

TECHNICAL NOTE – CML2350 HyNet Trenchless Crossing of the River Dee

DATE:	07 December 2023	CONFIDENTIALITY:	Public
SUBJECT:	Technical responses to NRW on Hydrology and Geosciences queries.		
PROJECT:	HyNet Onshore Pipeline DCO	AUTHOR:	Alistair Billington
CHECKED:	Daniel Hooley	APPROVED:	Lamia Gherbi

1. INTRODUCTION

1.1. PURPOSE OF THIS DOCUMENT

- 1.1.1. This document has been prepared to provide information on Hydrology and Geosciences to help NRW-MLT answer queries raised by NRW Advisory on marine licence application CML2350. The issues raised by NRW Advisory relate to the following broad topics:
- Has borehole data in the vicinity of the proposed crossing been reviewed to characterise the nature of the Made Ground?
 - Please revise the current dewatering management plan as requested.
 - Please provide more detail regarding the management of drill muds.
 - Provide a clear approach to minimise the risk of drilling fluid loss as well as a clear description of the nature of the sediments.
- 1.1.2. The following sections provide the additional information to answer the queries raised.

1.2. BOREHOLE DATA

- 1.1.3. The evaluation of the publicly available data from the British Geological Survey (BGS), and the boreholes installed for the GI, has identified that there is no Made Ground at the location of the River Dee trenchless crossing. It is, however, known that the flood defences comprising earth embankments will be of made ground. The trenchless crossing of the River Dee will not affect these embankments, and any works will be implemented a minimum of 16m away from the defence structures.
- 1.1.4. The results of recent geotechnical ground investigation and historical boreholes sourced from the BGS were used to prepare a geoarchaeological model. The result of the modelling was broadly consistent with the BGS mapping of the area, with superficial sedimentary sequences dominated by minerogenic sands, clays, and silts, likely laid down in intertidal/alluvial environments. The following resources were used:
- British Geological Survey (BGS) Onshore GeoIndex online viewer. Available online: <https://www.bgs.ac.uk/map-viewers/geoindex-onshore/>
 - Coal Authority Interactive Map viewer. Available online: <https://mapapps2.bgs.ac.uk/coalauthority/home.html>
 - British Geological Survey (BGS) Maps Portal. Available online: <https://www.bgs.ac.uk/information-hub/bgs-maps-portal/>
- 1.1.5. A Ground Investigation (GI) was also undertaken from November 2021 through to March 2022, which included two boreholes at the river Dee crossing. Borehole LB_21_44_BH was installed on the north side of the river Dee and comprised a sonic core drilled borehole with an inspection pit and CPT follow-up. An automatic water level reading device was also installed. Borehole LB_21_45_BH was installed on the

south side of the river Dee and comprised a sonic core drilled borehole. The location of Boreholes LB_21_44_BH, and LB_21_45_BH is shown in the **Exploratory Hole Location Plan Section 4.04** shown in **Appendix A**.

- 1.1.6. The response zone of groundwater monitoring borehole LB_21_44_BH is within the tidal flat sand deposits. The recorded groundwater elevations ranged from 1.5 to 2.9 mAOD from November 2021 to March 2022.
- 1.1.7. At Boreholes LB_21_44_BH, and LB_21_45_BH, Glacial Till Deposits were encountered from 0.30 to 31.17m BGL (see borehole logs at **Appendix A**). These deposits comprised
“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.”
- 1.1.8. The Environment Agency also provided groundwater level data and groundwater level contours, and historical borehole records were provided publicly by the BGS. This information was used to supplement the groundwater level information from the GI data where it was considered necessary to do so.

1.3. DEWATERING MANAGEMENT PLAN

- 1.1.9. The trenchless crossing of the River Dee is a component of the HyNet Carbon Dioxide Pipeline DCO application, and two crossing options are proposed; HDD, and micro-tunnelling. It is unlikely that any dewatering will be required for HDD, as it will not involve any excavations that require dewatering. The HDD fluids are collected in above ground sumps and tankered away for disposal (See **Figures 2-1**, and **2-2** in the **Environment Report**). For micro-tunnelling, only a small amount of dewatering is likely to be required during excavation of the launch and reception shafts for the micro-tunnelling machine (See **Figure 2-4** in the **Environment Report**). However, construction of the shafts involves sealing the sides of the shaft during excavation, to prevent collapse, and water ingress.
- 1.1.10. Notwithstanding, the Draft Development Consent Order includes Requirement 5 that requires the preparation of a Construction Environmental Management Plan (CEMP), which must include a Dewatering Management Plan. The Dewatering Management Plan will be applicable to all elements of the HyNet Carbon Dioxide Pipeline, which includes the trenchless crossing of the River Dee. The Dewatering Management Plan will be produced by the Construction Contractor and submitted to and approved by the relevant planning authority.
- 1.1.11. The Dewatering Management Plan will provide a general framework for assessing the potential risks arising from dewatering, but also to act as a vehicle for more specific and detailed assessment relevant to the location. The Dewatering Management Plan aims to keep the duration of pumping and the rates to a minimum which is achieved by minimising the required dewatering (D-WR-035 of the **REAC**, included with the Marine Licence application as document **PA2212 - HyNet CO2 Pipeline DCO-Marine Licence Application - REAC**). The Dewatering Management Plan will consider the guidance in the *Hydrogeological Impact Appraisal for Dewatering Abstractions*⁽¹⁾ and the *Temporary Dewatering from Excavations to Surface Water*⁽²⁾.
- 1.1.12. The Dewatering Management Plan will summarise all licences and permits to abstract and discharge from dewatering works issued by NRW (D-WR-035 of the **REAC**). Due to the temporary nature of the

¹ Environment Agency. (2007). Hydrogeological impact appraisal for dewatering abstractions. Bristol: Environment Agency

² Environment Agency. (2021). Temporary dewatering from excavations to surface water. Retrieved from Environment Agency: <https://www.gov.uk/government/publications/temporary-dewatering-from-excavations-to-surface-water/temporary-dewatering-from-excavations-to-surface-water>

dewatering activities, an abstraction permit may not be required if the exemption requirements outlined by the *Water Abstraction and Impounding Regulations 2017*⁽³⁾ are met.

1.1.13. The exemptions for Wales include:

- abstractions of 20 cubic metres a day or less; and
- draining water (dewatering) to prevent interference with building or engineering works, where the abstraction lasts for less than 6 consecutive months, subject to restrictions.

1.1.14. Accounting for the exemption outlined above, it is expected that abstraction licences will be required for some dewatering. These licences will be obtained prior to the works commencing.

1.1.15. In addition to permitting, the Dewatering Management Plan will include a detailed description of the main discharge points, abstraction and discharge rates, equipment used and construction sequence, any authorisation, and details of any pre-treatment required prior to discharge approved by NRW.

1.4. MANAGEMENT OF DRILLING MUDS AND PREVENTION OF DRILLING FLUID LOSS

Horizontal directional drilling

1.1.16. It is well understood that managing drilling muds and preventing the loss of drilling fluid is essential for the success, and environmental safety, of horizontal directional drilling (HDD) projects, especially when drilling under a river.

1.1.17. Given our current understanding of the geological conditions, and the depth of tunnelling (approximately 15m below riverbed) at the location of the River Dee crossing, it is highly unlikely that there would be any loss of drilling fluid when carrying out the HDD. Notwithstanding, the following measures are some of the key steps that will be employed to manage drilling muds should HDD be utilised for the trenchless crossing of the River Dee:

- **Site Assessment:** The results of recent geotechnical ground investigation and historical boreholes sourced from the BGS have been used to develop an understanding of the ground conditions at the River Dee crossing location. This has provided a good level of understanding of the geological conditions, soil composition, and potential challenges that may affect drilling fluid stability.
- **Drilling Fluid:** A drilling fluid will be chosen that is suitable for the specific geological conditions (clay Tidal Flat Deposits, and clay Glacial Till Deposits) and is environmentally friendly. The intention is to use a high-quality, non-toxic, and biodegradable drilling mud to minimise environmental impact.
- **Mud Properties:** The drilling mud properties will be regularly monitored, including viscosity, density, and gel strength, to ensure they are within the desired range for efficient drilling and stability.
- **Hydrostatic Pressure:** Proper hydrostatic pressure will be maintained in the borehole by adjusting the mud weight. This helps prevent the ingress of formation fluids and stabilises the borehole.
- **Mud Recycling System:** A mud recycling system will be installed to separate solids from the drilling fluid and reuse the clean fluid. This would minimise the need for fresh mud and reduce waste generation.
- **Lost Circulation Materials:** There is potential to use lost circulation materials (LCMs) to seal and bridge fractures in the formation, preventing the loss of drilling mud into porous zones.

³ UK Government. (2017). The Water Abstraction and Impounding (Exemptions) Regulations 2017. Retrieved from: The Water Abstraction and Impounding (Exemptions) Regulations 2017 (legislation.gov.uk): [The Water Abstraction and Impounding \(Exemptions\) Regulations 2017 \(legislation.gov.uk\)](https://www.legislation.gov.uk/uksi/2017/1000/contents/made)

- **Installation of Casing and Seals:** Casing and seals would be installed at critical points along the drill path to isolate and prevent the loss of drilling mud.
- **Real-time Monitoring:** Real-time monitoring systems would be employed to detect any changes in drilling parameters, fluid properties, or borehole conditions that may indicate potential issues.
- **Emergency Response Plan:** An emergency response plan will be developed and implemented in the unlikely event of a frac-out. The plan would include containment measures and procedures for mitigating environmental impact.
- **Regulatory Compliance:** Compliance with local and environmental regulations governing HDD operations will be maintained, and all necessary permits and approvals will be obtained before initiating the trenchless crossing.
- **Continuous Training:** Drilling personnel will be provided with training on best practices, safety protocols, and environmental stewardship to minimise the risk of incidents.

1.1.18. By carefully planning, monitoring, and implementing the preventive measures, our drilling operators will be able to effectively manage drilling muds and prevent frac-out incidents during HDD operations.

Micro-tunnelling

1.1.19. The micro-tunnelling will involve the use of a remotely controlled, guided boring machine to create a small-diameter tunnel through which to install our new pipeline. While micro-tunnelling is generally considered a more controlled and precise method compared to some other techniques, there is still some limited potential for frac-out and loss of drilling fluids if not managed properly.

1.1.20. As is the case for HDD, given our current understanding of the geological conditions, and the depth of tunnelling (approximately 8m below riverbed) it is highly unlikely that there would be any loss of drilling fluid when carrying out the micro-tunnelling. Notwithstanding, should micro-tunnelling be utilised, in addition to the measures described above for HDD, the following measures are some of the key steps that will be employed to manage drilling muds:

- **Pressure Control:** Earth Pressure Balance Tunnel Boring Machines (EPB TBM) can be used, which are specially designed to operate in soft ground conditions containing water under pressure, loose sedimentary deposits, sands gravels silts, clays, and a high water table. Micro-tunnelling will enable control of the pressure exerted by the drilling fluid thereby preventing fluid loss and frac-out.
- **Monitoring Systems:** Real-time monitoring systems can be implemented to help track drilling parameters, ground conditions, and pressure levels. Monitoring for any unexpected changes will allow our contractors to respond promptly and adjust the drilling process as needed.
- **Bentonite and Lubrication:** Bentonite is commonly used as a lubricating and stabilising agent in micro-tunnelling. Proper mixing and maintenance of bentonite concentrations will be carried out to help reduce friction, enhance fluid performance, and minimise the risk of frac-out.
- **Advance Rate and Soil Removal:** The advance rate of the micro-tunnelling machine and the rate of soil removal will be controlled to maintain the balance between the incoming drilling fluid and the removed soil, reducing the risk of frac-out.

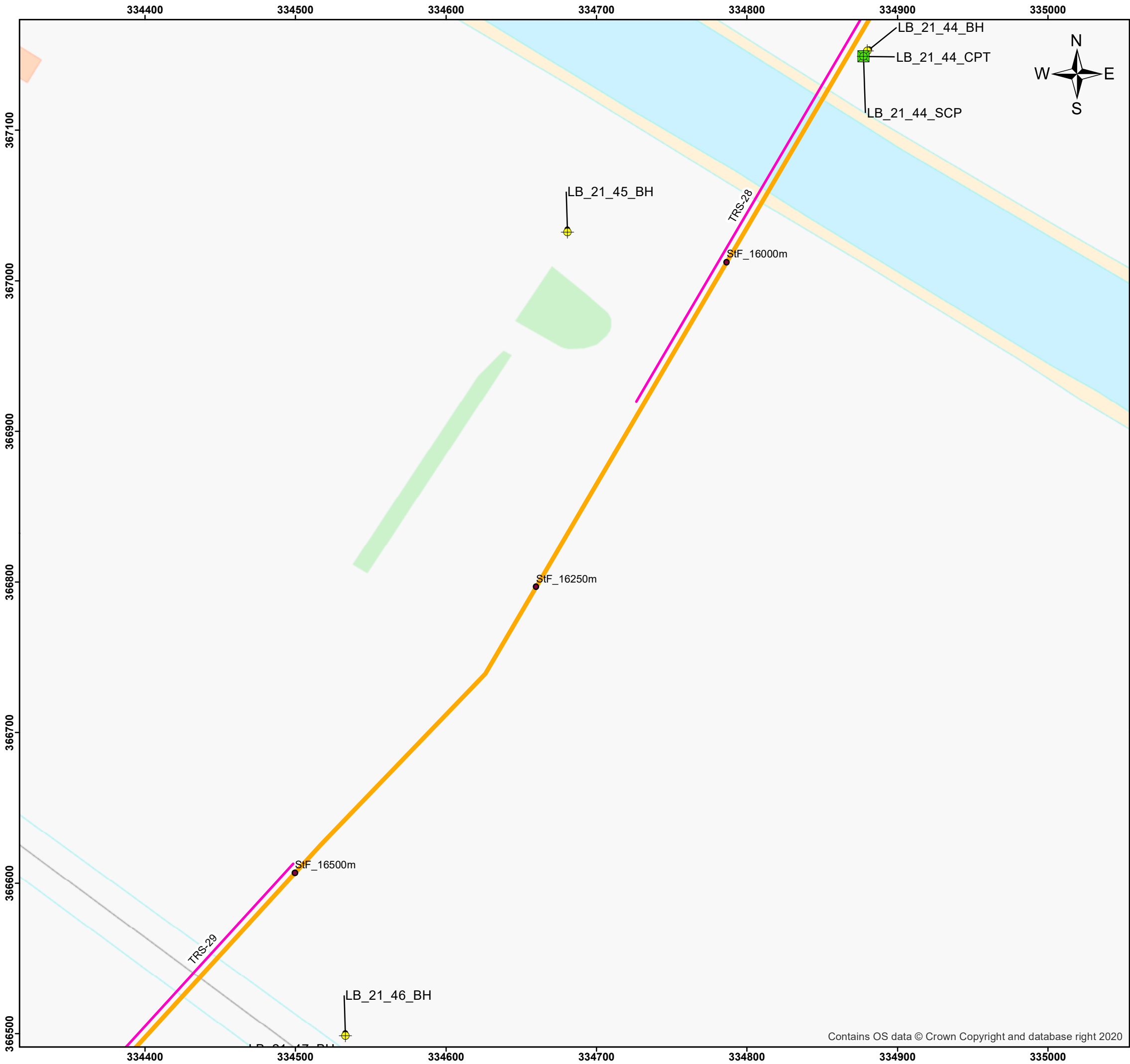
While micro-tunnelling is generally considered a low-risk method, the potential for frac-out and drilling fluid loss exists and will be actively managed. However, given the known ground conditions, by employing best practices, utilising appropriate technology, and closely monitoring drilling operations, the risk of frac-out during micro-tunnelling is highly unlikely.

APPENDIX A


Exploratory Hole Location Plan Section 4.04

Sonic Core Drilling borehole log – LB_21_44_BH

Sonic Core Drilling borehole log – LB_21_45_BH



Location










Scale: 1:500,000



0 2.5 5 10 15 20 25 30 35 40 Kilometres

Legend


Location Type

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


Route

-  GIS Route (20 inch diameter)
-  StF Route ; StF Route (36 inch diameter)

Crossing

-  Approximate Crossing Extent

Strucures

-  Strucures

Rev.	Date	Description	Initials
0	18/03/2022	Draft Issue	BAM
1	29/04/2022	Draft Issue	BAM
2	01/12/2022	Final Issue	LGD

Scale: 1:2,500


0 12.5 25 50 75 100 125 150 175 200 Meters

Coordinate System

British National Grid

Client


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



progetti

Consultant

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



FUGRO

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.
LGD	SDW	01/12/2022	F190089	A3	2

	Contract Name		LBA CCS Transport and Storage Project Ground Investigations				Location ID	
	Client		Eni UK Limited				LB_21_44_BH	
	Fugro Reference		F190089					
	Coordinates (m)		E334879.81 N367152.56	Ground Elevation (m Datum)		5.15	Sheet 1 of 1	
	Hole Type		Sonic Core Drilling				Status	Final

Equipment										
Depth From (m)	Depth To (m)	Hole Type	Date From	Date To	Equipment	Core Barrel	Core Bit	Drilling Crew	Logged By	Remarks
0.00 1.20	1.20 30.00	IP SNC	02/11/2021 03/11/2021	02/11/2021 04/11/2021	Hand excavated Eijelkamp CRS XL MAX		PCD	CG, JS, LD LM, JS, LD	CG CG/LT	

Progress						Rotary Details						Core Details		
Date (dd/mm/yyyy)	Time (hh:mm)	Hole Depth (m)	Casing Depth (m)	Water Depth (m)	Weather	Depth From (m)	Depth To (m)	Flush Type	Flush Return (%)	Flush Colour	Run Time (hh:mm)	Depth From (m)	Depth To (m)	Diameter (mm)
02/11/2021	07:30	0.00	0.00	0.00	Sunny	1.20	1.50	Water	0	Brown	00:05	1.20	1.50	101
02/11/2021	18:00	10.50	9.00	0.00	Dry	1.50	3.00	Water	0	Brown	00:05	1.50	3.00	101
03/11/2021	07:00	10.50	10.50	3.00	Dry	3.00	4.50	Water	0	Brown	00:05	3.00	4.50	101
03/11/2021	07:00	10.50	10.50	3.00	Dry	3.00	4.50	Water	0	Brown	00:05	3.00	4.50	101
03/11/2021	07:30	24.00	22.50	3.00		4.50	6.00	Water	0	Brown	00:05	4.50	6.00	101
04/11/2021	07:00	24.00	24.00	3.00		6.00	7.50	Water	0	Brown	00:05	6.00	7.50	101
04/11/2021	07:00	24.00	24.00	3.00		7.50	9.00	Water	0	Brown	00:05	7.50	9.00	101
04/11/2021	18:00	30.00	24.00	3.00		9.00	10.50	Water	0	Brown	00:05	9.00	10.50	101
						10.50	12.00	Water	0	Brown	00:05	10.50	12.00	101
						12.00	13.50	Water	0	Brown	00:05	12.00	13.50	101
						13.50	15.00	Water	0	Brown	00:05	13.50	15.00	101
						15.00	16.50	Water	0	Brown	00:05	15.00	16.50	101
						16.50	18.00	Water	0	Brown	00:05	16.50	18.00	101
						18.00	19.50	Water	0	Brown	00:05	18.00	19.50	101
						19.50	21.00	Water	0	Brown	00:05	19.50	21.00	101
						21.00	22.50	Water	0	Brown	00:05	21.00	22.50	101
						22.50	24.00	Water	0	Brown	00:05	22.50	24.00	101
						24.00	25.50	Water	0	Brown	00:05	24.00	25.50	101
						25.50	27.00	Water	0	Brown	00:05	25.50	27.00	101
						27.00	28.50	Water	0	Brown	00:05	27.00	28.50	101
						28.50	30.00	Water	0	Brown	00:05	28.50	30.00	101

Hole and Casing			
Depth To (m)	Hole Diameter (mm)	Depth To (m)	Casing Diameter (mm)
30.00	175	30.00	175

Chiselling / Slow Progress			
Depth From (m)	Depth To (m)	Duration (hh:mm)	Tool / Remark

Water Strike					Water Added	
Strike At (m)	Rise To (m)	Time Elapsed (mins)	Casing Depth (m)	Depth Sealed (m)	Depth From (m)	Depth To (m)


Water Strike Remarks				General Remarks			
Groundwater not encountered during excavation.				1. Prior to excavation, a Cable Avoidance Tool (CAT) survey was carried out. An inspection pit was hand-dug to 1.20m depth and rescanned using the CAT to check for services. Services were not located.			















Installation					Pipe					Backfill			
Type	Tip Depth / Distance (m)	Response Zone Top (m)	Response Zone Base (m)	Installation Date	ID	Top Depth (m)	Base Depth (m)	Diameter (mm)	Type	Depth From (m)	Depth To (m)	Backfill Material	Date
GMP	18.00	15.00	18.00	05/11/2021	1	0.00	15.00	50	Plain	-0.80	0.00	Upstanding Cover	05/11/2021
					1	15.00	18.00	50	Slotted	0.00	0.20	Concrete	05/11/2021
										0.20	14.50	Bentonite	05/11/2021
										14.50	18.50	Gravel	05/11/2021
										18.50	30.00	Bentonite	05/11/2021

Notes

- Abbreviations and results data defined in 'Exploratory Location Records Keysheets'

Checked By	CK	Elevation Datum	Ordnance Datum	Grid Coordinate System	OSGB
Template: FGSL/HBSI/FGSL BH Summary.hbt/Config Fugro Rev5/26/06/2019/TS+AW					Print Date
					30/08/2022

	Contract Name		LBA CCS Transport and Storage Project Ground Investigations				Location ID	
	Client		Eni UK Limited				LB_21_44_BH	
	Fugro Reference		F190089					
	Coordinates (m)		E334879.81 N367152.56	Ground Elevation (m Datum)		5.15	Sheet 1 of 6	
	Hole Type		Sonic Core Drilling				Status	Final


Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details					Backfill / Installation					
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	If (mm)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend						
0.10 - 0.20	D	1	< 0.1 ppm						TOPSOIL. Greyish brown sandy clayey SILT. Sand is fine. Occasional rootlets, root traces and pseudo-fibrous plant remains.	(0.30)	4.85							
0.10 - 0.30	B	2							[TOPSOIL] [SILT]									
0.30	ES	3							Greyish brown slightly gravelly sandy CLAY. Sand is fine. Gravel is fine.	0.30								
0.30 - 0.60	B	4							[TIDAL FLAT DEPOSITS] [CLAY]	(0.30)								
0.30	PID																	
0.60	D	5	N = 4 (S)						Greyish brown slightly clayey silty SAND. Sand is fine.	0.60	4.55							
									[TIDAL FLAT DEPOSITS] [SAND]	(0.30)								
0.90 - 1.20	B	6							Light greyish brown slightly clayey silty SAND. Sand is fine.	0.90				4.25				
1.10 - 1.20	D	7							[TIDAL FLAT DEPOSITS] [SAND]	(0.30)								
1.20 - 1.50	B	9	N = 4 (S)						Very loose light greyish brown very clayey SAND. Sand is fine.	1.20	3.95							
1.20 - 1.65	D	8							[TIDAL FLAT DEPOSITS] [SAND]									
1.20 - 1.65	SPT								100	N/A				N/A				
1.20 - 1.50																		
1.50 - 1.60	D	10	N = 4 (S)							(1.40)								
1.60 - 2.60	B	11																
1.50 - 3.00									2.30m to 2.60m; rare lenses (<10mm x 15mm) of grey and white fine and medium sand.									
									ASSUMED ZONE OF CORE LOSS. [NO RECOVERY]	2.60	2.55							
3.00 - 3.45	D	12	N = 9 (S)							(0.90)								
3.00 - 3.45	SPT																	
3.50 - 4.40	B	13							Medium dense light greyish brown SAND. Sand is fine and medium.	3.50	1.65							
3.00 - 4.50									[TIDAL FLAT DEPOSITS] [SAND]									
4.40 - 4.50	D	14	N = 24 (S)															
4.50 - 4.95	D	15																
4.50 - 4.95	SPT																	
4.80 - 5.90	B	16							4.50m to 4.80m; assumed zone of core loss.									
									4.80m to 5.90m; silty									
									Continued next page									

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Template: FGSL/HBSI/FGSL Rotary If.hbt/Config Fugro Rev5/23/12/2019/TS+AW	Print Date	30/08/2022
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<div>FUGRO</div>				Contract Name				LBA CCS Transport and Storage Project Ground Investigations				Location ID				
				Client				Eni UK Limited				LB_21_44_BH				
				Fugro Reference				F190089								
				Coordinates (m)				E334879.81 N367152.56		Ground Elevation (m Datum)						5.15
				Hole Type				Sonic Core Drilling				Status		Final		
Depth (m)		Sampling and In Situ Testing			Core Recovery				Strata Details							Backfill / Installation
Type	No.	Test Results		TCR (%)	SCR (%)	RQD (%)	If (mm)	Depth (m)	Strata Descriptions			Depth (Thickness) (m)	Level (m Datum)	Legend		
4.50 - 6.00				80	N/A	N/A			5.90m to 6.00m; occasional shell fragments and whole shells (<10mm x 20mm).			(4.00)				
5.90 - 6.00	D	17	N = 20 (S)					6								
6.00 - 6.45	D	18														
6.00 - 6.70	B	19														
6.00 - 6.45	SPT															
6.70 - 6.80	D	20	N = 42 (S)	100	N/A	N/A		7	6.60m to 6.90m; occasional shell fragments and whole shells (<10mm x 25mm).			7.50	-2.35			
6.00 - 7.50	B	21														
6.80 - 7.50																
7.50 - 7.95	D	22	N = 42 (S)					8	Dense light greyish brown SAND. Sand is fine and medium. [TIDAL FLAT DEPOSITS] [SAND] 7.50m to 8.00m; occasional shell fragments (<2mm x 10mm).							
7.50 - 8.20	B	23														
7.50 - 7.95	SPT															
8.20 - 8.30	D	24	50/215 mm (S)	100	N/A	N/A		9	8.10m to 8.30m; frequent pockets (<10mm x 60mm) of soft grey mottled black organic clay. Organic odour.							
7.50 - 9.00	B	25														
8.30 - 9.00																
9.00 - 9.45	D	26	50/215 mm (S)					9	9.00m to 9.37m; very dense.							
9.00 - 9.70	B	27														
9.00 - 9.36	SPT															
9.70 - 9.80	D	28		100	N/A	N/A			Continued next page							
9.00 - 10.50	B	29														
9.80 - 10.50																
Notes																
- Abbreviations and results data defined on 'Notes on Exploratory Position Records'																
Template: FGSL/HBSI/FGSL Rotary If.hbt/Config Fugro Rev5/23/12/2019/TS+AW												Print Date		30/08/2022		

	Contract Name		LBA CCS Transport and Storage Project Ground Investigations				Location ID			
	Client		Eni UK Limited				LB_21_44_BH			
	Fugro Reference		F190089							
	Coordinates (m)		E334879.81 N367152.56		Ground Elevation (m Datum)		5.15		Sheet 3 of 6	
	Hole Type		Sonic Core Drilling				Status		Final	

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details					Backfill / Installation
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	If (mm)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend	
10.50 - 10.95 10.50 - 11.20 10.50 - 10.95	D B SPT	30 31	N = 40 (S)					11	11.30m to 12.00m; silty.	(9.10)			
11.20 - 11.30 10.50 - 12.00 11.30 - 12.00	D B	32 33		100	N/A	N/A							
12.00 - 12.45 12.00 - 12.70 12.00 - 12.45	D B SPT	34 35	N = 33 (S)					12					
12.70 - 12.80 12.00 - 13.50 12.80 - 13.50	D B	36 37		100	N/A	N/A		13					
13.50 - 13.95 13.50 - 14.20 13.50 - 13.95	D B SPT	38 39	N = 30 (S)					14	13.50m to 14.00m; medium dense with rare whole shells (<5mm x 20mm).				
14.20 - 14.30 13.50 - 15.00 14.30 - 15.00	D B	40 41		100	N/A	N/A							
15.00 - 15.45 15.00 - 15.70	D B	42 43							Continued next page				


Notes


- Abbreviations and results data defined on 'Notes on Exploratory Position Records'


Template: FGSL/HBSI/FGSL Rotary If.hbt/Config Fugro Rev5/23/12/2019/TS+AW


Print Date

30/08/2022

		Contract Name		LBA CCS Transport and Storage Project Ground Investigations				Location ID								
		Client		Eni UK Limited				LB_21_44_BH								
		Fugro Reference		F190089												
		Coordinates (m)		E334879.81 N367152.56		Ground Elevation (m Datum)				5.15						
		Hole Type		Sonic Core Drilling				Status		Final						
Sheet 4 of 6																
Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details					Backfill / Installation			
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	If (mm)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend				
15.00 - 15.45	SPT		N = 33 (S)						15.30m to 15.60m; occasional shell fragments and whole shells (<5mm x 15mm).							
15.70 - 15.80	D	44	N = 19 (S)	100	N/A	N/A	16									
15.00 - 16.50																
15.80 - 16.50	B	45														
16.50 - 16.60	D	46	N = 19 (S)				17		Grey mottled light brown and black slightly sandy organic CLAY with occasional pockets (<10mm x 20mm) of brown pseudo-fibrous peat. Sand is fine and medium. Organic odour. [TIDAL FLAT DEPOSITS] [CLAY]	16.60	-11.45					
16.50 - 16.95	SPT														(0.50)	
16.70 - 16.80	D	47														
16.80 - 17.10	B	49														
17.10 - 17.20	D	48	N = 19 (S)	100	N/A	N/A	17		Soft and firm grey slightly sandy CLAY. Sand is fine and medium. [TIDAL FLAT DEPOSITS] [CLAY]	17.10	-11.95					
17.20 - 17.70	B	50													(0.50)	
16.50 - 18.00																
17.70 - 17.80	D	51	N = 19 (S)				18		Light brown very sandy clayey GRAVEL. Sand is fine and medium. Gravel is subangular and subrounded fine and medium of sandstone, mudstone and flint. [TIDAL FLAT DEPOSITS] [GRAVEL]	17.60	-12.45					
17.80 - 18.00	B	52													(0.40)	
18.00 - 18.39	D	53	50/240 mm (S)				18		Stiff and very stiff light brown slightly sandy slightly gravelly CLAY. Sand is fine and medium. Gravel is subangular and subrounded fine and medium of mixed lithologies including sandstone, mudstone and flint. [GLACIAL TILL DEPOSITS] [CLAY]	18.00	-12.85					
18.00 - 18.70	B	54														
18.00 - 18.39	SPT															
18.70 - 18.80	D	55	50/240 mm (S)	100	N/A	N/A	19									
18.00 - 19.50																
18.80 - 19.50	B	57														
19.50 - 20.00	UT	56	0/500 mm													
20.00 - 20.10	D	58														

	Contract Name		LBA CCS Transport and Storage Project Ground Investigations				Location ID													
	Client		Eni UK Limited				LB_21_44_BH													
	Fugro Reference		F190089																	
	Coordinates (m)		E334879.81 N367152.56		Ground Elevation (m Datum)		5.15		Sheet 5 of 6											
	Hole Type		Sonic Core Drilling				Status		Final											
Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details					Backfill / Installation							
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	If (mm)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend								
20.10 - 20.60	B	59		100	N/A	N/A		21												
19.50 - 21.00																				
20.60 - 20.70	D	60																		
20.70 - 21.00	B	61																		
21.00 - 21.45	D	62	N = 33 (S)																	
21.00 - 21.70	B	63																		
21.00 - 21.45	SPT																			
21.70 - 21.80	D	64	100	N/A	N/A		22													
21.00 - 22.50																				
21.80 - 22.50	B	65																		
22.50 - 22.95	D	66	N = 27 (S)																	
22.50 - 23.30	B	67																		
22.50 - 22.95	SPT																			
22.50 - 24.00	D	68	100	N/A	N/A		23													
23.30 - 23.40																				
23.40 - 24.00	B	69																		
24.00 - 24.45	D	70	N = 28 (S)																	
24.00 - 24.70	B	71																		
24.00 - 24.45	SPT																			
24.70 - 24.80	D	72	100	N/A	N/A															
24.00 - 25.50																				
24.80 - 25.10	B	73																		
Continued next page																				
Notes																				
- Abbreviations and results data defined on 'Notes on Exploratory Position Records'																				
Template: FGSL/HBSI/FGSL Rotary If.hbt/Config Fugro Rev5/23/12/2019/TS+AW											Print Date		30/08/2022							

			Contract Name		LBA CCS Transport and Storage Project Ground Investigations				Location ID				
			Client		Eni UK Limited				LB_21_44_BH				
			Fugro Reference		F190089								
			Coordinates (m)		E334879.81 N367152.56		Ground Elevation (m Datum)		5.15		Sheet 6 of 6		
			Hole Type		Sonic Core Drilling				Status		Final		
Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details					Backfill / Installation
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	If (mm)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend	
25.10 - 25.50	B	74	N = 27 (S)										
25.50 - 25.95 25.50 - 26.00 25.50 - 25.95	D B SPT	75 76											
26.00 - 26.10 26.10 - 26.60	D B	77 78						26					
25.50 - 27.00				100	N/A	N/A							
26.60 - 27.00	B	79	N = 24 (S)										
27.00 - 27.45 27.00 - 27.50 27.00 - 27.45	D B SPT	80 81						27					
27.50 - 27.60 27.60 - 28.00	D B	82 83											
27.00 - 28.50				100	N/A	N/A							
28.00 - 28.10 28.10 - 28.50	D B	84 85	N = 24 (S)										
28.50 - 28.95 28.50 - 29.00 28.50 - 28.95	D B SPT	86 87											
29.00 - 29.10 29.10 - 29.50	D B	88 89						28					
28.50 - 30.00				100	N/A	N/A							
29.50 - 30.00	B	90											
									End of Borehole at 30.00 m	30.00	-24.85		
Notes													
- Abbreviations and results data defined on 'Notes on Exploratory Position Records'													
Template: FGSL/HBSI/FGSL Rotary If.hbt/Config Fugro Rev5/23/12/2019/TS+AW										Print Date		30/08/2022	

	Contract Name		LBA CCS Transport and Storage Project Ground Investigations						Location ID	
	Client		Eni UK Limited						LB_21_44_CPT	
	Fugro Reference		F190089							
	Coordinates (m)		E334877.46 N367149.12		Ground Elevation (m Datum)		5.06		Sheet 1 of 1	
	Hole Type		Inspection Pit						Status	Final

Equipment										
Depth From (m)	Depth To (m)	Hole Type	Date From	Date To	Equipment	Core Barrel	Core Bit	Drilling Crew	Logged By	Remarks
0.00	1.20	IP	27/10/2021	27/10/2021	Hand excavated			LT, MW, CS	LT	

Progress						Rotary Details					Core Details			
Date (dd/mm/yyyy)	Time (hh:mm)	Hole Depth (m)	Casing Depth (m)	Water Depth (m)	Weather	Depth From (m)	Depth To (m)	Flush Type	Flush Return (%)	Flush Colour	Run Time (hh:mm)	Depth From (m)	Depth To (m)	Diameter (mm)
27/10/2021	16:00	0.00			Dry									
27/10/2021	16:30	1.20			Dry									

Hole and Casing			
Depth To (m)	Hole Diameter (mm)	Depth To (m)	Casing Diameter (mm)

Chiselling / Slow Progress			
Depth From (m)	Depth To (m)	Duration (hh:mm)	Tool / Remark

Water Strike			Water Added			
Strike At (m)	Rise To (m)	Time Elapsed (mins)	Casing Depth (m)	Depth Sealed (m)	Depth From (m)	Depth To (m)



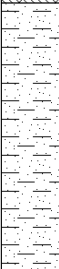

Water Strike Remarks					General Remarks				
Groundwater not encountered during excavation.					1. Prior to excavation, a Cable Avoidance Tool (CAT) survey was carried out. An inspection pit was hand-dug to 1.20m depth and rescanned using the CAT to check for services. Services were not located.				


Installation					Pipe					Backfill			
Type	Tip Depth / Distance (m)	Response Zone Top (m)	Response Zone Base (m)	Installation Date	ID	Top Depth (m)	Base Depth (m)	Diameter (mm)	Type	Depth From (m)	Depth To (m)	Backfill Material	Date

Notes

- Abbreviations and results data defined in 'Exploratory Location Records Keysheets'

Checked By	JR	Elevation Datum	Ordnance Datum	Grid Coordinate System	OSGB	
Template: FGSL/HBSI/FGSL BH Summary.hbt/Config Fugro Rev5/26/06/2019/TS+AW					Print Date	01/09/2022

	Contract Name		LBA CCS Transport and Storage Project Ground Investigations			Location ID				
	Client		Eni UK Limited			LB_21_44_CPT				
	Fugro Reference		F190089							
	Coordinates (m)		E334877.46 N367149.12	Ground Elevation (m Datum)	5.06	Sheet 1 of 1				
	Hole Type		Inspection Pit			Status	Final			
Sampling and In Situ Testing				Strata Details					Groundwater	
Depth (m)	Type	No.	Test Results	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend	Water Strike	Backfill / Installation
0.20 - 0.30	D	1			TOPSOIL. Soft dark brown sandy CLAY. Sand is fine and medium. [TOPSOIL] [SILT]	(0.30)				
0.40 0.40 0.40	HVane HVane HVane		45 kPa (15 kPa) 49 kPa (16 kPa) 51 kPa (17 kPa)		Stiff light brown mottled grey sandy CLAY. Sand is fine and medium. [TIDAL FLAT DEPOSITS] [CLAY]	0.30	4.76			
0.60 - 0.70	D	2				(0.90)				
				1						
					End of Inspection Pit at 1.20 m	1.20	3.86			
				2						
				3						
				4						
Notes					Pit Stability		Plan			
- Abbreviations and results data defined on 'Notes on Exploratory Position Records'					Stable		0.30 m  150°			
Template: FGSL/HBSI/FGSL Trial Pit.hbt/Config Fugro Rev5/05/12/2019/TS-AW							Print Date		01/09/2022	

	Contract Name		LBA CCS Transport and Storage Project Ground Investigations					Location ID	
	Client		Eni UK Limited					LB_21_45_BH	
	Fugro Reference		F190089						
	Coordinates (m)		E334680.72 N367032.31	Ground Elevation (m Datum)		4.43	Sheet 1 of 1		
	Hole Type		Sonic Core Drilling					Status	Final

Equipment										
Depth From (m)	Depth To (m)	Hole Type	Date From	Date To	Equipment	Core Barrel	Core Bit	Drilling Crew	Logged By	Remarks
0.00 1.20	1.20 30.00	IP SNC	31/03/2022 04/04/2022	31/03/2022 05/04/2022	Hand excavated Eijelkamp CRS XL MAX		PCD	ST TS, AF	ST MC	

Progress						Rotary Details						Core Details		
Date (dd/mm/yyyy)	Time (hh:mm)	Hole Depth (m)	Casing Depth (m)	Water Depth (m)	Weather	Depth From (m)	Depth To (m)	Flush Type	Flush Return (%)	Flush Colour	Run Time (hh:mm)	Depth From (m)	Depth To (m)	Diameter (mm)
31/03/2022	13:45	0.00			Dry	1.20	3.00	M	60	Brown	00:15	1.20	3.00	100
31/03/2022	14:15	1.20			Dry	3.00	4.50	M	60	Brown	00:15	3.00	4.50	100
04/04/2022	06:00	1.20	0.00		Shows, windy	4.50	6.00	M	60	Brown	00:15	4.50	6.00	100
04/04/2022	18:00	16.50	16.50	0.50		6.00	7.50	M	60	Brown	00:15	6.00	7.50	100
05/04/2022	07:30	16.50	16.50	3.00	Overcast	7.50	9.00	M	60	Brown	00:15	7.50	9.00	100
05/04/2022	18:00	30.00	28.50	3.00		9.00	10.50	M	60	Brown	00:15	9.00	10.50	100
						10.50	12.00	M	60	Brown	00:30	10.50	12.00	100
						12.00	13.50	M	60	Brown	00:30	12.00	13.50	100
						13.50	15.00	M	60	Brown	00:30	13.50	15.00	100
						15.00	16.50	M	60	Brown	00:30	15.00	16.50	100
						16.50	18.00	M	60	Brown	00:20	16.50	18.00	100
						18.00	19.50	M	60	Brown	00:20	18.00	19.50	100
						19.50	21.00	M	60	Brown	00:20	19.50	21.00	100
						21.00	22.50	M	60	Brown	00:20	21.00	22.50	100
						22.50	24.00	M	60	Brown	00:20	22.50	24.00	100
						24.00	25.50	M	60	Brown	00:20	24.00	25.50	100
						25.50	27.00	M	60	Brown	00:20	25.50	27.00	100
						27.00	28.50	M	60	Brown	00:20	27.00	28.50	100
						28.50	30.00	M	60	Brown	00:20	28.50	30.00	100

Hole and Casing			
Depth To (m)	Hole Diameter (mm)	Depth To (m)	Casing Diameter (mm)
28.50 30.00	175 145	13.50 27.00	175 175

Chiselling / Slow Progress			
Depth From (m)	Depth To (m)	Duration (hh:mm)	Tool / Remark

Water Strike					Water Added	
Strike At (m)	Rise To (m)	Time Elapsed (mins)	Casing Depth (m)	Depth Sealed (m)	Depth From (m)	Depth To (m)



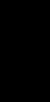

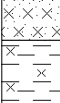
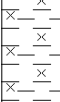
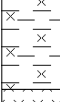
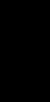

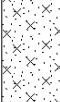
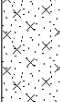
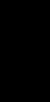
Water Strike Remarks				General Remarks			
Groundwater not encountered during excavation.				1. Prior to excavation, a Cable Avoidance Tool (CAT) survey was carried out. An inspection pit was hand-dug to 1.20m depth and rescanned using the CAT to check for services. Services were not located.			


Installation					Pipe					Backfill			
Type	Tip Depth / Distance (m)	Response Zone Top (m)	Response Zone Base (m)	Installation Date	ID	Top Depth (m)	Base Depth (m)	Diameter (mm)	Type	Depth From (m)	Depth To (m)	Backfill Material	Date
										0.00	30.00	Bentonite	05/04/2022

Notes

- Abbreviations and results data defined in 'Exploratory Location Records Keysheets'

Checked By	PG/CK	Elevation Datum	Ordnance Datum	Grid Coordinate System	OSGB	
Template: FGSL/HBSI/FGSL BH Summary.hbt/Config Fugro Rev5/26/06/2019/TS+AW					Print Date	30/08/2022

		Contract Name		LBA CCS Transport and Storage Project Ground Investigations				Location ID								
		Client		Eni UK Limited				LB_21_45_BH								
		Fugro Reference		F190089												
		Coordinates (m)		E334680.72 N367032.31		Ground Elevation (m Datum)		4.43		Sheet 1 of 6						
		Hole Type		Sonic Core Drilling				Status		Final						
Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details					Backfill / Installation			
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	If (mm)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend				
0.10 0.10	B D	2 1	N = 3 (S)						TOPSOIL. Grass over dark brown slightly gravelly clayey SAND with frequent rootlets (<1mm). Sand is fine and medium. Gravel is subangular and subrounded fine and medium of sandstone. [TOPSOIL] [SAND]	(0.40)	4.03					
0.40 0.40 0.50	B D ES	4 3 5							Brown sandy SILT. Sand is fine. [TIDAL FLAT DEPOSITS] [SILT]	0.40						
0.70 0.70	B D	7 6								(0.80)						
1.00 1.00 1.10	B D ES	9 8 10						1								
1.20 - 1.65 1.20 - 1.65	D SPT	11							Soft light brown silty CLAY with occasional lenses (<10mm x 10mm x 20mm) of orangish brown fine sand. [TIDAL FLAT DEPOSITS] [CLAY]	1.20						
1.50 - 2.30	B	30							1.20m to 1.50m; assumed zone of core loss. 1.50m to 2.30m; sandy silt with rare gravel.	(1.23)						
1.20 - 3.00			N = 4 (S)	83	N/A	N/A		2			2.00					
2.30 - 2.40	D	31							Grey clayey SILT. [TIDAL FLAT DEPOSITS] [SILT]	2.43						
2.80 - 3.00	D	32								(0.57)						
3.00 - 3.45 3.00 - 3.45	D SPT	12						3	Loose grey and light brown silty SAND with occasional lenses (< 40mm x 50mm x 60mm) of dark grey clay and rare shell fragments (2mm x 10mm x 10mm). Sand is fine. [TIDAL FLAT DEPOSITS] [SAND]	3.00						
3.50 - 3.60 3.60 - 4.50	D B	33 34								(1.82)						
3.00 - 4.50				93	N/A	N/A		4								
4.50 - 4.95 4.50 - 4.95 4.60 - 4.80	D SPT D	13 35	N = 8 (S)								-0.39					
4.90 - 5.00 5.00 - 6.00	D B	36 37							Medium dense light brown slightly silty SAND with frequent shell fragments (<5mm x 15mm x 20mm)	4.82						
Continued next page																
Notes																
- Abbreviations and results data defined on 'Notes on Exploratory Position Records'																
Template: FGSL/HBSI/FGSL Rotary If.hbt/Config Fugro Rev5/23/12/2019/TS+AW										Print Date		30/08/2022				


	Contract Name		LBA CCS Transport and Storage Project Ground Investigations				Location ID	
	Client		Eni UK Limited				LB_21_45_BH	
	Fugro Reference		F190089					
	Coordinates (m)		E334680.72 N367032.31	Ground Elevation (m Datum)		4.43	Sheet 2 of 6	
	Hole Type		Sonic Core Drilling				Status	Final

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details					Backfill / Installation
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	If (mm)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend	
4.50 - 6.00				93	N/A	N/A			and rare gravel. Sand is fine and medium. Gravel is subangular and subrounded fine and medium of mudstone and sandstone. [TIDAL FLAT DEPOSITS] [SAND]				
6.00 - 6.45	D SPT	14	N = 16 (S)					6					
6.00 - 6.45													
6.40 - 6.50		D		38									
6.50 - 7.50	B	39											
6.00 - 7.50				93	N/A	N/A		7					
7.50 - 7.60	D D# SPT B	40	N = 11 (S)										
7.50 - 7.95		15											
7.50 - 7.95													
7.60 - 8.30		41											
7.50 - 9.00				100	N/A	N/A							
8.35 - 8.45	D	42							8.33m to 8.45m; with frequent shell fragments and lenses (30mm x 40mm x 50mm) of dark grey clay.				
8.90 - 9.00	D	43								(8.05)			
9.00 - 10.00	B D SPT	44	N = 19 (S)					9					
9.00 - 9.45		16											
9.00 - 9.45													
9.00 - 10.50				100	N/A	N/A							
10.00 - 10.20	D	45							Continued next page				

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'







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	Contract Name		LBA CCS Transport and Storage Project Ground Investigations				Location ID	
	Client		Eni UK Limited				LB_21_45_BH	
	Fugro Reference		F190089					
	Coordinates (m)		E334680.72 N367032.31	Ground Elevation (m Datum)		4.43	Sheet 3 of 6	
	Hole Type		Sonic Core Drilling				Status	Final

Depth (m)	Sampling and In Situ Testing		Core Recovery				Strata Details					Backfill / Installation				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	If (mm)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)		Legend			
10.50 - 10.95	D#	17	N = 21 (S)					11	10.10m to 10.30m; mottled orangish brown.							
10.50 - 10.95	SPT															
10.80 - 11.00	D	46														
11.00 - 12.00	B	47		100	N/A	N/A		12		12.87	-8.44					
10.50 - 12.00																
12.00 - 12.45	D	18	N = 27 (S)					13	Medium dense brown gravelly clayey SAND with frequent shell fragments (<2mm x 10mm x 15mm) and gastropod shell (25mm x 30mm x 50mm). With rare cobble sized clasts of black peat. [TIDAL FLAT DEPOSITS] [SAND] 13.25m to 13.30m; with rare cobble sized clasts (40mm x 70mm x 80mm) of black peat.	(1.18)						
12.00 - 12.45	SPT															
12.50 - 12.70	D	48														
12.00 - 13.50				100	N/A	N/A		14	14.00m to 14.03m; gravel is subrounded (30mm x 40mm x 55mm) of mudstone. Dense light brown and greyish brown SAND with rare gravel sized fragments of peat (15mm x 20mm x 20mm). Sand is fine and medium locally fine to coarse. [TIDAL FLAT DEPOSITS] [SAND]	14.05	-9.62					
12.90 - 13.10	D	49														
13.10 - 14.00	B	50														
13.50 - 13.95	D	19	N = 17 (S)													
13.50 - 13.95	SPT															
14.10 - 14.20	D	51		100	N/A	N/A										
14.20 - 15.00	B	52														
13.50 - 15.00																
15.00	D	20														
15.00 - 15.20	D	53														
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		Contract Name		LBA CCS Transport and Storage Project Ground Investigations					Location ID				
		Client		Eni UK Limited					LB_21_45_BH				
		Fugro Reference		F190089									
		Coordinates (m)		E334680.72 N367032.31		Ground Elevation (m Datum)		4.43					
		Hole Type		Sonic Core Drilling					Status		Final		
Sheet 4 of 6													
Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details					Backfill / Installation
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	If (mm)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend	
15.00 - 15.45	SPT		N = 40 (S)						15.00m to 15.30m; sand is fine to coarse.	(2.38)			
15.50 - 16.30	B	54											
15.00 - 16.50				100	N/A	N/A		16					
16.50 - 16.70	D	55							Plastic dark brown strongly decomposed (H8) pseudo-fibrous PEAT with low fine fibres, low coarse fibres and no wood remains (F1, R1, W0). [TIDAL FLAT DEPOSITS]	16.43	-12.00		
16.50 - 16.95	D	21							16.50m to 16.95m; SPT (D21) recovered as dark brown peat and grey clay.	(0.27)			
16.50 - 16.95	SPT		N = 7 (S)						Soft grey slightly sandy CLAY. [TIDAL FLAT DEPOSITS] [CLAY]	16.70	-12.27		
16.80 - 16.95	D	56											
17.00 - 17.30	C	57						17					
16.50 - 18.00				100	N/A	N/A			17.30m to 18.00m; with rare fine gravel.	(1.45)			
17.30 - 18.00	B	58											
18.00 - 18.45	D	22							18.00m to 18.45m; SPT (D22) recovered as grey clay and dark grey gravelly sand.				
18.00 - 18.45	SPT		N = 6 (S)					18					
18.20 - 18.35	D	59							Dark grey gravelly slightly clayey SAND. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of sandstone and mudstone. [TIDAL FLAT DEPOSITS] [SAND]	18.15	-13.72		
18.55 - 18.70	D	60							Firm and stiff brown slightly gravelly CLAY. Gravel is angular to subrounded fine and medium of sandstone and mudstone. [GLACIAL TILL DEPOSITS] [CLAY]	(0.33)			
18.70 - 19.00	C	61								18.48	-14.05		
18.00 - 19.50				100	N/A	N/A		19					
19.50 - 19.95	D	23											
19.50 - 19.95	SPT		N = 29 (S)										
19.70 - 20.50	B	62							19.70m to 20.50m; slightly sandy. Sand is fine to coarse.				
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	Client		Eni UK Limited				LB_21_45_BH			
	Fugro Reference		F190089							
	Coordinates (m)		E334680.72 N367032.31		Ground Elevation (m Datum)		4.43		Sheet 5 of 6	
	Hole Type		Sonic Core Drilling				Status		Final	

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details					Backfill / Installation
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	If (mm)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend	
19.50 - 21.00				100	N/A	N/A							
20.50 - 20.80	C	63											
20.80 - 20.95	D	64											
21.00 - 21.45 21.00 - 21.45	D SPT	24	N = 22 (S)					21					
21.50 - 22.30	B	65											
21.00 - 22.50				100	N/A	N/A		22					
22.30 - 22.45	D	66											
22.50 - 22.95 22.50 - 22.95	D SPT	25	N = 26 (S)										
22.70 - 23.50	B	67						23					
22.50 - 24.00				100	N/A	N/A							
23.50 - 23.80	C	68											
23.80 - 23.95	D	69											
24.00 - 24.45 24.00 - 24.80 24.00 - 24.45	D B SPT	26 70	N = 24 (S)					24	24.00m to 24.80m; sandy.	(11.52)			
24.00 - 25.50 24.80 - 24.95	D	71		100	N/A	N/A							
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	Contract Name		LBA CCS Transport and Storage Project Ground Investigations				Location ID			
	Client		Eni UK Limited				LB_21_45_BH			
	Fugro Reference		F190089							
	Coordinates (m)		E334680.72 N367032.31		Ground Elevation (m Datum)		4.43		Sheet 6 of 6	
	Hole Type		Sonic Core Drilling				Status		Final	

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details					Backfill / Installation
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	If (mm)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend	
25.50 - 25.95 25.50 - 26.30 25.50 - 25.95	D B SPT	27 72	N = 28 (S)										
25.50 - 27.00 26.30 - 26.95	D	73		100	N/A	N/A		26					
27.00 - 27.45 27.00 - 27.45	D SPT	28	N = 26 (S)					27					
27.20 - 28.00	B	74											
27.00 - 28.50				100	N/A	N/A							
28.00 - 28.30	C	75						28					
28.30 - 28.45	D	76											
28.50 - 28.95 28.50 - 28.95	D SPT	29	N = 30 (S)										
28.70 - 29.50	B	77											
28.50 - 30.00				100	N/A	N/A		29	28.70m to 29.50m; sandy.				
29.50 - 29.80	C	78											
29.80 - 29.95	D	79											
									End of Borehole at 30.00 m	30.00	-25.57		

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