C_7	92000	<0.0	No	<0.0	No	0.01	No	0.01	No
Aromatics C_7-C_8	100000	<0.0	No	<0.0	No	0.01	No	0.01	No
Aromatics C_8-C_{10}	9300	<0.0	No	<0.0	No	0.01	No	0.01	No
Aromatics C_{10}-C_{12}	10000	<0.0	No	0.3	No	<0.01	No	<0.01	No
Aromatics C_{12}-C_{16}	10000	<0.0	No	1.8	No	<0.01	No	<0.01	No
Aromatics C_{16}-C_{21}	7800	<0.0	No	4.7	No	<0.01	No	<0.01	No
Aromatics C_{21}-C_{35}	7900	<0.0	No	70.0	No	<0.01	No	<0.01	No
Aromatics C_{35}-C_{40}	7900	<0.0	No	36.9	No	<0.01	No	<0.01	No
Aromatics C_5-C_{44}	7900	<0.0	No	113.6	No	<0.01	No	0.04	No
Ali/Aro C_{10}-C_{44} Total		<0.0	No	147.4	No	<0.01	No	0.07	No
MBTE		<0.0	No	<0.0	No	0.01	No	0.01	No

Geology		Topsoil		Made Ground		Tidal Flat Deposits		Glacial Till Deposits	
No. of Samples		4		2		14		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
C_5-C_{10} Gasoline Range Organiser (GRO)	25000	0.1	No	0.1	No	0.10	No	0.10	No
[(1)] = LQM/CIEH S4UL's – POS Park – 2.5% SOM, [(2)] = CL:AIRE C4SLs – POS Park – 2.5% SOM, [(3)] = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit SOM:									

E.2.8.3 Asbestos Screening

Table E.27: Section 4 A458 Asbestos Screening Summary

Strata	Locations				Depth (m)	Results
Topsoil	LB_21_43_TP	LB_21_42_TP	LB_21_50_TP	LB_21_46_BH	0.2 - 0.3	NAD
Made Ground	LB_21_47_BH	LB_21_49_BH			0.3	NAD
Tidal Flat Deposits	LB_21_45_BH LB_21_45_BH LB_21_51_BH LB_21_52_BH	LB_21_53_TP LB_21_54_BH LB_21_55_BH LB_21_56_BH	LB_21_44_BH LB_21_46_BH LB_21_47_BH LB_21_49_BH	LB_21_54_BH LB_21_56_BH	0.3 - 2.0	NAD
Glacial Till Deposits	LB_21_110_BH				0.8	NAD
Notes: NAD – No Asbestos Detected						

E.2.9 Section 5 Aston Hall BVS

E.2.9.1 Metal Screening Summary

Table E.28: Section 5 Aston Hall BVS Generic Metal Screening Summary

Geology		Topsoil		Glacial Till Deposits	
No. of Samples		2		2	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C
Arsenic	170	13.1	No	7.8	No
Cadmium	532	0.6	No	0.2	No
Chromium III	33000	27.7	No	27.9	No
Chromium VI	220	0.0	No	0.0	No
Copper	44000	30.6	No	21.7	No
Lead	1300	63.5	No	28.2	No
Mercury	240	0.3	No	0.1	No
Nickel	3400	24.5	No	29.1	No
Selenium	1800	0.6	No	0.3	No
Zinc	170000	128.1	No	44.0	No
Cyanide	34	0.4	No	0.2	No

(1) = LQM/CIEH S4UL's – Commercial, (2) = CL:AIRE C4SLs – Commercial, (3) = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit

E.2.9.2 PAHs and TPHs Screening Summary

Table E.29: Section 5 Aston Hall BVS PAHs and TPHs Screening Summary

Geology		Topsoil		Glacial Till Deposits	
No. of Samples		2		2	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Speciated PAHs					
Acenaphthene	30000	<0.01	No	<0.01	No
Acenaphthylene	30000	<0.01	No	<0.01	No
Anthracene	150000	<0.01	No	0.01	No
Benzo(a)anthracene	62	0.02	No	0.01	No
Benzo(a)pyrene	13	0.02	No	0.01	No
Benzo(b)fluoranthene	16	0.04	No	<0.01	No
Benzo(ghi)perylene	1600	0.01	No	0.01	No
Benzo(k)fluoranthene	440	0.01	No	<0.01	No
Chrysene	120	0.04	No	0.01	No
Dibenz(ah)anthracene	1.4	0.01	No	0.01	No
Fluoranthene	6400	0.05	No	0.01	No
Fluorene	20000	<0.01	No	<0.01	No
Indeno(123cd)pyrene	180	0.02	No	0.01	No
Naphthalene	3000	0.01	No	<0.01	No
Phenanthrene	6300	0.03	No	0.01	No
Pyrene	15000	0.05	No	0.01	No
Speciated TPHs (Ali/Aro)					
Aliphatic C_5-C_6	180000	0.01	No	0.01	No
Aliphatic C_6-C_8	320000	0.01	No	0.01	No
Aliphatic C_8-C_{10}	21000	0.01	No	0.01	No
Aliphatic C_{10}-C_{12}	24000	<0.01	No	<0.01	No
Aliphatic C_{12}-C_{16}	26000	<0.01	No	<0.01	No
Aliphatic C_{16}-C_{21}	490000	<0.01	No	<0.01	No
Aliphatic C_{21}-C_{35}	490000	<0.01	No	<0.01	No
Aliphatic C_{35}-C_{44}	490000	<0.01	No	<0.01	No
Aliphatic C_{10}-C_{44}	490000	<0.01	No	<0.01	No
Aromatics C_5-C_7	92000	0.01	No	0.01	No
Aromatics C_7-C_8	100000	0.01	No	0.01	No
Aromatics C_8-C_{10}	9300	0.01	No	0.01	No
Aromatics C_{10}-C_{12}	10000	<0.01	No	<0.01	No

Geology		Topsoil		Glacial Till Deposits	
No. of Samples		2		2	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Aromatics C_{12}-C_{16}	10000	<0.01	No	<0.01	No
Aromatics C_{16}-C_{21}	7800	<0.01	No	<0.01	No
Aromatics C_{21}-C_{35}	7900	<0.01	No	<0.01	No
Aromatics C_{35}-C_{44}	7900	<0.01	No	<0.01	No
Aromatics C_{10}-C_{44}	7900	<0.01	No	<0.01	No
Ali/Aro C_{10}-C_{44} Total		<0.01	No	<0.01	No
MBTE		0.01	No	0.01	No
C_5-C_{10} Gasoline Range Organiser (GRO)	25000	0.10	No	0.10	No
[1] = LQM/CIEH S4UL's – POS Park – 2.5% SOM, [2] = CL:AIRE C4SLs – POS Park – 2.5% SOM, [3] = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit SOM:					

E.2.9.3 Asbestos Screening

Table E.30: Section 5 Aston Hall BVS Asbestos Screening Summary

Strata	Locations		Depth (m)	Results
Topsoil	LB_21_93_TP	LB_21_94_TP	0.2	NAD
Glacial Till Deposits	LB_21_95_BH	LB_21_93_CPT	0.4 – 1.0	NAD
Notes: NAD – No Asbestos Detected				

E.2.10 Section 5 Northop AGI

E.2.10.1 Metal Screening Summary

Table E.31: Section 5 Northop AGI Generic Metal Screening Summary

Geology		Topsoil		Glacial Till Deposits	
No. of Samples		1		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C
Arsenic	170	15.5	No	8.5	No
Cadmium	532	0.7	No	0.1	No
Chromium III	33000	25.5	No	23.6	No
Chromium VI	220	0	No	0.0	No
Copper	44000	39.7	No	23.9	No
Lead	1300	66.0	No	19.2	No
Mercury	240	0.1	No	0.0	No
Nickel	3400	32.1	No	23.1	No
Selenium	1800	0.2	No	0.0	No
Zinc	170000	271.8	No	53.2	No
Cyanide	34	0.1	No	0.0	No

(1) = LQM/CIEH S4UL's – Commercial, (2) = CL:AIRE C4SLs – Commercial, (3) = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit

E.2.10.2 PAHs and TPHs Screening Summary

Table E.32: Section 5 Northop AGI PAHs and TPHs Screening Summary

Geology		Topsoil		Glacial Till Deposits	
No. of Samples		1		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Speciated PAHs					
Acenaphthene	30000	<0.01	No	<0.01	No
Acenaphthylene	30000	<0.01	No	<0.01	No
Anthracene	150000	<0.01	No	<0.01	No
Benzo(a)anthracene	62	<0.01	No	<0.01	No
Benzo(a)pyrene	13	<0.01	No	0.01	No
Benzo(b)fluoranthene	16	<0.01	No	<0.01	No
Benzo(ghi)perylene	1600	<0.01	No	<0.01	No
Benzo(k)fluoranthene	440	<0.01	No	<0.01	No
Chrysene	120	<0.01	No	0.01	No
Dibenz(ah)anthracene	1.4	<0.01	No	0.01	No
Fluoranthene	6400	<0.01	No	<0.01	No
Fluorene	20000	<0.01	No	<0.01	No
Indeno(123cd)pyrene	180	<0.01	No	0.01	No
Naphthalene	3000	<0.01	No	<0.01	No
Phenanthrene	6300	<0.01	No	<0.01	No
Pyrene	15000	<0.01	No	<0.01	No
Speciated TPHs (Ali/Aro)					
Aliphatic C_5-C_6	180000	0.01	No	0.01	No
Aliphatic C_6-C_8	320000	0.01	No	0.01	No
Aliphatic C_8-C_{10}	21000	0.01	No	0.01	No
Aliphatic C_{10}-C_{12}	24000	<0.01	No	<0.01	No
Aliphatic C_{12}-C_{16}	26000	<0.01	No	<0.01	No
Aliphatic C_{16}-C_{21}	490000	<0.01	No	<0.01	No
Aliphatic C_{21}-C_{35}	490000	<0.01	No	<0.01	No
Aliphatic C_{35}-C_{44}	490000	<0.01	No	<0.01	No
Aliphatic C_{10}-C_{44}	490000	<0.01	No	<0.01	No
Aromatics C_5-C_7	92000	0.01	No	0.01	No
Aromatics C_7-C_8	100000	0.01	No	0.01	No
Aromatics C_8-C_{10}	9300	0.01	No	0.01	No
Aromatics C_{10}-C_{12}	10000	<0.01	No	<0.01	No

Geology		Topsoil		Glacial Till Deposits	
No. of Samples		1		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Aromatics C_{12}-C_{16}	10000	<0.01	No	<0.01	No
Aromatics C_{16}-C_{21}	7800	<0.01	No	<0.01	No
Aromatics C_{21}-C_{35}	7900	<0.01	No	<0.01	No
Aromatics C_{35}-C_{44}	7900	<0.01	No	<0.01	No
Aromatics C_{10}-C_{44}	7900	<0.01	No	<0.01	No
Ali/Aro C_{10}-C_{44} Total		<0.01	No	<0.01	No
MBTE		0.01	No	0.01	No
C_5-C_{10} Gasoline Range Organiser (GRO)	25000	0.10	No	0.10	No
[1] = LQM/CIEH S4UL's – POS Park – 2.5% SOM, [2] = CL:AIRE C4SLs – POS Park – 2.5% SOM, [3] = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit SOM:					

E.2.10.3 Asbestos Screening

Table E.33: Section 5 Northrop AGI Asbestos Screening Summary

Strata	Locations	Depth (m)	Results
Topsoil	LB_21_105_TP	0.2	NAD
Glacial Till Deposits	LB_21_103_BH	0.5	NAD
Notes: NAD – No Asbestos Detected			

E.2.11 Section 5 Pipeline

E.2.11.1 Metal Screening Summary

Table E.34: Section 5 Pipeline Generic Metals Screening Summary

Geology		Topsoil		Made Ground		Glaciofluvial Deposits, Devensian		Glacial Till Deposits		Pennine Middle Coal Measures Fm	
No. of Samples		6		15		5		8		3	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C
Arsenic	170	14.2	No	27.1	No	6.3	No	24.9	No	40.9	No
Cadmium	532	1.1	No	0.5	No	0.2	No	0.3	No	0.1	No
Chromium III	33000	24.7	No	41.7	No	16.6	No	25.9	No	10.9	No
Chromium VI	220	0.0	No	0.0	No	0.0	No	0.0	No	0.0	No
Copper	44000	25.8	No	57.9	No	18.3	No	31.5	No	19.3	No
Lead	1300	101.4	No	138.1	No	0.1	No	62.5	No	298.2	No
Mercury	240	0.1	No	0.1	No	0.0	No	0.3	No	0.3	No
Nickel	3400	13.4	No	30.3	No	16.6	No	27.1	No	10.4	No
Selenium	1800	0.3	No	1.4	No	0.4	No	0.1	No	0.9	No
Zinc	170000	143.3	No	220.8	No	53.3	No	80.8	No	41.7	No
Cyanide	34	0.5	No	0.4	No	0.4	No	0.3	No	0.0	No

(1) = LQM/CIEH S4UL's – Commercial, (2) = CL:AIRE C4SLs – Commercial, (3) = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit

E.2.11.2 PAHs and TPHs Screening Summary

Table E.35: Section 5 Pipeline PAHs and TPHs Screening Summary

Geology		Topsoil		Made Ground		Glaciofluvial Deposits, Devensian		Glacial Till Deposits		Pennine Middle Coal Measures Fm	
No. of Samples		6		9		3		8		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Speciated PAHs											
Acenaphthene	30000	<0.01	No	0.03	No	<0.01	No	<0.01	No	<0.01	No
Acenaphthylene	30000	<0.01	No	0.21	No	<0.01	No	<0.01	No	<0.01	No
Anthracene	150000	0.01	No	0.44	No	0.02	No	0.01	No	<0.01	No
Benzo(a)anthracene	62	0.05	No	0.63	No	0.02	No	0.05	No	0.02	No
Benzo(a)pyrene	13	0.03	No	0.72	No	0.02	No	0.14	No	0.01	No
Benzo(b)fluoranthene	16	0.05	No	0.84	No	0.02	No	0.02	No	0.02	No
Benzo(ghi)perylene	1600	0.02	No	0.46	No	0.01	No	0.02	No	0.01	No
Benzo(k)fluoranthene	440	0.02	No	0.34	No	0.01	No	0.01	No	0.01	No
Chrysene	120	0.04	No	0.67	No	0.02	No	0.02	No	0.02	No
Dibenz(ah)anthracene	1.4	0.01	No	0.08	No	0.01	No	0.01	No	0.01	No
Fluoranthene	6400	0.06	No	2.01	No	0.06	No	0.04	No	0.05	No
Fluorene	20000	<0.01	No	0.13	No	0.01	No	<0.01	No	<0.01	No
Indeno(123cd)pyrene	180	0.02	No	0.36	No	0.01	No	0.01	No	0.01	No
Naphthalene	3000	<0.01	No	0.16	No	<0.01	No	<0.01	No	0.03	No
Phenanthrene	6300	0.03	No	0.93	No	0.03	No	0.02	No	0.04	No
Pyrene	15000	0.05	No	1.83	No	0.05	No	0.01	No	0.04	No

Geology		Topsoil		Made Ground		Glaciofluvial Deposits, Devensian		Glacial Till Deposits		Pennine Middle Coal Measures Fm	
No. of Samples		6		9		3		8		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Speciated TPHs (Ali/Aro)											
Aliphatic C_5-C_6	180000	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No
Aliphatic C_6-C_8	320000	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No
Aliphatic C_8-C_{10}	21000	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No
Aliphatic C_{10}-C_{12}	24000	<0.01	No	5.19	No	<0.01	No	<0.01	No	<0.01	No
Aliphatic C_{12}-C_{16}	26000	<0.01	No	3.56	No	<0.01	No	<0.01	No	<0.01	No
Aliphatic C_{16}-C_{21}	490000	<0.01	No	3.92	No	<0.01	No	<0.01	No	<0.01	No
Aliphatic C_{21}-C_{35}	490000	<0.01	No	21.64	No	<0.01	No	4.35	No	<0.01	No
Aliphatic C_{35}-C_{44}	490000	<0.01	No	<0.01	No	<0.01	No	<0.01	No	<0.01	No
Aliphatic C_{10}-C_{44}	490000	<0.01	No	29.20	No	<0.01	No	4.35	No	<0.01	No
Aromatics C_5-C_7	92000	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No
Aromatics C_7-C_8	100000	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No
Aromatics C_8-C_{10}	9300	0.01	No	0.01	No	0.01	No	0.01	No	0.01	No
Aromatics C_{10}-C_{12}	10000	<0.01	No	8.15	No	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{12}-C_{16}	10000	<0.01	No	12.46	No	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{16}-C_{21}	7800	<0.01	No	18.57	No	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{21}-C_{35}	7900	<0.01	No	34.09	No	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{35}-C_{44}	7900	<0.01	No	0.14	No	<0.01	No	<0.01	No	<0.01	No
Aromatics C_{10}-C_{44}	7900	<0.01	No	73.38	No	<0.01	No	<0.01	No	<0.01	No
Ali/Aro C_{10}-C_{44} Total		<0.01	No	102.58	No	<0.01	No	4.35	No	<0.01	No

Geology		Topsoil		Made Ground		Glaciofluvial Deposits, Devensian		Glacial Till Deposits		Pennine Middle Coal Measures Fm	
No. of Samples		6		9		3		8		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
MBTE		0.01	No	0.01	No	0.01	No	0.01	No	0.01	No
C_5-C_{10} Gasoline Range Organiser (GRO)	25000	0.10	No	0.10	No	0.10	No	0.10	No	0.10	No
[1] = LQM/CIEH S4UL's – POS Park – 2.5% SOM, [2] = CL:AIRE C4SLs – POS Park – 2.5% SOM, [3] = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit SOM:											

E.2.11.3 Asbestos Screening

Table E.36: Section 5 Pipeline Asbestos Screening Summary

Strata	Locations			Depth (m)	Results
Topsoil	LB_21_75_TP LB_21_70_TP	LB_21_61_CPT LB_21_107_TP	LB_21_91_TP LB_21_76_TP	0.2	NAD
Made Ground	LB_21_106_TP LB_21_109_BH LB_21_58_TP	LB_21_69_TP LB_21_109_TP LB_21_63_BH	LB_21_69_TP LB_21_109_BH LB_21_63_BH	0.2 – 4.0	NAD
Glaciofluvial Deposits , Devensian	LB_21_63_BH	LB_21_60_BH	LB_21_62_CPT	0.5 – 2.8	NAD
Glacial Till Deposits	LB_21_58_TP LB_21_65_BH LB_21_92_TP	LB_21_59_BH LB_21_74_BH LB_21_73_BH	LB_21_64_BH LB_21_66_TP	0.2 – 1.4	NAD
Pennine Middle Coal Measures Formation	LB_21_109_TP			3.9	NAD
Notes:; NAD – No Asbestos Detected					

E.2.12 Section 6 Flint AGI

E.2.12.1 Metal Screening Summary

Table E.37: Section 6 Flint AGI Generic Metals Screening Summary

Geology		Topsoil		Glacial Till Deposits	
No. of Samples		2		2	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C
Arsenic	170	10.6	No	7.9	No
Cadmium	532	0.4	No	0.1	No
Chromium III	33000	23.3	No	25.8	No
Chromium VI	220	0.0	No	0.0	No
Copper	44000	28.7	No	16.1	No
Lead	1300	131.8	No	32.6	No
Mercury	240	0.04	No	0.0	No
Nickel	3400	18.2	No	26.9	No
Selenium	1800	0.3	No	0.0	No
Zinc	170000	88.9	No	40.3	No
Cyanide	34	2.3	No	0.0	No

(1) = LQM/CIEH S4UL's – Commercial, (2) = CL:AIRE C4SLs – Commercial, (3) = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit

E.2.12.2 PAHs and TPHs Screening Summary

Table E.38: Section 6 Flint AGI PAHs and TPHs Screening Summary

Geology		Topsoil		Glacial Till Deposits	
No. of Samples		2		2	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Speciated PAHs					
Acenaphthene	30000	<0.01	No	<0.01	No
Acenaphthylene	30000	<0.01	No	<0.01	No
Anthracene	150000	0.01	No	<0.01	No
Benzo(a)anthracene	62	0.01	No	0.01	No
Benzo(a)pyrene	13	0.01	No	0.01	No
Benzo(b)fluoranthene	16	0.02	No	0.01	No
Benzo(ghi)perylene	1600	0.01	No	<0.01	No
Benzo(k)fluoranthene	440	0.02	No	0.01	No
Chrysene	120	0.01	No	0.01	No
Dibenz(ah)anthracene	1.4	0.01	No	0.01	No
Fluoranthene	6400	0.02	No	0.02	No
Fluorene	20000	<0.01	No	<0.01	No
Indeno(123cd)pyrene	180	0.01	No	0.01	No
Naphthalene	3000	<0.01	No	0.01	No
Phenanthrene	6300	0.01	No	0.02	No
Pyrene	15000	0.02	No	0.02	No
Speciated TPHs (Ali/Aro)					
Aliphatic C_5-C_6	180000	0.01	No	0.01	No
Aliphatic C_6-C_8	320000	0.01	No	0.01	No
Aliphatic C_8-C_{10}	21000	0.01	No	0.01	No
Aliphatic C_{10}-C_{12}	24000	<0.01	No	10.38	No
Aliphatic C_{12}-C_{16}	26000	<0.01	No	11.10	No
Aliphatic C_{16}-C_{21}	490000	<0.01	No	14.43	No
Aliphatic C_{21}-C_{35}	490000	<0.01	No	32.71	No
Aliphatic C_{35}-C_{44}	490000	<0.01	No	5.45	No
Aliphatic C_{10}-C_{44}	490000	<0.01	No	74.07	No
Aromatics C_5-C_7	92000	0.01	No	0.01	No
Aromatics C_7-C_8	100000	0.01	No	0.01	No
Aromatics C_8-C_{10}	9300	0.01	No	0.01	No
Aromatics C_{10}-C_{12}	10000	<0.01	No	<0.01	No

Geology		Topsoil		Glacial Till Deposits	
No. of Samples		2		2	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Aromatics C_{12}-C_{16}	10000	<0.01	No	<0.01	No
Aromatics C_{16}-C_{21}	7800	<0.01	No	<0.01	No
Aromatics C_{21}-C_{35}	7900	<0.01	No	<0.01	No
Aromatics C_{35}-C_{44}	7900	<0.01	No	<0.01	No
Aromatics C_{10}-C_{44}	7900	<0.01	No	<0.01	No
Ali/Aro C_{10}-C_{44} Total		<0.01	No	74.07	No
MBTE		0.01	No	0.01	No
C_5-C_{10} Gasoline Range Organiser (GRO)	25000	0.10	No	0.10	No
[1] = LQM/CIEH S4UL's – POS Park – 2.5% SOM, [2] = CL:AIRE C4SLs – POS Park – 2.5% SOM, [3] = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit SOM:					

E.2.12.3 Asbestos Screening

Table E.39: Section 5 Flint AGI Asbestos Screening Summary

Strata	Locations		Depth (m)	Results
Topsoil	LB_21_84_TP	LB_21_87_TP	0.2	NAD
Glacial Till Deposits	LB_21_88_BH	LB_21_85_BH	0.6	NAD
Notes: NAD – No Asbestos Detected				

E.2.13 Section 6 Pipeline

E.2.13.1 Metal Screening Summary

Table E.40: Section 6 Pipeline Generic Metal Screening Summary

Geology		Topsoil		Shallow drift Deposits	
No. of Samples		4		4	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C
Arsenic	170	10.6	No	10.9	No
Cadmium	532	0.5	No	1.4	No
Chromium III	33000	25.5	No	26.8	No
Chromium VI	220	0.0	No	0.0	No
Copper	44000	29.5	No	24.2	No
Lead	1300	2.8	No	112.2	No
Mercury	240	0.05	No	0.1	No
Nickel	3400	17.3	No	22.7	No
Selenium	1800	0.3	No	0.0	No
Zinc	170000	99.6	No	164.4	No
Cyanide	34	2.8	No	0.6	No

(1) = LQM/CIEH S4UL's – Commercial, (2) = CL:AIRE C4SLs – Commercial, (3) = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit

E.2.13.2 PAHs and TPHs Screening Summary

Table E.41: Section 6 Pipeline PAHs and TPHs Screening Summary

Geology		Topsoil		Shallow drift deposits	
No. of Samples		4		4	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Speciated PAHs					
Acenaphthene	30000	<0.01	No	<0.01	No
Acenaphthylene	30000	<0.01	No	<0.01	No
Anthracene	150000	<0.01	No	0.01	No
Benzo(a)anthracene	62	0.06	No	0.06	No
Benzo(a)pyrene	13	<0.01	No	0.01	No
Benzo(b)fluoranthene	16	0.02	No	0.02	No
Benzo(ghi)perylene	1600	0.01	No	0.01	No
Benzo(k)fluoranthene	440	0.01	No	0.02	No
Chrysene	120	0.01	No	0.03	No
Dibenz(ah)anthracene	1.4	0.01	No	0.01	No
Fluoranthene	6400	0.02	No	0.05	No
Fluorene	20000	<0.01	No	<0.01	No
Indeno(123cd)pyrene	180	<0.01	No	0.01	No
Naphthalene	3000	<0.01	No	0.01	No
Phenanthrene	6300	0.01	No	0.03	No
Pyrene	15000	0.02	No	0.05	No
Speciated TPHs (Ali/Aro)					
Aliphatic C_5-C_6	180000	0.01	No	0.01	No
Aliphatic C_6-C_8	320000	0.01	No	0.01	No
Aliphatic C_8-C_{10}	21000	0.01	No	0.01	No
Aliphatic C_{10}-C_{12}	24000	<0.01	No	<0.01	No
Aliphatic C_{12}-C_{16}	26000	<0.01	No	<0.01	No
Aliphatic C_{16}-C_{21}	490000	2.74	No	<0.01	No
Aliphatic C_{21}-C_{35}	490000	0.26	No	<0.01	No
Aliphatic C_{35}-C_{44}	490000	<0.01	No	<0.01	No
Aliphatic C_{10}-C_{44}	490000	3.00	No	<0.01	No
Aromatics C_5-C_7	92000	0.01	No	0.01	No
Aromatics C_7-C_8	100000	0.01	No	0.01	No
Aromatics C_8-C_{10}	9300	0.01	No	0.01	No

Geology		Topsoil		Shallow drift deposits	
No. of Samples		4		4	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Aromatics C_{10}-C_{12}	10000	<0.01	No	<0.01	No
Aromatics C_{12}-C_{16}	10000	<0.01	No	<0.01	No
Aromatics C_{16}-C_{21}	7800	<0.01	No	<0.01	No
Aromatics C_{21}-C_{35}	7900	<0.01	No	<0.01	No
Aromatics C_{35}-C_{44}	7900	<0.01	No	<0.01	No
Aromatics C_{10}-C_{44}	7900	<0.01	No	<0.01	No
Ali/Aro C_{10}-C_{44} Total		3.00	No	<0.01	No
MBTE		0.01	No	0.01	No
C_5-C_{10} Gasoline Range Organiser (GRO)	25000	0.10	No	0.10	No
(1) = LQM/CIEH S4UL's – POS Park – 2.5% SOM, (2) = CL:AIRE C4SLs – POS Park – 2.5% SOM, (3) = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit SOM:					

E.2.13.3 Asbestos Screening

Table E.42: Section 6 Pipeline Asbestos Screening Summary

Strata	Locations	Depth (m)	Results
Topsoil	LB_21_79_TP LB_21_83_TP LB_21_80_TP LB_21_89_TP	0.2	NAD
Glacial Till Deposits	LB_21_78_BH LB_21_81_BH LB_21_77_BH LB_21_82_TP	0.2 – 0.6	NAD
Notes: NAD – No Asbestos Detected			

E.2.14 Section 7 Pipeline

E.2.14.1 Metal Screening Summary

Table E.43: Section 7 Pipeline Generic Metal Screening Summary

Geology		Topsoil		Glacial Till Deposits	
No. of Samples		3		8	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C
Arsenic	170	11.6	No	21.9	No
Cadmium	532	0.6	No	2.5	No
Chromium III	33000	26.7	No	27.7	No
Chromium VI	220	0.0	No	0.0	No
Copper	44000	19.7	No	34.8	No
Lead	1300	147.6	No	421.9	No
Mercury	240	0.1	No	0.1	No
Nickel	3400	17.6	No	33.2	No
Selenium	1800	0.3	No	0.5	No
Zinc	170000	109.7	No	384.0	No
Cyanide	34	0.3	No	0.4	No

(1) = LQM/CIEH S4UL's – Commercial, (2) = CL:AIRE C4SLs – Commercial, (3) = Atkins ATRISK SSV (Mar 2011).
* = Site Value (C_M) less than analytical detection limit

E.2.14.2 PAHs and TPHs Screening Summary

Table E.44: Section 7 Pipeline PAHs and TPHs Screening Summary

Geology		Topsoil		Glacial Till Deposits	
No. of Samples		3		8	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Speciated PAHs					
Acenaphthene	30000	<0.01	No	<0.01	No
Acenaphthylene	30000	<0.01	No	<0.01	No
Anthracene	150000	<0.01	No	0.01	No
Benzo(a)anthracene	62	0.02	No	0.03	No
Benzo(a)pyrene	13	<0.01	No	<0.01	No
Benzo(b)fluoranthene	16	0.01	No	0.01	No
Benzo(ghi)perylene	1600	<0.01	No	<0.01	No
Benzo(k)fluoranthene	440	<0.01	No	<0.01	No
Chrysene	120	0.01	No	0.01	No
Dibenz(ah)anthracene	1.4	0.01	No	<0.01	No
Fluoranthene	6400	0.01	No	0.01	No
Fluorene	20000	<0.01	No	<0.01	No
Indeno(123cd)pyrene	180	0.01	No	0.01	No
Naphthalene	3000	<0.01	No	<0.01	No
Phenanthrene	6300	0.01	No	<0.01	No
Pyrene	15000	0.01	No	0.01	No
Speciated TPHs (Ali/Aro)					
Aliphatic C_5-C_6	180000	0.01	No	0.29	No
Aliphatic C_6-C_8	320000	0.01	No	0.01	No
Aliphatic C_8-C_{10}	21000	0.01	No	0.01	No
Aliphatic C_{10}-C_{12}	24000	<0.01	No	<0.01	No
Aliphatic C_{12}-C_{16}	26000	<0.01	No	<0.01	No
Aliphatic C_{16}-C_{21}	490000	<0.01	No	<0.01	No
Aliphatic C_{21}-C_{35}	490000	<0.01	No	<0.01	No
Aliphatic C_{35}-C_{44}	490000	<0.01	No	<0.01	No
Aliphatic C_{10}-C_{44}	490000	<0.01	No	<0.01	No
Aromatics C_5-C_7	92000	0.01	No	0.01	No
Aromatics C_7-C_8	100000	0.01	No	0.01	No
Aromatics C_8-C_{10}	9300	0.01	No	0.01	No
Aromatics C_{10}-C_{12}	10000	<0.01	No	<0.01	No

Geology		Topsoil		Glacial Till Deposits	
No. of Samples		3		8	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Aromatics C_{12}-C_{16}	10000	<0.01	No	<0.01	No
Aromatics C_{16}-C_{21}	7800	<0.01	No	<0.01	No
Aromatics C_{21}-C_{35}	7900	<0.01	No	<0.01	No
Aromatics C_{35}-C_{44}	7900	<0.01	No	<0.01	No
Aromatics C_{10}-C_{44}	7900	<0.01	No	<0.01	No
Ali/Aro C_{10}-C_{44} Total		<0.01	No	<0.01	No
MBTE		0.01	No	0.01	No
C_5-C_{10} Gasoline Range Organiser (GRO)	25000	0.10	No	0.29	No
(1) = LQM/CIEH S4UL's – POS Park – 2.5% SOM, (2) = CL:AIRE C4SLs – POS Park – 2.5% SOM, (3) = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit SOM:					

E.2.14.3 Asbestos Screening

Table E.45: Section 7 Pipeline Asbestos Screening Summary

Strata	Locations				Depth (m)	Results
Topsoil	LB_21_301_TP	LB_21_309_TP	LB_21_302_TP		0.1 - 0.3	NAD
Glacial Till Deposits	LB_21_303_TP LB_21_308_TP	LB_21_305_TP LB_21_307_TP	LB_21_304_TP LB_21_310_TP	LB_21_306_TP LB_21_311_TP	0.2 – 0.7	NAD
Notes: NAD – No Asbestos Detected						

E.2.15 Section 8 Valve Houses (Point of Ayr)

E.2.15.1 Metal Screening Summary

Table E.46: Section 8 Valve Houses Generic Metal Screening Summary

Geology		Made Ground		Tidal Flat Deposits	
No. of Samples		12		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C	Max. Conc. (C_M) recorded mg/kg	Does C_M exceed C_C
Arsenic	170	10.8	No	5.3	No
Cadmium	532	0.9	No	0.3	No
Chromium III	33000	61.7	No	0.1	No
Chromium VI	220	0.0	No	-	No
Copper	44000	33.2	No	0.1	No
Lead	1300	169.2	No	0.0	No
Mercury	240	0.1	No	0.0	No
Nickel	3400	30.1	No	1.5	No
Selenium	1800	0.9	No	-	No
Zinc	170000	208.4	No	0.4	No
Cyanide	34	6.4	No	15.1	No

(1) = LQM/CIEH S4UL's – Commercial, (2) = CL:AIRE C4SLs – Commercial, (3) = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit

E.2.15.2 PAHs and TPHs Screening Summary

Table E.47: Section 8 Valve Houses PAHs and TPHs Screening Summary

Geology		Made Ground		Tidal Flat Deposits	
No. of Samples		12		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Speciated PAHs					
Acenaphthene	30000	0.01	No	0.01	No
Acenaphthylene	30000	0.30	No	<0.01	No
Anthracene	150000	0.03	No	<0.01	No
Benzo(a)anthracene	62	0.13	No	<0.01	No
Benzo(a)pyrene	13	0.17	No	0.01	No
Benzo(b)fluoranthene	16	0.23	No	<0.01	No
Benzo(ghi)perylene	1600	0.09	No	<0.01	No
Benzo(k)fluoranthene	440	0.08	No	<0.01	No
Chrysene	120	0.15	No	<0.01	No
Dibenz(ah)anthracene	1.4	0.01	No	<0.01	No
Fluoranthene	6400	0.28	No	0.01	No
Fluorene	20000	0.03	No	<0.01	No
Indeno(123cd)pyrene	180	0.06	No	<0.01	No
Naphthalene	3000	0.14	No	0.05	No
Phenanthrene	6300	0.53	No	0.01	No
Pyrene	15000	0.26	No	0.01	No
Speciated TPHs (Ali/Aro)					
Aliphatic C_5-C_6	180000	0.01	No	-	No
Aliphatic C_6-C_8	320000	0.01	No	-	No
Aliphatic C_8-C_{10}	21000	0.01	No	-	No
Aliphatic C_{10}-C_{12}	24000	1.50	No	-	No
Aliphatic C_{12}-C_{16}	26000	1.20	No	-	No
Aliphatic C_{16}-C_{21}	490000	1.50	No	-	No
Aliphatic C_{21}-C_{35}	490000	14.04	No	-	No
Aliphatic C_{35}-C_{44}	490000	<0.01	No	-	No
Aliphatic C_{10}-C_{44}	490000	2.31	No	-	No
Aromatics C_5-C_7	92000	0.04	No	-	No
Aromatics C_7-C_8	100000	0.01	No	-	No
Aromatics C_8-C_{10}	9300	0.01	No	-	No
Aromatics C_{10}-C_{12}	10000	0.90	No	-	No

Geology		Made Ground		Tidal Flat Deposits	
No. of Samples		12		1	
Analyte	Critical Conc. (C_C) mg/kg	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C	Max. Conc. (C_M) (mg/kg)	Has C_M exceeded C_C
Aromatics C_{12}-C_{16}	10000	1.14	No	-	No
Aromatics C_{16}-C_{21}	7800	1.60	No	-	No
Aromatics C_{21}-C_{35}	7900	0.00	No	-	No
Aromatics C_{35}-C_{44}	7900	0.00	No	-	No
Aromatics C_{10}-C_{44}	7900	0.00	No	-	No
Ali/Aro C_{10}-C_{44} Total		2.31	No	-	No
MBTE		0.01	No	-	No
C_5-C_{10} Gasoline Range Organiser (GRO)	25000	0.10	No	-	No
[1] = LQM/CIEH S4UL's – POS Park – 2.5% SOM, [2] = CL:AIRE C4SLs – POS Park – 2.5% SOM, [3] = Atkins ATRISK SSV (Mar 2011). * = Site Value (C_M) less than analytical detection limit SOM:					

E.2.15.3 Asbestos Screening

Table E.48: Section 8 Valve Houses Asbestos Screening Summary

Strata	Locations					Depth (m)	Results
Made Ground	LB_21_160_BH	LB_21_162_IP	LB_21_160_BH	LB_21_161_BH	LB_21_163_IP	0.0 – 1.0	NAD
	LB_21_160_BH	LB_21_162_IP	LB_21_160_BH	LB_21_161_BH	LB_21_164_IP		
	LB_21_161_BH	LB_21_163_IP	LB_21_160_BH	LB_21_161_BH			
	LB_21_161_BH	LB_21_164_IP	LB_21_160_BH	LB_21_161_BH			
Notes: NAD – No Asbestos Detected							

E.3 Full Location Fugro Generic Assessment Criteria (GACs) Summary

E.3.1 GAC Summary: Parks and Open Spaces (POS)

Appendix F

Water Quality Standards

Appendix F Contents

F.1 Water Quality Standard

F.2 Fugro Water Quality Assessments

F.2.1 Section 1 Pipeline

Table F.1: WQS; Section 1 Pipeline

Geology		Tidal Flat Deposits		Number of Samples >CT
No. of Samples		1 (W)		
Analyte	UK / EU DWS (mg/l)	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	
Heavy Metals				
Dissolved Arsenic	0.01	0.0025766	No	
Dissolved Boron	1	0.3278537	No	
Dissolved Cadmium	0.005	0.0000599	No	
Dissolved Chromium	0.05	0.0016008	No	
Dissolved Copper	2	0.0049022	No	
Dissolved Lead	0.01	0.0022502	No	
Dissolved Magnesium	-			
Dissolved Mercury	0.001	0.0000117	No	
Dissolved Nickel	-	0.0175655	-	
Dissolved Zinc	0.5	0.1555042	No	
Inorganics				
pH	-	6.71	-	
BOD	-			
COD	-			
Total Cyanide	0.05	0	No	
Ammoniacal Nitrogen as N	0.39			
Chloride	250			
Nitrate as NO3	50			
Nitrate as N	50			
Sulphate as SO4 (2:1 Ext)	BRE SUITE	182.648	-	
Sulphur	-			
Total Organic Carbon	-			
Petroleum Hydrocarbons				
EPH (C8-C40)	0.01	0	No	
PAHs				
Naphthalene	-	0.0000217	-	
Acenaphthylene	-	0.0000026	-	
Acenaphthene	-	0.0000039	-	
Fluorene	-	0.0000098	-	
Phenanthrene	-	0.0000425	-	
Anthracene	-	0.0000044	-	

Geology		Tidal Flat Deposits		Number of Samples >CT
No. of Samples		1 (W)		
Analyte	UK / EU DWS (mg/l)	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	
Fluoranthene	-	0.0000253	-	
Pyrene	-	0.0000264	-	
Benzo(a)anthracene	-	0.0000119	-	
Chrysene	-	0	-	
Benzo(b)fluoranthene	0.0001	0	No	
Benzo(k)fluoranthene	0.0001	0	No	
Benzo(a)pyrene	0.00001	0	No	
Indeno(123cd)pyrene	0.0001	0	No	
Dibenzo(ah)anthracene	-	0	-	
Benzo(ghi)perylene	0.0001	0	No	
PAHs	-	0.000106	-	
Phenols				
Phenol	-	0	-	

(1) = UK Drinking Water Standards. * = Site Value (CM) less than analytical detection limit. ** = Only PAH's & TPH's above analytical detection limit assessed. Where range is given it depends upon the hardness of the water.

F.2.2 Section 2 Pipeline

Table F.2: WQS; Section 2 Pipeline

Geology		Tidal Flat Deposits		Glaciofluvial Deposits, Devensian				Glacial Till Deposits		Chester Formation				Number of Samples >CT
No. of Samples		1 (W)		1 (EW)				1 (EW)		1 (EW)				
Analyte	UK / EU DWS (mg/l)	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	WHO DWS (mg/l)	Has max. CT Value Been Exceeded	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	WHO DWS (mg/l)	Has max. CT Value Been Exceeded	
Heavy Metals														
Dissolved Arsenic	0.01	0.0007878	No	3.7966	Yes	0.01	Yes			0.0006399	No			1
Dissolved Boron	1	0.1661994	No	43.0658	Yes	2.4	Yes			0.0200226	No			1
Dissolved Cadmium	0.005	0.0008541	No	0.0228	Yes	0.003	Yes			0.0004915	No			1
Dissolved Chromium	0.05	0.0039968	No	0.2107	Yes	0.05	Yes			0.0000342	No			1
Dissolved Copper	2	0.0048006	No	0.1282	No					0.0004267	No			
Dissolved Lead	0.01	0.0025315	No	0.0567	Yes	0.05	Yes			0.00001555	No			1
Dissolved Magnesium	-			10.5658										
Dissolved Mercury	0.001	0.0000107	No	0.0004	No					0.0000083	No			
Dissolved Nickel	-	0.0320142	-	2.1646	-					0.0011203	-			
Dissolved Zinc	0.5	0.3688995	No	64.015	Yes	-				0.0022264	No			1
Inorganics														
pH	-	4.56	-	7.22	-			7.78	-	7.6	-			
BOD	-			0	-			14.92	-	3.24	-			
COD	-			91.2	-			2815	-	19.8	-			
Total Cyanide	0.05	0	No	0	No					0	No			
Ammoniacal Nitrogen as N	0.39			0.2065	No			0.0742	No	0.0686	No			
Chloride	250			11.6808	No			40.165	No	50.95	No			
Nitrate as NO3	50			0.5	No			0.692	No	6.663	No			
Nitrate as N	50													
Sulphate as SO4 (2:1 Ext)	BRE SUITE	417.715												
Sulphur	-													
Total Organic Carbon	-			3.16				99.87		32.36				
Petroleum Hydrocarbons														
EPH (C8-C40)	0.01	0.070139	Yes	0						0.0216978	Yes			2
PAHs														
Naphthalene	-	0.0000141	-	0.0000157	-					0.0000619	-			
Acenaphthylene	-	0.0000009	-	0.0000009	-					0.0000028	-			
Acenaphthene	-	0.0000021	-	0.0000019	-					0.0000087	-			
Fluorene	-	0.0000021	-	0.0000021	-					0.0000142	-			
Phenanthrene	-	0	-	0.0000064	-					0.000085	-			
Anthracene	-	0.0000059	-	0.0000005	-					0	-			
Fluoranthene	-	0.0000014	-	0.0000015	-					0.0000394	-			
Pyrene	-	0.0000017	-	0.0000011	-					0.0000384	-			
Benzo(a)anthracene	-	0.0000022	-	0.0000009	-					0.0000154	-			
Chrysene	-	0.000002	-	0.0000007	-					0.0000143	-			

Geology		Tidal Flat Deposits		Glaciofluvial Deposits, Devensian				Glacial Till Deposits		Chester Formation				Number of Samples >CT
No. of Samples		1 (W)		1 (EW)				1 (EW)		1 (EW)				
Analyte	UK / EU DWS (mg/l)	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	WHO DWS (mg/l)	Has max. CT Value Been Exceeded	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	WHO DWS (mg/l)	Has max. CT Value Been Exceeded	
Benzo(b)fluoranthene	0.0001	0	No	0	No					0.0000257	No			
Benzo(k)fluoranthene	0.0001	0	No	0	No					0.0000072	No			
Benzo(a)pyrene	0.00001	0	No	0.0000015	No					0.0000111	Yes	0.00007	No	0
Indeno(123cd)pyrene	0.0001	0.0000047	No	0.0000023	No					0.000008	No			
Dibenzo(ah)anthracene	-	0	-	0	-					0	-			
Benzo(ghi)perylene	0.0001	0.0000064	No	0	No					0.0000081	No			
PAHs	-	0	-	0	-					0.0003055	-			
Phenols														
Phenol	-	0	-	0	-			0	-	0	-			

(1) = UK Drinking Water Standards. * = Site Value (CM) less than analytical detection limit. ** = Only PAH's & TPH's above analytical detection limit assessed. Where range is given it depends upon the hardness of the water.

F.2.3 Section 2 Stanlow

Table F.3: WQS; Section 2 Stanlow

Geology		Chester Formation				Number of Samples >CT
No. of Samples		1 (EW)				
Analyte	UK / EU DWS (mg/l)	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	WHO DWS (mg/l)	Has max. CT Value Been Exceeded	
Heavy Metals						
Dissolved Arsenic	0.01	0.0006399	No			
Dissolved Boron	1	0.0200226	No			
Dissolved Cadmium	0.005	0.0004915	No			
Dissolved Chromium	0.05	0.0000342	No			
Dissolved Copper	2	0.0004267	No			
Dissolved Lead	0.01	0.00001555	No			
Dissolved Magnesium	-					
Dissolved Mercury	0.001	0.0000083	No			
Dissolved Nickel	-	0.0011203	-			
Dissolved Zinc	0.5	0.0022264	No			
Inorganics						
pH	-	7.6	-			
BOD	-	3.24	-			
COD	-	19.8	-			
Total Cyanide	0.05	0	No			
Ammoniacal Nitrogen as N	0.39	0.0686	No			
Chloride	250	50.95	No			
Nitrate as NO3	50	6.663	No			
Nitrate as N	50					
Sulphate as SO4 (2:1 Ext)	BRE SUITE					
Sulphur	-					
Total Organic Carbon	-	32.36				
Petroleum Hydrocarbons						
EPH (C8-C40)	0.01	0.0216978	Yes			2
PAHs						
Naphthalene	-	0.0000619	-			
Acenaphthylene	-	0.0000028	-			
Acenaphthene	-	0.0000087	-			
Fluorene	-	0.0000142	-			
Phenanthrene	-	0.000085	-			
Anthracene	-	0	-			
Fluoranthene	-	0.0000394	-			
Pyrene	-	0.0000384	-			
Geology			Chester Formation			

No. of Samples			1 (EW)			
Analyte	UK / EU DWS (mg/l)	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	WHO DWS (mg/l)	Has max. CT Value Been Exceeded	Number of Samples >CT
Benzo(a)anthracene	-	0.0000154	-			
Chrysene	-	0.0000143	-			
Benzo(b)fluoranthene	0.0001	0.0000257	No			
Benzo(k)fluoranthene	0.0001	0.0000072	No			
Benzo(a)pyrene	0.00001	0.0000111	Yes	0.00007	No	0
Indeno(123cd)pyrene	0.0001	0.000008	No			
Dibenzo(ah)anthracene	-	0	-			
Benzo(ghi)perylene	0.0001	0.0000081	No			
PAHs	-	0.0003055	-			
Phenols						
Phenol	-	0	-			

(1) = UK Drinking Water Standards. * = Site Value (CM) less than analytical detection limit. ** = Only PAH's & TPH's above analytical detection limit assessed. Where range is given it depends upon the hardness of the water.

F.2.4 Section 4 Pipeline

Table F.4: WQS; Section 4 Pipeline

Geology		Tidal Flat Deposits				Glacial Till Deposits Chester Formation				Number of Samples >CT
No. of Samples		1 (EW)				2 (EW)				
Analyte	UK / EU DWS (mg/l)	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	WHO DWS (mg/l)	Has max. CT Value Been Exceeded	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	WHO DWS (mg/l)	Has max. CT Value Been Exceeded	
Heavy Metals										
Dissolved Arsenic	0.01	0.0023059	No							
Dissolved Boron	1	0.7347516	No							
Dissolved Cadmium	0.005	0.0000076	No							
Dissolved Chromium	0.05	0.0002575	No							
Dissolved Copper	2	0.0001089	No							
Dissolved Lead	0.01	0.0000603	No							
Dissolved Magnesium	-	109.096	-			39.6022	-			
Dissolved Mercury	0.001	0.0000008	No							
Dissolved Nickel	-	0.0010359	-							
Dissolved Zinc	0.5	0.0456495	No							
Inorganics										
pH	-	7.38	-			7.66	-			
BOD	-	1	-			0.6	-			
COD	-	50.1	-			154	-			
Total Cyanide	0.05	0	No							

Ammoniacal Nitrogen as N	0.39	1.5771	Yes	-	Yes	0.4236	Yes	-	Yes	2
Chloride	250	1448.381	Yes	-		175.5736	No			1
Nitrate as NO3	50					4.439	No			
Nitrate as N	50	0.107	No			0.0794	No			
Sulphate as SO4 (2:1 Ext)	BRE SUITE									
Geology			Tidal Flat Deposits			Glacial Till Deposits Chester Formation				
No. of Samples			1 (EW)			2 (EW)				
Analyte	UK / EU DWS (mg/l)	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	WHO DWS (mg/l)	Has max. CT Value Been Exceeded	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	WHO DWS (mg/l)	Has max. CT Value Been Exceeded	Number of Samples >CT
Sulphur	-									
Total Organic Carbon	-	3.58	-			2287.75	-			
Petroleum Hydrocarbons										
EPH (C8-C40)	0.01	0	No							
PAHs										
Naphthalene	-	0.0000143	-							
Acenaphthylene	-	0.0000008	-							
Acenaphthene	-	0.0000023	-							
Fluorene	-	0.0000026	-							
Phenanthrene	-	0.0000062	-							
Anthracene	-	0.0000068	-							
Fluoranthene	-	0.0000014	-							
Pyrene	-	0.0000014	-							

Benzo(a)anthracene	-	0.0000023	-							
Chrysene	-	0.0000006	-							
Benzo(b)fluoranthene	0.0001	0.0000014	No							
Benzo(k)fluoranthene	0.0001	0	No							
Benzo(a)pyrene	0.00001	0.0000013	No							
Indeno(123cd)pyrene	0.0001	0.0000016	No							
Dibenzo(ah)anthracene	-	0	-							
Benzo(ghi)perylene	0.0001	0.0000012	No							
PAHs	-	0	-							
Phenol										
Phenol	-	0	-							
(1) = UK Drinking Water Standards. * = Site Value (CM) less than analytical detection limit. ** = Only PAH's & TPH's above analytical detection limit assessed. Where range is given it depends upon the hardness of the water.										

F.2.5 Section 5 Pipeline

Table F.5: WQS; Section 5 Pipeline

Geology		Glaciofluvial Deposits, Devensian		Pennine Middle Coal Measures Formation				Number of Samples >CT
No. of Samples		1 (EW)		2 (EW)				
Analyte	UK / EU DWS (mg/l)	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	WHO DWS (mg/l)	Has max. CT Value Been Exceeded	
Heavy Metals								
Dissolved Arsenic	0.01							
Dissolved Boron	1							
Dissolved Cadmium	0.005							
Dissolved Chromium	0.05							
Dissolved Copper	2							
Dissolved Lead	0.01							
Dissolved Magnesium	-	14.8008	-	31.01	-			
Dissolved Mercury	0.001							
Dissolved Nickel	-							
Dissolved Zinc	0.5							
Inorganics								
pH	-	7.27	-	7.59	-			
BOD	-	1.8	-	16.36	-			
COD	-	201	-	128	-			
Total Cyanide	0.05							
Ammoniacal Nitrogen as N	0.39	0.2834	No	1.6937	Yes	-	Yes	1
Chloride	250	18.9926	No	23.0072	No			
Nitrate as NO3	50	8.0082	No	4.9508	No			
Nitrate as N	50							
Sulphate as SO4 (2:1 Ext)	BRE SUITE							
Sulphur	-							
Total Organic Carbon	-	0.97	-	4.84	-			
(1) = UK Drinking Water Standards. * = Site Value (CM) less than analytical detection limit. ** = Only PAH's & TPH's above analytical detection limit assessed. Where range is given it depends upon the hardness of the water.								

F.2.6 Section 8 Point of Ayr

Table F.6: WQS; Section 8 Point of Ayr

Geology		Tidal Flat Deposits 1 (W)				
No. of Samples						Number of Samples >CT
Analyte	UK / EU DWS (mg/l)	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	WHO DWS (mg/l)	Has max. CT Value Been Exceeded	
Heavy Metals						
Dissolved Arsenic	0.01	0.0053	No			
Dissolved Boron	1	0.27	No			
Dissolved Cadmium	0.005	0.0003	No			
Dissolved Chromium	0.05	0.0000972	No			
Dissolved Copper	2	0.0000687	No			
Dissolved Lead	0.01	0.0000209	No			
Dissolved Magnesium	-					
Dissolved Mercury	0.001	0.0000304	No			
Dissolved Nickel	-	0.001546	-			
Dissolved Zinc	0.5	0.0004348	No			
Inorganics						
pH	-	7.83	-			
BOD	-					
COD	-					
Total Cyanide	0.05					
Ammoniacal Nitrogen as N	0.39	0.006	No			
Chloride	250	417.855	Yes	250	Yes	1
Nitrate as NO3	50					
Nitrate as N	50	0.1816	No			
Sulphate as SO4 (2:1 Ext)	BRE SUITE					
Sulphur	-					
Total Organic Carbon	-					
Petroleum Hydrocarbons						
EPH (C8-C40)	0.01	1.433877	Yes	no visible film	-	1
PAHs						
Naphthalene	-	0.0000458	-			
Acenaphthylene	-	0.000001	-			
Acenaphthene	-	0.0000072	-			
Fluorene	-	0.0000035	-			
Phenanthrene	-	0.0000097	-			
Anthracene	-	0.0000016	-			
Fluoranthene	-	0.0000065	-			

Geology	Tidal Flat Deposits					
No. of Samples	1 (W)					
Analyte	UK / EU DWS (mg/l)	Max. Conc. [CT] (mg/l)	Has max. CT Value Been Exceeded	WHO DWS (mg/l)	Has max. CT Value Been Exceeded	Number of Samples >CT
Pyrene	-	0.0000081	-			
Benzo(a)anthracene	-	0.0000038	-			
Chrysene	-	0.0000018	-			
Benzo(b)fluoranthene	0.0001	0.000001	No			
Benzo(k)fluoranthene	0.0001	0.0000006	No			
Benzo(a)pyrene	0.00001	0.0000055	No			
Indeno(123cd)pyrene	0.0001	0.000002	No			
Dibenzo(ah)anthracene	-	0	-			
Benzo(ghi)perylene	0.0001	0.0000014	No			
PAHs	-	0	-			
Phenols						
Phenol	-	0				

(1) = UK Drinking Water Standards. * = Site Value (CM) less than analytical detection limit. ** = Only PAH's & TPH's above analytical detection limit assessed. Where range is given it depends upon the hardness of the water.

Appendix G

Gas and Groundwater Monitoring Data

Appendix G Contents

G.1 Gas Monitoring Results

G.2 Groundwater Monitoring Results

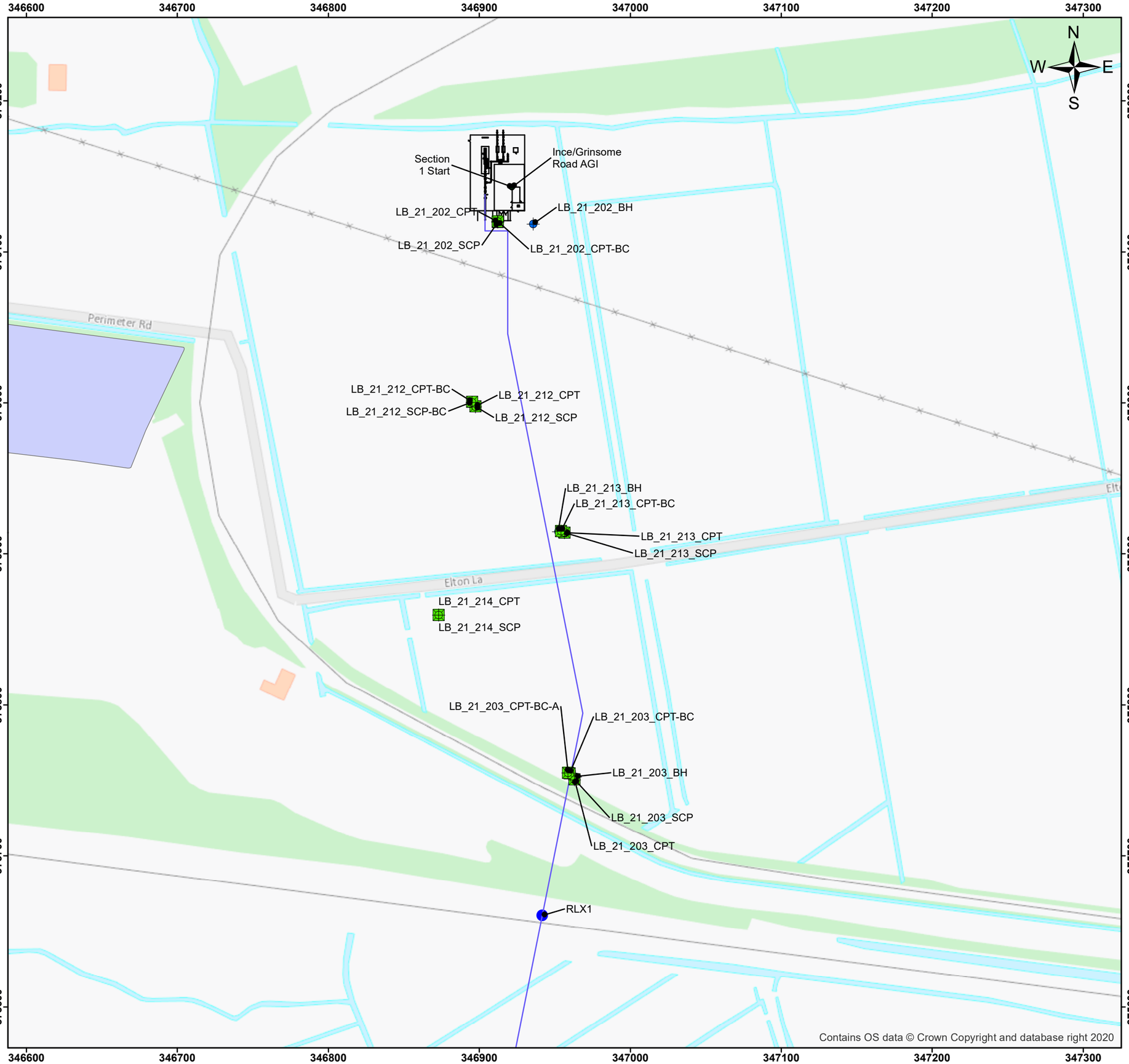
G.3 Diver Data

Explanation

The following plots are based on the automatic water level reading devices, called Divers, which have been installed in some of the groundwater installations installed along the route. The plots are based on time on the x axis and depth below ground level (m bgl) on the y axis. Table G.1 provides a summary of the locations, borehole number and installation date. Note that locations referencing pipeline means they are located along the route of the pipeline and not at above ground structures. They are also listed in order in which they are encountered heading east-west.

Table G.1: Summary of diver locations, boreholes and initial installation date.

Location/Section	Borehole Reference	Diver Installation Date
Section StF_2 Stanlow AGI	LB_21_02_BH	26/01/2022
Section 2 - Pipeline	LB_21_05_BH LB_21_114_BH LB_21_16_BH LB_21_19_BH	26/01/2022 26/01/2022 13/04/2022 19/04/2022
Section 3 - Pipeline	LB_21_123_BH	14/04/2022
Section 4 - Pipeline	LB_21_44_BH LB_21_47_BH LB_21_55_BH	26/01/2022 12/04/2022 26/01/2022
Section 5 - Pipeline	LB_21_109_BH LB_21_64_BH	26/01/2022 14/04/2022
Section 8 – Point of Ayr AGI	LB_21_160_BH	12/04/2022



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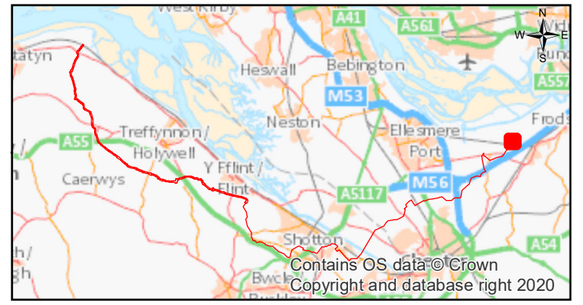

Scale: 1:500,000
0 2 4 8 12 16 20 24 28 32 Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
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Scale: 1:2,500
0 10 20 40 60 80 100 120 140 160 Metres

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Figure Title

Exploratory Hole Location Plan

Figure Number

Section 1.01

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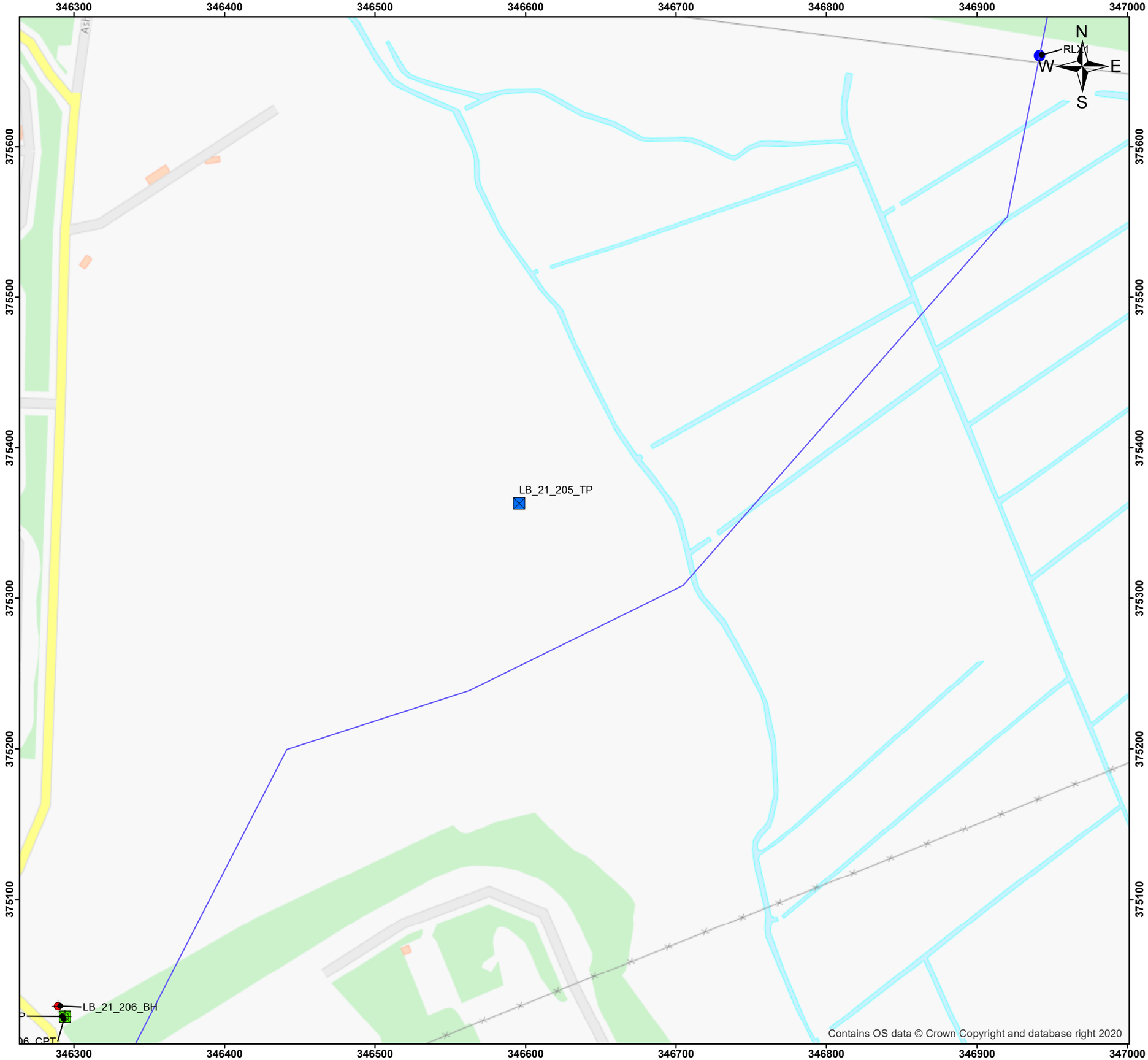

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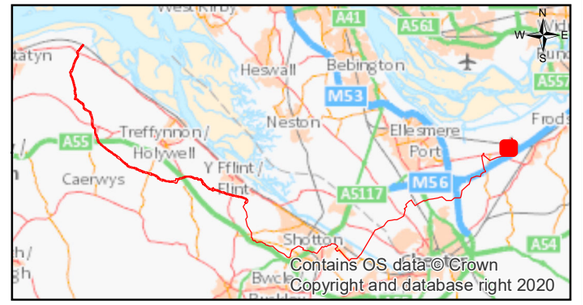

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Legend

Location Type

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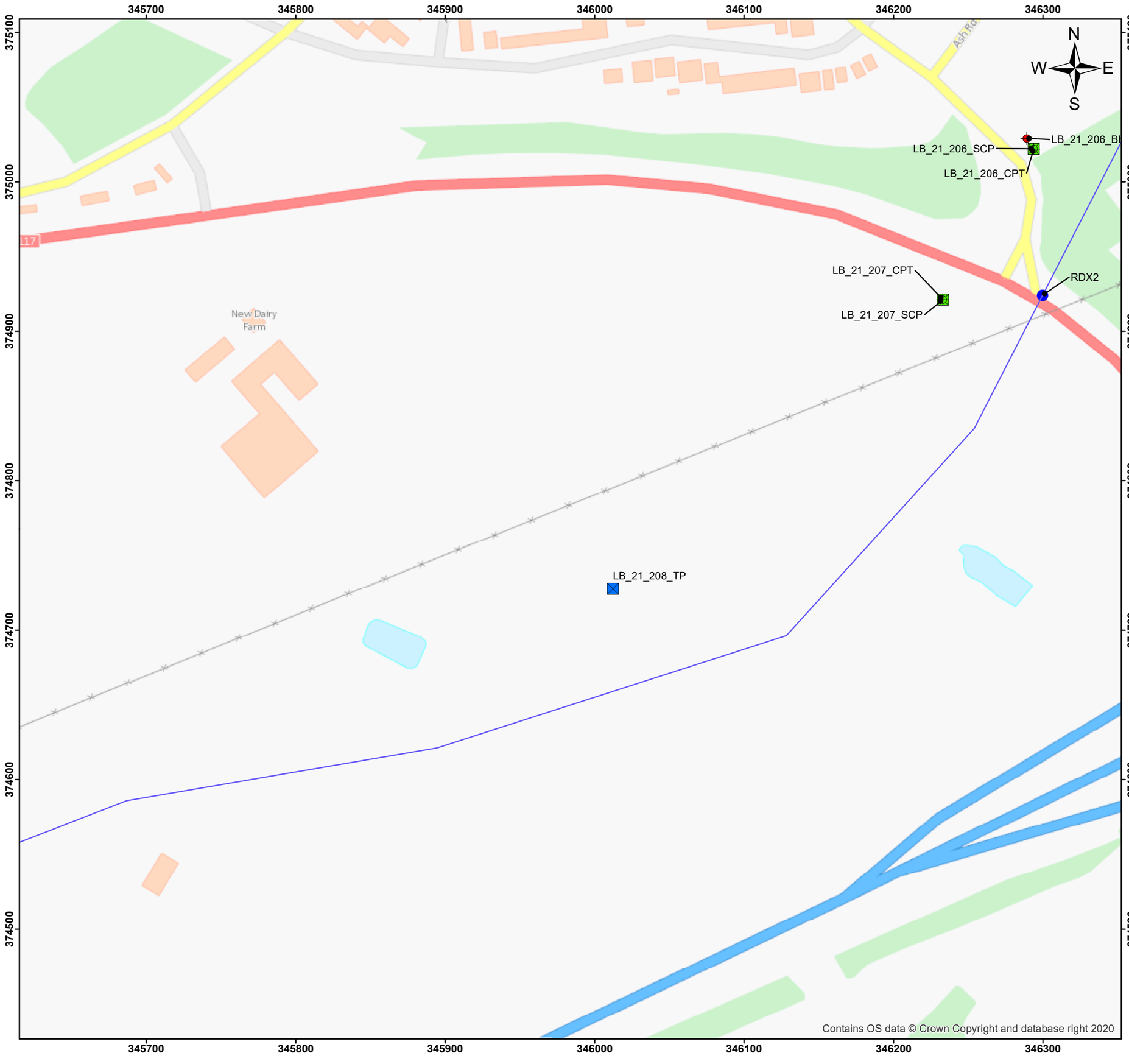

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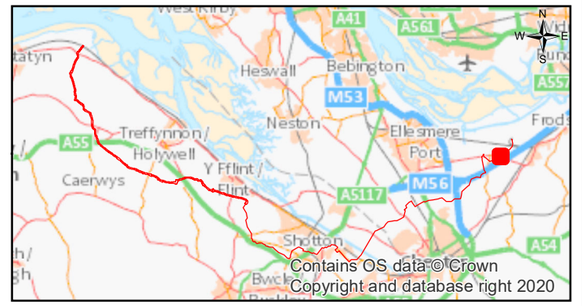

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Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
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0 10 20 40 60 80 100 120 140 160 Metres

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Exploratory Hole Location Plan

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Section 1.03

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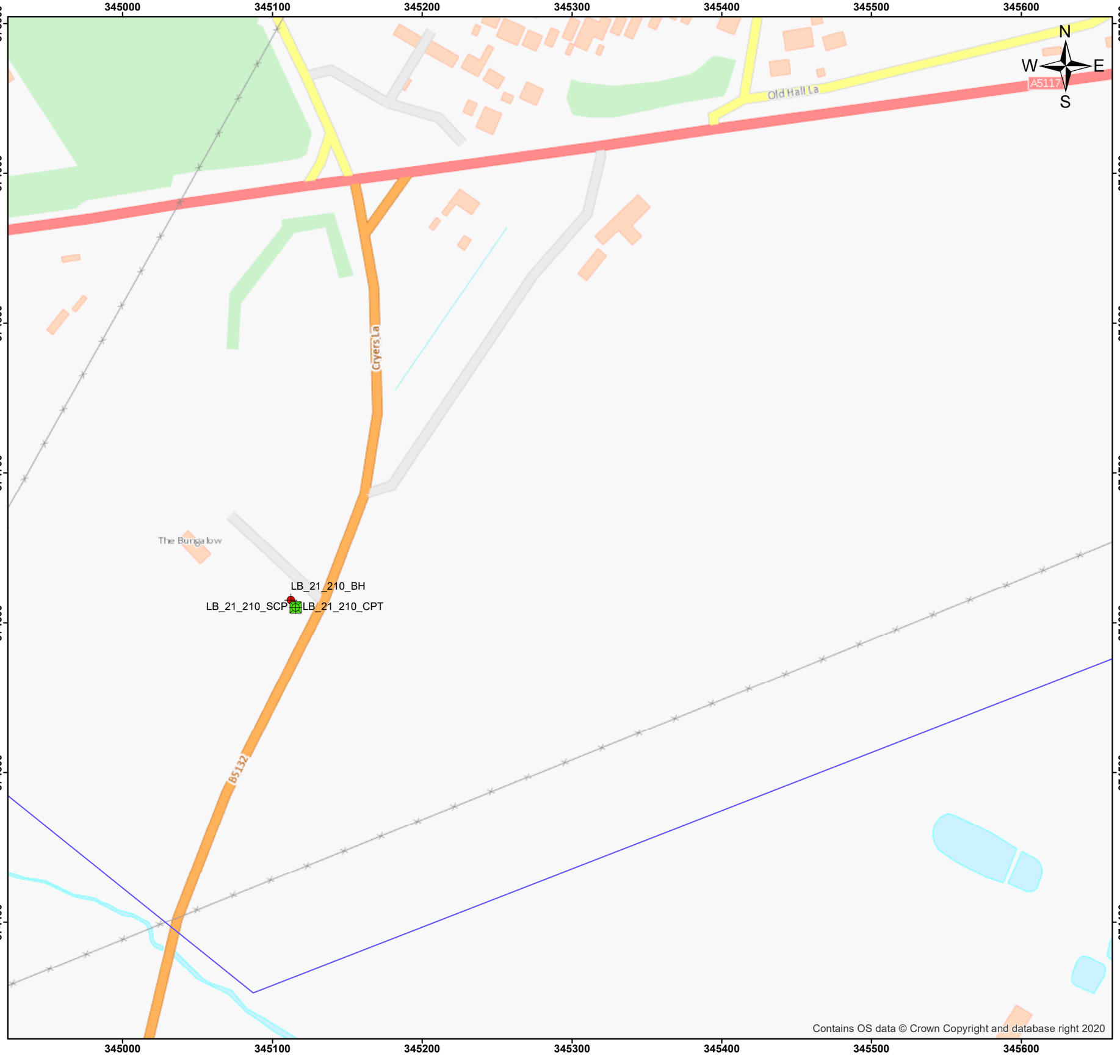

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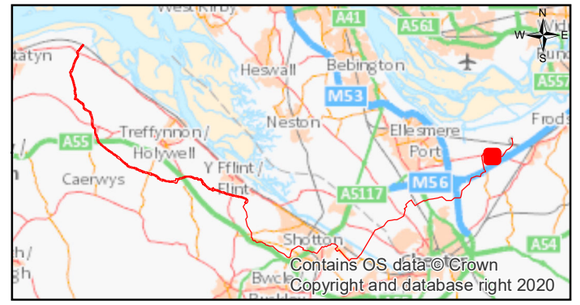

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Legend

Location Type

- Cable Percussion Borehole
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Name

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Exploratory Hole Location Plan

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Section 1.04

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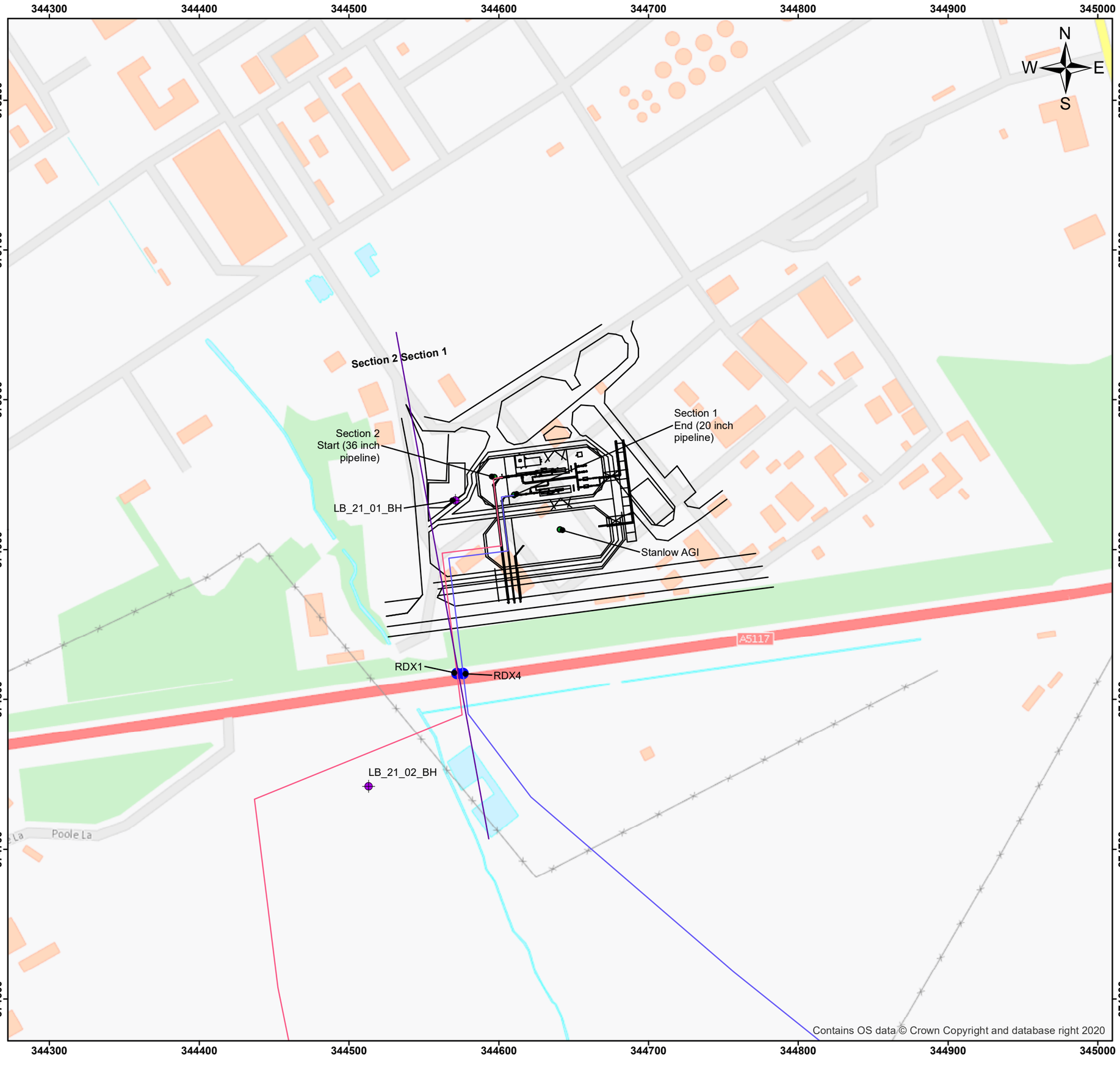

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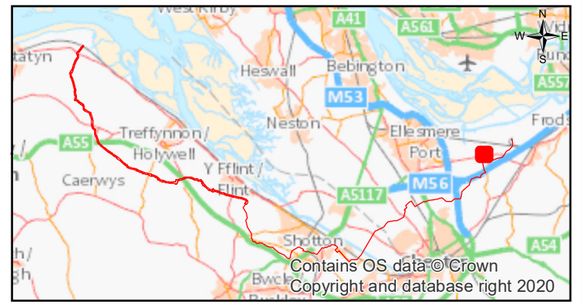

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Legend

Location Type

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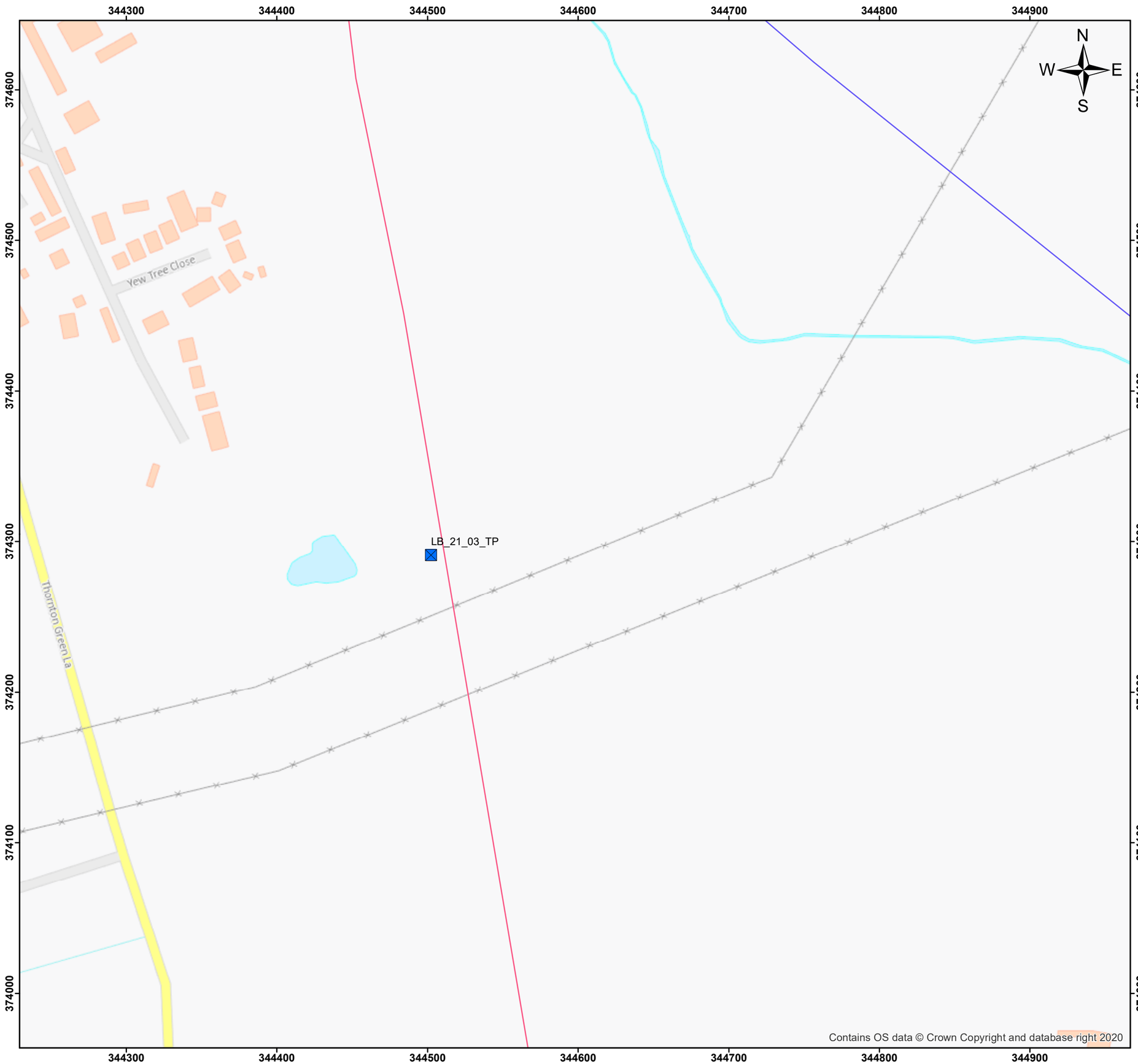

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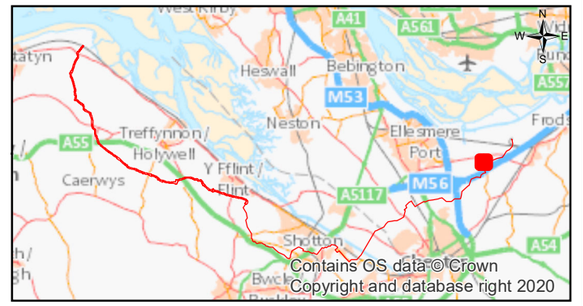

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Legend

Location Type

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Figure Number
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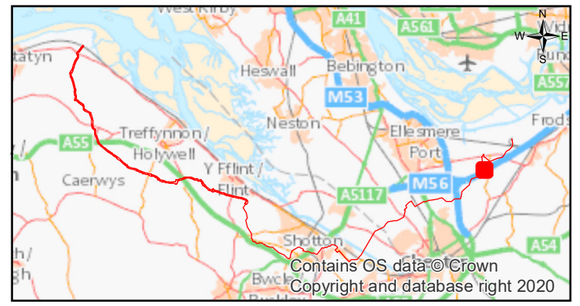

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Legend

Location Type

- Cable Percussion Borehole
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Section 2.02

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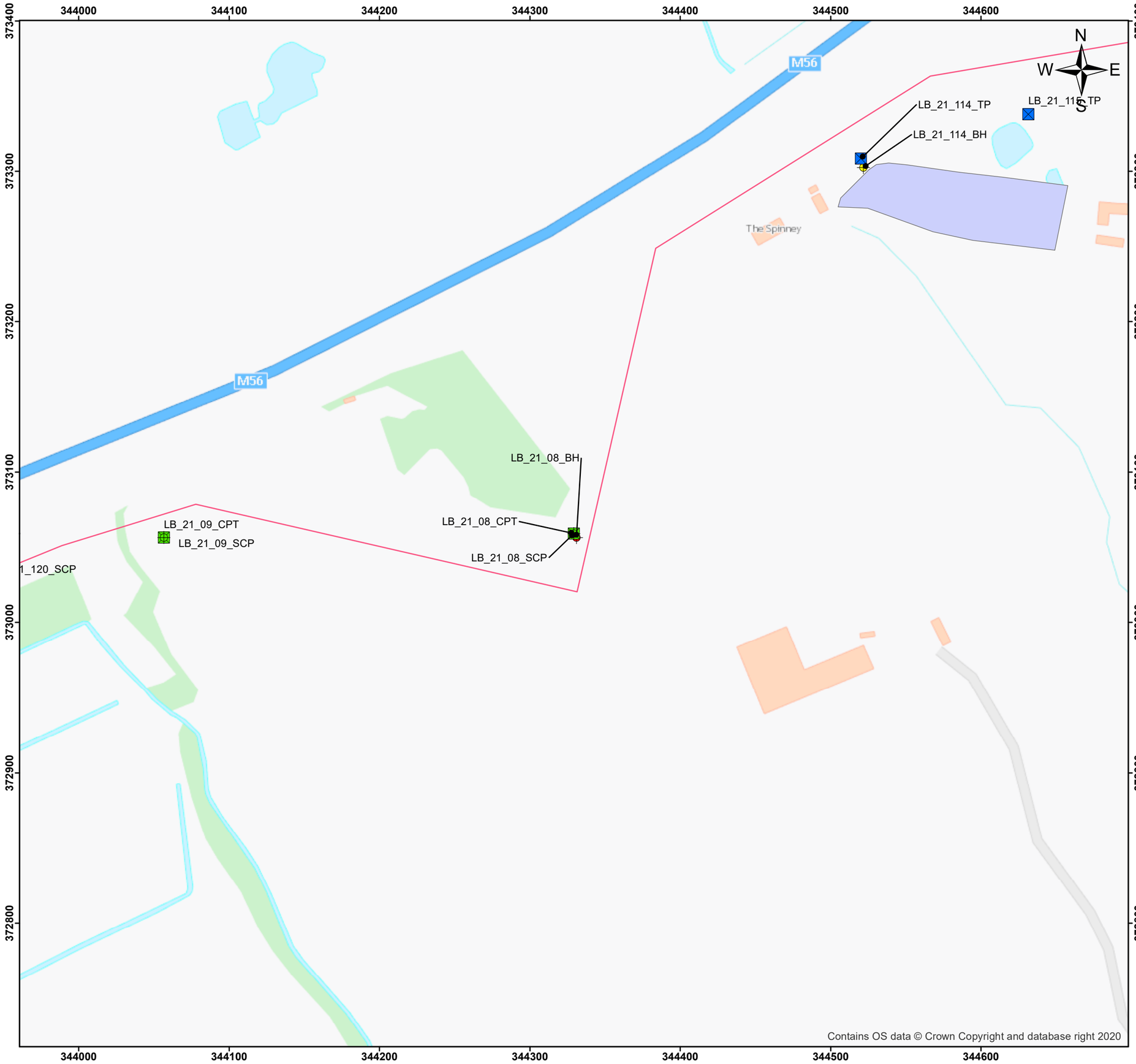

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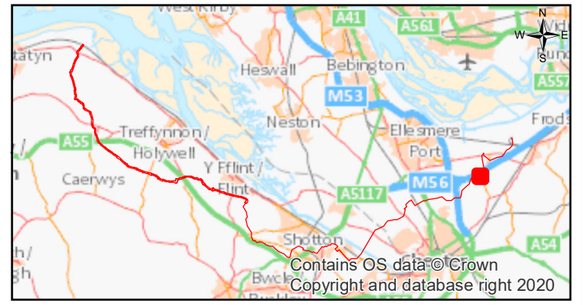

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Legend

Location Type

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Scale: 1:2,500
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Figure Title

Exploratory Hole Location Plan

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Section 2.03

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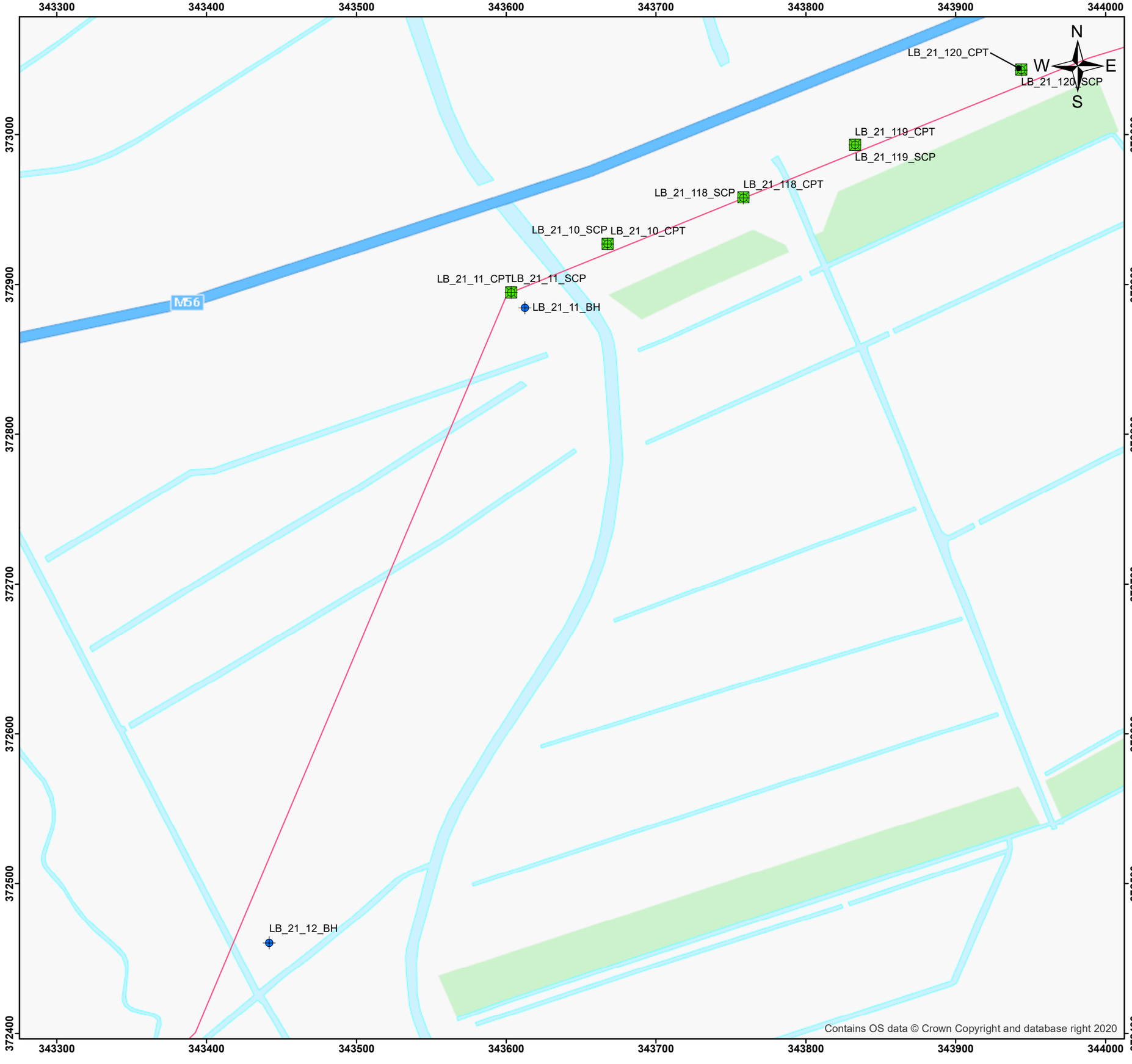

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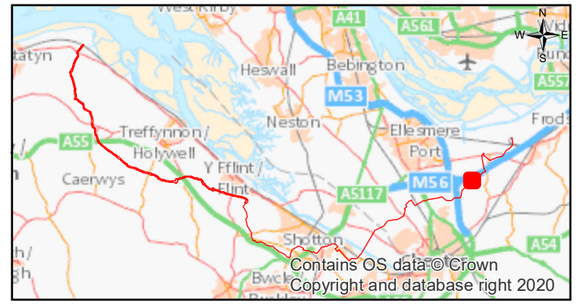


Scale: 1:500,000
0 2 4 8 12 16 20 24 28 32 Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500
0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System
British National Grid

Client
EniProgetti S.p.A
Eni House, Basing View
Basingstoke, RG21 4YY
https://www.eni.com/

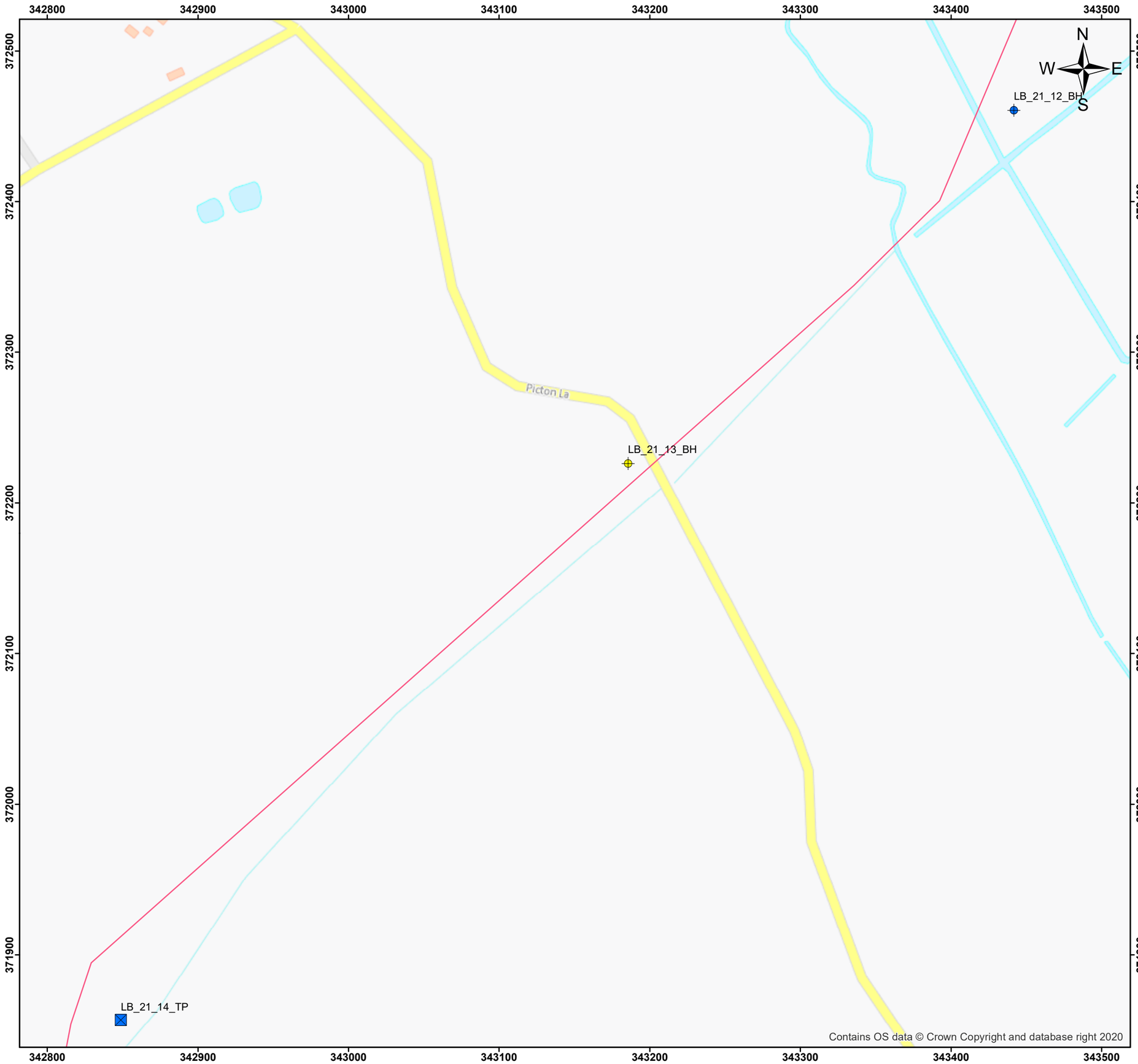
Consultant
Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingfo
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title
LBA CCS Transport and Storage Project Ground Investigations

Figure Title
Exploratory Hole Location Plan

Figure Number
Section 2.04

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



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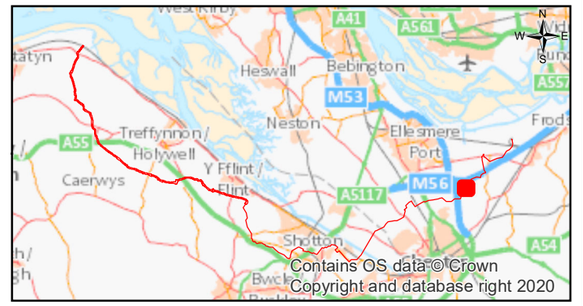


Scale: 1:500,000

0 2 4 8 12 16 20 24 28 32 Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500

0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System

British National Grid

Client

EniProgetti S.p.A
Eni House, Basing View
Basingstoke, RG21 4YY
https://www.eni.com/

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingfo
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

LBA CCS Transport and Storage Project Ground Investigations

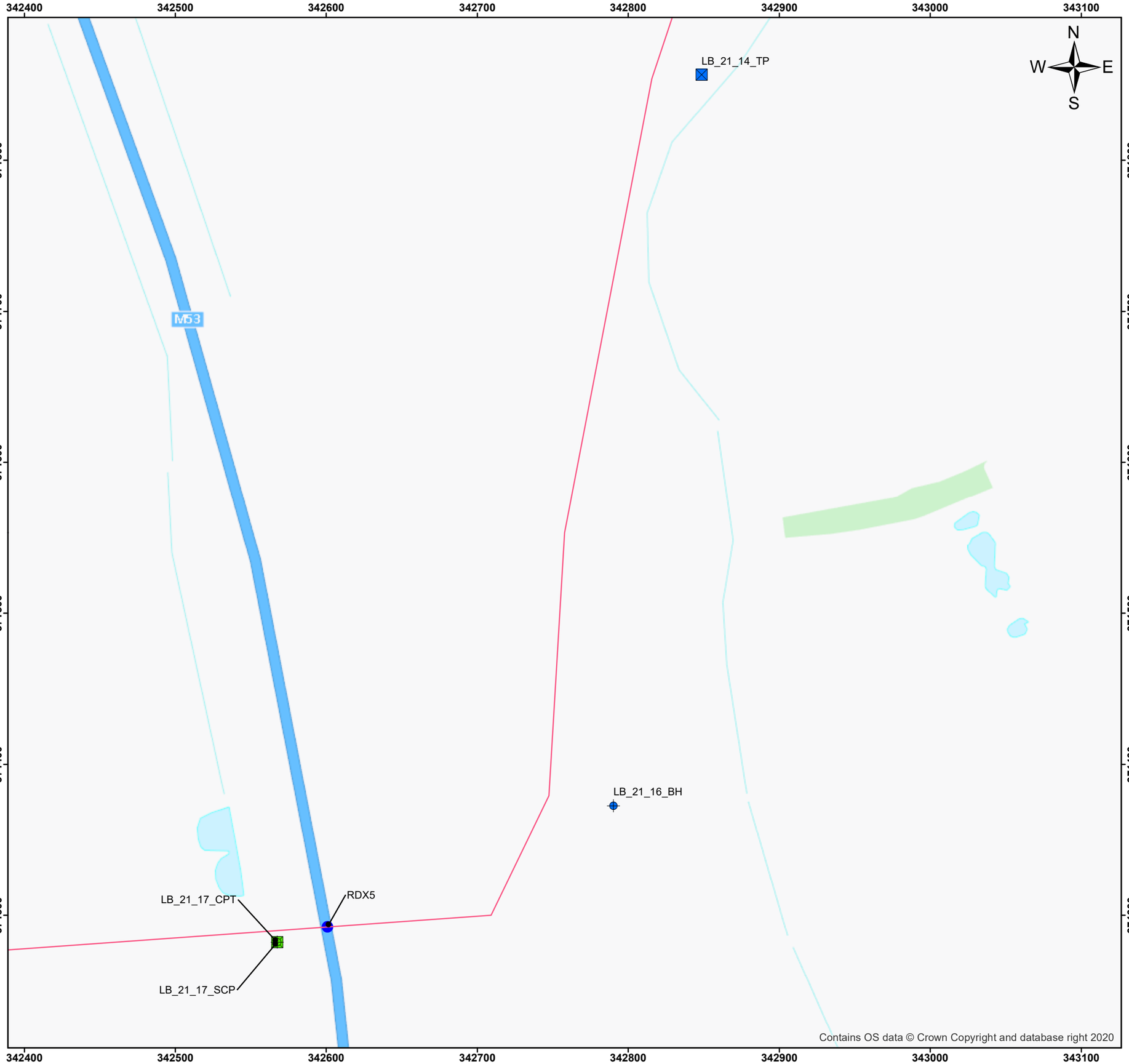
Figure Title

Exploratory Hole Location Plan

Figure Number

Section 2.05

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



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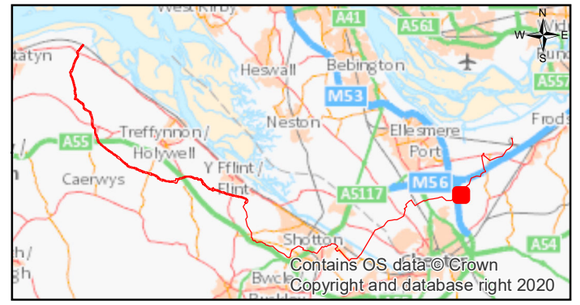

Scale: 1:500,000

0 2 4 8 12 16 20 24 28 32 Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500

0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System

British National Grid

Client

EniProgetti S.p.A
Eni House, Basing View
Basingstoke, RG21 4YY
https://www.eni.com/

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingfo
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Project Title

LBA CCS Transport and Storage Project Ground Investigations

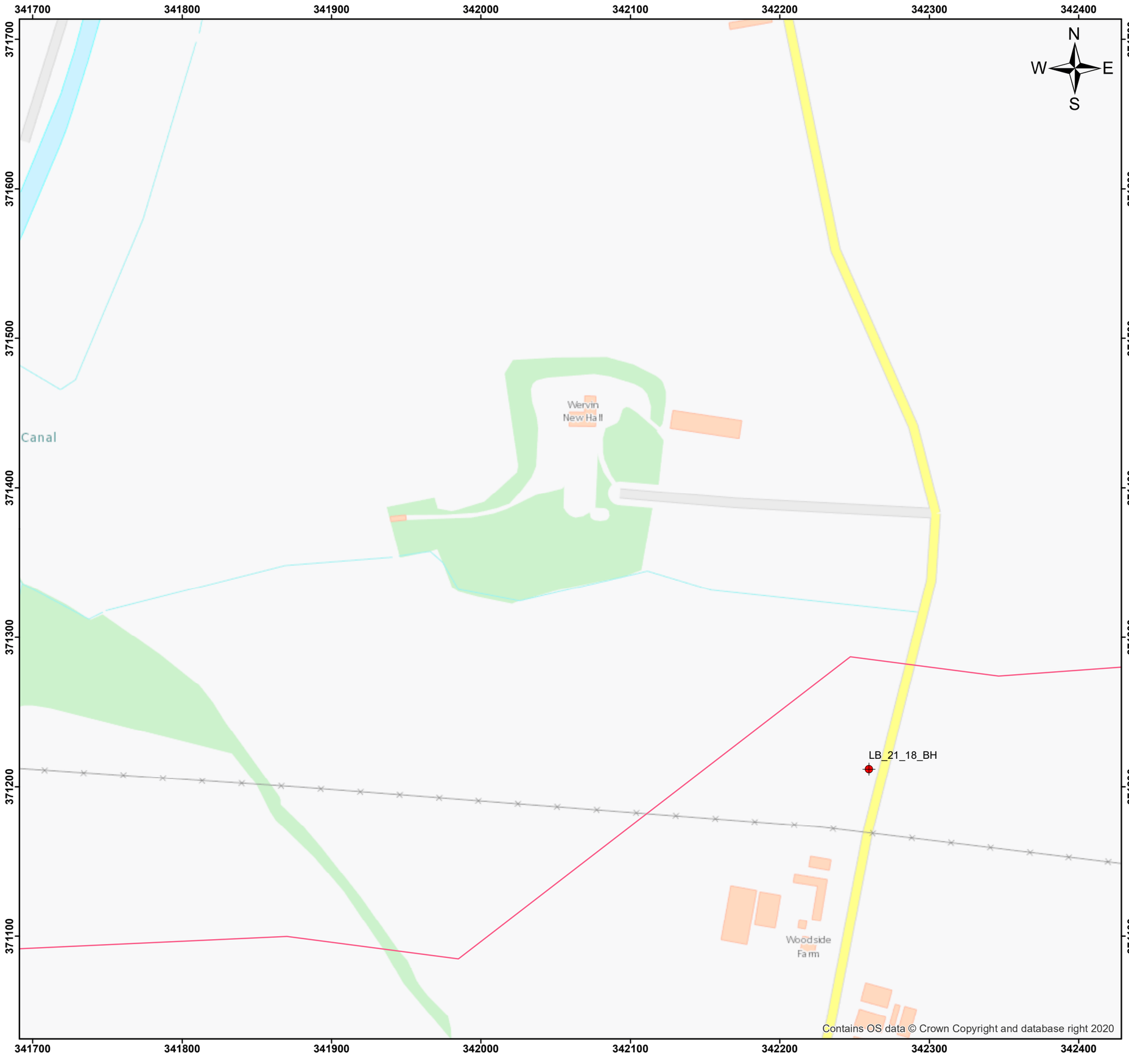
Figure Title

Exploratory Hole Location Plan

Figure Number

Section 2.06

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



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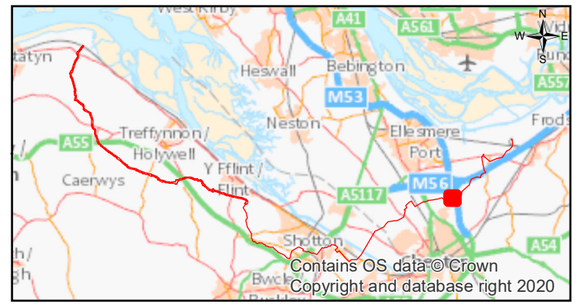

Scale: 1:500,000

0 2 4 8 12 16 20 24 28 32 Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500

0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System

British National Grid

Client

EniProgetti S.p.A
Eni House, Basing View
Basingstoke, RG21 4YY
https://www.eni.com/

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingfo
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Project Title

LBA CCS Transport and Storage Project Ground Investigations

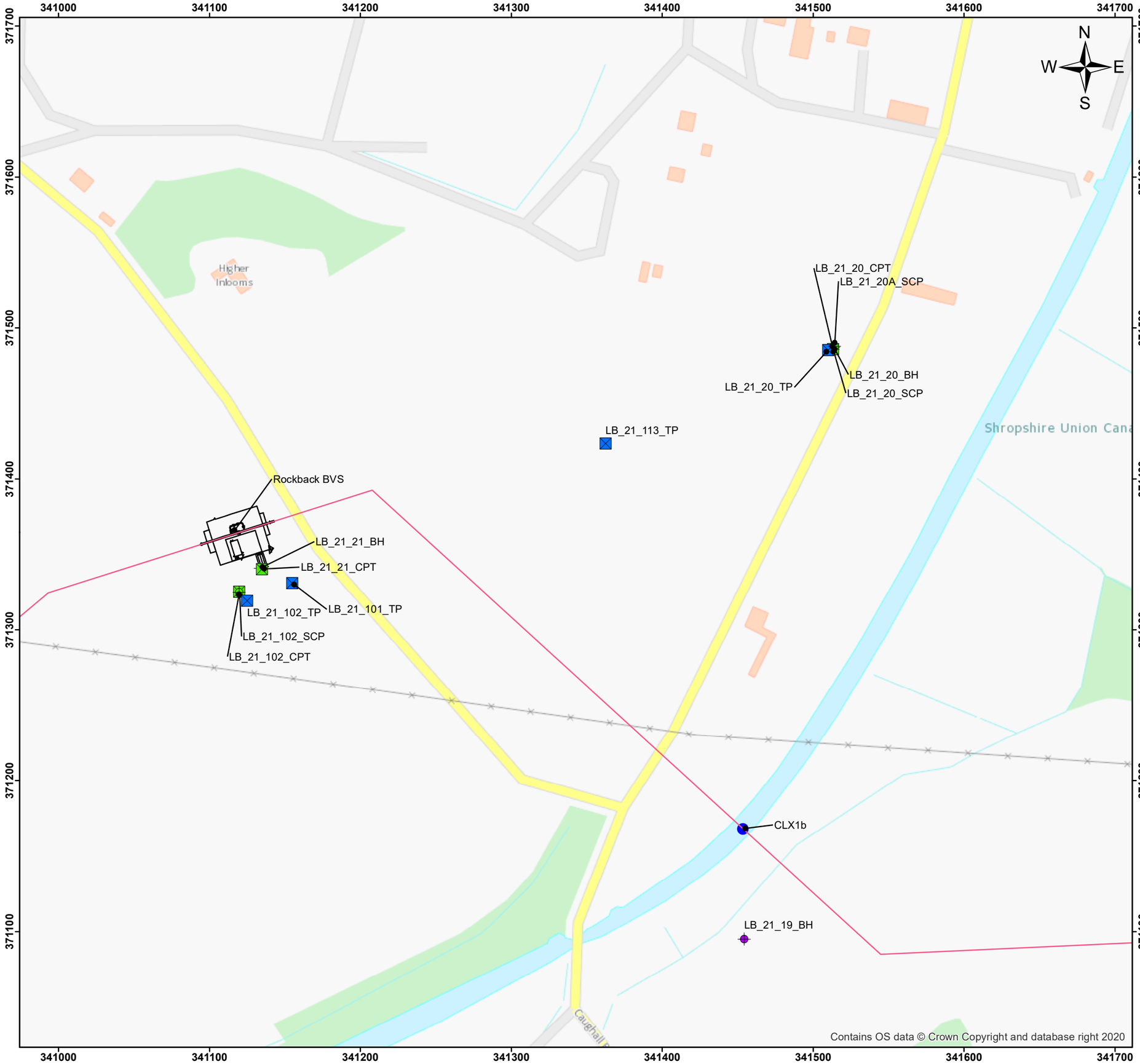
Figure Title

Exploratory Hole Location Plan

Figure Number

Section 2.07

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



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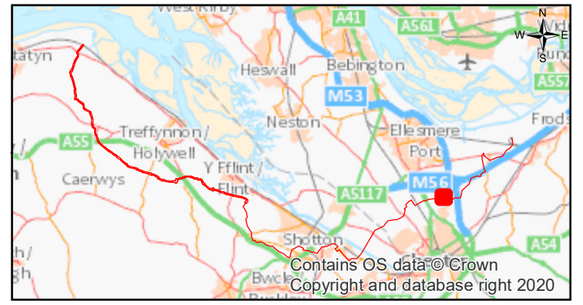

Scale: 1:500,000

0 2 4 8 12 16 20 24 28 32 Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500

0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System

British National Grid

Client

EniProgetti S.p.A
Eni House, Basing View
Basingstoke, RG21 4YY
https://www.eni.com/

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingfo
Oxfordshire, OX10 9RB, United Kingdom
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VAT No. GB 133 1704 09
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Project Title

LBA CCS Transport and Storage Project Ground Investigations

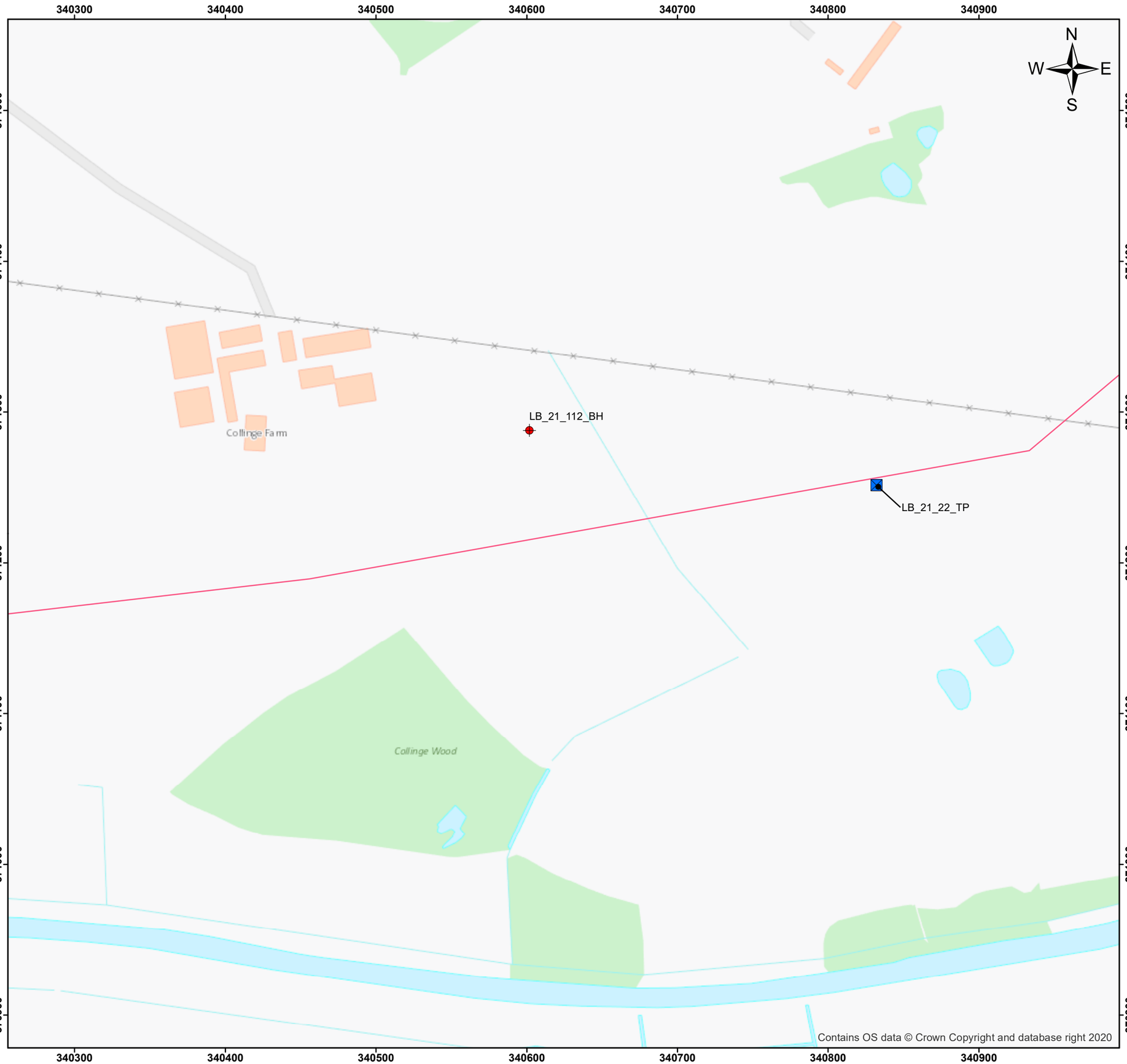
Figure Title

Exploratory Hole Location Plan

Figure Number

Section 2.08

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



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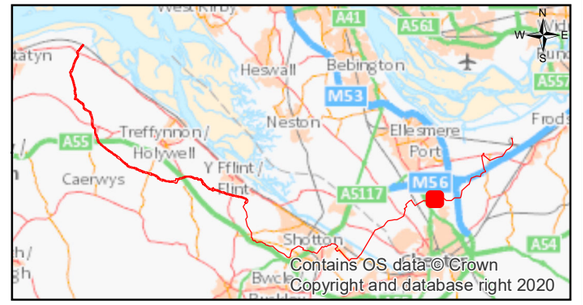

Scale: 1:500,000
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Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500
0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System
British National Grid

Client
EniProgetti S.p.A
Eni House, Basing View
Basingstoke, RG21 4YY
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Project Title

LBA CCS Transport and Storage Project Ground Investigations

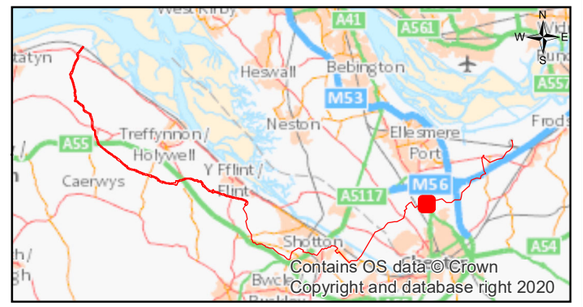
Figure Title

Exploratory Hole Location Plan

Figure Number
Section 2.09

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3

Location



Scale: 1:500,000

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Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500

0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System

British National Grid

Client

EniProgetti S.p.A
Eni House, Basing View
Basingstoke, RG21 4YY
https://www.eni.com/

Consultant

Fugro GeoServices Limited
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Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
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Project Title

LBA CCS Transport and Storage Project Ground Investigations

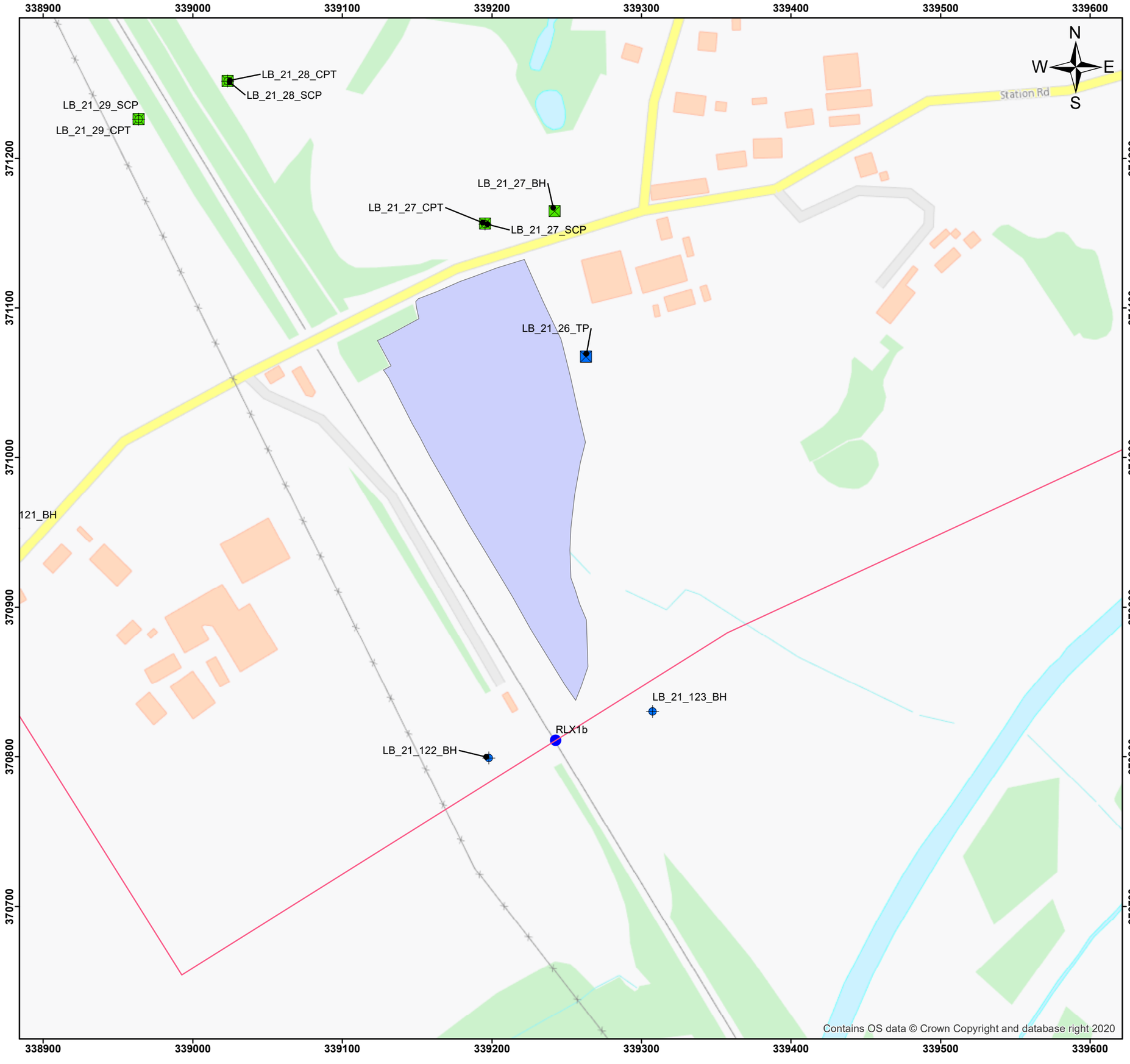
Figure Title

Exploratory Hole Location Plan

Figure Number

Section 2.10

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



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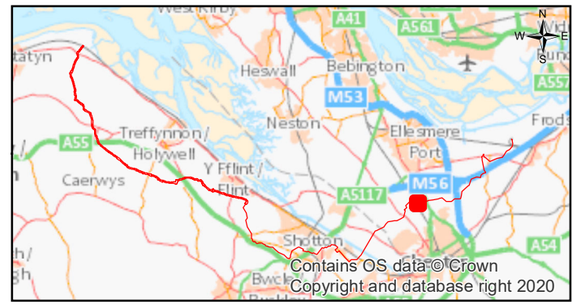

Scale: 1:500,000

0 2 4 8 12 16 20 24 28 32 Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500

0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System

British National Grid

Client

EniProgetti S.p.A
Eni House, Basing View
Basingstoke, RG21 4YY
https://www.eni.com/

Consultant

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Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
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Project Title

LBA CCS Transport and Storage Project Ground Investigations

Figure Title

Exploratory Hole Location Plan

Figure Number

Section 3.01

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3

338300 338400 338500 338600 338700 338800 338900

371100 371000 370900 370800 370700 370600

N W E S

LB_21_30_BH

LB_21_121_BH

LB_21_31_TP

LB_21_32_BH

LB_21_32_CPT

LB_21_32_SCP

Station Rd

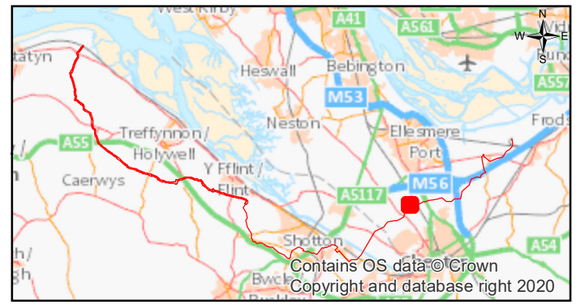
Gipsy La

Grove Rd

Well La

Willow Lea

Location



Scale: 1:500,000

0 2 4 8 12 16 20 24 28 32 Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500

0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System

British National Grid

Client

EniProgetti S.p.A
Eni House, Basing View
Basingstoke, RG21 4YY
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Project Title

LBA CCS Transport and Storage Project Ground Investigations

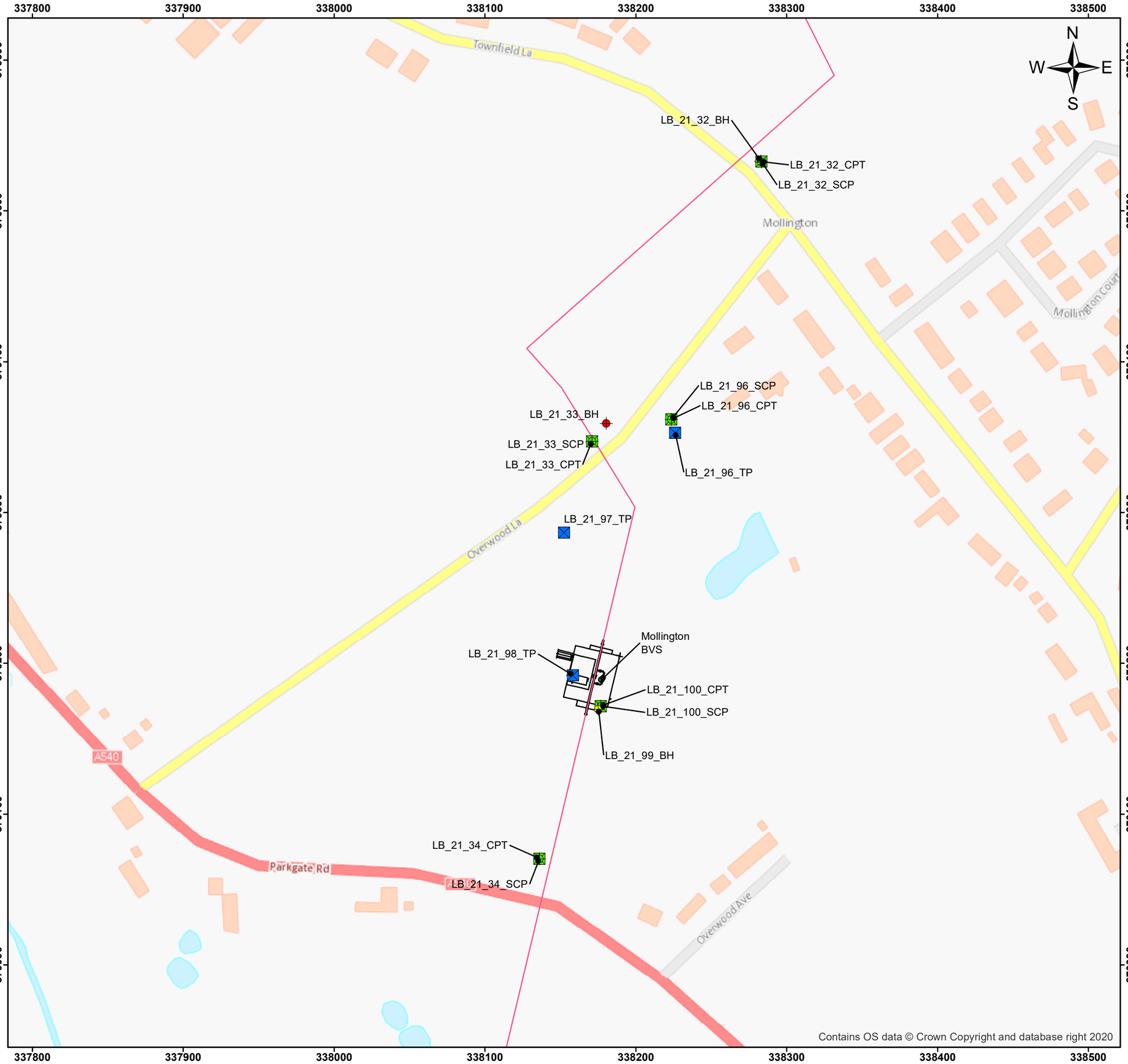
Figure Title

Exploratory Hole Location Plan

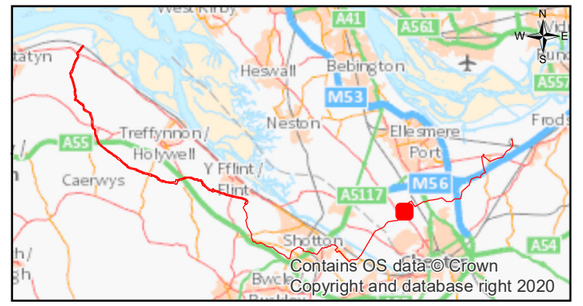
Figure Number

Section 3.02

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



Location



Scale: 1:500,000
0 2 4 8 12 16 20 24 28 32 Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500
0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System
British National Grid

Client
EniProgetti S.p.A
Eni House, Basing View
Basingstoke, RG21 4YY
https://www.eni.com/

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Fugro House, Hithercroft Road, Wallingfo
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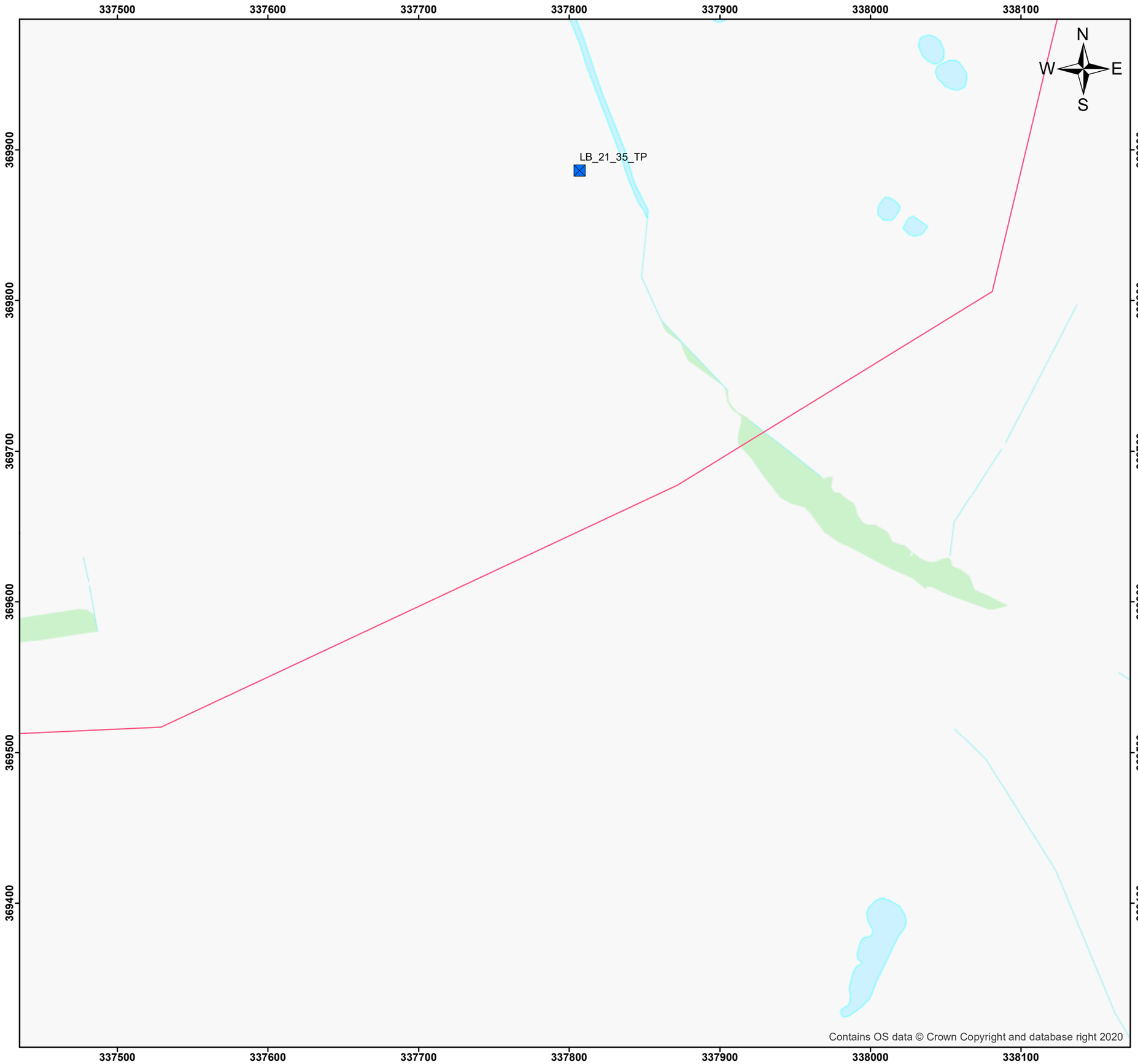
VAT No. GB 133 1704 09
www.fugro.com

Project Title
LBA CCS Transport and Storage Project Ground Investigations

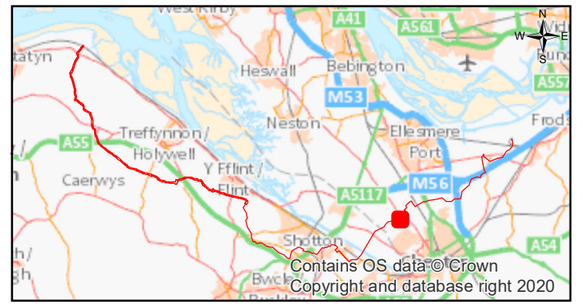
Figure Title
Exploratory Hole Location Plan

Figure Number
Section 3.03

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



Location



Scale: 1:500,000
0 2 4 8 12 16 20 24 28 32 Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500
0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System
British National Grid

Client
EniProgetti S.p.A
Eni House, Basing View
Basingstoke, RG21 4YY
https://www.eni.com/

Consultant
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Project Title

LBA CCS Transport and Storage Project Ground Investigations

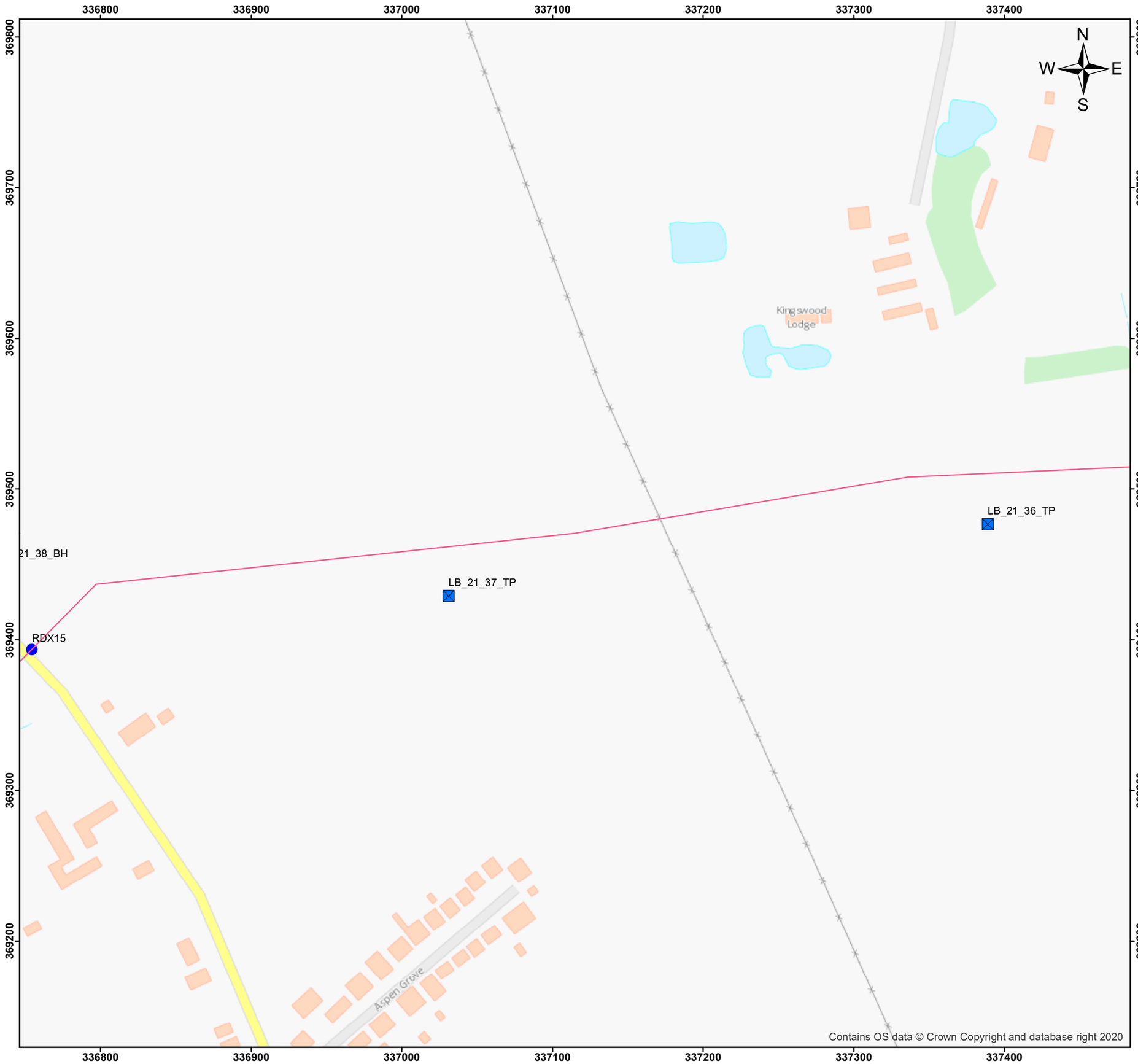
Figure Title

Exploratory Hole Location Plan

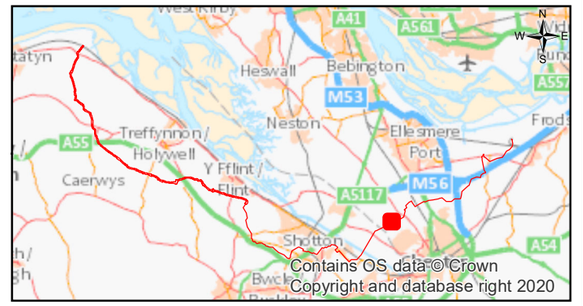
Figure Number

Section 3.04

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



Location



Scale: 1:500,000

0 2 4 8 12 16 20 24 28 32 Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
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1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500

0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System

British National Grid

Client

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VAT No. GB 133 1704 09
www.fugro.com

Project Title

LBA CCS Transport and Storage Project Ground Investigations

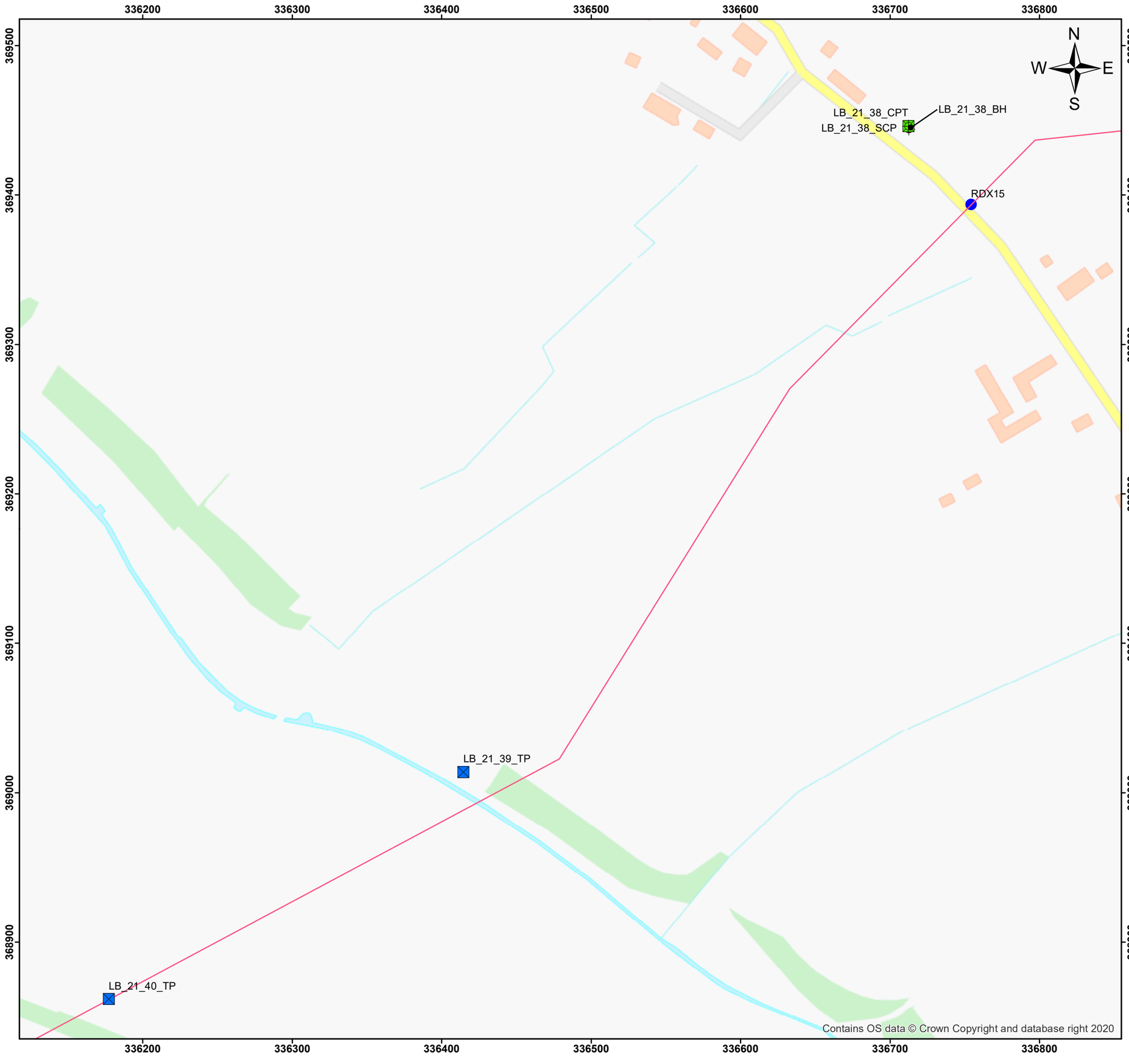
Figure Title

Exploratory Hole Location Plan

Figure Number

Section 3.05

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



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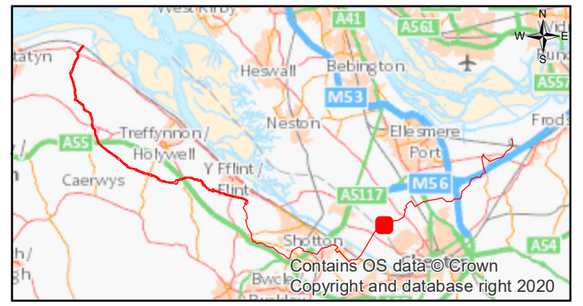

Scale: 1:500,000
0 2 4 8 12 16 20 24 28 32 Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500
0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System
British National Grid

Client
EniProgetti S.p.A
Eni House, Basing View
Basingstoke, RG21 4YY
https://www.eni.com/

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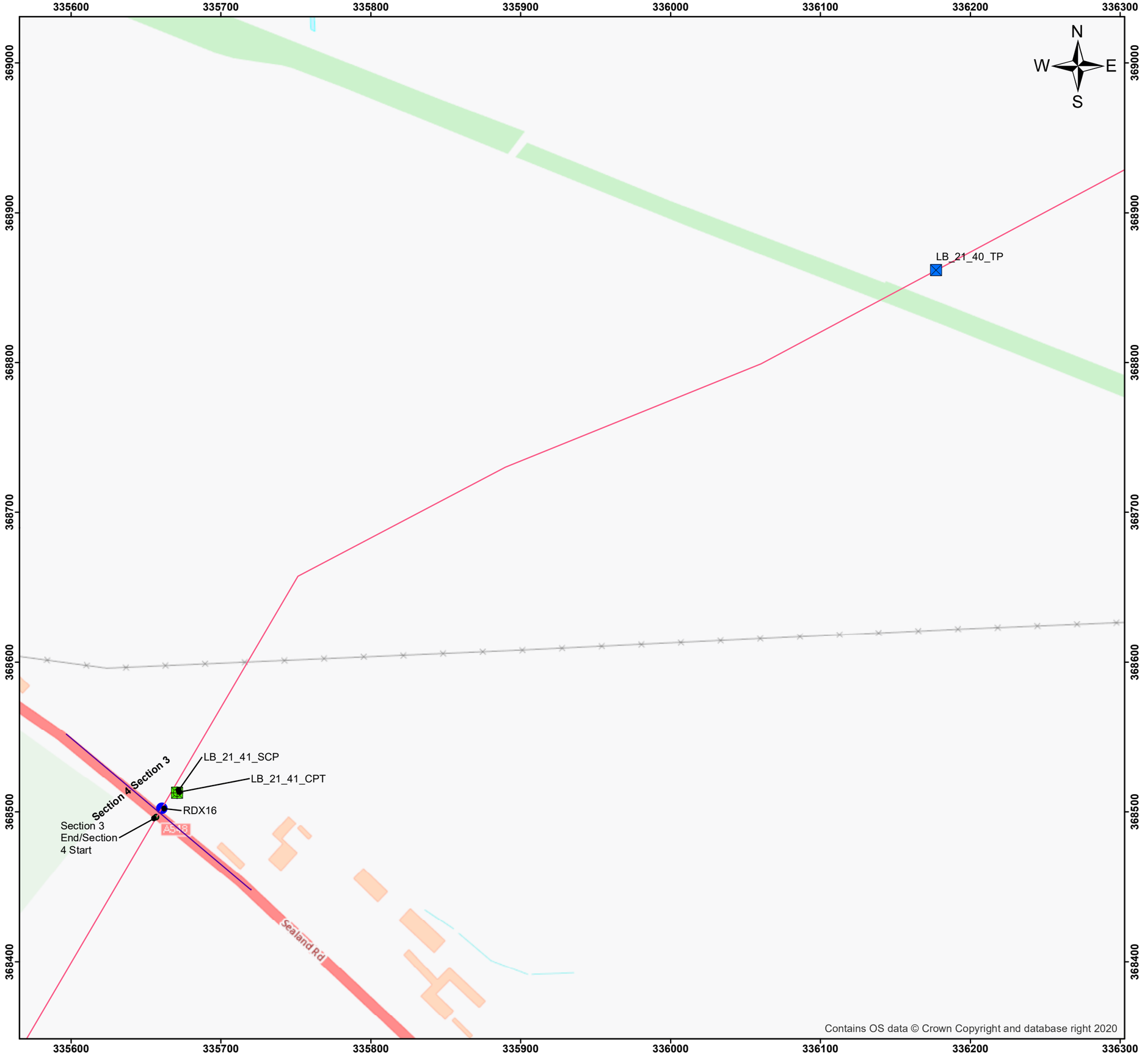
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title
LBA CCS Transport and Storage Project Ground Investigations

Figure Title
Exploratory Hole Location Plan

Figure Number
Section 3.06

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



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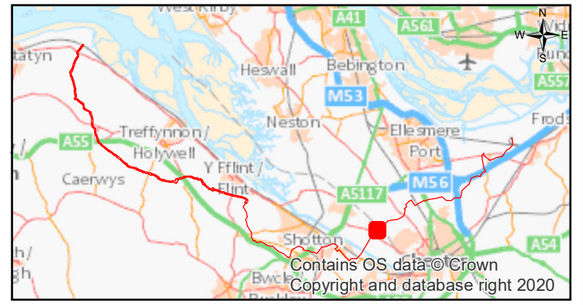

Scale: 1:500,000
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Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500
0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System
British National Grid

Client
EniProgetti S.p.A
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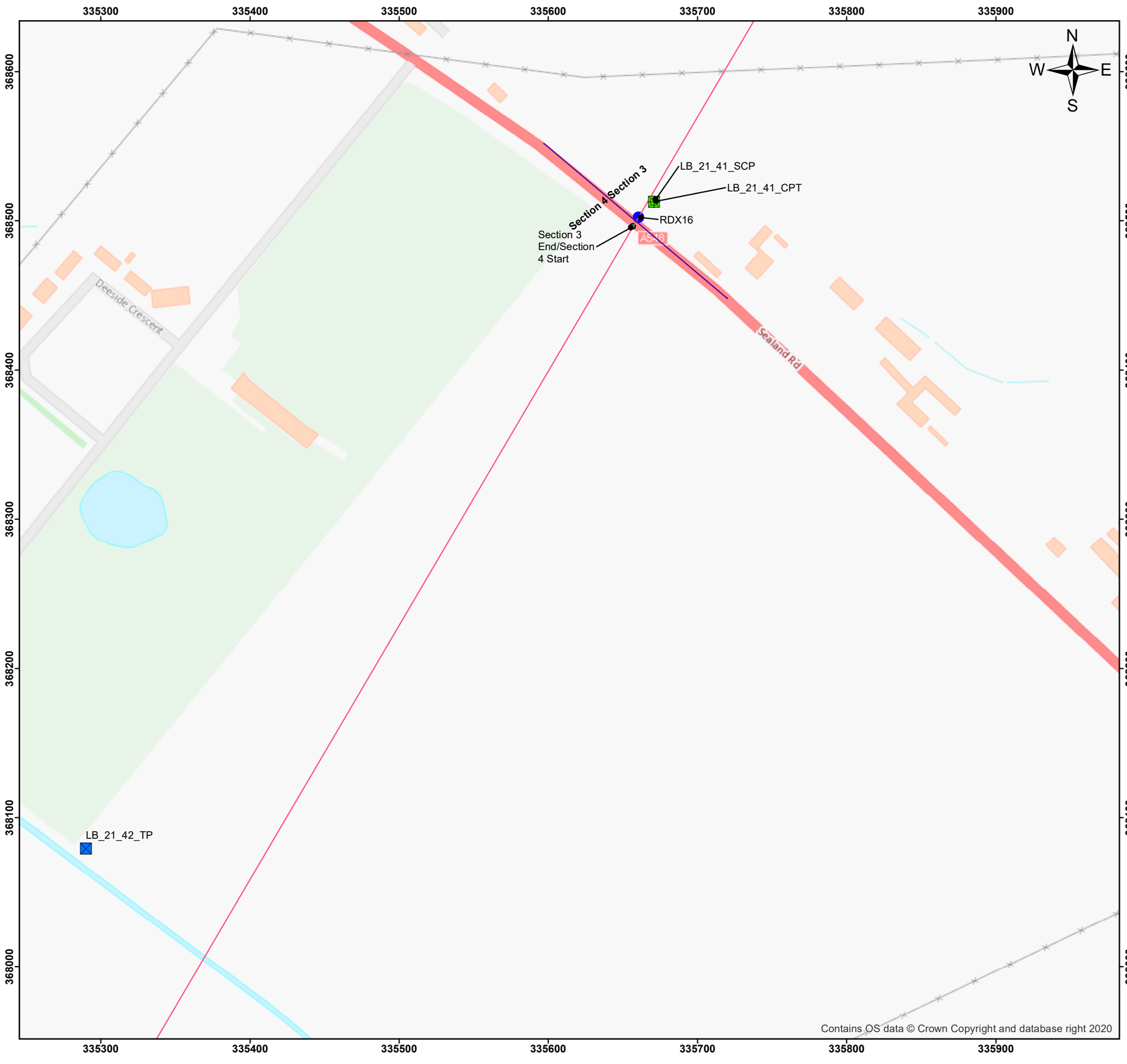
Project Title
LBA CCS Transport and Storage Project Ground Investigations

Figure Title
Exploratory Hole Location Plan

Figure Number
Section 3.07

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



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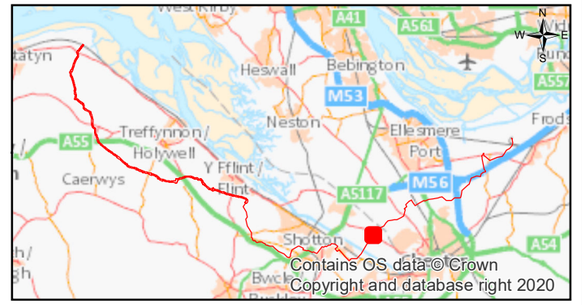

Scale: 1:500,000
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Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500
0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System
British National Grid

Client
EniProgetti S.p.A
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Basingstoke, RG21 4YY
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Project Title

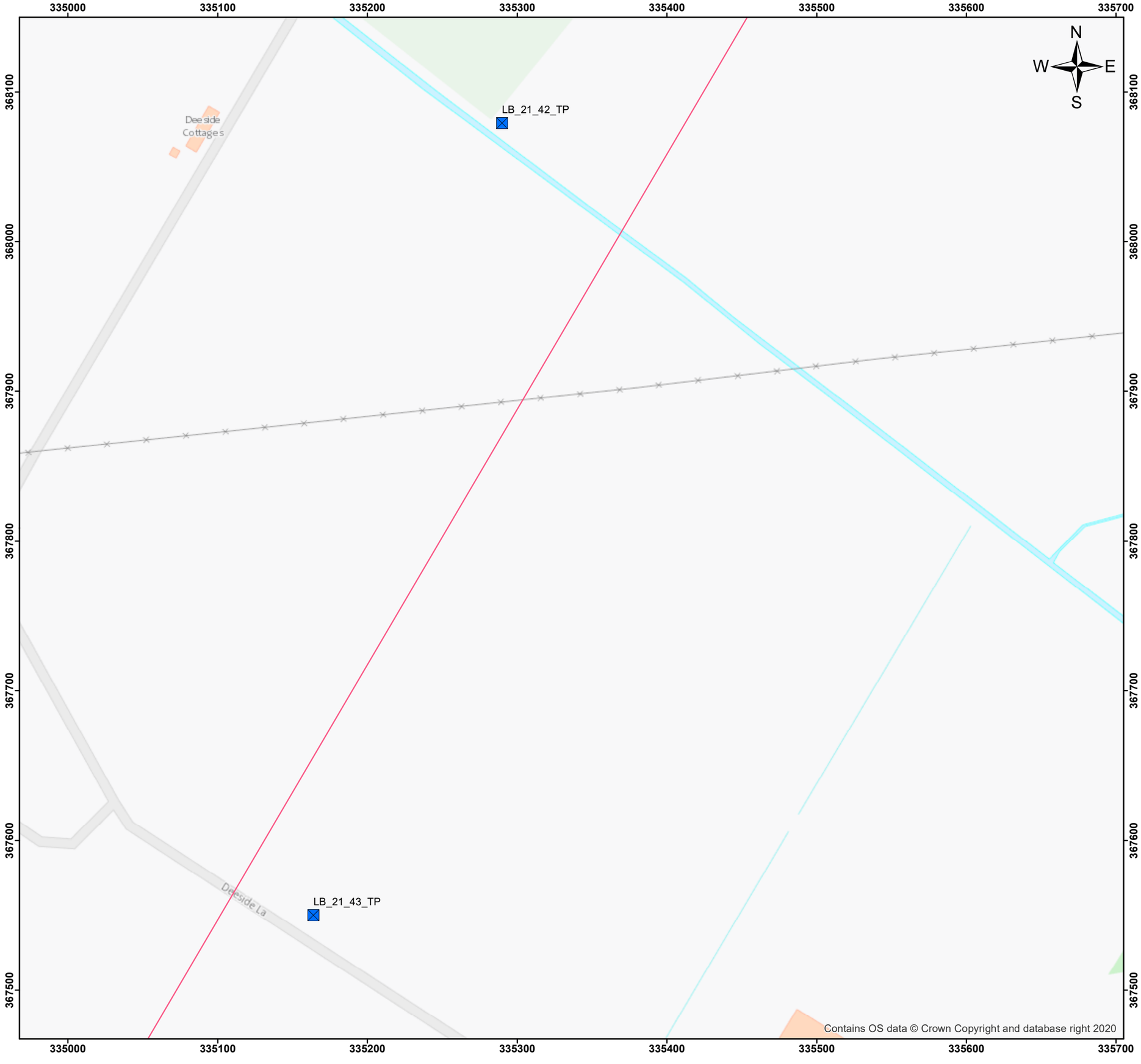
LBA CCS Transport and Storage Project Ground Investigations

Figure Title

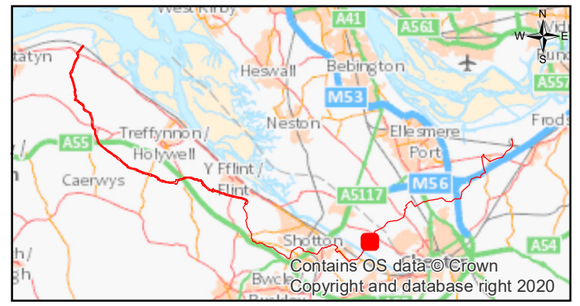
Exploratory Hole Location Plan

Figure Number
Section 4.01

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



Location



Scale: 1:500,000
0 2 4 8 12 16 20 24 28 32 Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500
0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System
British National Grid

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EniProgetti S.p.A
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Project Title
LBA CCS Transport and Storage Project Ground Investigations

Figure Title
Exploratory Hole Location Plan

Figure Number
Section 4.02

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
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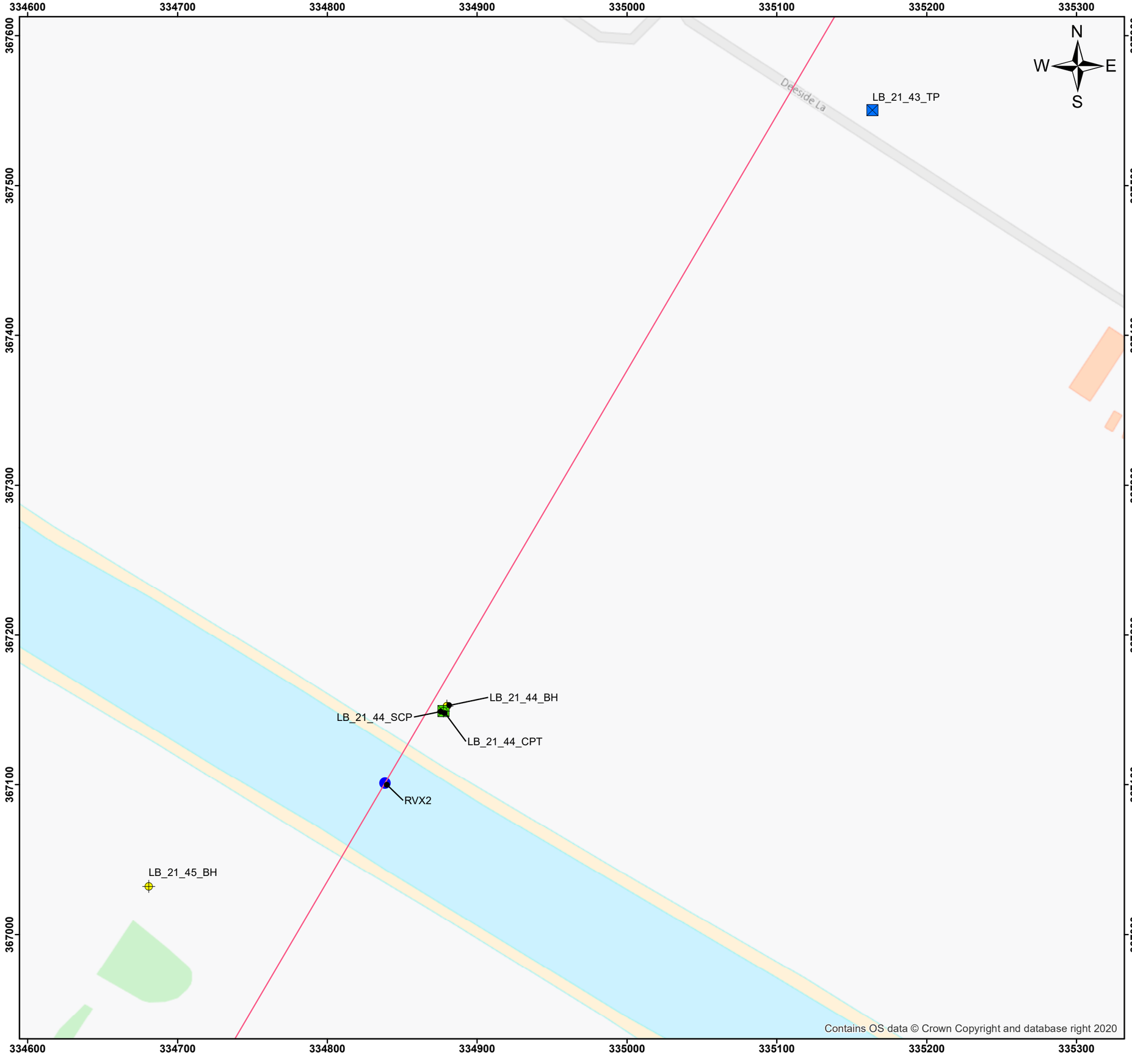

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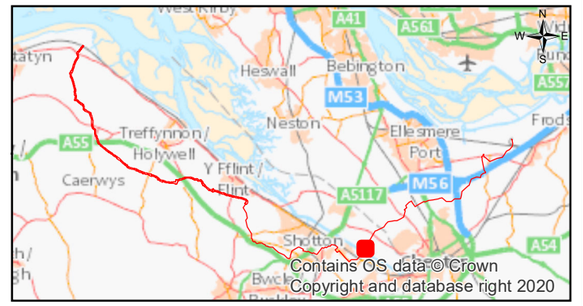

Scale: 1:500,000

0 2 4 8 12 16 20 24 28 32 Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500

0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System

British National Grid

Client

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Basingstoke, RG21 4YY
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Project Title

LBA CCS Transport and Storage Project Ground Investigations

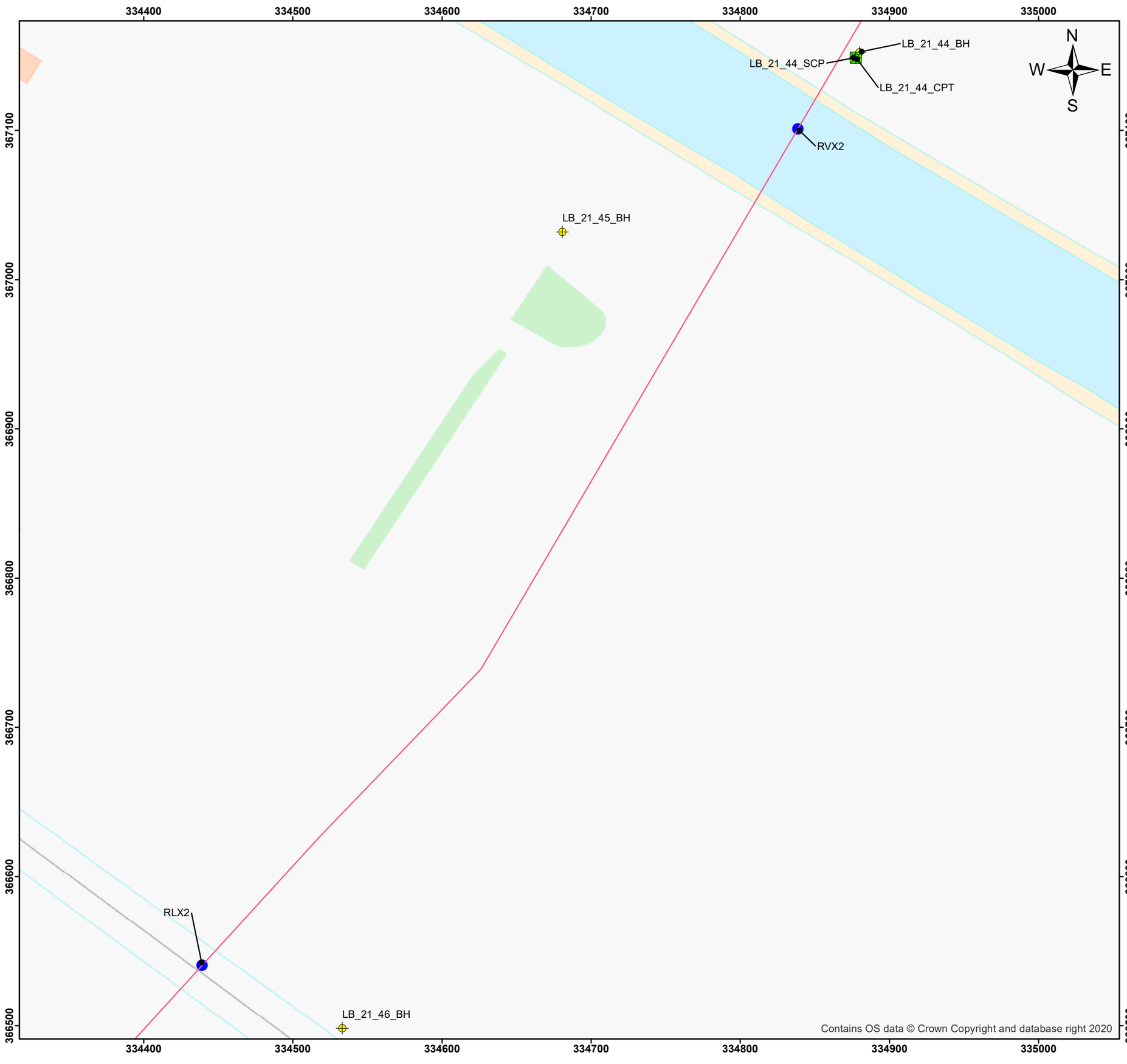
Figure Title

Exploratory Hole Location Plan

Figure Number

Section 4.03

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



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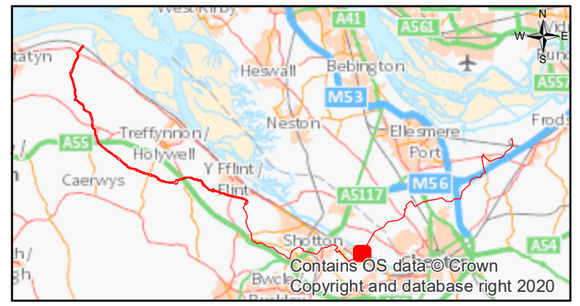

Scale: 1:500,000
0 2 4 8 12 16 20 24 28 32
Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500
0 10 20 40 60 80 100 120 140 160
Metres

Coordinate System
British National Grid

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Project Title

LBA CCS Transport and Storage Project Ground Investigations

Figure Title

Exploratory Hole Location Plan

Figure Number

Section 4.04

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
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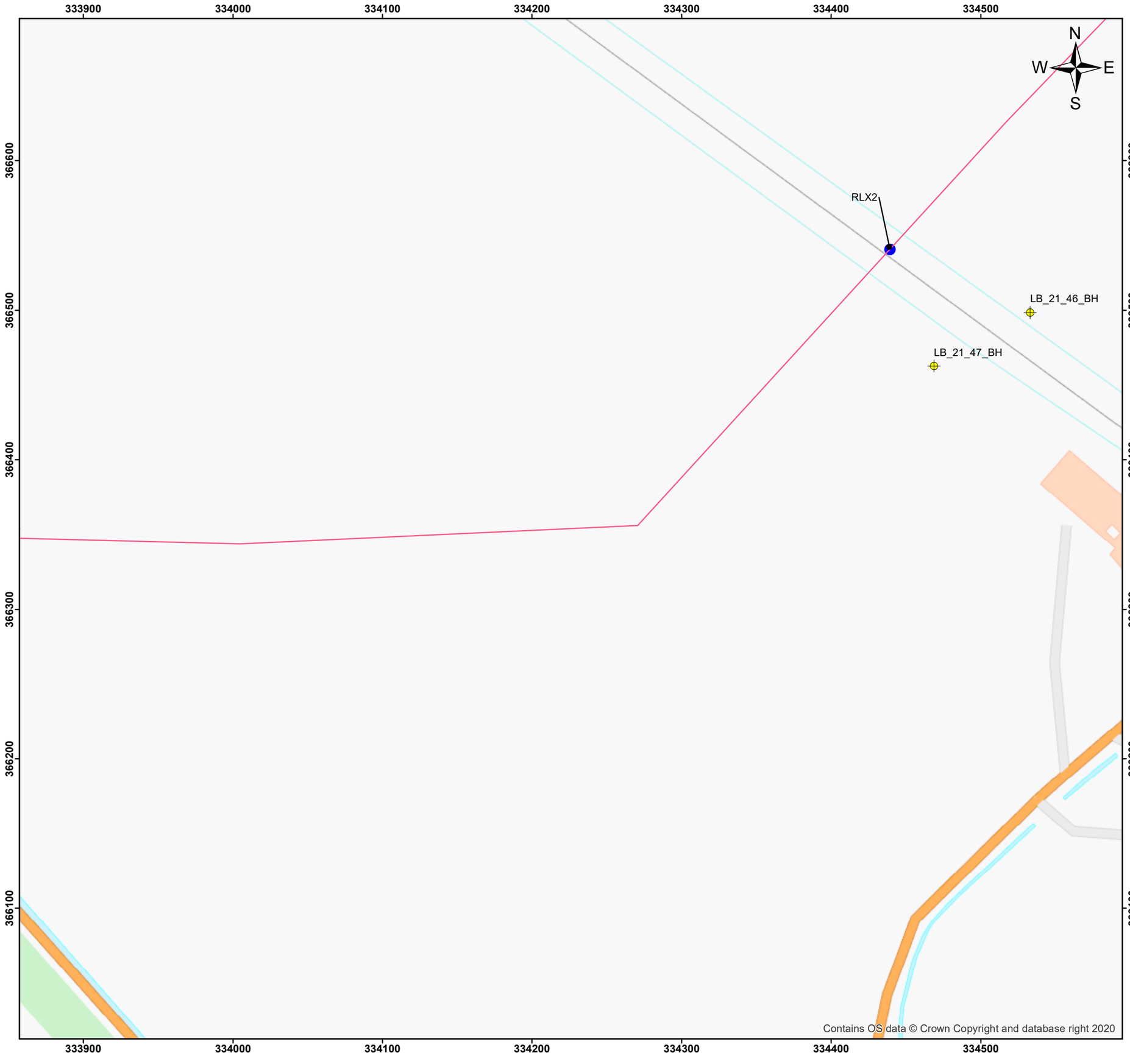

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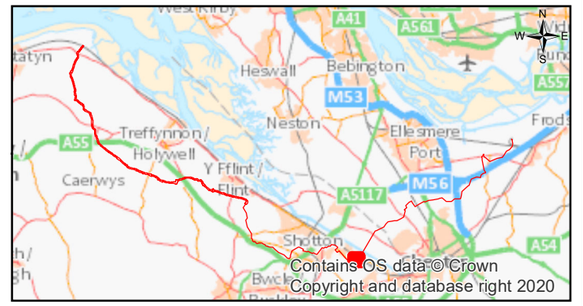

Scale: 1:500,000
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Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500
0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System
British National Grid

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Basingstoke, RG21 4YY
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Project Title

LBA CCS Transport and Storage Project Ground Investigations

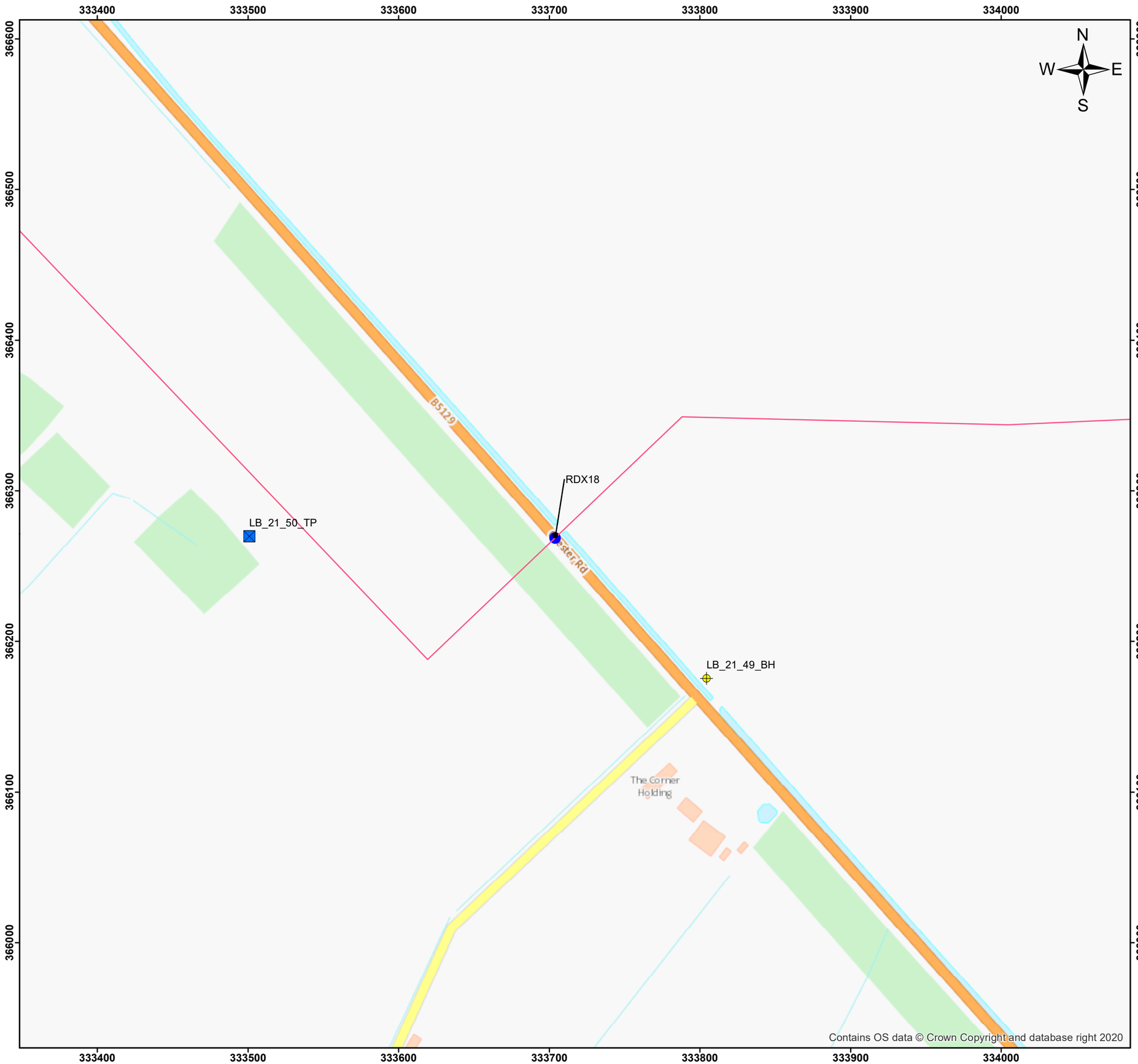
Figure Title

Exploratory Hole Location Plan

Figure Number

Section 4.05

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



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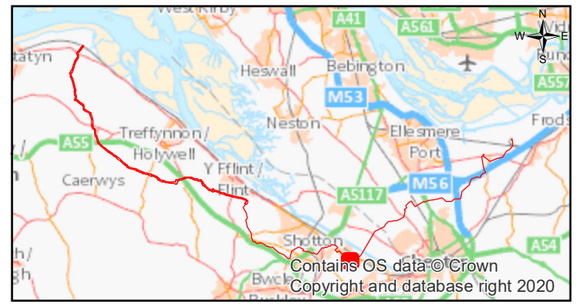

Scale: 1:500,000

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Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500

0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System

British National Grid

Client

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Project Title

LBA CCS Transport and Storage Project Ground Investigations

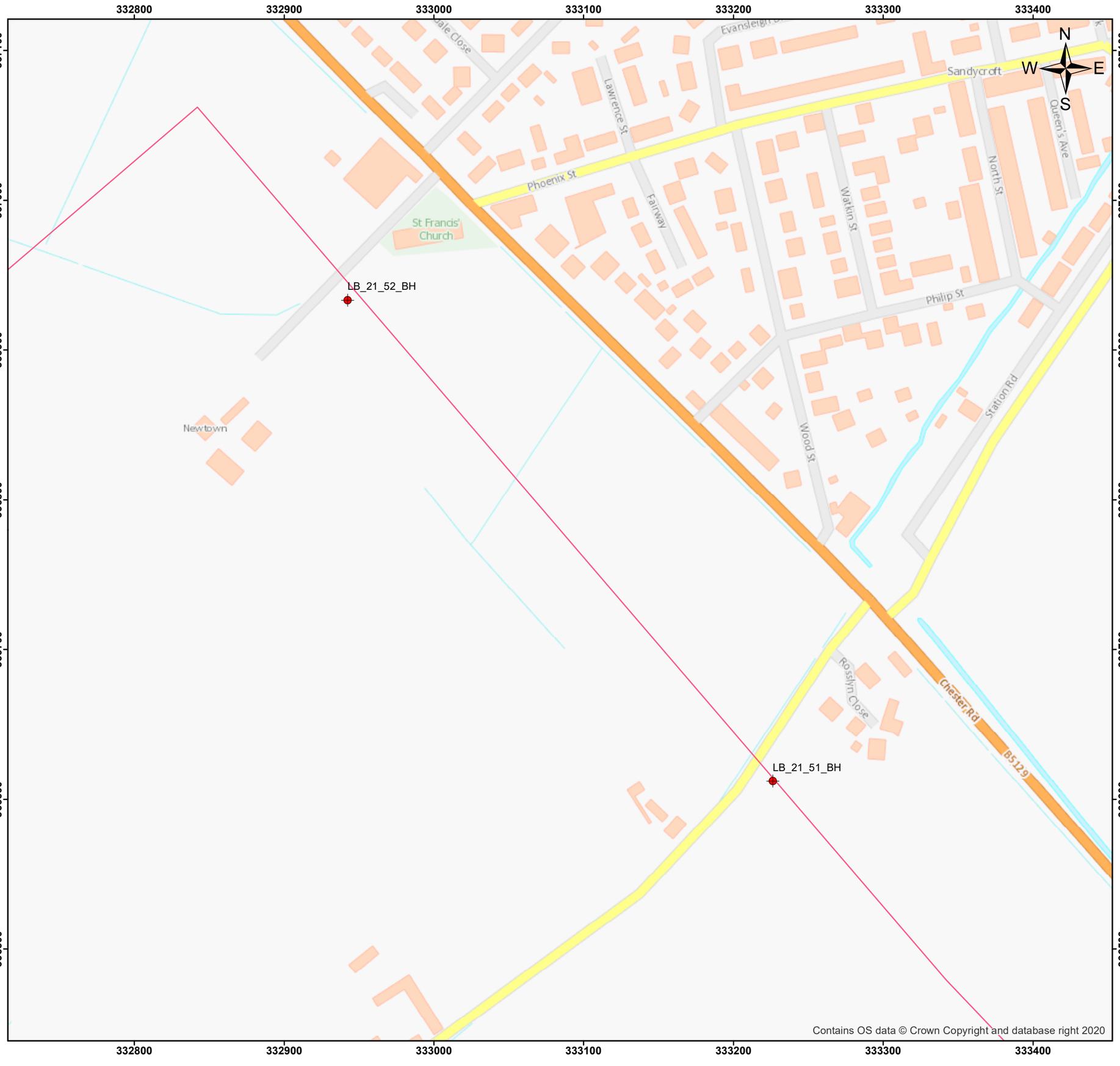
Figure Title

Exploratory Hole Location Plan

Figure Number

Section 4.06

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



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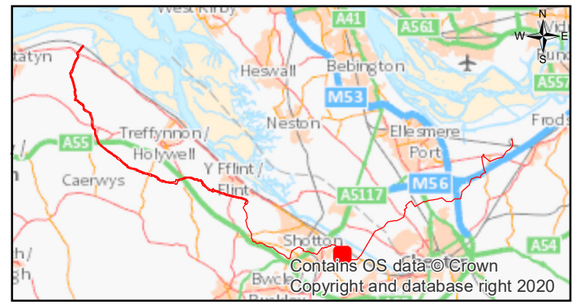

Scale: 1:500,000
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Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
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2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500
0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System
British National Grid

Client
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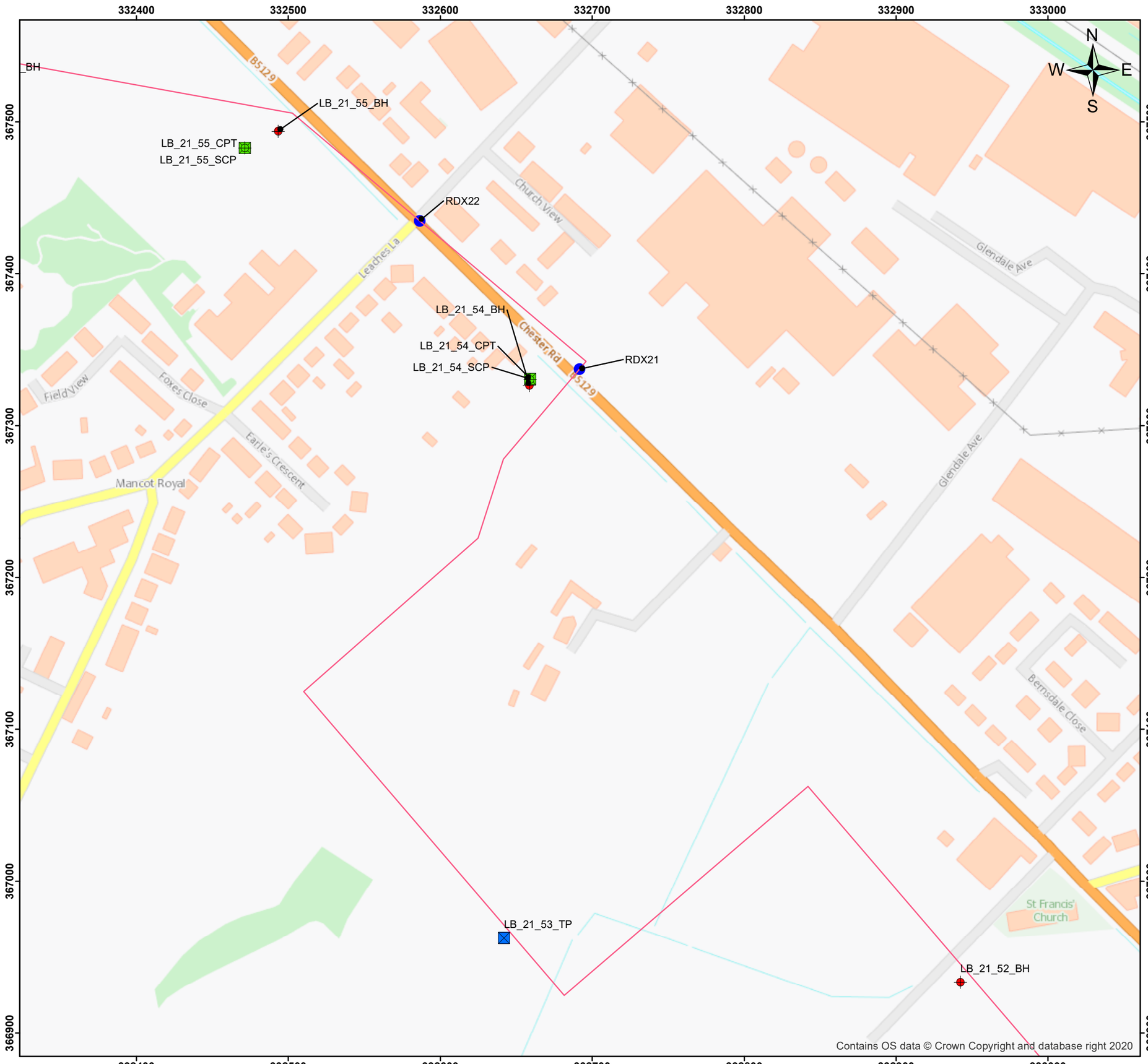
Project Title
LBA CCS Transport and Storage Project Ground Investigations

Figure Title
Exploratory Hole Location Plan

Figure Number
Section 4.07

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



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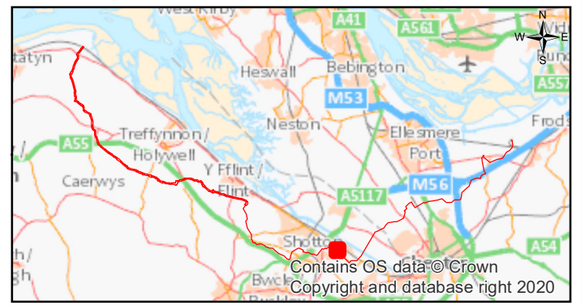

Scale: 1:500,000
0 2 4 8 12 16 20 24 28 32
Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
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2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500
0 10 20 40 60 80 100 120 140 160
Metres

Coordinate System
British National Grid

Client
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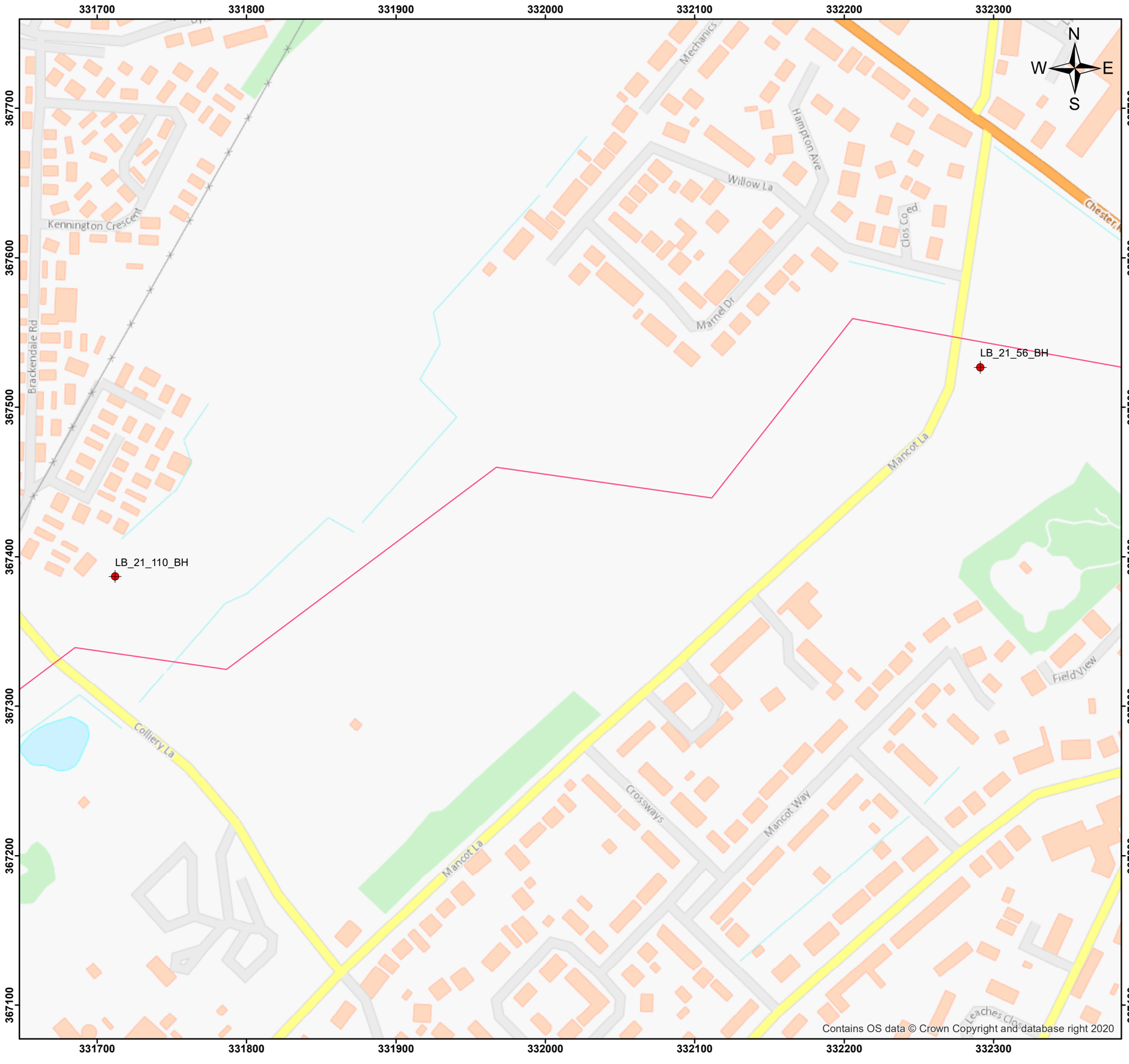
Project Title
LBA CCS Transport and Storage Project Ground Investigations

Figure Title
Exploratory Hole Location Plan

Figure Number
Section 4.08

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



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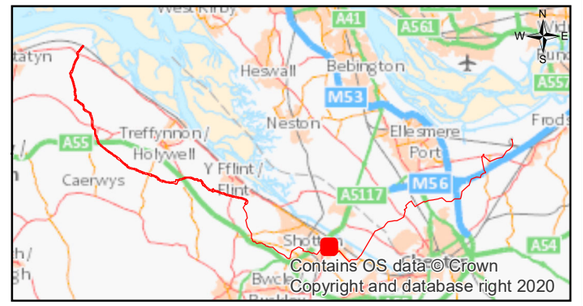

Scale: 1:500,000
0 2 4 8 12 16 20 24 28 32 Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500
0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System

British National Grid

Client

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Eni House, Basing View
Basingstoke, RG21 4YY
https://www.eni.com/

Consultant

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Project Title

LBA CCS Transport and Storage Project Ground Investigations

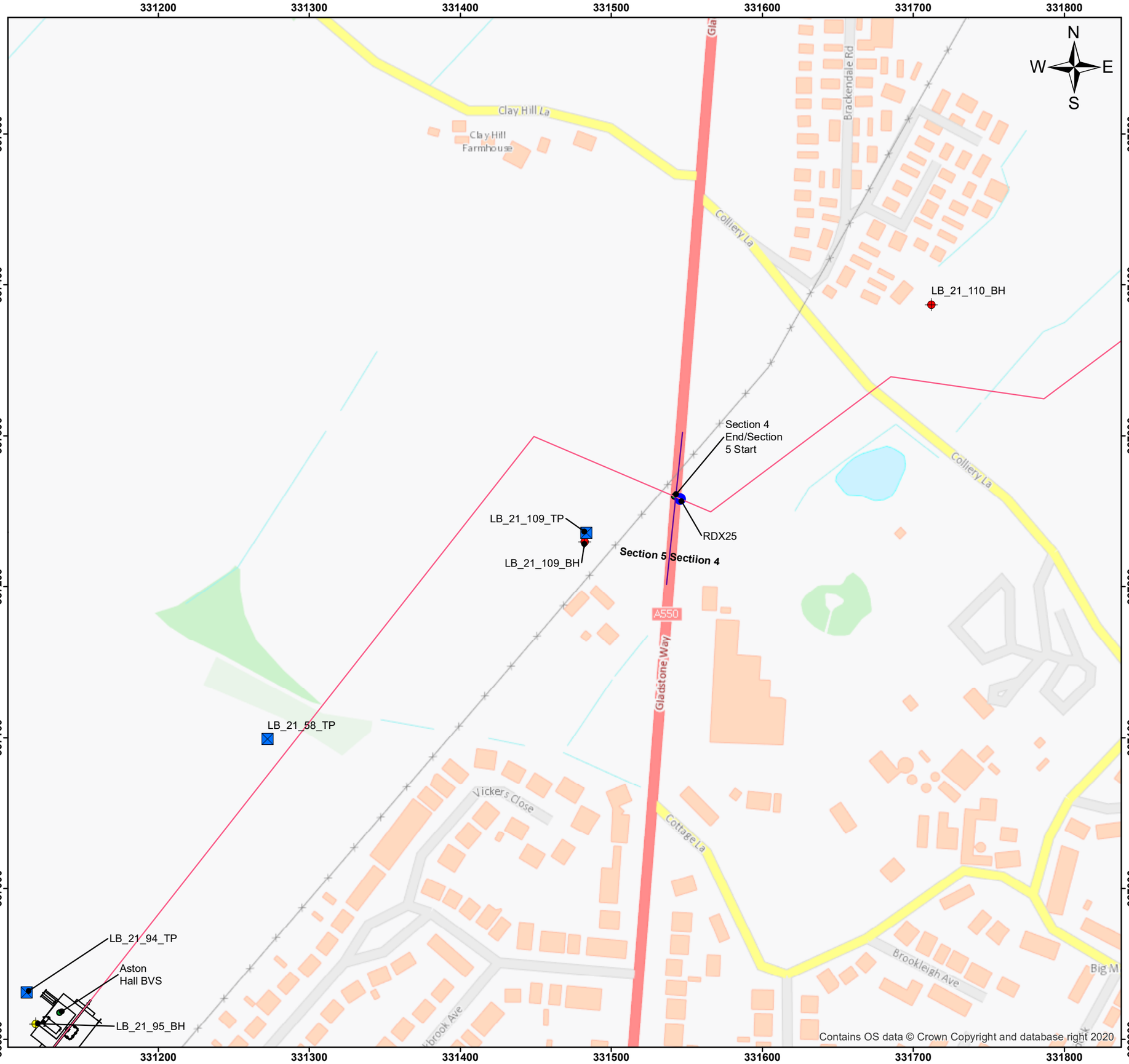
Figure Title

Exploratory Hole Location Plan

Figure Number

Section 4.09

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



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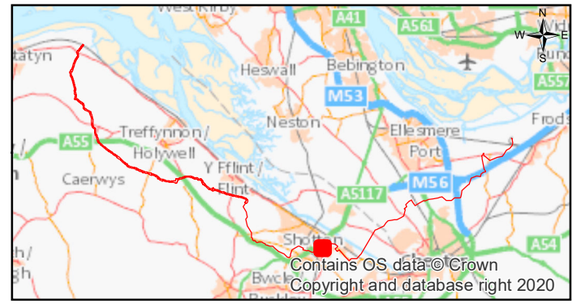

Scale: 1:500,000
0 2 4 8 12 16 20 24 28 32 Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500
0 10 20 40 60 80 100 120 140 160 Metres

Coordinate System
British National Grid

Client
EniProgetti S.p.A
Eni House, Basing View
Basingstoke, RG21 4YY
https://www.eni.com/

Consultant
Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingfo
Oxfordshire, OX10 9RB, United Kingdom
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Project Title

LBA CCS Transport and Storage Project Ground Investigations

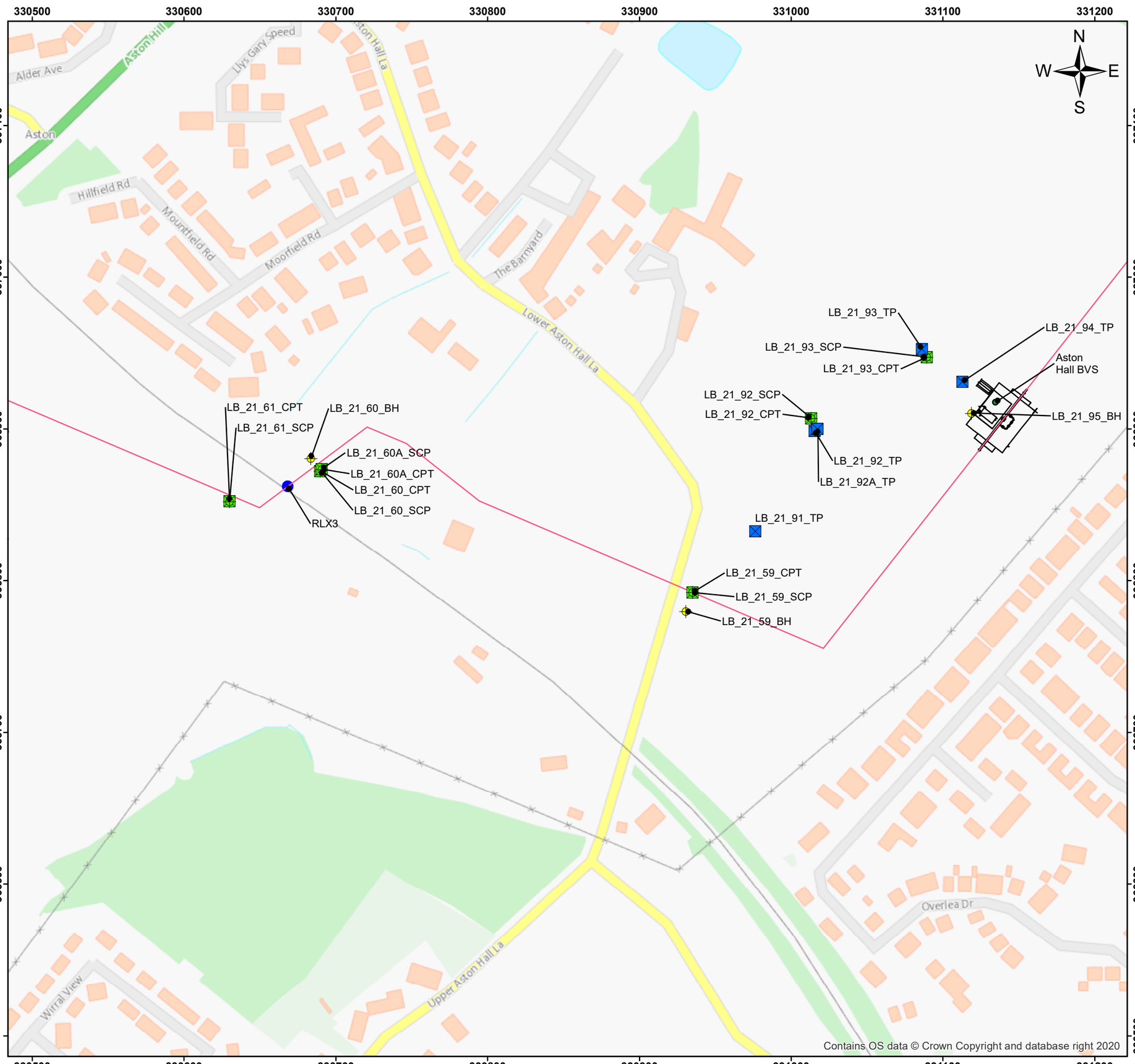
Figure Title

Exploratory Hole Location Plan

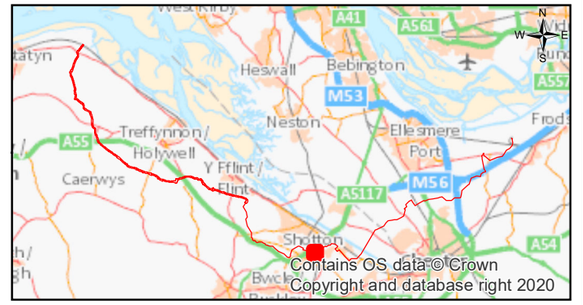
Figure Number

Section 5.01

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3



Location



Scale: 1:500,000
0 2 4 8 12 16 20 24 28 32
Kilometres

Legend

Location Type

- Cable Percussion Borehole
- Inspection Pit
- Rotary Cored Borehole
- Inspection Pit with CPT folow-on
- Sonic Core Drilled Borehole
- Sonic Core Drilled Borehole with Rotary follow-on
- Trial Pit

Name

- Existing Infrastructure
- GtS
- StF
- Route Structures
- Historic Landfill Sites
- Crossings

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	05/09/2022	Draft Issue	BAM

Scale: 1:2,500
0 10 20 40 60 80 100 120 140 160
Metres

Coordinate System
British National Grid

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Project Title

LBA CCS Transport and Storage Project Ground Investigations

Figure Title

Exploratory Hole Location Plan

Figure Number

Section 5.02

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
BAM	SDW	18/03/2022	F190089	A3	3