

A collage of six images related to geotechnical engineering: a large concrete pipe, a soil profile with a probe, a worker in a high-visibility suit, a red truck with 'Southern' branding, a person using a handheld device, and a close-up of soil and gravel.

Phase 2 Ground Investigation Report

Project Name: Molesworth Street, Rochdale, OL16 1TQ

Client: Glanville Consultants Limited (on behalf of McDonalds)

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SUMMARY

The site is currently used as a car park and is located immediately to the south of the junction for Molesworth Street and Water Street in Rochdale, Lancashire. It is proposed to redevelop the site with a new McDonalds building in the east, together with associated car parking in the west and a drive-thru lane etc. Based on the supplied proposed layout, it appears that there will only be limited soft landscaping around the perimeter of the site.

Geological records indicate the site to be underlain by superficial Glaciofluvial Deposits over Old Lawrence Rock and Pennine Lower Coal Measures Formation on the south-westernmost edge of the site. Superficial Till deposits and Alluvial deposits are also mapped within close vicinity to the site.

A desk study has been carried out (STL J15721-DS, Issue 2), which indicates that the site has a history of industrial land use including a clay brick and tile manufacturer, print works, iron works and garages, and the site is currently used as a car park. The site has also been located within an industrial/commercial area. It is possible the site may have also been used historically as a petrol filling station, which means there may have been buried fuel tanks and, if so, these may remain beneath the site and may represent an ongoing source and of hydrocarbon contamination. A petroleum licencing search, from Greater Manchester Fire and Rescue Service, did not identify any evidence that petroleum spirit was stored at this address. A careful watch should be kept for any such structures, however.

A Preliminary Unexploded Ordnance (UXO) risk assessment was undertaken by a specialist subcontractor as part of the desk study. This concluded that the risk of UXO was not considered to be higher than the 'background risk' of finding UXO in this part of the UK. No further action was recommended. The assessment was made with specific regard to the proposed investigation works and its conclusions may not be appropriate to other activities.

A single phase of intrusive investigation was carried out. Access was restricted by the presence of buildings and buried services, and the operational needs of the on-site business and numerous parked cars on the forecourt. It should not be assumed that the same ground conditions would apply to these inaccessible areas. Boreholes WLS07a-c encountered a concrete slab beneath the blacktop surfacing which we were unable to break through; therefore, further investigation may be required in this area to confirm the ground conditions.

The soils encountered generally comprised Made Ground to a depth of between 0.8-4mbgl, over silty sandy organic clays & clayey silty gravelly sands [Alluvium] to between 4-9mbgl, over stiff to very stiff silty sandy gravelly clay [Till deposits].

Groundwater strikes were recorded in BH02 at 9.4m and BH03 at 3.0m and 6.5m. Water was recorded between 2.7-4.1mbgl within four of the windowless boreholes on completion. The three deep boreholes were installed with groundwater monitoring wells to 20m depth and four shallow windowless boreholes were installed to 3-4m depth. Standing groundwater levels were recorded between 1.5-3.7mbgl during subsequent monitoring.

Piled foundations are recommended for this site. From the viewpoint of pile type, and given the close proximity of adjacent structures, a bored pile solution is considered to be a more appropriate pile type. In terms of bored piles and, noting the presence of potentially unstable soils (made ground and loose sands/silts), and groundwater, a continuous flight auger grout injected pile (CFA) would be best suited to the ground conditions encountered. A series of preliminary estimated CFA pile capacities are provided in section 20.

NHBC Low Volume Change Potential precautions will apply.

The sulphate content of the fill and natural soil analysed was found to fall within Class DS-2. The ACEC classification for the site is AC-2.

Significant inflows of groundwater into excavations would not be anticipated, nor would the requirement for specialist de-watering activities. Seepage of groundwater into excavations should be anticipated, especially from the superficial soils, although these should be managed with simple pumping methods.

Suspended floor slabs are advised. Gas protection measures will also be required within the floor slab, in accordance with Characteristic Situation 2

Detailed information on the proposed development, such as detailed final layout, loadings and serviceability limits was not provided. Accordingly, where geotechnical design advice is provided it is on the prescriptive basis allowed for by Eurocode 7: employing conventional and conservative design rules.

Some metals, asbestos and petroleum hydrocarbon impact has been recorded in the soils analysed from site, along with some impact of the perched groundwater and a gas risk. Some basic remediation is required to mitigate the risk to the receptors, along with some further investigation of the groundwater risk.

Basic PPE and good site practice (such as the use of welfare facilities) is considered acceptable to mitigate the minor risk to the contractors, unless more significant contamination is encountered.

300mm of certified clean topsoil is recommended for the minimal area of soft landscaping proposed. This should be placed above an 'alert' membrane to separate the imported topsoil from the underlying Made Ground.

Organic contaminants present in the soils, particularly PAH's and petroleum hydrocarbons found in the Made Ground soils could affect plastic underground service pipes (such as the types used by water and gas supply companies). Guidance should be sought from the relevant companies regarding any proposed plant in the affected area. Many water supply companies now require higher specification pipe on contaminated sites, even following remediation.

Based on the ground gas monitoring, the gas regime for the site is assessed as Characteristic Situation 2, and basic gas protection measures will be required. Depleted oxygen was also noted which could pose a risk to construction works should there be any confined space working. It is recommended work spaces are adequately ventilated.

To date only limited groundwater sampling and laboratory analysis has been undertaken. This has identified elevated concentrations of petroleum hydrocarbons within BH02, which is located towards the centre of the site. Further groundwater sampling and analysis is required to better assess the risk. Depending on the findings, additional soil investigation may then be required.

The presence of contamination may affect the classification of waste soils, or the potential for their re-use. The results of the chemical analysis carried out indicate that the recorded concentrations for TPH in the soils with exceedances above any of the hazardous waste thresholds were recorded. Four samples of Made Ground soils are classified as Hazardous with EWC code 17 05 03, including hazardous properties such as HP7 Carcinogenic, HP11 Mutagenic and HP14 Ecotoxic. The remaining samples of Made Ground and natural soils are classified as Non-Hazardous with EWC code 17 05 04.

The contamination screening values used are valid at the time of writing but may be subject to change and any such changes will have implications for the assessments based on them. Their validity should be confirmed at the time of site development.

As with any site, areas of contamination not identified during investigation works may come to light during the course of redevelopment. Accordingly, a discovery strategy must be in place during the redevelopment to ensure that any hitherto unknown contamination is identified and dealt with in an appropriate manner. Depending on the nature of any such contamination, it may prove necessary to reassess the remedial strategy for the site. The presence of contamination may affect the classification of waste soils, or the potential for their re-use.

A formal remediation strategy and verification plan should be agreed with the regulatory authorities prior to commencement of any remedial works. This should be formalised after the additional investigation proposed.

The investigation was conducted and this report has been prepared for the sole internal use and reliance of Glanville Consultants Limited (on behalf of McDonalds) and their appointed Engineers. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Southern Testing Laboratories Ltd. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The findings and opinions conveyed via this investigation report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Ltd. believes are reliable. Nevertheless, Southern Testing Laboratories Ltd. cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

The recommendations contained in this report are made in respect of the particular context of the investigation as described in the report and may not be appropriate to alternative development schemes. This report should be considered in its entirety and Southern Testing Laboratories Ltd accepts no responsibility for and excludes liability in respect of any omission or alteration made by others, and any use of the report for any purpose other than that for which it was produced.

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For and on behalf of Southern Testing Laboratories Limited

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A INTRODUCTION

1 Authority

Our authority for carrying out this work is contained in a signed STL Project Order Form from Mr K Jackson, on behalf of Glanville Consultants Ltd, dated 3rd June 2024 (PO number GCH1086). This is in relation to our quotation Q240775 dated 30th May 2024.

2 Location

The site is currently used as a car park, located immediately to the south of the junction for Molesworth Street and Water Street in Rochdale, Lancashire.

The approximate National Grid Reference of the site is SD 90118 13371. The site location is indicated on Figure 1 within Appendix A.

3 Proposed Construction

It is proposed to redevelop the site with a new McDonalds building in the east, together with associated car parking in the west and a drive-thru lane etc. Based on the supplied proposed layout (included in Appendix A) it appears that only limited soft landscaping is proposed around the perimeter of the site.

For the purposes of the contamination risk assessment, in relation to the proposed development, a Commercial/Industrial classification has been used CLEA Model [1] / C4SL Report [2].

The gas sensitivity of the proposed development is therefore rated as Low CIRIA C665 Ref [3]

4 Object

This is a Phase II geotechnical and/or contamination (risk estimation and evaluation) investigation (Tier 1).

The object of the investigation was to assess foundation bearing conditions and other soil parameters relevant to the proposed development, and to assess the likely nature and extent of soil, groundwater and soil gas contamination on the site.

5 Scope

This report presents our exploratory hole logs and test results and our interpretation of these data.

An Unexploded Ordnance (UXO) risk assessment was included within the Phase 1 Desk Study Report (J15721-DS). The assessment was made with specific regard to the proposed investigation works/site development and its conclusions may not be appropriate to other activities. It recommended that no further action was required.

As with any site there may be differences in soil conditions between exploratory hole positions.

This report is not an engineering design and the figures and calculations contained in the report should be used by the Engineer, taking note that variations will apply, according to variations in design loading, in techniques used, and in site conditions. Our figures therefore should not supersede the Engineer's design.

The ground investigation has been completed with reference to BS 5930 Ref [4] and BS 10175 Ref [5].

The findings and opinions conveyed via this investigation report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Ltd. believes are reliable. Nevertheless, Southern Testing Laboratories Ltd. cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

The investigation was conducted and this report has been prepared for the sole internal use and reliance of Glanville Group. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Southern Testing Laboratories Ltd. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The recommendations contained in this report are made in respect of the particular context of the investigation as described in the report and may not be appropriate to alternative development schemes. This report should be

considered in its entirety and Southern Testing Laboratories Ltd accepts no responsibility for and excludes liability in respect of any omission or alteration made by others, and any use of the report for any purpose other than that for which it was produced.

Detailed information on the proposed development, such as detailed final layout, loadings and serviceability limits was not provided. Accordingly, where geotechnical design advice is provided it is on the prescriptive basis allowed for by Eurocode 7: employing conventional and conservative design rules.

The contamination screening values used are valid at the time of writing but may be subject to change and any such changes will have implications for the assessments based on them. Their validity should be confirmed at the time of site development.

B BACKGROUND INFORMATION

6 Desk Study

A Phase 1 Desk Study Report was carried out for the site (STL report ref. J15721-DS, Issue 2, Nov 2024).

The desk study indicated that the site has a history of industrial land use, including a clay brick and tile manufacturer, print works, iron works and garages, and is currently used as a car park. The site has also been located within an industrial/commercial area. It is possible the site may have been used as a petrol filling station which means there may be have been buried fuel tanks and, if so, these may remain beneath the site and represent a risk of hydrocarbon contamination. However, a petroleum licencing search, from Greater Manchester Fire and Rescue Service, did not identify any evidence that petroleum spirit was stored at this address.

Based on the Desk Study search and walkover survey, it was concluded that the overall risk of on-site contamination, associated with both historical and current land use, was low to moderate in the context of the proposed commercial use of the site. Furthermore, the risk of off-site contamination migrating on to the subject site from contemporary sources was also considered low to moderate.

A Phase II intrusive investigation was recommended to assess the contamination risk for the site, to include sampling and testing of any Made Ground, the underlying natural soils and groundwater in order to determine the nature and extent of any contamination on the site, and whether there is a need for any remedial works or additional assessment.

A potential risk from ground gases was also identified due to potentially infilled land both onsite and in the near vicinity. Therefore, ground gas monitoring was recommended to be carried out within the location of the building to better assess the gas risk.

6.1 Geology

The British Geological Survey Map, No. 76 (Rochdale) and No. 85 (Manchester), indicate that the site geology consists of superficial Glaciofluvial Deposits over Old Lawrence Rock and Pennine Lower Coal Measures Formation on the south-westernmost edge of the site. Superficial Till deposits and Alluvial deposits are also mapped within close vicinity to the site.

6.1.1 Glaciofluvial Deposits

The deposits comprise sediments transported and deposited by glacial meltwater, either sub-glacially, en-glacially, supra-glacially or downstream of glaciers via meltwater channels and/or glacial outwash events. Deposits are formed via number of processes and therefore vary greatly in depth. Sediments commonly comprise of sand and gravel, with moderate sorting and bedding. Fines including clay have generally been washed out leaving the sand and gravel which is commonly non-cohesive and highly permeable; a good bearing capacity and low settlement is common. However, lenses of silt, clay or organic material can be locally present.

6.1.2 Till Deposits

Till is typically an unsorted and unstratified drift, generally overconsolidated, deposited directly by and underneath a glacier without subsequent reworking by water from the glacier. It consists of a heterogeneous mixture of clay, sand, gravel, and boulders varying widely in size and shape (diamicton).

6.1.3 Alluvium

Alluvium is a geologically recent deposit found in association with watercourses. It is typically soft to firm, normally consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. A stronger, desiccated surface zone may be present.

Running sand or silt may be encountered. Excavations are often unstable. Bottom heave may be encountered in clayey soils below 3m.

It is inherently variable and rapid lateral transitions in soil type should be anticipated.

6.1.4 Pennine Lower Coal Measures Formation / Old Lawrence Rock

These deposits generally consist of interbedded grey mudstone, siltstone and pale grey sandstone. Marine fossils are commonly contained within mudstone in the lower part and there are more numerous and thicker coal seams in the upper part.

The Pennine Lower Coal Measures Formation is the parent unit of Old Lawrence Rock.

6.2 UXO Risk Management

A preliminary UXO risk assessment has been prepared by 1st Line Defence (ref PA19968-00) and a copy can be found in Appendix C of the Phase 1 Desk Study Report (STL J15721-DS). The assessment was made with specific regard to the proposed investigation works/site works and its conclusions may not be appropriate to other activities.

The report indicated that during WWII the site was within an area which sustained an overall very low density of bombing according to official Home Office bombing statistic, with just 4 HE bombs recorded within the Country Borough of Rochdale. The report suggest that no evidence could be found at this preliminary stage to suggest that these four bombs were located within close proximity of the site.

This report has concluded that the risk of UXO is not considered to be higher than the 'background risk' of finding UXO in this part of the UK. It was recommended that no further action was required.

The possibility of unexploded ordnance (UXO) being encountered on a site falls within the category of a potentially significant risk and should be addressed as a legal duty under the Construction (Design and Management) Regulations by the Client as early as possible in a project.

The CIRIA publication C681 Ref [6] has been developed to provide a consistent framework for the management of potential risks posed by UXO during site investigation and groundwork phases of construction. The process adopts a tiered approach, divided into four distinct stages; Preliminary risk assessment, Detailed risk assessment, Risk mitigation and Implementation.

7 Site Description

The site is located on the southern side of the junction of Water Street and Molesworth Street. The northern part of the site is used by a Kia car dealership for parking cars. There is a 'Webuyanycar' office/cabin towards the centre of the northern boundary. The remainder of the site is used for car parking. The whole site is covered with blacktop hardstanding which appears to be in good condition.

The site generally slopes towards the north and the east in some parts, with level differences of 5m+ from the south, falling towards the north/north-east.

In the southern part of the site, the car parking is on two different levels separated by a steep wooded bank and in parts a brick/stone retaining wall (approximately 3m high). Parts of the retaining wall are noted to be in poor condition.

7.1 Site Photographs

A series of photographs showing the site is included in Appendix H.

C GROUND INVESTIGATION

8 Strategy and Method

The strategy adopted for the intrusive investigation comprised the following:

Activity / Method	Purpose	Max Depth Range (mbgl)	Installations / Notes
WLS01-09 Dynamic Windowless Sampling	Boreholes to investigate the shallow ground conditions within external areas. To allow SPT's and collection of samples for geotechnical and contamination testing. Installation of shallow land gas and groundwater monitoring wells.	3.45-6.45m	50mm gas / groundwater monitoring wells installed within WLS01, WLS02, WLS05 & WLS08.
BH01-BH03 Cable Percussive	Boreholes to assess deeper ground conditions and allow SPT's and samples for contamination and geotechnical testing.	20.0m	150mm diameter. Installed with 50mm diameter gas / groundwater monitoring wells
DCP01-09	In-situ DCP CBR tests.	0.4m to 1.0m	Located adjacent to each windowless boreholes.

Exploratory hole locations are shown in Figure 2 in Appendix A.

In-situ test and sampling methods descriptions employed are given in Appendix B together with the test results.

SPT Energy Ratio certificates and a Summary Table of SPT N Values is provided within Appendix B.

Access was restricted by the presence of buildings and buried services, the operational needs of the on-site business and numerous parked cars on the forecourt. It should not be assumed that the same ground conditions would apply to these inaccessible areas.

It should be noted that WLS07a-c encountered a concrete slab beneath the blacktop surfacing which we were unable to break through with a power pack and gun. Therefore, further investigation may be required in this area to confirm the ground conditions.

9 Weather Conditions

The fieldwork was carried out between 22nd July and 31st July 2024, at which time the weather was generally sunny and dry with occasional overnight rainfall.

From Met Office data, the rainfall in the south of England in the preceding three months was approximately 131% the normal average for May, 34% the normal average for June and 133% the normal average for July.

10 Soils as Found

The soils encountered are described in detail on the attached exploratory hole logs (Appendix A), but in general comprised Made Ground over silty sandy organic clays & clayey silty gravelly sands [Alluvium] over stiff to very stiff silty sandy gravelly clay [Till deposits]. A summary is given below.

Depth (m)	Thickness (m)	Soil Type	Description
GL to 0.1/0.2m	0.1m to 0.2m	Made Ground	BLACKTOP surfacing Over Concrete in WLS07a-c
0.1/0.2m to 0.8/4.0m	0.68m to 3.9m		Dark grey/brown, silty very sandy cobble GRAVEL. Gravel generally comprised flint, brick, concrete and clinker. Cobbles consist of brick and concrete.

Depth (m)	Thickness (m)	Soil Type	Description
			Greyish brown, clayey silty gravelly SAND. Gravel generally comprised brick, flint, concrete, clinker, glass, plastic and limestone. Hydrocarbon odour noted between 2.0m and 2.5m in BH02 and from 2.0ma and 2.5m in WLS04.
			Dark brownish grey/black, very silty sandy slightly gravelly CLAY. Gravel generally comprised brick, flint, concrete, tile and ceramic. Hydrocarbon odour noted between 2.5ma and 4.0m in BH02.
2.0/3.0m to 4.0/9.0m	1.0m to 7.0m	Alluvium	Very soft to firm dark grey mottled orangish brown, very silty sandy occasionally organic CLAY.
			Loose to medium dense, dark brownish grey, clayey very silty slightly gravelly fine to medium SAND/very sandy SILT.
4.0/9.0m to 20m+ (Depth to base not proven)	11m+ to 16m+	Till Deposits	Stiff to very stiff, dark brownish grey, silty slightly sandy to sandy slightly gravelly CLAY. Gravel consist of fine to coarse sub-angular to sub-rounded sandstone/siltstone.

10.1 Visual and Olfactory Evidence of Contamination

Made ground was encountered in all boreholes. The depth of made ground varied to between 0.8m to 4.0mbgl. A hydrocarbon odour was noted in BH02 between 1.65m and 4.0mbgl and in WLS04 between 2.0m and 2.5mbgl.

11 Groundwater Observations

Groundwater was observed in the exploratory holes as follows:

Hole ID	Comment
BH01	Borehole recorded as dry during drilling.
BH02	Water strike recorded at 9.4m, rose to 7m after 20 minutes. Borehole recorded as dry on completion of drilling.
BH03	Water strike recorded a 3.0m and rose to 2m in 20 minutes. A further water strike recorded at 6.5m and rose to 5m in 20 minutes. Borehole recorded as dry on completion of drilling.
WLS01	Groundwater at 2.89m on completion of borehole.
WLS02	Groundwater at 4.11m on completion of borehole.
WLS03	Borehole dry on completion.
WLS04	Groundwater at 3.1m on completion of borehole.
WLS05	Groundwater at 2.74m on completion of borehole.
WLS06	Groundwater at base on completion of borehole.
WLS08	Borehole dry on completion.
WLS09	Borehole dry on completion.

A summary of the groundwater levels taken during the ground investigation works is provided in the tables below.

Date/Time	Groundwater Levels					
	BH01		BH02		BH02	
	mbgl	mAOD	mbgl	mAOD	mbgl	mAOD
24/07/2024 08:00	2.63	123.01	-	-	-	-
24/07/2024 15:30	2.63	123.01	-	-	-	-
25/07/2024 08:00	2.62	123.02	3.21	122.80	-	-
25/07/2024 16:00	2.62	123.02	3.21	122.80	-	-
26/07/2024 15:00	2.61	123.03	3.20	122.81	3.04	123.43
27/07/2024 09:30	2.57	123.07	3.02	122.99	3.03	123.44
29/07/2024 11:00	2.55	123.09	3.02	122.99	2.97	123.50
30/07/2024 08:30	2.57	123.07	3.02	122.99	2.97	123.50
31/07/2024 14:00	2.56	123.08	3.02	122.99	2.96	123.51

Date/Time	Groundwater Levels							
	WLS01		WLS02		WLS05		WLS08	
	mbgl	mAOD	mbgl	mAOD	mbgl	mAOD	mbgl	mAOD
29/07/2024	2.89*	123.22	4.11*	122.86	-	-	-	-
30/07/2024	1.96	124.15	3.69	123.28	2.74*	-	-	-
31/07/2024	1.96	124.15	3.68	123.29	2.35	125.24	Dry* to 3.45m	Dry* to 124.85m

*after installation

D DISCUSSION OF GEOTECHNICAL TEST RESULTS AND RECOMMENDATIONS

12 Geotechnical Laboratory Tests

The following geotechnical laboratory testing was carried out on selected samples in order to aid material classification and characterise soil properties. The test method references and results are given in Appendix C.

Laboratory Test	Number of Samples Tested	Stratum
Moisture Content	9	3 No. Alluvium 6 No. Till Deposits
Atterberg Limit	9	3 No. Alluvium 6 No. Till Deposits
Particle Size Distribution	6	5 No. Alluvium 1 No. Till Deposits
Single Stage Unconsolidated Undrained Triaxial Test (UUT)	5	5 No. Till Deposits

Laboratory Test	Number of Samples Tested	Stratum
BRE SD1 Suite	13	4 No. Made Ground 3 No. Alluvium 6 No. Till Deposits

13 Soil Classification and Properties

13.1 Made Ground

Shallow surface hard standing, in the form of Blacktop, was encountered at each exploratory hole location. Within WLS07a-WLS07c, concrete was encountered beneath the blacktop which we were unable to break through.

The made ground materials beneath was found to be generally composed of a silty sandy occasionally cobbly gravel, silty sandy gravelly clays and/or clayey silty gravelly sands. These contained various anthropogenic materials, including brick, concrete, clinker, ceramic, glass, plastic and limestone.

SPT N values within the made ground varied between 0 and 38, although frequently <10.

No geotechnical laboratory testing was carried out within the Made Ground soils.

A hydrocarbon odour was noted within the made ground in BH02 between 1.65m and 4.0mbgl and in WLS04 between 2.0m and 2.5mbgl.

The made ground should be anticipated to be very variable in both composition and thickness across the site and potentially having a high compressibility.

Within WLS01a a concrete obstruction was encountered at 0.55mbgl. Similarly, in the locations of WLS07a-c, concrete was encountered beneath the blacktop surfacing. Additionally, in boreholes WLS06a-b the boreholes refused on brick at 1.15-1.23m, respectively. As such, obstructions may be encountered and an allowance should be made for breaking out sub-surface obstructions associated with existing and past developments.

13.2 Alluvial Deposits

These deposits were seen to be variable with soils ranging from very silty sandy occasionally organic clays to clayey very silty gravelly sand/very sandy silt. The distribution of individual soil types across the site is not predictable and rapid changes in soil type should be anticipated both vertically and laterally.

The clay materials were found to be generally very soft to firm in nature with SPT N values of 1 to 11. Unconfined compressive strength values, measured using a hand penetrometer on disturbed samples of clay, varied from 20 to 280 kPa, which is the equivalent to undrained shear strength values of approximately 10 to 140 kPa.

Three Atterberg test was undertaken on samples of the silty sandy organic clay soils recovered from depths of 2-3.5m; these indicated a clay of low plasticity, with Liquid Limits of 23-27%, Plastic Limits of 15-24% and a modified Plasticity Indices of 3-8%, indicating a Negligible Volume Change Potential.

The sandy gravel materials were found to be very loose to loose in nature with SPT N values recorded of between 0 to 8. One SPT N value of 16 was recorded in BH03 at 7.5mbgl.

The sand/silt materials tested had the following range of particle size distribution results.

Hole ID / Depth (m)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobbles (%)
WLS05 at 1.0m	9	20	71	0	
WLS05 at 1.5m	9	13	77	1	
BH03 at 3.0m	10	34	54	1	0
WLS02 at 5.1m	8	24	65	3	
BH02 at 7.2m	25	36	34	5	0

Hole ID / Depth (m)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobbles (%)
BH03 at 7.5m	8	32	58	3	0

13.3 Till Deposits

These clay soils at the site were generally seen as dark brownish grey, silty slightly sandy slightly gravelly to gravelly CLAY. The gravel consists of fine to coarse sandstone, siltstone and quartz. A clayey very silty fine sand layer was noted between 18.5-19.0m in BH01 only.

These clay soils were found to be stiff to very stiff in nature with SPT N values between 4 and 47, generally increasing with depth. Unconfined compressive strength values, measured using a hand penetrometer on disturbed samples of clay varied from 80 to 450 kPa, which is the equivalent to undrained shear strength values of approximately 45 to 225 kPa. The UCS values generally increased with depth.

Super heavy dynamic probing was carried out through the base of WLS01 & WLS02 to confirm the depth of the till deposits. In WLS01 probe blows per 100mm were recorded between 2-9 blows between 5.5-9.5mbgl, increasing to N values between 12-16 blows between 9.5-11mbgl. In WLS02 probe blows per 100mm were recorded between 1-7 blows between 7.0-11mbgl, increasing to N values between 6-16 blows between 11-14.5mbgl.

The Atterberg limit results for 6 samples analysed, from depths of 4-18m, indicated clays of low to intermediate plasticity. Liquid Limit results were seen within the range 24 to 35%, Plastic Limit results between 14 to 16% and modified Plasticity Indices between 8 to 19%, indicating a Low Volume Change Potential.

Bulk density measurements for the clay samples were seen within the range of 1.85 to 2.16 Mg/m³. A bulk unit weight (γ_b) of 20 kN/m³ is therefore considered appropriate as a characteristic value for the Boulder Clay at this site.

A plot of cohesion against depth has been included within Appendix D as Figure P1, based upon the limited UUT test results and SPT N values (using a factor f_1 of 4.5 as suggested by Stroud

13.4 Summary of Geotechnical Parameters

Soil Type: Made Ground

Parameters	Range	Suggested Design Value
SPT (N Value)	0-38	5
Effective Cohesion, c' (kPa)	Not tested ⁽¹⁾	0
Bulk Density (Mg/m ³)	Not tested ⁽¹⁾	1.8
Long term effective internal friction angle ϕ' (degrees)	Not tested ⁽¹⁾	25

Soil Type: Alluvium (Clay)

Parameters	Range	Suggested Design Value
SPT-N value	1-11	5
Plasticity Index (%)	3-8	6
Effective Cohesion, c' (kPa)	Not tested ⁽¹⁾	0
Bulk Density (Mg/m ³)	Not tested ⁽¹⁾	1.8
Long term effective internal friction angle ϕ' (degrees)	Not tested ⁽¹⁾	25

(1) Where not testing has been undertaken, the suggested design values are based on our experience of similar soils.

Soil Type: Alluvium (Sand)

Parameters	Range	Suggested Design Value
SPT-N value	0-16	4
Effective Cohesion, c' (kPa)	Not tested ⁽¹⁾	0
Bulk Density (Mg/m ³)	Not tested ⁽¹⁾	1.9
Long term effective internal friction angle ϕ' (degrees)	-	28

(1) Where not testing has been undertaken, the suggested design values are based on our experience of similar soils.

Soil Type: Till Deposits

Parameters	Range	Suggested Design Value
SPT-N value	4-47	20
Plasticity Index (%)	8 - 19	16
Effective Cohesion c' (kPa)	-	See Figure P1
Bulk Density (Mg/m ³)	1.85 – 2.16	2.0
Coefficient of Compressibility, M_v (m ² /MN)	Not tested ⁽¹⁾	0.2
Long term effective internal friction angle ϕ' (degrees)	Not tested ⁽¹⁾	26

(2) Where not testing has been undertaken, the suggested design values are based on our experience of similar soils.

14 Groundwater Levels

The three deep boreholes were installed with groundwater monitoring wells to 20m depth and four shallow windowless boreholes were installed to 3-4m depth. The monitoring data are summarised in the tables below.

Date/Time	Groundwater Levels					
	BH01		BH02		BH03	
	mbgl	mAOD	mbgl	mAOD	mbgl	mAOD
13 th August 2024	3.06	122.58	2.57	123.44	3.03	123.44
28 th August 2024	2.89	122.75	2.53	123.48	3.05	123.42
11 th September 2024	2.11	123.53	2.52	123.49	2.86	123.61
25 th September 2024	3.02	122.62	2.56	123.45	3.08	123.39
8 th October 2024	2.97	122.67	2.54	123.47	3.04	123.43
22 nd October 2024	1.98	123.66	2.49	123.52	3.01	123.46

Date/Time	Groundwater Levels							
	WLS01		WLS02		WLS05		WLS08	
	mbgl	mAOD	mbgl	mAOD	mbgl	mAOD	mbgl	mAOD
13 th August 2024	1.98	124.13	3.68	123.29	2.45	125.14	1.83	123.02
28 th August 2024	1.97	124.14	3.67	123.30	2.66	124.99	1.84	123.01
11 th September 2024	1.70	124.41	3.52	123.45	2.42	125.17	1.53	123.32
25 th September 2024	1.91	124.20	3.65	123.32	2.46	125.13	1.76	123.09

Date/Time	Groundwater Levels							
	WLS01		WLS02		WLS05		WLS08	
	mbgl	mAOD	mbgl	mAOD	mbgl	mAOD	mbgl	mAOD
8 th October 2024	1.90	124.21	3.64	123.33	2.30	125.29	1.66	123.19
22 nd October 2024	1.83	124.28	3.64	123.33	1.51	126.08	2.27	122.58

Groundwater levels vary considerably from season to season and year to year, often rising close to the ground surface in wet or winter weather, and falling in periods of drought. Long-term monitoring from boreholes or standpipes is required to assess the ground water regime and this was not possible during the course of this site investigation.

Based on the observations to date, standing groundwater levels are recorded between 1.5-3.7mbgl. Allowance should be made for seepages within the superficial materials. Where seepages are encountered, the soils will soften rapidly.

It is envisaged that seepages above the water table could be controlled within excavations by locally pumping from sumps.

15 Swelling and Shrinkage

Shrinkable soils are subject to changes in volume as their moisture content is altered. Soil moisture contents vary from season to season and can be influenced by a number of factors including the action of roots. The resulting shrinkage or swelling of the soil can cause subsidence or heave damage to foundations, the structures they support and services.

The designer should be aware that precautions regarding swelling and shrinkage are applicable, and in this respect NHBC precautions provide a helpful guide with respect to minimum foundation depths and deepening, particularly within the zone of influence of vegetation.

Assessment of foundation depths should take into account trees, hedgerow and shrubs which are to be removed, are to remain or are proposed in any planting scheme; and which may be allowed to reach maturity.

We would recommend that, on balance, a NHBC LOW Volume Change Potential site classification be adopted for design purposes covering the natural clay materials.

Full details of protective measures are given in NHBC Standards Ref [7], Chapter 4.2 to which the reader is referred.

16 Lateral Pressure & Heave

Where foundations are more than 1.5m deep, and are within the zone of influence of existing or removed trees, then precautions will also need to be taken against the effects of lateral swelling of soils beneath house units due to removal of trees, or cutting tree roots.

A helpful guide with respect to requirements for the relief of lateral pressure is set out in the NHBC Standards Ref [7], Chapter 4.2 to which the reader is referred. The basic requirement is that compressible material or void former should be installed on the inner face of external foundation walls. With piled foundations, additional voids are required below ring beams.

17 Soakaways

Preliminary falling head soakage testing was carried out in borehole WLS05 only. No further soakage testing was carried out within other boreholes due to the depth of the Made Ground encountered.

17.1 Soakage Test Results

The preliminary falling head soakage testing is based on the BRE paper DG365, Ref [8] which describes a method for site testing to determine soil infiltration rates at the proposed site of a soakaway. The in-situ test method is described in Appendix B.

One soakage tests were carried out across the site, at the location shown on the attached site plan Figure 3, in Appendix A. The full results of the soakage tests are presented within Appendix B.

The DG365 Ref [8], states that each pit should be allowed to drain three times to near empty, with filling on the same or consecutive days.

The infiltration rate from each trial hole is summarised in the table below. The soakage rate in this report is expressed as $\text{l/m}^2/\text{minute}$, which is a convenient rate to use. The BRE use a unit of m/sec , which is the value in $\text{l/m}^2/\text{minute}$ divided by 60,000.

Test ID	Test Depth (mbgl)	Design Infiltration Rate		Notes
		$\text{l/m}^2/\text{minute}$	m/sec	
WLS05	3.0m	0.21	3.45×10^{-6}	Water at 2.35m at start of test.
		0.15	2.41×10^{-6}	Water at 2.34m at start of test.
		0.17	2.83×10^{-6}	Water at 2.4m at start of test.

*Water levels did not fall below 25% the max water depth. Calculations based on actual fall of water level achieved.

Note: The Design Infiltration Rate is the lowest of the three tests ($0.15 \text{ l/m}^2/\text{minute}$ / $2.41 \times 10^{-6} \text{ m/sec}$).

Full BRE 365 soakage testing, carried out within trial pits, may be required for formal soakaway design.

Given the depth of potentially unstable made ground encountered across the site, shallow soakage may not be suitable at the site and a positive drainage system may need to be considered

17.2 General Guidance on Design of Soakaways

Any soakaway scheme may require the approval of the Environment Agency, Building Control and, where applicable, the adopting Highways Authority.

Soakaways are used to store the immediate surface water run-off from hard surfaced areas, such as roof or carparks, and allow for efficient infiltration into the adjacent soil. They should be designed to discharge their stored water sufficiently quickly to provide the necessary capacity to receive run-off from a subsequent storm. The time taken for discharge depends upon the soakaway shape and size, and the surrounding soil's infiltration characteristics.

Groundwater levels can vary considerably from season to season and year to year, often rising in wet or winter weather, and falling in periods of drought. As such, a high groundwater table may affect the storage capacity of soakaways. In addition, it should be noted that an unsaturated zone may be required between the base of soakaways and the groundwater table, by the Environment Agency. Longer term monitoring may be required to establish actual groundwater levels as part of the planning approval process.

The design of soakaways can be square, circular (conventional) or trench excavations, and may be rubble filled, perforated precast concrete ring units, plastic cells or any similar structure that collects rainwater and run-off and allow discharge directly into the ground. Depending on the geological conditions, and depth at which suitable infiltration is achieved, soakaways can also be deep bored.

Long-term maintenance and inspection must be considered during the design and construction process. Maintenance of silt traps, gully pots and interceptors will improve the long-term performance of soakaways. The use of wet well chambers within the soakaway system can further assist in pollutant trapping and extending the operating life of soakaways.

Risk of pollution to the quality of groundwater must be considered as part of the design.

Generally, roof and surface run-off should not significantly impact on groundwater quality and subject to appropriate approvals from the Environment Agency could be discharged directly to soakaways. However, although again subject to approvals from the Environment Agency, paved surface run-off for larger trafficked areas should generally be passed through a suitable form of oil interception device prior to discharge to the soakaway.

Care must be taken to ensure that the discharge of large volumes of surface run-off into the soil does not disrupt the existing sub-surface drainage patterns. Similarly, in areas of sloping topography, consideration should be given to the siting of soakaways to avoid potential discharge and or flooding of down slope areas.

Soakaways should not normally be constructed closer than 10 m to buildings.

18 Sulphates and Acidity

Chemical analysis has been undertaken of sixteen soils to establish the aggressive chemical environment for concrete, in accordance with the BRE Special Digest 1, Ref [9]. The site category determined is that of a natural and brownfield location that contain pyrites (or potential pyrites), as the underlying soils form part of the Pennine Lower Coal Measures Formation.

The recorded pH values are in the range 7.3-10.4 for these sixteen samples. Water soluble sulphate values are in the range of 18.6-300 mg/l.

Given the sample numbers tested (thirteen) the characteristic value for sulphate concentration has been determined from the mean of highest 20% of measured concentrations (259 mg/l).

The Design Sulphate Class is DS-1. Groundwater should be assumed to be mobile. The ACEC site classification is AC-1.

Potential sulphates were also assessed for the samples tested, in accordance with the guidance within BRE SD1. The highest value calculated for total potential sulphates (0.48%) increases the above classification to DS-2, AC-2.

19 Foundations and Bearing Capacity

All loadings should be transferred beneath any fill or made ground, topsoil, soft or disturbed soils and be placed within the underlying natural soils.

Based on the results of this investigation, with Made Ground generally up to 3-4m depth underlain by loose soils up to 6m depth, a piled foundation solution is considered most appropriate for this site.

20 Piling

As with any piling scheme, discussions should be held with selected piling contractors to discuss the technical and financial merits of their various systems. With respect to overall resources, the equipment available should be appropriate for the soils described, and anticipated, and be able to achieve the depths and diameters considered with an appropriate safety margin.

Noting that seepages/inflows were noted and standing water levels were measured, the specialist contractor should take appropriate measures to ensure that his system caters for the ingress of groundwater.

From the viewpoint of pile type, and given the close proximity of adjacent structures, a bored pile solution is considered to be a more appropriate pile type. In terms of bored piles and, noting the presence of potentially unstable soils (made ground and loose sands/silts), and groundwater, a continuous flight auger grout injected pile (CFA) would be best suited to the ground conditions encountered. Careful monitoring during construction of these pile types is, however, required.

It should be noted that subsurface obstructions could be encountered in the form of old foundations, drain runs etc. accordingly allowances should be made for their removal/breaking out when carrying out piling works and excavations.

Piles on this site will derive the majority of their capacity from the skin friction within the clay, base resistance will provide a much smaller contribution. Within the clay the design of piles is typically based on a cohesive model using a plot of undrained cohesion versus depth derived from both SPT results and triaxial tests. The equivalence factor for SPT to undrained cohesion was chosen as $f_1 = 4.5$. The plot of results from the boreholes is appended as Figure P1 (Appendix D) on which a suggested design line is indicated.

For the purpose of providing preliminary estimates of pile capacities, we have assumed the following crude soil model, which is based on the findings of our boreholes.

Depth to base (mbgl)	Soil Type
GL – 6.0m	Made Ground and loose/soft soils – nil skin friction assumed
6.0m – 20.0m	Clay – Cohesion profile as plotted in Figure P1 Appendix D

A standing water table of 1.5m has been assumed at this stage.

Based on the above, a series of preliminary estimated CFA pile capacities have been tabulated below, assuming an overall factor of safety of 2.5.

Preliminary Pile Capacities, kN				
Pile length (mbgl)	Pile Diameter			
	300mm	350mm	400mm	450mm
8m	50	60	70	85
9m	65	80	100	115
10m	85	105	125	145

The above noted pile capacities are for individually loaded piles. It is anticipated that the final design will be subject to more detailed calculations and structural analysis; as such, our preliminary assumed parameters and calculated values should therefore not supersede the Engineer's or specialist piling Contractors final design.

21 Floor Slabs

Due to the presence of Made Ground to depths generally greater than 600mm, and shallow clay soils, allowance should be made for fully suspended ground floor slabs. However, it is understood that floor slabs for a typical McDonalds building are suspended regardless.

Gas protection measures will also be required within the floor slab, in accordance with Characteristic Situation 2 (see Section 28).

22 Settlement

Based on the recommendations given above, settlement for the proposed structure should be within tolerable limits.

23 Excavations and Dewatering

Statutory support will be required in all excavations where personnel must work.

An allowance should be made for breaking out sub-surface obstructions associated with existing and past developments. It should be noted that trial holes WLS07a-c all encountered a concrete slab beneath the blacktop surfacing.

The made ground materials will be prone to instability in open excavations during wet weather, or where seepages are encountered. The more cohesive materials will soften rapidly if exposed to moisture, or the elements, and the granular materials may run and be highly unstable in excavations or boring operations below the water table.

Where excavation is proposed in close proximity to existing structures care will need to be taken to avoid undermining existing foundations.

Significant inflows of groundwater into excavations would not be anticipated nor would the requirement for specialist de-watering activities. Seepage of groundwater into excavations should be anticipated, especially from the superficial soils; however, these should be managed with simple pumping methods.

24 Pavement Construction

Based on the available data, it is anticipated that the formation to proposed pavement areas will comprise Made Ground soils.

A DCP CBR test was carried out adjacent to each windowless borehole (DCP01-09). Please note DCP01 refused at 0.4mbgl, DCP02 refused at 0.8mbgl, DCP06 refused at 0.85mbgl and DCP09 refused at 0.9mbgl. No DCP CBR was carried out adjacent to windowless WLS07 due to encountering concrete.

The results of in-situ DCP CBR testing generally indicated CBR values in the range of 1.2 to 52% at the anticipated formation level of 0.5 to 1.0mbgl. However, it should be noted that in-situ CBR readings can vary significantly depending on a number of factors, including the presence of granular materials and the moisture content of the soil, and this can in turn vary depending on the weather and other site conditions leading up to and during testing. For these reasons, it is deemed that the results of in-situ DCP CBR testing alone represent the CBR value only on the day of the test, and under the conditions prevailing at the time, and should not, in isolation, be considered as being equivalent to the Design CBR value.

No Atterberg limit testing was carried out on samples of Made Ground soils but Atterberg limit testing on the natural soils at site indicate plasticity indices in the range of 3-19%, with an average value of 12%. On the basis of guidance in the DMRB Ref [8] and assuming a natural sandy clay soil, a CBR value of about 1.5-3.5% is estimated for a thin pavement construction for poor construction conditions with a high water table.

Given that the soils are likely to be disturbed by heavy plant during demolition and construction it would be suggested that the CBR value is reassessed as construction progresses. Further sampling and laboratory testing may be necessary to satisfy Local Highway Authority design guidance, in terms of frequency and types of testing, if roads are to be submitted for adoption.

The formation should be considered potentially frost-susceptible.

Given the potential presence of Made ground soils at formation level, it is suggested the formation is inspected for soft spots, and that these are removed and filled to a minimum of 500mm and proof-rolled prior to construction. Consideration could be given to the inclusion of a geo-grid within the road/carpark construction to minimise the effects of any differential settlement.

24.1 Pavement Construction – General Guidance

The most important element of any road construction is drainage and attention must be given not only to the drainage of the subsoil but to the various layers of construction. To this end, the formation should be shaped to a camber or crossfall to allow water movement out of the sub-base.

Sub-base and coarse capping materials tend to segregate during placing operations, particularly when end-tipped. On soft clay sub-grades this can lead to punching and softening of the formation. The use of an appropriate geotextile or geo-fabric, laid in accordance with manufacturer's recommendations/guidance, should help to minimise this.

The formation should be proof-rolled in a manner appropriate to the sub-grade soils, and any soft spots found should be excavated and replaced with compacted granular material. The surface of the formation should then be appropriately compacted, prior to laying the capping layer and/or sub-base.

Construction traffic should be kept off formations and it is often advisable to leave a protective layer of soil above formation level until the last moment before reducing to formation level and placing the capping and/or sub-base.

E DISCUSSION OF GEOENVIRONMENTAL TEST RESULTS AND RECOMMENDATIONS

25 Analytical Framework

There is no single methodology that covers all the various aspects of the assessment of potentially contaminated land and groundwater. Therefore, the analytical framework adopted for this investigation is made up of a number of procedures, which are outlined below. All of these are based on a Risk Assessment methodology centred on the identification and analysis of Source – Pathway – Receptor linkages.

The CLEA model Ref [1], provides a methodology for quantitative assessment of the long-term risks posed to human health by exposure to contaminated soils. Toxicological data is used to calculate a Soil Guideline Value (SGV) for an individual contaminant, based on the proposed site use; these represent minimal risk concentrations and may be used as screening values.

In the absence of any published SGVs for certain substances, Southern Testing have derived or adopted Tier 1 screening values for initial assessment of the soil, based on available current UK guidance including the LQM/CIEH S4UL's Ref [10] and CL:AIRE Soil Generic Assessment Criteria Ref [11]. In addition, in 2014, DEFRA Ref [12] published the results of a research programme to develop screening values to assist decision making under Part 2A of the Environmental Protection Act. Category 4 screening levels were published for 6 substances, with reference to human health risk only. This guidance includes revisions of the CLEA exposure parameters, presenting parameters for public open space land use scenarios, and also of the toxicological approach. The screening levels represent a low risk scenario, based on a 'Low Level of Toxicological Concern' rather than the 'Minimal Risk' of CLEA. Category 4 screening levels for further substances have been published subsequently. The analytical results of this investigation may be considered relative to these levels.

Site-specific assessments are undertaken wherever possible and/or applicable.

CLEA requires a statistical treatment of the test results to take into account the normal variations in concentration of potential contaminants in the soil and allow comparisons to be made with published guidance.

The results of any groundwater analyses are compared to relevant quality criteria, e.g. Environmental Quality Standards (EQS) or Drinking Water Standards (DWS).

Ground gases are assessed in accordance with the guidance given in CIRIA C665 Ref [3] and BS8485 Ref [13].

The contamination screening values used are valid at the time of writing but may be subject to change and any such changes will have implications for the assessments based upon them. Their validity should be confirmed at the time of site development.

26 Site Investigation – Soils

26.1 Sampling Regime

The number of sample locations was limited and was partly targeted at potential sources of contamination and also intended to provide general coverage.

Access was restricted by the presence of buildings and buried services, the operational needs of the on-site business and numerous parked cars on the forecourt.

26.2 Testing

The potential for contamination by a historic commercial/industrial land use, including historic brick works, print works, works/factory, garage (potentially a fuel filling station) and parked cars, was identified in the preliminary conceptual model. Therefore, the following tests were selected.

Test Suite	Number of Samples	Soil Tested
STL Key Contamination Suite / Preliminary Waste Characterisation Suite	13	12 No. Made Ground Soils 1 No. Natural Soils
TPH CWG with Aliphatic/Aromatic Split	1	1 No. Made Ground Soils
TPH (Texas Split (banded C6-C40))	4	4 No. Made Ground Soils
VOC by GC-MS	2	2 No. Made Ground Soils
SVOC by GC-MS	2	2 No. Made Ground Soils
Total Organic Carbon	4	4 No. Made Ground Soils
WAC – Full 2 Batch Leach Suite	3	2 No. Made Ground soils 1 No. Natural Soils

The test results are presented in full in Appendix E. A summary and discussion of the significance of the results and identified contamination sources is given below.

26.3 Test Results and Identified Contamination Sources

26.3.1 General Contaminants

The results of the key contaminant tests have been analysed in accordance with the CLEA methodology. The samples have been grouped into two populations comprising made ground and natural soil. For each parameter in each population the sample mean is calculated and compared to a Tier 1 screening value. If the sample mean exceeds the screening value, the soil may be regarded as contaminated and further assessment may be required. If neither the sample mean nor any single value exceeds the screening value, the soil may be regarded as not contaminated, though further confirmatory assessment may be required. Where any single parameter value exceeds the screening value but the sample mean does not, further statistical analysis may be applied to that parameter if the available data is suitable. Such analysis would include an assessment of the Normality of the distribution of the data, consideration of the presence of outliers, and the calculation of a UCL estimate of the mean.

Summary data is presented in the tables below and the laboratory analysis is included in Appendix E. The screening values and source notes are presented in Table 1 "Tier 1 Screening Values" at the front of Appendix E.

Soil Type: Made Ground

Samples: BH01 0.5-1.0m, BH01 1.8-3.0m, BH02 2.5-3.0m, BH03 1.0-2.0m, WLS01 0.2m, WLS01 1.0m, WLS02 0.4, WLS03 0.6m, WLS04 0.2m, WLS05 0.2m, WLS06 0.5m.

Contaminants	Units	No of Samples Tested	Range	Sample Mean	Tier 1 Screening Values ² Commercial / Industrial
Arsenic (As)	mg/kg	12	3.2-48	16.6	640
Cadmium (Cd)	mg/kg	12	<0.2-2.6	0.6	190
Trivalent Chromium (CrIII) ¹	mg/kg	12	15-68	23.3	8600
Hexavalent Chromium (CrVI)	mg/kg	12	<1.8- 36	4.9	33
Lead (Pb)	mg/kg	12	9.2-2300	280.5	2330
Mercury (Hg)	mg/kg	12	<0.3-2.8	0.6	29-320
Selenium (Se)	mg/kg	12	<1.0-1.3	1.1	12,000
Nickel (Ni)	mg/kg	12	13-48	25.7	980
Copper (Cu)	mg/kg	12	13-2200	282.3	68,000
Zinc (Zn)	mg/kg	12	42-1200	275.4	730,000
Phenol	mg/kg	12	<1.0	<1.0	440-1300
Benzo(a)pyrene (BaP)	mg/kg	12	<0.05-27	3.3	36
Naphthalene	mg/kg	12	<0.05-6.4	1.2	77-430+
Total PAH's	mk/kg	12	<0.80 – 495	75.9	/
Total Cyanide (CN)	mg/kg	12	<1.0-8.1	2.1	/
Acidity (pH values)	pH Units	12	7.7-11	8.9	/
Soil Organic Matter	%	12	0.6-7.4	3.6	/

¹ Assumed as Total Cr minus CrVI

² The most conservative Tier 1 Screening Value for the site have been used. For the majority of the site the screening values for a Commercial/Industrial land use could be adopted.

The concentrations exceeding the tier 1 screening value for a commercial land-use as outlined below.

- WLS06 at 0.5m = Hexavalent Chromium 36mg/kg.

Although just below the screening values, high concentrations were also recorded in WLS06 at 0.5m = Lead 2300mg/kg and WLS04 at 2.0m = Benzo(a)pyrene 27mg/kg.

No other concentrations of the potential contaminants tested for were above the Tier 1 screening value.

Using the Contaminated Land Statistics Calculator^a to further analyse these results, the elevated concentrations of hexavalent chromium, lead and benzo(a)pyrene shows the maximum concentrations (as detailed above) to be outliers within the dataset. For both hexavalent chromium and lead there is 99% certainty that the true mean of the dataset is less than the critical concentration. For benzo(a)pyrene there is not enough evidence to prove the true mean of the dataset is less than the critical concentration. However, the mean concentration is 3.26 mg/kg, with an Upper Confidence Level of 13.2 mg/kg.

Benzo(a)pyrene is used as a surrogate marker for all genotoxic PAH's, in line with HPA guidance Ref [14]. The test data has been compared with the concentration limits reported for the Culp study, as recommended by HPA, and is consistent with this approach. On the basis of the test results, the genotoxic PAH's in the sample WLS04 at 2.0m would be considered to pose a potential risk to human health.

The measured concentrations of total PAH's in the samples from WLS04@2.0m and WLS06@0.5m exceed the UKWIR thresholds for the use of plastic water supply pipes / British Plastics Federation Pipes Group thresholds for drainage and sewage pipes.

Soil Type: Natural Soils

Contaminants	Units	No of Samples Tested	BH03 at 7.0m	Tier 1 Screening Values ² Commercial / Industrial
Arsenic (As)	mg/kg	1	6.7	640
Cadmium (Cd)	mg/kg	1	<0.2	190
Trivalent Chromium (CrIII) ¹	mg/kg	1	21	8600
Hexavalent Chromium (CrVI)	mg/kg	1	<1.8	33
Lead (Pb)	mg/kg	1	10	2330
Mercury (Hg)	mg/kg	1	<0.3	29-320
Selenium (Se)	mg/kg	1	<1.0	12,000
Nickel (Ni)	mg/kg	1	26	980
Copper (Cu)	mg/kg	1	18	68,000
Zinc (Zn)	mg/kg	1	57	730,000
Phenol	mg/kg	1	<1.0	440-1300
Benzo(a)pyrene (BaP)	mg/kg	1	<0.05	36
Naphthalene	mg/kg	1	0.05	77-430+
Total Cyanide (CN)	mg/kg	1	<1.0	/
Acidity (pH values)	pH Units	1	8.5	/
Soil Organic Matter	%	1	1.6	/

¹ Assumed as Total Cr minus CrVI

^a ESI Contaminated Land Statistical Calculator Version 2.0

² The most conservative Tier 1 Screening Value for the site have been used. For the majority of the site the screening values for a Commercial/Industrial land use could be adopted.

On the basis of the above limited laboratory analysis, the sample of natural soil would be considered uncontaminated given the site's proposed end use.

26.3.2 Asbestos Containing Materials

No potential asbestos containing materials were observed in the exploratory holes during the site investigation works.

Thirteen samples of soil from across the site were sent for an asbestos screen. Loose chrysotile fibres were detected in two samples of made ground soil (BH01 at 0.5-1.0m, WLS01 at 0.2m).

The results of quantification analysis of these samples is summarised in the following table.

Sample (Location & Depth)	Soil type	Presence & ID	Asbestos Quantification (%)
BH01 at 0.5-1.0m	Made Ground	Chrysotile – loose fibres	<0.001
WLS01 0.2m	Made Ground	Chrysotile – loose fibres	<0.001

Both samples returned quantification results of less than 0.001%, which is the laboratory limit of detection.

There is currently no set screening value for asbestos in soil, however, both samples are well below the hazardous waste limit of 0.1%.

Considering the proposed development, where a majority of the site is covered with the building and hard standing parking areas, the risk to the proposed end users is very low. However, on the basis of the testing undertaken to date, there is a higher risk to site workers during any groundworks, although this can be mitigated as discussed below.

It should also be noted that the exploratory holes are of small size relative to the area investigated. Therefore, the samples obtained may not reflect the full composition of the soils on the site, and there is always the potential for pockets of asbestos or for asbestos containing materials to be present, which have not been detected in the sampling.

It is also our experience that asbestos containing materials are quite often encountered in buried pockets and beneath slabs (sometimes adhering to the concrete) on older sites.

26.3.3 Organic Contaminants - Petroleum Hydrocarbons

A hydrocarbon odour as noted in the made ground soils in BH02 between 1.65-4.0m. The results of petroleum hydrocarbon testing is summarised in the table below.

Hydrocarbon Substance or Fraction		Measured Concentrations in mg/kg
		BH02 2.5-3.0m
BTEX	Benzene	<5.0
	Toluene	<5.0
	Ethylbenzene	<5.0
	Xylenes	<5.0
MTBE		<5.0
A.P.H.	>EC5-EC6	<0.01

Hydrocarbon Substance or Fraction		Measured Concentrations in mg/kg
		BH02 2.5-3.0m
	>EC6-EC8	<0.01
	>EC8-EC10	0.43
	>EC10-EC12	31
	>EC12-EC16	160
	>EC16-EC21	8.6
	>EC21-EC35	<8.0
	>EC5-EC35	200
Aromatics	>EC5-EC7 (Benzene)	<0.01
	>EC7-EC8 (Toluene)	<0.01
	>EC8-EC10	<0.02
	>EC10-EC12	9
	>EC12-EC16	42
	>EC16-EC21	<10
	>EC21-EC35	<10
	>EC5-EC35	51
Hazard Index		0.006

Petroleum hydrocarbon mixtures are assessed using the Hazard Index approach. The calculated Hazard Index values for the above sample is less than 1, indicating that the recorded concentration is above tolerable limits for long term exposure with regards to human health.

In addition to the fully detailed analysis above, a number of samples were subject to a simple banded analysis, primarily to provide a better depth profile for the contamination. A hydrocarbon odour was also noted from 2-2.5m in WLS04. The results are presented below.

Hydrocarbon Substance or Fraction	Measured Concentrations in mg/kg							
	BH01 0.5-1.0m	BH03 1.0-2.0m	BH03 7.0m	WLS01 1.0m	WLS02 0.4m	WLS02 3.5m	WLS04 at 2.0m	WLS06 0.5m
TPH (>EC6-EC8)	-	<0.01	-	<0.01	<0.01	-	-	<0.01
TPH (>EC8-EC10)	-	<0.02	-	<0.02	<0.02	-	-	<0.02
TPH (>EC10-EC12)	-	<2.0	-	<2.0	<2.0	-	-	23
TPH (>EC12-EC16)	-	8	-	<4.0	11	-	-	88
TPH (>EC16-EC21)	-	69	-	<10	26	-	-	180
TPH (>EC21-EC40)	-	1800	-	48	44	-	-	360
TPH Total (>EC6-EC40)	-	1900	-	54	82	19	2000	650
TPHC10-C40	1200	1900	<10	-	-	-	-	-

Hydrocarbon Substance or Fraction	Measured Concentrations in mg/kg							
	BH01 0.5-1.0m	BH03 1.0-2.0m	BH03 7.0m	WLS01 1.0m	WLS02 0.4m	WLS02 3.5m	WLS04 at 2.0m	WLS06 0.5m
Petroleum Range Organics (EC6-EC10)	<1.0	<1.0	<1.0	-	-	-	-	-

With the exception of BH02 from 1.65-4.0m and WLS04 from 2.0-2.5m, no petroleum hydrocarbon odours were noted in the soils from the above boreholes.

The concentrations of the heavier end petroleum hydrocarbons in BH03@1.0-2.0m and WLS06@0.5m would be considered elevated, as would the total concentration of petroleum hydrocarbons recorded in BH01@0.5-1.0m and WLS04@2.0m.

The measured concentrations of the petroleum hydrocarbon fractions in these samples exceed the UKWIR thresholds for the use of plastic water supply pipes / British Plastics Federation Pipes Group thresholds for drainage and sewage pipes. Guidance should be sought from the relevant companies regarding any proposed plant in the affected area. Many water supply companies now require higher specification pipe on contaminated sites, even following remediation.

Further consideration is required with respect to groundwater and vapour generation. See section 27 below.

26.3.4 Organic Contaminants – SVOCs/VOCs

Two samples of Made Ground (BH02 at 2.5-3.0m & WLS01 at 1.0m) were tested for VOCs and SVOCs. All concentrations were recorded below the respective laboratory limit of detection. The only other compounds with concentrations above the laboratory's limit of detection, were PAHs (as discussed in Section 26.3.1 above).

27 Site Investigation – Waters

27.1 Sampling Regime

Groundwater samples were taken from the boreholes 4-5 days after the installation of the monitoring wells.

27.2 Testing

The potential for contamination by an historic industrial/commercial land use was identified in the preliminary conceptual model.

Water samples were collected from BH02 and BH03 on 30th July 2024. For BH02 the groundwater level was recorded a 3.02mbgl before sampling and the sample was recorded as brown, opaque with a slightly hydrocarbon odour. For BH03 groundwater level was recorded at 2.97mbgl before sampling and the sample was recorded as greyish brown, opaque with no odour.

The underlying superficial Glaciofluvial Deposits and Pennine Lower Coal Measures Formation are both classed as Secondary A Aquifers, although not located within a source protection zone. The nearest groundwater abstraction listed as 155m east of the site.

The following tests were selected on the basis of the conceptual model.

Test Suite	Number of Samples	Locations Sampled
STL Key Contaminants Suite	2	Boreholes BH02 and BH03
TPH CWG with Aliphatic/Aromatic Split	2	Boreholes BH02 and BH03

The test results are presented in full in Appendix E. A summary and discussion of the significance of the results and identified contamination sources is given below.

27.3 Test Results and Identified Contamination

To determine whether there is a source of groundwater contamination at a concentration posing a risk to the quality of controlled waters, the groundwater concentrations are compared to their respective target concentrations (Ct) in the table below.

Due to the site setting, the underlying secondary aquifer is considered to be the most sensitive controlled waters receptor in the vicinity of the site.

The target concentrations (Ct) have been based conservatively on UK Drinking Water Standards (UKDWS) where available. In the absence of UKDWS, environmental quality standards (EQS; freshwater) and World Health Organisation values have been adopted. However, it is noted that there are no statutory quality standards for many of the individual determinants.

Results from the groundwater samples analysed are summarised in the table below. Where available, UK standards have been used as a means of assessing the recorded concentrations, with any exceedances shown in bold.

Contaminant		Measured Concentrations in µg/l		Environmental Quality Standard (µg/l)	UK Drinking Quality Standard (µg/l)
		BH02	BH03		
Metals	Arsenic (dissolved)	1.2	0.7	50	10
	Cadmium (dissolved)	0.03	0.03	5	5
	Copper (dissolved)	1.2	1.4	1	2000
	Lead (dissolved)	<0.2	<0.2	4	10
	Mercury (dissolved)	<0.05	<0.05	1	1
	Nickel (dissolved)	5.9	13	50	20
	Selenium (dissolved)	<0.6	<0.6	/	10
	Zinc (dissolved)	1.5	14	10.9	/

None of the dissolved metals analysed exceeded the target concentrations for UK Drinking Water Standards. As indicated above, the site is not located in groundwater source protection zone and there are no private water abstraction wells within 150m of the site. The recorded concentrations are very unlikely to pose any risk to groundwater receptors. Given that the recorded concentrations are less than drinking water standards, the risks to human health through the pathways of direct contact, consumption and inhalation are also considered to be low.

Total dissolved Zinc concentrations in BH03 slightly exceeded their respective EQS values. However, it should be noted that the EQS values for copper and zinc are based on bioavailability and not all of the total concentrations measured will be available and therefore cannot be compared. The nearest surface water feature is the River Roch located approximately 40m north-west of the site. The risk to surface water receptors is considered to be negligible. In our experience, slightly elevated concentrations of zinc are also not uncommon in perched groundwater samples.

Contaminants			Unit	BH02	BH03	Tier 1 Screening Value
Petro leum	Aliph atic	EC5-EC6	µg/l	<1.0	<1.0	15,000 ^a
		>EC6-EC8	µg/l	<1.0	<1.0	15,000 ^a

Contaminants			Unit	BH02	BH03	Tier 1 Screening Value
		>EC8-EC10	µg/l	<1.0	<1.0	300 ^a
		>EC10-EC12	µg/l	1200	<10	300 ^a
		>EC12-EC16	µg/l	1600	<10	300 ^a
		>EC16-EC21	µg/l	90	<10	/
		>EC21-EC35	µg/l	<10	<10	/
	Aromatic	EC5-EC7 (Benzene)	µg/l	<1.0	<1.0	1.0 ^a 10 ^b 20,000 ^c
		>EC7-EC8 (Toluene)	µg/l	<1.0	<1.0	700 ^a 74 ^b 2.1×10^7 ^c
		>EC8-EC10	µg/l	<1.0	<1.0	800 ^a
		>EC10-EC12	µg/l	480	<10	90 ^a
		>EC12-EC16	µg/l	190	<10	90 ^a
		>EC16-EC21	µg/l	100	<10	90 ^a
		>EC21-EC35	µg/l	<10	<10	90 ^a

^a World Health Organisation (WHO) guide values for TPHCWG fractions in drinking water

^b Freshwater specific pollutants and operational environmental quality standards Annual average EQS

^c Development of GAC for Assessing Vapour Risks to Human Health from Volatile Contaminants in Groundwater, SoBRA ver. 1.0 (Feb. 2017) based on a commercial site end use

Elevated concentration of petroleum hydrocarbons were recorded in BH02, with concentrations in excess of the guide values for drinking water. No concentration of VOC's was recorded above the laboratory limit of detection. This concurs with the visual and olfactory evidence during sampling and the impact recorded in the soil sample from this borehole.

No concentrations of petroleum hydrocarbons or VOC's were recorded in BH03 above the laboratory limit of detection.

28 Site Investigation - Gas

28.1 Gas Sources

The desk study identified a potential source of land gases from the potentially infilled land onsite in the near vicinity, as well a potential vapour risk for petroleum hydrocarbon from the possible historic garage (fuel filling station) on-site. However, a petroleum licencing search, with Greater Manchester Fire and Rescue Service, did not identify any evidence that petroleum spirit was stored at this address.

These types of sources are characterised as being of Low to Moderate generation potential, Wilson and Haines Ref [15].

28.2 Sampling Strategy

The number and spacing of the gas monitoring wells was based on a targeted investigation of the potential gas sources on site and to provide general coverage for the proposed development. A vapour survey was also undertaken at the same time due the hydrocarbon contamination identified on site (and in the Preliminary Conceptual Model).

28.3 Monitoring Programme and Results

The sensitivity of the proposed development is rated as Low and, therefore, 6 gas readings were taken over a period of 3 months (CIRIA C665 Ref [3], Table 5.5). The results of the monitoring programme are given in full in Appendix G and are summarised below.

Borehole Gas Monitoring Results							
Monitoring well	BH01	BH02	BH03	WLS01	WLS02	WLS05	WLS08
Response zone / Stratum	3m to 20m Natural Soils	1m to 20m Made Ground & Natural Soils	3m to 20m Natural Soils	1m to 3m Made Ground & Natural Soils	1m to 4m Made Ground & Natural Soils	1m to 3m Made Ground & Natural Soils	1m to 3m Made Ground & Natural Soils
Evidence of contamination	None	Hydrocarbon Odour 1.65-4.0m	None	None	None	None	None
No. of Monitoring Events	6	6	6	6	6	6	6
Methane range CH ₄ (%)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carbon dioxide range CO ₂ (%)	0.8-4.1	0.1-0.6	2.3-3.3	0.1-2.7	1.5-3.4	4.6- 8.7	2.9- 10.6
Oxygen range O ₂ (%)	14.2-17.7	15.7-20.4	16.5-19.1	16.9-20.2	6.3 -15.4	6.5 -14.1	5.1 -15.6
Flow rate range l/hr	<0.1	<0.1-0.1	0.2-0.4	<0.1-0.1	<0.1	<0.1-0.1	<0.1-0.2
BH differential pressure range (Pa)	1-4	1-4	19-32	1-14	2-3	2-12	2-17
PID measurement (ppm)	0.4-0.9	0.3-1.7	0.3-1.8	0.4-1.2	0.5-1.9	0.3-1.4	0.5-1.1
Water level (mbgl)	1.98-3.06	2.49-2.57	2.86-3.08	1.70-1.98	3.52-3.68	1.51-2.60	1.53-2.27
Atmospheric pressure during monitoring (mb)	992-1027	992-1027	992-1027	992-1027	992-1027	992-1027	992-1027

Construction details for wells are provided on the logs (Appendix A). The slotted pipe extended from the bottom of the hole to between 1m and 3m below ground level with plain pipe to the surface. Pea shingle was then poured around all the slotted sections and bentonite around the plain sections to seal and prevent any migration of contaminants or surface water into the borehole. The flush protective cover was cemented in securely to allow access.

Six monitoring visits have been carried out between 13th August 2024 and 22nd October 2024. The monitoring visits were carried out over a reasonable range of atmospheric pressures (992-1027mb). Steadily falling pressures (1-5mbar) were recorded in the 24 hours prior to the first, second, fourth and fifth monitoring events and steadily rising pressures (5-10mb) were recorded during the third and sixth monitoring events.

Standing water levels were recorded between 1.7m and 3.68mbgl. It is acknowledged that the wells, particularly BH01 and BH03, were at least partially flooded during the monitoring programme, although never completely.

No concentrations of methane above the limit of detection (0.1%) have been recorded in any of the monitoring wells.

A slightly elevated concentration (exceeding 5%) of carbon dioxide was recorded in WLS05 during the final three monitoring events and during the first three monitoring events in WLS08. Slightly depleted oxygen levels were also recorded in WLS02, WLS05 and WLS08, which may reflect the shallower groundwater levels recorded during these monitoring event.

Concentration of volatile organic compounds, measured within the PID, are all below 2ppm. In BH02, where petroleum hydrocarbon impact was recorded in the groundwater, VOC concentrations were measured between 0.3 and 1.7ppm which is not considered a significant vapour risk.

Flow rates of 0.0 to 0.4/hr were recorded over the monitoring period and differential borehole pressures were recorded between 1 and 32Pa.

28.3.1 Site Characterisation & Gas Screening Values

Based on the results to date, gas screening values together with characteristic situations have been calculated for the measured methane and carbon dioxide concentrations in each borehole. The table below shows the determined characteristic situations.

Borehole	Maximum Peak Concentrations (%)		Max flow (l/hr)	Q _{hg} – CH ₄ (l/hr)	Q _{hg} – CO ₂ (l/hr)	Characteristic Situation – CH ₄	Characteristic Situation – CO ₂
	CH ₄	CO ₂	Peak	CH ₄	CO ₂		
BH01	<0.1	4.1	<0.1	<0.0001	0.0041	1	1
BH02	<0.1	0.6	0.1	0.0001	0.0006	1	1
BH03	<0.1	3.3	0.4	0.0004	0.0132	1	1
WLS01	<0.1	2.7	0.1	<0.0001	0.0027	1	1
WLS02	<0.1	3.4	<0.1	<0.0001	0.0034	1	1
WLS05	<0.1	8.7	<0.1	<0.0001	0.0087	1	1
WLS08	<0.1	10.6	0.2	0.0002	0.0212	1	1

On the basis of the measurements in the above table, the site GSV is taken to be 0.021 l/h, which is the worst case for methane and carbon dioxide and acknowledged as a conservative approach. A GSV of 0.021 l/h indicates a characteristic situation 1 (CS1; GSV <0.07 l/hr). However, as carbon dioxide above 5% was recorded in a couple of the boreholes during the monitoring visits to date, consideration should be given to increasing the categorisation of the site to the next level (CS2).

Based on the results to date, and the depth of fill encountered on site, some protective measures, in accordance with Characteristic Situation 2, are recommended.

29 Summary of Identified Contamination

Elevated concentrations of Hexavalent Chromium (36mg/kg in WLS05 at 0.5m), Lead (2300mg/kg in WLS05 at 0.5m) and BaP (27mg/kg in WLS04 at 2.0m) were recorded within the Made Ground soil samples analysed.

Loose chrysotile fibres were also detected in two samples of made ground soil screened (BH01 at 0.5-1.0m, WLS01 at 0.2m), although no asbestos was observed in the trial holes during sampling. Both samples returned quantification results of less than 0.001%, which is the laboratory limit of detection. This suggest a low risk.

A hydrocarbon odour was noted in the made ground soils in BH02 between 1.65-4.0m and WLS04 from 2.0-2.5m. The concentrations of the heavier end petroleum hydrocarbons in BH03 at 1.0-2.0m and WLS06 at 0.5m would be considered elevated, as would the total concentration of petroleum hydrocarbons found in BH01 at 0.5-1.0m and WLS04 at 2.0m.

The results of the groundwater sampling and laboratory analysis have identified elevated concentrations of petroleum hydrocarbons in one of the two deep monitoring wells (BH02). Concentrations of some parameters in the samples taken from this borehole have been found to exceed both the guide values for drinking water standards.

Gas and vapour monitoring has identified elevated concentrations of carbon dioxide in WLS08 & WLS02 and slightly depleted oxygen levels were also recorded WLS02, WLS05 and WLS08.

30 Risk Evaluation

The object of the risk evaluation is to assess the pollution linkages for specific contaminant groups considered in the conceptual model, identify any unacceptable risks and, therefore establish whether there is a need for further investigation and/or remedial action.

The risks are considered in the context of the specific development proposals for the site and, therefore, the conclusions may not be appropriate for alternative schemes.

30.1 Hexavalent Chromium, Lead & Benzo(a)pyrene in Made Ground Soils

Elevated concentrations of Hexavalent Chromium and Lead were recorded in one sample of made ground tested (WLS05 at 0.5m). Using the Contaminated Land Statistics Calculator to further analyse these results, the elevated concentrations of hexavalent chromium and lead shows the maximum concentrations to be outliers within the dataset. For both hexavalent chromium and lead there is 99% certainty that the true mean of the dataset is less than the critical concentration. However, borehole WLS05 is located within a proposed parking area and the Source-Pathway-Receptor pollutant linkage is broken by the permanent hard barrier, so remediation is not considered to be required.

One sample of Made Ground tested (WLS04 at 2.0m) recorded an elevated concentration of BaP, although it doesn't exceed the threshold for a commercial end-use. Using the Contaminated Land Statistics Calculator for benzo(a)pyrene there is not enough evidence to prove the true mean of the dataset is less than the critical concentration. However, the mean concentration is 3.26 mg/kg, with an Upper Confidence Level of 13.2 mg/kg. Again, the location of borehole WLS04 is located within the proposed drive thru lane, therefore the Source-Pathway-Receptor pollutant linkage is broken by the permanent hard barrier so remediation is not considered to be required.

However, if exposed, these soils may pose a risk to ground workers during the development works.

Also, the elevated concentrations of PAH in the Made Ground will pose a risk to new service pipes.

30.2 Hydrocarbons in Made Ground Soils

A hydrocarbon odour as noted in the Made Ground soils in BH02 between 1.65-4.0m and WLS04 between 2.0-2.5m.

A sample of Made Ground soil from BH02 (2.5-3.0m) recorded relatively low concentrations petroleum hydrocarbon mixtures and the calculated Hazard Index values for the above sample is less than 1, indicating that the recorded concentration is above tolerable limits for long term exposure with regards to human health.

The concentrations of the heavier end petroleum hydrocarbons in BH03 at 1.0-2.0m and WLS06 at 0.5m would be considered elevated, as would the total concentration of petroleum hydrocarbons found in BH01 at 0.5-1.0m and WLS04 at 2.0m.

Boreholes BH01-03 WLS04 and WLS06 are located below proposed build, parking or drive thru areas therefore are not considered to pose a significant risk to future site user. However, the elevated concentrations of petroleum hydrocarbons in the Made Ground may pose a potential risk to ground workers and will be a consideration in the selection of materials for the laying of new services runs. Further consideration is also required with respect to groundwater (see below).

30.3 Asbestos in Made Ground

Loose asbestos fibres were encountered in two samples of the Made Ground screened, although none was observed in the small diameter trial holes. Whilst there are currently no set screening values for asbestos in soils, both of the samples recorded concentrations below the laboratory limit of detection (<0.001%) which suggests a low risk.

Where such material remain undisturbed the risk to human health is very low. However, on disturbance or removal, e.g. during groundworks and other construction activities, the risk are higher. Site workers are likely to be most exposed, but passers-by and close neighbours could also be affected during any such works. Appropriate PPE, RPE and dust control measures will need to be put in place during any works which remove or disturb the Made Ground. The contractors should be provided with a copy of this report for their own health and safety assessment.

It should be noted that, given the limited nature of the intrusive investigation works undertaken to date, and the depth and variable composition of the Made Ground, it is possible that further asbestos containing material may be encountered. A careful watch for any such material must be kept during site clearance and groundworks.

30.4 Ground Gases

Carbon dioxide concentrations exceeding 5% were recorded within two boreholes during the monitoring events, although the risk is considered to be low, with no flow recorded and no vapour risk. Some protective measures, in accordance with Characteristic Situation 2 are considered to be required.

Depleted oxygen was also noted which could pose a risk to construction works should there be any confined space working. It is recommended work spaces are adequately ventilated.

30.5 Organic Contaminants in the Groundwater

To date, only limited groundwater sampling and laboratory analysis has been undertaken. This has identified elevated concentrations of petroleum hydrocarbons within BH02, which is located towards the centre of the site.

From the Desk Study a planning application search indicated that the site may have been used as a petrol filling station which means it is possible that there may have been buried fuel tanks and, if so, these may remain beneath the site and may represent a risk and source of hydrocarbon contamination. A petroleum licencing search, from Greater Manchester Fire and Rescue Service, did not identify any evidence that petroleum spirit was stored at this address. However, this does not rule out the presence of buried fuel tanks on site

The Desk Study indicated the superficial and bedrock geology to be classified as a Secondary A Aquifer. The site is not located within source protection zone with the nearest groundwater abstraction is listed as 144m east of the site for boiler feed and private water supplies (domestic). A few other groundwater abstractions are listed within 1km, however, these predominantly relate to commercial/industrial uses.

At this stage, it is recommended that further groundwater sampling and analysis is undertaken, being extended to the other monitoring wells that hold water and, if access is available, the nearby surface water receptor (the River Roch located approximately 40m north-west of the site). Subject to the findings, additional soil investigation may then be required to assess the on-site source.

This will then allow an assessment to be made as to the nature and extent of any remediation works required on the site.

30.6 Revised Conceptual Model

The preliminary site model has been refined in light of the findings of this investigation and is summarised below.

Metals	Petroleum Hydrocarbons	PAHs	Land Gas	Asbestos	Pathways	Receptors
P	Y	N	n/a	P	Ingestion/inhalation of contaminated soil & dust	Human Health
N	Y	N	n/a	n/a	Dermal contact with contaminated soil & dust	
N	Y	N	Y	n/a	Inhalation of vapours or gases	
n/a	n/a	n/a	n/a	n/a	Uptake into edible fruit and vegetables	
N	N	N	n/a	n/a	Surface water run-off into surface water features	

Metals	Petroleum Hydrocarbons	PAHs	Land Gas	Asbestos	Pathways	Receptors
N	Y	P	n/a	n/a	Migration through ground into surface water or groundwater	Water Environment
N	P	P	n/a	n/a	Off-site migration of contaminated groundwater	
N	P	P	n/a	n/a	Vegetation on site growing in contaminated soil	Flora and Fauna
N	P	P	n/a	n/a	Aquatic life in affected waters	
N	Y	Y	n/a	n/a	Contact with contaminated soils	Building materials / buried services
N	N	N	N	n/a	Fire or explosion	

Key:

Y Pollutant linkage likely

N Pollutant linkage not likely

P Pollutant linkage possible

n/a Pathway not applicable to contaminant

30.7 Relevant Pollutant Linkages

A number of Relevant and Possible Pollutant Linkages for which remedial action will be required have been identified in the revised conceptual model, as follows.

Contaminant / Source	Pathways	Receptor
PAH's in Made Ground	Soil/dust dermal exposure Soil/dust ingestion/inhalation Direct Contact	Site/construction workers Structures/services
Lead and Chromium	Soil/dust dermal exposure Soil/dust ingestion/inhalation	Site/construction workers
Asbestos in Made Ground	Soil/dust dermal exposure Soil/dust ingestion/inhalation	Site/construction workers Customers/Staff
Petroleum hydrocarbons in Made Ground Soils	Soil/dust dermal exposure Soil/dust ingestion/inhalation Direct contact Leaching Migration	Site/construction workers Structures/services Groundwater Surface Water Receptor
Elevated Carbon Dioxide, depleted Oxygen during gas monitoring	Inhalation	Site/construction workers Customers/Staff

31 Soil Waste Management

31.1 Re-use of Soils

It is anticipated that the arisings from groundworks on this site will comprise Made Ground and natural soils.

Clean natural arisings from groundworks may be re-used on site without further testing, where there is a definite use for such materials, e.g. raising levels or construction of landscaping layers or bunds as set out in the approved plans for the development.

Treated contaminated soils may be reused on site under an appropriate Materials Management Plan, where certain criteria are met, in accordance with the CL:AIRE Definition of Waste Code of Practice, Ref [16].

31.2 Disposal of Soils

Some soils will require removal from site and disposal to suitably licensed landfills. Different guidelines and charges will apply to different waste classifications. As waste producers, the Developer holds responsibilities under the various governing regulations, particularly the Waste Duty of Care Code of Practice under the Environmental Protection Act 1990, Ref [17].

The chemical analyses appended to this report can be used to inform the initial classification of the soils as either Hazardous or Non-Hazardous, and derive the appropriate EWC code, for offsite disposal or transfer. Waste Acceptance Criteria (WAC) testing may be needed for confirmation of the material's classification, and will be required to demonstrate an inert classification. A preliminary assessment has been carried out, see Section F.

There are strict requirements in place for the accurate description of wastes using EWC codes and, therefore, it is essential that materials that would be given different descriptions (e.g. blacktop, made ground and natural soils), as well as those with different classifications, are carefully segregated during excavation and storage on site. This will also ensure the most cost effective disposal. Mixing these materials can give rise to significant difficulties in disposal and also substantially increase costs.

Soil arisings may be transferred to other development sites under a Materials Management Plan, where certain criteria are met, in accordance with the CL:AIRE Definition of Waste Code of Practice Ref [16].

All soils leaving site will need to be pre-treated. Waste minimisation by selective excavation is a recognised form of pre-treatment.

32 Discussion and Conclusions

The site is currently used as a car park and it is proposed to redevelop the site with a new McDonalds building in the east, together with associated car parking in the west and a drive-thru lane etc. with limited soft landscaping around the perimeter of the site.

A desk study has been carried out (STL J15721-DS, Issue 2) indicates that the site has a history of industrial land use including a clay brick and tile manufacturer, print works, iron works and garages, and the site is currently used as a car park. The site has also been located within an industrial/commercial area. It is possible the site may have been used as a petrol filling station which means there may have been buried fuel tanks and if so these may remain beneath the site and may represent a risk of hydrocarbon contamination. A petroleum licencing search, from Greater Manchester Fire and Rescue Service, however, did not identify any evidence that petroleum spirit was stored at this address.

Based on the site investigation and laboratory testing undertaken to date, relevant and potential pollutant linkages, for which some further assessment and remedial action will be required, have been identified for petroleum hydrocarbons in groundwater and ground gases, respectively.

Some measures are required to mitigate the risk to site workers, site staff/customers and new service pipes from a variety of contaminants.

Basic PPE and good site practice (such as the use of welfare facilities) is considered acceptable to mitigate the minor risk to site staff, unless more significant contamination is encountered.

300mm of certified clean topsoil is recommended for the minimal area of soft landscaping proposed. This should be placed above an 'alert' membrane to separate the imported topsoil from the underlying Made Ground. This is considered suitable to mitigate the minor contamination risk, although the landscape contractors may have their own requirements in terms of depth to provide a suitable growing medium.

Organic contaminants present in the soils, particularly PAH's and petroleum hydrocarbons found in the Made Ground soils could affect plastic underground service pipes (such as the types used by water and gas supply companies). Guidance should be sought from the relevant companies regarding any proposed plant in the affected area. Many water supply companies now require higher specification pipe on contaminated sites, even following remediation. Allow for Proteca-Line pipes.

Based on the ground gas monitoring undertaken to date, the gas regime for the site is assessed as Characteristic Situation 2, and gas protection measures will be required. The proposed development comprises building type C of BS8485 and, therefore, the gas protection measures should provide a minimum protection score of 2.5; BS 8485 Table 4. Independent verification of gas resistant membrane installation is required to ensure that the appropriate gas protection score is achieved.

Depleted oxygen was also noted which could pose a risk to construction works should there be any confined space working. It is recommended work spaces are adequately ventilated.

To date only limited groundwater sampling and laboratory analysis has been undertaken. This has identified elevated concentrations of petroleum hydrocarbons within BH02, which is located towards the centre of the site. At this stage, it is recommended that further groundwater sampling and analysis is undertaken, being extended to the other monitoring wells that hold water and, if access is available, the nearby surface water receptor (the River Roch located approximately 40m north-west of the site). Subject to the findings, additional soil investigation may then be required to assess the on-site source.

This will then allow an assessment to be made as to the nature and extent of any remediation works required on the site.

Boreholes WLS07a-c encountered a concrete slab beneath the blacktop surfacing which we were unable to break through, therefore further investigation may be required in this area to confirm the ground conditions.

As with any site, areas of contamination not identified during site investigation works may come to light in the course of redevelopment. Accordingly, a discovery strategy must be in place during the redevelopment to ensure that any hitherto unknown contamination is identified and dealt with in an appropriate manner. Depending on the nature of any such contamination, it may prove necessary to reassess the remedial strategy for the site.

A formal remediation strategy and verification plan should be agreed with the regulatory authorities prior to commencement of any remedial works.

The existing monitoring wells on the site should then be decommissioned, to prevent the upward migration of gas/downward migration of contamination to the groundwater.

33 General Guidance

Allowance should be made for experienced verification of any remedial works.

It may be that specific local requirements apply to this site, of which we are not aware at this time.

In general terms, the workforce and general public should be protected from contact with contaminated material. There is a range of relevant documents published by the Health and Safety Executive, and organisations such as CIRIA, and the BRE.

F WASTE DISPOSAL

34 Introduction

The Landfill Directive, introduced to the UK via the Landfill Regulations (England and Wales) 2002 aims to reduce reliance on landfill as a disposal option. The Regulations include updated Waste Acceptance Criteria (WAC) as limit values for waste destined to various classes of landfill. The developer has a statutory responsibility under the Duty of Care Regulations of the Environmental Protection Act 1990 to ensure that contaminated soil and water is disposed of offsite to a suitably licensed waste management facility in a safe and approved manner.

To comply with the Duty of Care, all wastes taken off site, in solid or liquid form, must be handled by a registered waste carrier and be accompanied by a consignment note that describes the waste.

35 Preliminary Waste Classification and WAC Analysis

If arisings from the constructions works are intended for disposal, then there is a requirement to determine prior to disposal whether these would classify as:

- Hazardous
- Non hazardous

The current relevant waste legislation and technical guidance (WM3 v1.2.GB Oct 2021) on the assessment and classification of hazardous waste, sets out the requirement for classification and provides the basis for the methodology employed to ensure compliance with the regulations. This report sets out to fulfil the requirements of basic characterisation.

Waste classification indicates whether the material is hazardous or non-hazardous. If material is classified as non-hazardous, there is a choice of sending the material to a non-hazardous or an inert landfill (subject to meeting inert waste acceptance levels based on WAC analysis). Where the waste is classified as hazardous, WAC analysis will be required to demonstrate that the concentrations meet the acceptance levels for hazardous landfill or stable non-reactive hazardous (SNRH) landfill.

The List of Wastes (England) Regulations 2005 shows those wastes that are absolute entries (i.e. hazardous waste regardless of their concentration) and mirror entries (hazardous waste only if hazardous substances are present above the specified threshold concentrations). Section 17 of the List of Wastes relates to Construction and Demolition Wastes (including Excavated Soil from Contaminated Sites, stones and dredging spoil). Contaminated soil is a "mirror entry", and is not automatically assigned a hazardous or non-hazardous nature.

Instead, an assessment of the composition of the soil is undertaken to determine the concentrations of hazardous substances, and the waste classified accordingly. The assessment of contaminated soil to determine whether it is hazardous waste is dependent on the presence of "hazardous substances" exceeding particular thresholds.

36 Results of the Preliminary Assessment

The waste classification assessment has been undertaken using the results of the chemical analyses on the samples analysed. The classification of the materials was conducted using the concentration of each identified substance attributed to its 'worst-case' compound (where relevant), as per Environment Agency (EA) document WM3 v1.2.BG (2021) and The Classification, Labelling and Packaging of Substances and Mixtures Regulation 1272/2008 (CLP). The assessment was carried out using the HazWaste Online Toolkit. The details of the waste classification are presented in Appendix F.

The results of the chemical analysis carried out indicate that the recorded concentrations for TPH in the soils with exceedances above any of the hazardous waste thresholds were recorded.

No visible pieces or fibres of asbestos were recorded but loose chrysotile fibres were detected in two samples of made ground soil tested (BH01 at 0.5-1.0m, WLS01 at 0.2m). Both samples returned quantification results of less than 0.001%, which is the laboratory limit of detection.

A summary of the assessment results is presented below:

Sample Location	Sample Depth (m bgl)	Material	Classification	EWC	Hazardous Properties
BH01	0.5-1.0	Made Ground	Hazardous	17 05 03	HP 7: Carcinogenic HP 11: Mutagenic
BH01	1.8-3.0	Made Ground	Non-Hazardous	17 05 04	n/a
BH02	2.5-3.0	Made Ground	Non-Hazardous	17 05 04	n/a
BH03 (WLS02 1.75m)	1.0-2.0	Made Ground	Hazardous	17 05 03	HP 7: Carcinogenic HP 11: Mutagenic
BH03	7.0	Natural Soils	Non-Hazardous	17 05 04	n/a
WLS01	0.2	Made Ground	Non-Hazardous	17 05 04	n/a
WLS01 (BH02 0.5-1m)	1.0	Made Ground	Hazardous	17 05 03	HP 14: Ecotoxic
WLS02	0.4	Made Ground	Non-Hazardous	17 05 04	n/a
WLS02	3.5	Made Ground	Non-Hazardous	17 05 04	n/a
WLS03	0.6	Made Ground	Non-Hazardous	17 05 04	n/a
WLS04	2.0	Made Ground	Non-Hazardous	17 05 04	n/a
WLS05	0.2	Made Ground	Non-Hazardous	17 05 04	n/a
WLS06	0.5	Made Ground	Hazardous	17 05 03	HP 7: Carcinogenic HP 14: Ecotoxic

Based on the results of the chemical analysis, the Natural soils are classified as Non-Hazardous with EWC code 17 05 04.

Four samples of Made Ground soils are classified as Hazardous with EWC code 17 05 03, including hazardous properties such as HP7 Carcinogenic, HP11 Mutagenic and HP14 Ecotoxic.

The remaining samples of Made Ground soils are classified as Non-Hazardous with EWC code 17 05 04.

37 Results of Waste Acceptance Criteria (WAC) Analysis

Waste Acceptance Criteria Analysis was carried out on two Made Ground samples (BH02 0.5-1.0m & WLS02 1.75m) and a sample of Natural Ground (BH02 4.0-5.0m). The results of the WAC analysis are summarised below:

Made Ground (BH02 0.5-1.0m & WLS02 1.75m)

The result of the WAC analysis carried out on sample BH02 at 0.5-1.0m indicates that the concentrations of Mineral Oli, Total PAH (WAC-17) and pH exceed the threshold value for inert landfill. The remaining determinants exceeded the threshold limits.

The WAC analysis carried out on the sample of made ground from WLS02 indicates that the material can be disposed of as INERT.

Natural Soils (BH02 4.0-5.0m)

The WAC analysis carried out indicates that the natural material can be disposed of as INERT.

38 Recommendations

The chemical analyses undertaken in the course of this investigation have been used to carry out a preliminary waste classification of the materials on site. This report should be forwarded to waste receiving sites for their final decision. Additional testing and Waste Acceptance Criteria (WAC) testing may be needed for confirmation of material's classification.

If more significant contamination is encountered during the construction works, this may affect the waste classification.

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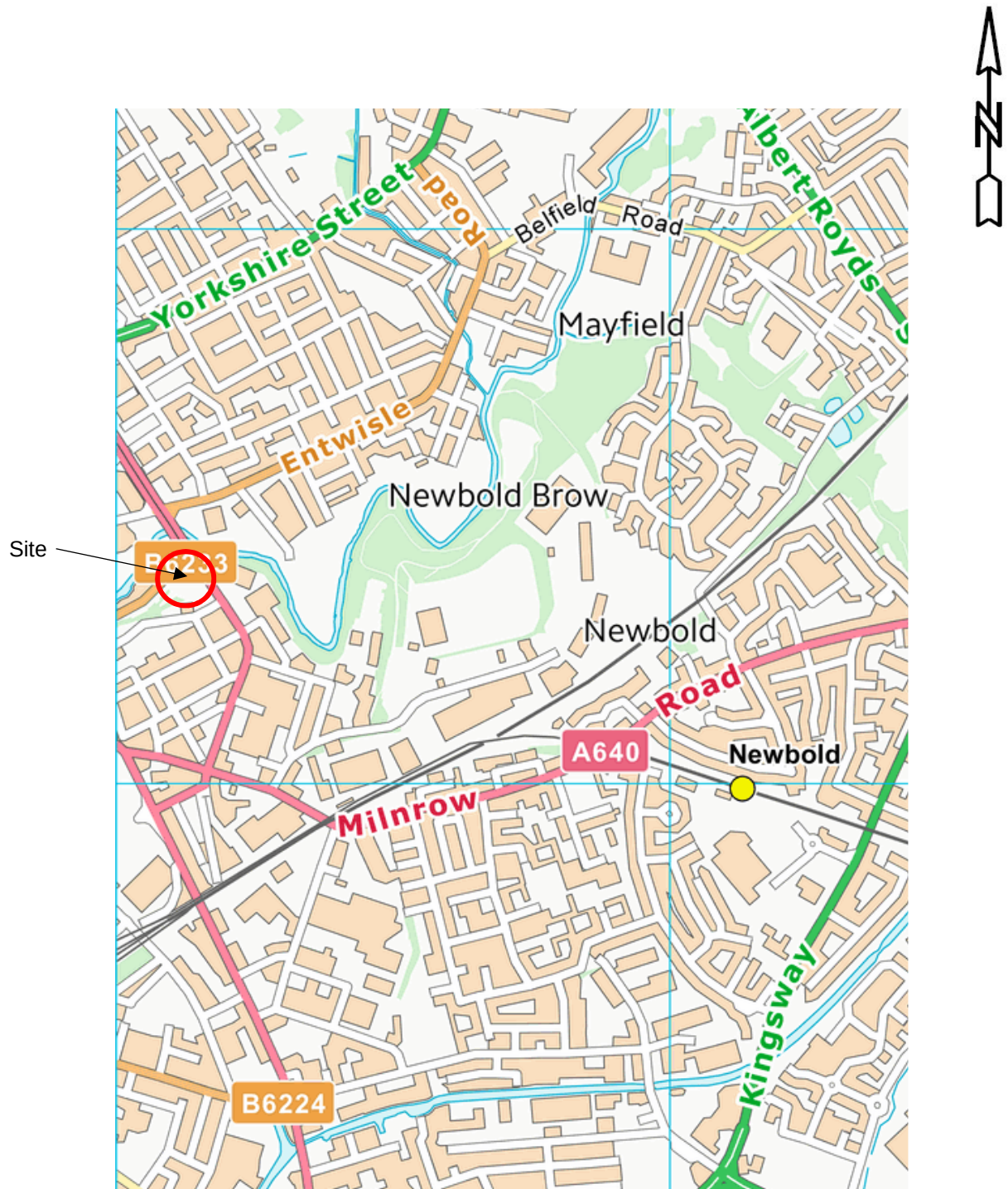
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APPENDIX A

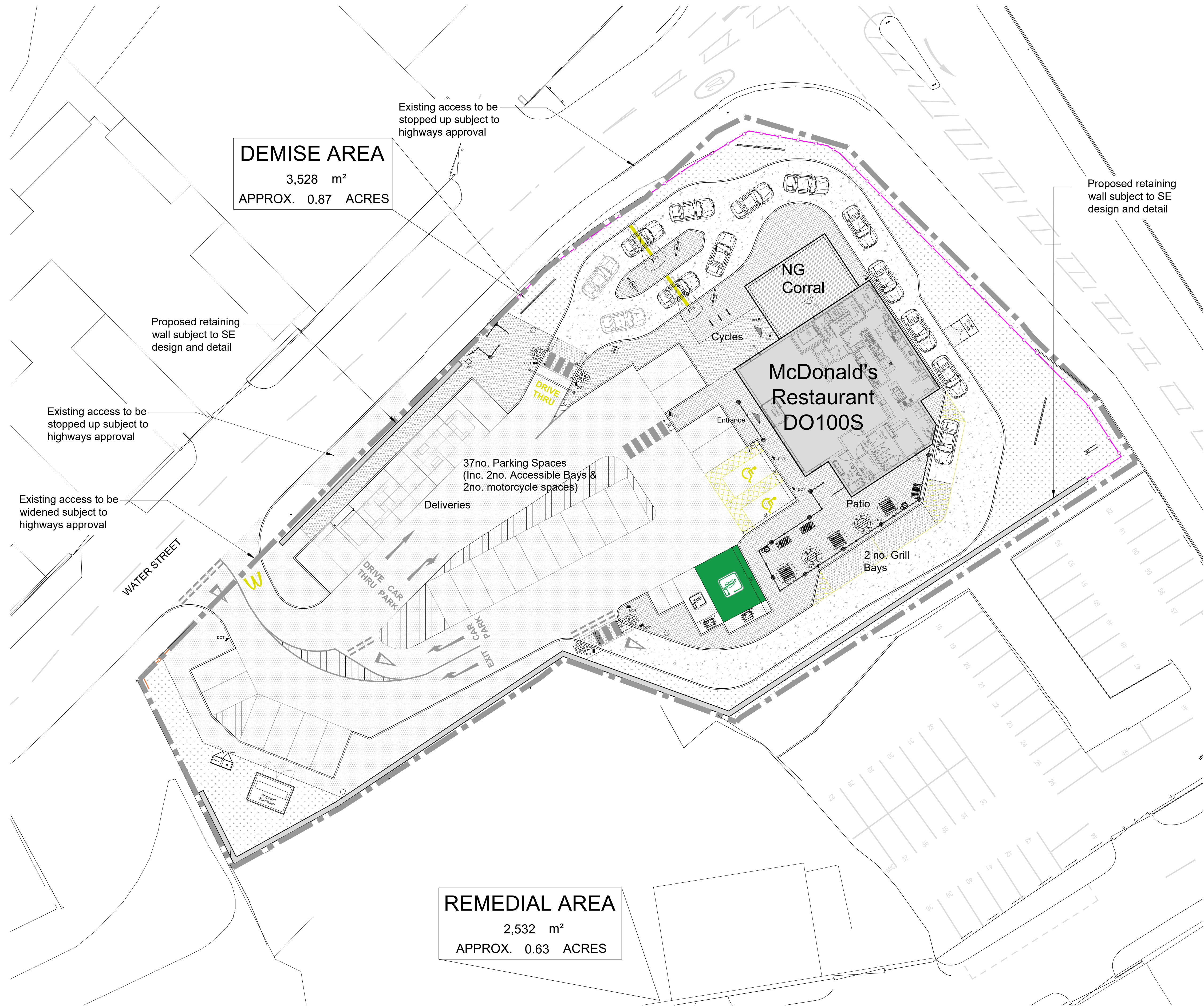
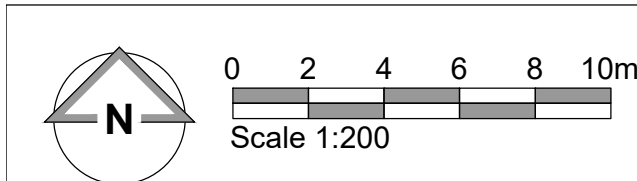
**Site Plans and Exploratory
Hole Logs**





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Site:	Molesworth Street, Rochdale, OL16 1TQ	Project ID	J15721
Figure 1	Site Location Plan	Date:	12/12/2024



Patio Aubliam Furniture Schedule	
Circular Table - 4 Seat 1600mm Ø (H 780mm) Galvanised steel frame with laminated timber effect finish	
Rectangular Table - 8 Seat 600mm x 2600mm (H 780mm) Galvanised steel frame with laminated timber effect finish	
Rectangular Table - 4 Seat 1250mm x 1450mm (H 780mm) Galvanised steel frame with laminated timber effect finish	
Rectangular Table - 2 Seat 700mm x 1450mm (H 780mm) Galvanised steel frame with laminated timber effect finish	
Trash Bin 482 x 482mm (H 1217mm). Galvanised steel frame with laminated timber effect finish	
Ash Bin 297 x 297mm (H 891mm). Galvanised steel frame with laminated timber effect finish	
Parasol 2.1 m Octagonal Parasol (black canopy with white McDonald's text)	

General Site Proposal Notes:
DOT denotes Department of Transport Signs. For Signage type refer to AEW drawing no. 13484_AEW_2285_0000
DK denotes drop kerb to be installed
All drive thru related road markings to be in yellow thermoplastic material
Car park related road markings to be in white thermoplastic material
Standard parking bays to be finished in white thermoplastic material
All junction road markings to be lined in white thermoplastic material
Accessible parking bays to be lined in yellow thermoplastic material to current Part M standards with relevant DOT signage and drop kerbs as indicated
Parked order bays to be lined in yellow thermoplastic material with relevant DOT signage
All pedestrian crossings set out in white thermoplastic material. Tactile paving where crossing leads to safe destination
Drop kerbs to be installed along delivery routes

- NOTES**
- All dimensions and levels are to be checked on site.
 - Any discrepancies are to be reported to the architect before any work commences.
 - This drawing shall not be scaled to ascertain any dimensions. Work to figured dims only.
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 - All works are to be undertaken in accordance with Building Regulations and the latest British Standards.
 - All proprietary materials and products are to be used strictly in accordance with the manufacturers recommendations.

CDM 2015
Client notified of duties: **At Design Workshop**
Principal Designer: **CSS**
Unless noted below, all known hazards have been highlighted on the drawing:

Drawing based on:

- Glanville's Topographical Site Survey, Drawing no: 4230334/4101, Dated: June 2024
- OS Map

McDonald's Demise Boundary Indicated:

Proposed Schedule of Parking	
Accessible Bays	02
Grill Bays	02
Motorcycles Bays	02
Courier Bays	03
EYCP Bays	02
General Bays	26
Total Parking Bays	37

Schedule of Areas	
Proposed Site Area (Hectares)	0.3518
Proposed Building (GEA / m²) (Excluding Corral)	474

Proposed Site Finishes	
Tarmacadam - Car Park	
Imprinted concrete - As entrained concrete with full layer works, hardening agent and curing system; through-colour concrete grey, random cobble pattern. Drive Thru Lane	
Marshalls 200x100 Charcoal Keyblock Paving - Patio	
Tarmacadam - Footpaths	
Turf & low level shrubs - Soft Landscaping	
Brushed concrete - DT lane where road markings and delivery route	
Coated bollards Painted Black	
Tactile Blister Paving	
Target Bin	
LP Denotes Lamppost	
150mm Diameter stainless steel protective bollard	
Proposed 1100MM Close Boarded Timber Fence	
Proposed 900mm Timber knee rail fence	
Proposed Retaining Wall	

B	15/08/2024	HF	TSS
Proposed Building GEA updated			
A	09/08/2024	HN	TSS
Boundary extended, Annotation & Key updated			
-	16/07/2024	HN	TSS
Initial issue			
REV	Date	Drawn by -	Checked by -

Status Purpose of Issue
S2 For Information
drawing stage **Planning**
client

McDonald's Restaurants Ltd

project store
MOLESWORTH STREET, ROCHDALE **2285**

drawing title
Proposed Site Plan

date **12/07/2024** drawn **HN**
scale@A1 **1:200** checked **TSS**

Proposed Site Plan

PLANNING

KEY TO LANDSCAPE PROPOSALS

Existing Site

- Existing Trees to be Retained**
- Existing trees located off site to be retained and protected from damage during construction

Proposed Planting Details

All areas of new landscaping to have the existing topsoil and subsoil decompacted by hand digging or rotorvator. If any imported topsoil is required it should be placed to a depth of 450mm minimum in shrub beds and be free of weeds or any detritus/stones larger than 50mm.

Planting should take place during the dormant planting season ie 1st October to 28th February. Tree planting shall be implemented as per British Standard 8545 (Trees: from nursery to independence in the landscape - Recommendations).

Grassland Verges

Areas of grassland to be established in landscaped verges around the site. Cultivate and grade soil, bring top 150mm to a fine tilth, rake and bring to given levels, remove all stones and debris over 50mm, lay turf in stretcher bond, firm turves using wooden turf beater.

- Species Rich Turf (453m²)**
- New areas of grass verge to be established using Species Rich Turf supplied by wildflowerturf.co.uk (or similar approved)

Specimen Tree Planting

Heavy Standard specimen trees planted in locations indicated as per the following specification:

Excavate tree pit 750mm x 750mm x 600mm deep (or larger to suit root ball), backfill topsoil mixed with 80 litres of peat free compost and secure tree in an upright position with a single timber stake and rubber tie and spacer.

- Specimen Tree Planting (6 no.)**
- 3.0-3.5m high, 12-14 cm girth Heavy Standard root balled trees (supplied by Barcham Trees or similar approved) to be pit planted as per above specification in locations shown
- 3 x Acer campestre (Field Maple) - Ac
3 x Sorbus aria (Whitebeam) - Sar

Tree Pits & Support

Diameter and depth of tree pit to be dependant on the size of the rootball. Minimum size 900 x 900 x 750 deep

- 1 No synthetic tie (100mm below top of stake)
- 1 No 75mm dia, softwood FSC stake, sharpened and knocked approx 1.0m into the soil until secure
- 300mm topsoil
600mm subsoil

Ornamental Shrub Planting

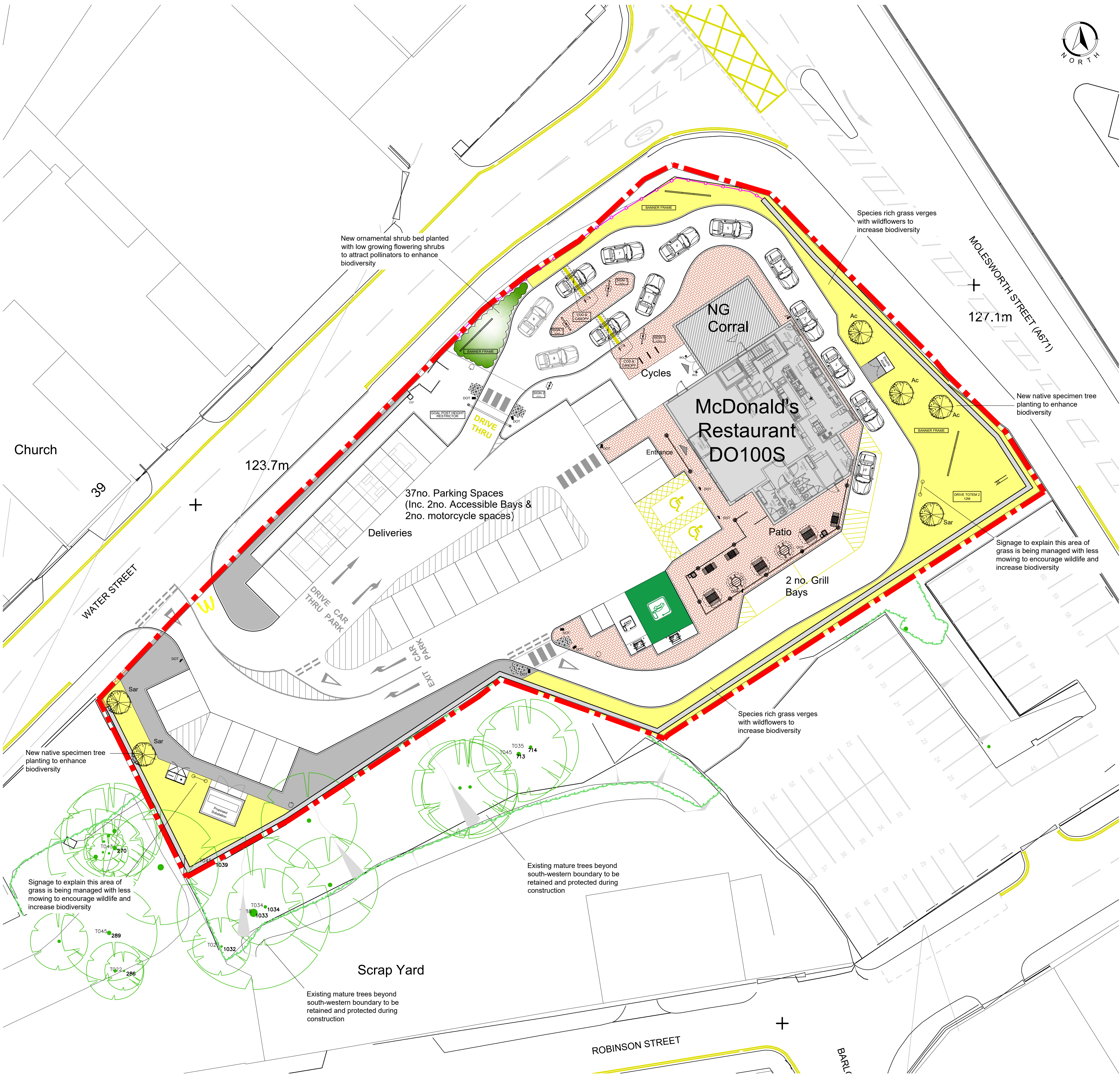
Areas of shrub planting for ecological enhancement to be planted in groups around the perimeter of the site. Cultivate and grade soil, bring top 150mm to a fine tilth prior to planting.

- Shrubs (26m²)**
- Shrubs to be pit planted 4 per m². Planted to provide colourful, groundcover with ecological value. All plants to be 5 litre pot grown stock, planted in random groups of 5, 7 or 9 plants of same species throughout the planting bed. 160 plants in total
- Euonymus fortunei 'Emerald Gaiety' x 30no.
Brachyglottis 'Sunshine' (Senecio) x 30no.
Ceanothus 'Blue Mound' (Californian lilac) x 30no.
Hypericum 'Hidcote' (St John's Wort) x 25no.
Lavendula angustifolia 'Hidcote' (Lavender) x 25no.
Pachysandra terminalis (Green Carpet) x 20no.

Proposed Surfacing

Refer to Architects drawing for full details of all new surfacing

- Pedestrian Circulation**
- New tarmacadam surfaced footways
- Pedestrian Circulation**
- New block paving surfaced footways



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Notes:

This drawing is based on:

- 13484_AEW_2285_0004_Proposed Site Plan, by AEW dated 16.07.24

Biodiversity Signage

Signboards to be located within wildflower meadow area to explain the grass is being mown less often to create a wildflower meadow to attract pollinators and wildlife to increase the biodiversity of the site



Rev	Date	Description	Drawn	Checked
Client				
McDonald's				
Project				
Proposed New Drive Thru Molesworth Street Rochdale				
Title				
Landscaping Scheme				
Drawing Status				
FOR PLANNING APPROVAL				
Drawn	MB	Checked	LB	
Date	29.07.24	Scale (A1)	1:200	

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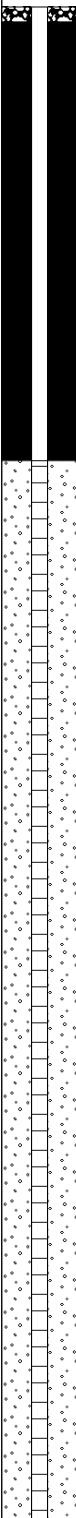
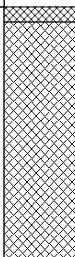
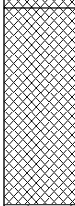
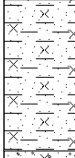
Environmental Consultants to the Construction Industry

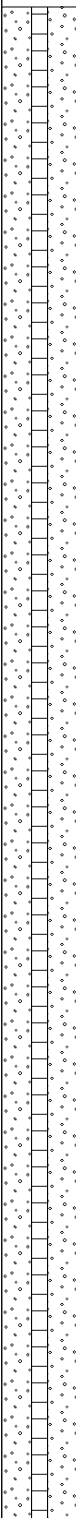
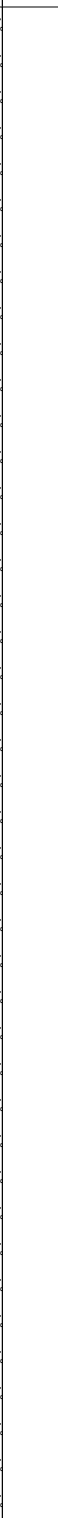
BREACH Code for Sustainable Homes Assessors - Landscape Architecture - Transportation
Life Cycle Costing - Energy Assessment - SAP - BPC - SBEM - Daylight Calculations

Job Number	Drawing Number	Rev
A6748	01	



Project Name:	Molesworth Street, Rochdale	Project ID:	J15721	Figure 2 - Cable Percussive Borehole Location Plan  Southern Testing Environmental & Geotechnical
Location:	Rochdale, OL16 1TL	Engineer:	VF	
Client:	Glanville Consultants Ltd	Scale:	1:750	

				Start - End Date:		Project ID:		Hole Type:		BH01			
				22/07/2024 - 23/07/2024		J15721		CP		Sheet 1 of 2			
Client:		Glanville Consultants Ltd				Co-ordinates:			Level (m AOD)		Logger:		
						E 390113 - N 413355			125.64		VF		
Project Name:		Molesworth Street, Rochdale				Location:		Rochdale, OL16 1TL					
Well	Water Strikes	Samples and Insitu Testing			Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description				
		Depth (m bgl)	Type	Results									
		0.10 - 1.20	B	N=13 (3,3/4,3,3,3)	125.54	(0.10)		0.10	BLACKTOP SURFACING			1	
		0.50 - 1.00	ES			(1.60)			Medium dense, dark brown black, silty very sandy cobbly GRAVEL. Sand is fine to coarse grained. Gravel consists of fine to coarse angular to subangular flint, brick, concrete and clinker. Cobbles consist of angular brick and concrete.				
		1.20 - 1.65	ES						MADE GROUND				
		1.20	SPT (S)										
		1.70 - 2.00	B	N=0 (0,1/0,0,0,0)	123.94			1.70	Very loose, dark greyish brown, clayey very silty slightly gravelly fine SAND. Gravel consists of fine to medium angular brick.			2	
		1.80 - 3.00	ES						MADE GROUND				
		2.00 - 2.45	B			(1.30)							
		2.00	SPT (S)										
		3.00 - 3.45	B	N=4 (1,1/1,1,1,1)	122.64			3.00	Soft, dark grey mottled orangish brown, very silty sandy CLAY. Sand is fine grained.			3	
		3.00 - 4.00	ES			(1.00)			ALLUVIUM				
		3.00	SPT (S)										
		3.50	HP		121.64								
		4.00 - 4.45	B	N=12 (2,2/3,3,3,3)				4.00	Stiff, dark brownish grey, silty sandy slightly gravelly organic CLAY with occasional patches of very silty fine sand. Sand is fine grained. Gravel consists of fine to coarse subangular to subrounded siltstone/sandstone.			4	
		4.00	ES			(3.00)			TILL				
		4.00	SPT (S)										
		5.00 - 5.45	B										
		5.00	HP	N=11 (3,3/3,3,2,3)									5
		5.00	SPT (S)										
		6.00 - 6.45	B										
		6.00	ES										
		6.00	SPT (S)	N=13 (3,3/4,3,3,3)								6	
		7.00	HP		118.64								
		7.50 - 7.95	B										
		7.50	ES										
		7.50	HP	N=20 (4,5/5,4,5,6)									7
		7.50	SPT (S)										
		9.00 - 9.45	U										
		9.00	HP										
		9.50	ES	UCS(kPa)=380									8
Remarks:											9		
Borehole dry during drilling.											10		
Water added to aid drilling between 2.0-3.6mbgl.													
Status:		FINAL		Log Print Date and Time:		25/09/2024 03:07		Log Approved By:		JNR			

				Start - End Date:		Project ID:		Hole Type:		BH01						
				22/07/2024 - 23/07/2024		J15721		CP		Sheet 2 of 2						
Client:		Glanville Consultants Ltd				Co-ordinates:			Level (m AOD)		Logger:					
						E 390113 - N 413355			125.64		VF					
Project Name:		Molesworth Street, Rochdale				Location:		Rochdale, OL16 1TL								
Well	Water Strikes	Samples and Insitu Testing			Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description							
		Depth (m bgl)	Type	Results												
		10.50 - 10.95	B	UCS(kPa)=330 N=30 (5,6/7,7,8,8)	(13.00)				Very stiff, dark brown, silty slightly sandy to sandy slightly gravelly CLAY. Sand is fine to medium grained. Gravel consists of fine to coarse subangular to subrounded sandstone/siltstone. TILL			11				
		10.50	ES													
			HP													
			SPT													
			(S)													
		12.00 - 12.45	U												12	
		12.50	ES													13
		13.50 - 13.95	ES													
		13.50	SPT	N=32												14
			(S)	(5,7/7,8,8,9)												
		15.00 - 15.45	U													15
		15.00	HP	UCS(kPa)=360												16
		15.50	ES													
		16.50 - 16.95	B													
			ES													
		16.50	HP	UCS(kPa)=240												17
			SPT	N=39												
			(S)	(5,7/8,9,10,12)												
		18.00 - 18.45	B													18
			ES													
		18.00	HP	UCS(kPa)=230												
		SPT	N=42								19					
		(S)	(6,7/8,10,12,12)													
						105.64			20.00	End of Borehole at 20.00m			20			
Remarks:																
Borehole dry during drilling.																
Water added to aid drilling between 2.0-3.6mbgl.																
Status:		FINAL		Log Print Date and Time:		25/09/2024 03:07		Log Approved By:		JNR						

	Start - End Date:	Project ID:	Hole Type:	BH01
	22/07/2024 - 23/07/2024	J15721	CP	Sheet 1 of 1

Depth Related Hole Information									
Top Depth (m)	Base Depth (m)	Hole Type	Start Date	End Date	Crew	Plant Used	Contractor	Logged By	Remarks
0.00 1.20	1.20 20.00	IP CP	22/07/2024 22/07/2024	22/07/2024 23/07/2024	DF/SF DF/SF	Hand Dug Dando 2500	VC Drilling VC Drilling	VF VF	

Hole Diameter			Casing Diameter		
Hole Diameter (mm)	Depth to Base (m)	Remarks	Casing Diameter (mm)	Depth to Base (m)	Remarks
150	20.00		150	20.00	

Project Specific Time Related Remarks				Drilling Progress by Time				
Date Time Start	Date Time End	Duration	Remarks	Date Time	Depth (m)	Casing Depth (m)	Water Depth (m)	Remarks

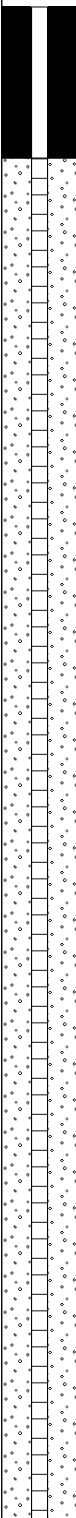
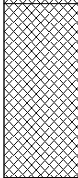
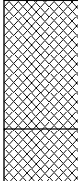
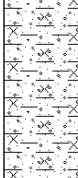
SPT								
Top Depth (m)	Test Type	Casing Depth (m)	Water Depth (m)	Self Weight Penetration (mm)	Reported Result (N Value)	Hammer Serial No.	Energy Ratio %	Remarks
1.20 2.00 3.00 4.00 5.00 6.00 7.50 10.50 13.50 16.50 18.00	S S S S S S S S S S S S	1.20 1.50 3.00 4.00 5.00 6.00 7.50 10.50 13.50 16.50 18.00	2.00	0 0 0 0 0 0 0 0 0 0 0 0	N=13 (3,3/4,3,3,3) N=0 (0,1/0,0,0,0) N=4 (1,1/1,1,1,1) N=12 (2,2/3,3,3,3) N=11 (3,3/3,3,2,3) N=13 (3,3/4,3,3,3) N=20 (4,5/5,4,5,6) N=30 (5,6/7,7,8,8) N=32 (5,7/7,8,8,9) N=39 (5,7/8,9,10,12) N=42 (6,7/8,10,12,12)	AR2499 AR2499 AR2499 AR2499 AR2499 AR2499 AR2499 AR2499 AR2499 AR2499 AR2499	70 70 70 70 70 70 70 70 70 70 70	

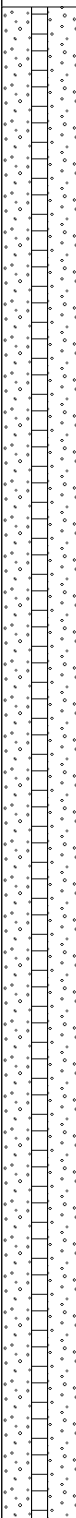
Water Strikes and Details							
Depth Strike (m)	Date Time	Depth Casing (m)	Depth Sealed (m)	Remarks	Time Elapsed (mins)	Water Depth (m)	Remarks

Backfill Details				Chiselling Details				
Depth Top (m)	Depth Base (m)	Material	Remarks	From (m)	To (m)	Start (Date / Time)	Duration (hh:mm)	Remarks
0.00 0.10 3.00	0.10 3.00 20.00	Blacktop Bentonite Gravel Backfill						

Installation Details						Pipe Construction				
Distance	Point Ref.	Type	Top of Response Zone (m)	Base of Response Zone (m)	Pipe Ref.	Pipe Reference	Depth Top (m)	Depth Base (m)	Diameter (mm)	Pipe Type
20.00	BH01	SP	3.00	20.00	BH01	BH01 BH01	0.00 3.00	3.00 20.00	50 50	PLAIN SLOTTED

Status:	FINAL	Log Print Date and Time:	25/09/2024 03:07	Log Approved By:	JNR
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				Start - End Date:		Project ID:		Hole Type:		BH02																			
				23/07/2024 - 25/07/2024		J15721		CP		Sheet 1 of 3																			
Client:		Glanville Consultants Ltd				Co-ordinates:			Level (m AOD)		Logger:																		
						E 390130 - N 413372			126.01		VF																		
Project Name:		Molesworth Street, Rochdale				Location:		Rochdale, OL16 1TL																					
	Water Strikes	Samples and Insitu Testing			Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description																				
		Depth (m bgl)	Type	Results																									
		0.10 - 1.00	B	N=5 (3,2/2,1,1,1)	125.91	(0.10)		0.10	BLACKTOP SURFACING			1																	
		0.50 - 1.00	ES		125.51	(0.40)		0.50	Greyish brown, very sandy fine to coarse angular GRAVEL of brick and concrete.																				
		1.00 - 2.00	ES		124.36	(1.15)			1.65	MADE GROUND																			
		1.20 - 1.65	B							123.51	(0.85)		2.50	Loose dark brown/black, clayey to very clayey very gravelly fine to coarse ashy SAND. Gravel consists of fine to coarse angular to subangular clinker, brick, flint and concrete.															
		1.20	SPT (S)											MADE GROUND															
		2.00 - 2.45	U	N=0 (0,0/0,0,0,0)	122.01		4.00	Soft to firm, dark brown, very silty sandy slightly gravelly CLAY. Sand is fine grained. Gravel consists of fine to coarse subangular to rounded brick, flint and ceramic. Slight hydrocarbon odour.			2																		
		2.50	ES					123.51	(1.50)	7.20		MADE GROUND																	
		2.50 - 3.00										118.81	(3.20)	9.00	Very soft, dark brownish grey/black, sandy gravelly organic CLAY. Sand is fine to coarse grained. Gravel consists of fine to coarse angular to subangular brick, concrete, flint, tile and ceramic. Hydrocarbon odour.														
		3.00 - 3.45	B												117.01	(1.80)	9.00	MADE GROUND											
		3.00	SPT (S)															Stiff. dark brown, silty sandy slightly gravelly CLAY. Sand is fine grained. Gravel consists of fine to coarse subangular to rounded siltstone/sandstone. TILL											
		4.00 - 4.45	B	N=11 (2,3/3,2,3,3)	122.01		4.00	TILL			4																		
		4.00	ES									118.81	(3.20)	7.20	From 6.0m, very soft.														
		4.00 - 5.00																117.01	(1.80)	9.00	Firm to stiff, silty sandy slightly gravelly CLAY. Sand is fine to coarse grained. Gravel consists of fine to coarse subangular to subrounded flint and sandstone. TILL								
		5.00 - 5.45	B																					117.01	(1.80)	9.00	Very stiff, dark brown and bluish grey, silty sandy slightly gravelly to gravelly CLAY with occasional bands of fine sand. Sand is fine to medium grained. Gravel consists of fine to coarse subangular to rounded sandstone/siltstone and quartz. TILL		
		5.00	ES																										
		5.00	HP	UCS(kPa)=190	(3.20)		7.20	From 6.0m, very soft.			6																		
		5.00	SPT (S)	N=12 (2,3/3,3,3,3)								118.81	(3.20)	7.20	Firm to stiff, silty sandy slightly gravelly CLAY. Sand is fine to coarse grained. Gravel consists of fine to coarse subangular to subrounded flint and sandstone. TILL														
		5.70	B	117.01														(1.80)	9.00	Very stiff, dark brown and bluish grey, silty sandy slightly gravelly to gravelly CLAY with occasional bands of fine sand. Sand is fine to medium grained. Gravel consists of fine to coarse subangular to rounded sandstone/siltstone and quartz. TILL									
		6.00 - 6.45	ES																				117.01	(1.80)	9.00	Very stiff, dark brown and bluish grey, silty sandy slightly gravelly to gravelly CLAY with occasional bands of fine sand. Sand is fine to medium grained. Gravel consists of fine to coarse subangular to rounded sandstone/siltstone and quartz. TILL			
		6.00	SPT (S)																										
		6.50	HP	UCS(kPa)=90	118.81		7.20	Firm to stiff, silty sandy slightly gravelly CLAY. Sand is fine to coarse grained. Gravel consists of fine to coarse subangular to subrounded flint and sandstone. TILL			7																		
		7.20	B	117.01								(1.80)	9.00	Very stiff, dark brown and bluish grey, silty sandy slightly gravelly to gravelly CLAY with occasional bands of fine sand. Sand is fine to medium grained. Gravel consists of fine to coarse subangular to rounded sandstone/siltstone and quartz. TILL															
		7.20	HP														117.01	(1.80)	9.00	Very stiff, dark brown and bluish grey, silty sandy slightly gravelly to gravelly CLAY with occasional bands of fine sand. Sand is fine to medium grained. Gravel consists of fine to coarse subangular to rounded sandstone/siltstone and quartz. TILL									
		7.50 - 7.95	U																				117.01	(1.80)	9.00	Very stiff, dark brown and bluish grey, silty sandy slightly gravelly to gravelly CLAY with occasional bands of fine sand. Sand is fine to medium grained. Gravel consists of fine to coarse subangular to rounded sandstone/siltstone and quartz. TILL			
		8.00	ES																										
		9.00 - 9.45	B	N=4 (1,1/1,1,1,1)	117.01		9.00	Very stiff, dark brown and bluish grey, silty sandy slightly gravelly to gravelly CLAY with occasional bands of fine sand. Sand is fine to medium grained. Gravel consists of fine to coarse subangular to rounded sandstone/siltstone and quartz. TILL			9																		
		9.00	ES									117.01	(1.80)	9.00	Very stiff, dark brown and bluish grey, silty sandy slightly gravelly to gravelly CLAY with occasional bands of fine sand. Sand is fine to medium grained. Gravel consists of fine to coarse subangular to rounded sandstone/siltstone and quartz. TILL														
		9.00	HP															117.01	(1.80)	9.00	Very stiff, dark brown and bluish grey, silty sandy slightly gravelly to gravelly CLAY with occasional bands of fine sand. Sand is fine to medium grained. Gravel consists of fine to coarse subangular to rounded sandstone/siltstone and quartz. TILL								
		9.00	SPT (S)																					117.01	(1.80)	9.00	Very stiff, dark brown and bluish grey, silty sandy slightly gravelly to gravelly CLAY with occasional bands of fine sand. Sand is fine to medium grained. Gravel consists of fine to coarse subangular to rounded sandstone/siltstone and quartz. TILL		
		9.00	HP																										
		9.00	SPT (S)	UCS(kPa)=340	(1.80)		9.00	Very stiff, dark brown and bluish grey, silty sandy slightly gravelly to gravelly CLAY with occasional bands of fine sand. Sand is fine to medium grained. Gravel consists of fine to coarse subangular to rounded sandstone/siltstone and quartz. TILL			10																		
		9.00	HP	N=47 (5,7/9,11,14,13)								117.01	(1.80)	9.00	Very stiff, dark brown and bluish grey, silty sandy slightly gravelly to gravelly CLAY with occasional bands of fine sand. Sand is fine to medium grained. Gravel consists of fine to coarse subangular to rounded sandstone/siltstone and quartz. TILL														
		9.00	SPT (S)	117.01														(1.80)	9.00	Very stiff, dark brown and bluish grey, silty sandy slightly gravelly to gravelly CLAY with occasional bands of fine sand. Sand is fine to medium grained. Gravel consists of fine to coarse subangular to rounded sandstone/siltstone and quartz. TILL									
		9.00	HP																				117.01	(1.80)	9.00	Very stiff, dark brown and bluish grey, silty sandy slightly gravelly to gravelly CLAY with occasional bands of fine sand. Sand is fine to medium grained. Gravel consists of fine to coarse subangular to rounded sandstone/siltstone and quartz. TILL			
		9.00	SPT (S)																										
Remarks:																													
Water strike at 9.0mbgl, rising to 7.0m in 20mins.																													
Status:		FINAL		Log Print Date and Time:		25/09/2024 03:07		Log Approved By:		JNR																			

				Start - End Date:		Project ID:		Hole Type:		BH02			
				23/07/2024 - 25/07/2024		J15721		CP		Sheet 2 of 3			
Client:		Glanville Consultants Ltd				Co-ordinates:			Level (m AOD)		Logger:		
						E 390130 - N 413372			126.01		VF		
Project Name:		Molesworth Street, Rochdale				Location:		Rochdale, OL16 1TL					
	Water Strikes	Samples and Insitu Testing			Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description				
		Depth (m bgl)	Type	Results									
		10.50 - 10.95	B						Very stiff, dark brown and bluish grey, silty sandy slightly gravelly to gravelly CLAY with occasional bands of fine sand. Sand is fine to medium grained. Gravel consists of fine to coarse subangular to rounded sandstone/siltstone and quartz. TILL				
		10.50	ES HP SPT (S)	UCS(kPa)=330 N=29 (4,4/6,7,7,9)							11		
		12.00 - 12.45	U								12		
		12.50	ES										
		13.00 - 13.95	B								13		
		13.00	HP	UCS(kPa)=350									
		13.50 - 13.95	ES										
		13.50	SPT (S)	N=36 (5,7/7,9,10,10)							14		
		15.00 - 15.45	B								15		
		15.00	ES HP SPT (S)	UCS(kPa)=390 N=36 (5,6/7,9,10,10)							16		
		16.50 - 16.95	B										
		16.50	ES HP SPT (S)	UCS(kPa)=400 N=36 (7,8/8,8,9,11)							17		
		18.00 - 18.45	B								18		
		18.00	ES HP SPT (S)	UCS(kPa)=420 N=40 (8,8/9,9,10,12)							19		
		19.50 - 19.95	ES										
		19.50	HP	UCS(kPa)=400							20		
					106.01			20.00					
Remarks:													
Water strike at 9.0mbgl, rising to 7.0m in 20mins.													
Status:		FINAL			Log Print Date and Time:		25/09/2024 03:07		Log Approved By:		JNR		

					Start - End Date:		Project ID:		Hole Type:		BH02	
					23/07/2024 - 25/07/2024		J15721		CP		Sheet 3 of 3	
Client:		Glanville Consultants Ltd					Co-ordinates:		Level (m AOD)		Logger:	
							E 390130 - N 413372		126.01		VF	
Project Name:		Molesworth Street, Rochdale					Location:		Rochdale, OL16 1TL			
Well	Water Strikes	Samples and Insitu Testing			Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description			
		Depth (m bgl)	Type	Results								
			SPT (S)	N=39 (5,5/8,10,9,12)					End of Borehole at 20.00m			
												21
												22
												23
												24
												25
												26
												27
												28
												29
												30
Remarks:												
Water strike at 9.0mbgl, rising to 7.0m in 20mins.												
Status:		FINAL			Log Print Date and Time:		25/09/2024 03:07		Log Approved By:		JNR	

	Start - End Date:	Project ID:	Hole Type:	BH02
	23/07/2024 - 25/07/2024	J15721	CP	Sheet 1 of 1

Depth Related Hole Information									
Top Depth (m)	Base Depth (m)	Hole Type	Start Date	End Date	Crew	Plant Used	Contractor	Logged By	Remarks
0.00 1.20	1.20 20.00	IP CP	23/07/2024 23/07/2024	23/07/2024 25/07/2024	DF/SF DF/SF	Hand Dug Dando 2500	VC Drilling VC Drilling	VF VF	

Hole Diameter			Casing Diameter		
Hole Diameter (mm)	Depth to Base (m)	Remarks	Casing Diameter (mm)	Depth to Base (m)	Remarks
150	20.00		150	19.50	

Project Specific Time Related Remarks				Drilling Progress by Time				
Date Time Start	Date Time End	Duration	Remarks	Date Time	Depth (m)	Casing Depth (m)	Water Depth (m)	Remarks

SPT								
Top Depth (m)	Test Type	Casing Depth (m)	Water Depth (m)	Self Weight Penetration (mm)	Reported Result (N Value)	Hammer Serial No.	Energy Ratio %	Remarks
1.20	S	1.20		0	N=5 (3,2/2,1,1,1)	AR2499	70	
3.00	S	3.00		0	N=0 (0,0/0,0,0,0)	AR2499	70	
4.00	S	4.00		0	N=11 (2,3/3,2,3,3)	AR2499	70	
5.00	S	5.00		0	N=12 (2,3/3,3,3,3)	AR2499	70	
6.00	S	6.00		0	N=4 (1,1/1,1,1,1)	AR2499	70	
9.00	S	9.00		0	N=47 (5,7/9,11,14,13)	AR2499	70	
10.50	S	10.50		0	N=29 (4,4/6,7,7,9)	AR2499	70	
13.50	S	13.50		0	N=36 (5,7/7,9,10,10)	AR2499	70	
15.00	S	15.00		0	N=36 (5,6/7,9,10,10)	AR2499	70	
16.50	S	16.50		0	N=36 (7,8/8,8,9,11)	AR2499	70	
18.00	S	18.00		0	N=40 (8,8/9,9,10,12)	AR2499	70	
19.50	S	19.50		0	N=39 (5,5/8,10,9,12)	AR2499	70	

Water Strikes and Details							
Depth Strike (m)	Date Time	Depth Casing (m)	Depth Sealed (m)	Remarks	Time Elapsed (mins)	Water Depth (m)	Remarks
9.40	24/07/2024 00:00:00	9.00			20	7.00	

Backfill Details				Chiselling Details				
Depth Top (m)	Depth Base (m)	Material	Remarks	From (m)	To (m)	Start (Date / Time)	Duration (hh:mm)	Remarks
0.00 1.00	1.00 20.00	Bentonite Gravel Backfill						

Installation Details						Pipe Construction				
Distance	Point Ref.	Type	Top of Response Zone (m)	Base of Response Zone (m)	Pipe Ref.	Pipe Reference	Depth Top (m)	Depth Base (m)	Diameter (mm)	Pipe Type
20.00	BH02	SP			BH02	BH02 BH02	0.00 1.00	1.00 20.00	50 50	PLAIN SLOTTED

Status:	FINAL	Log Print Date and Time:	25/09/2024 03:07	Log Approved By:	JNR
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Rochdale, OL16 1TL

Status:	FINAL	Log Print Date and Time:	25/09/2024 03:07	Log Approved By:	JNR
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Depth Related Hole Information									
Top Depth (m)	Base Depth (m)	Hole Type	Start Date	End Date	Crew	Plant Used	Contractor	Logged By	Remarks
0.00 1.20	1.20 20.00	IP CP	25/07/2024 25/07/2024	25/07/2024 26/07/2024	DF/SF DF/SF	Hand Dug Dando 2500	VC Drilling VC Drilling	VF VF	

Hole Diameter			Casing Diameter		
Hole Diameter (mm)	Depth to Base (m)	Remarks	Casing Diameter (mm)	Depth to Base (m)	Remarks
150	20.00		150	10.50	Unable to progress casing past 10.5m.

Project Specific Time Related Remarks				Drilling Progress by Time				
Date Time Start	Date Time End	Duration	Remarks	Date Time	Depth (m)	Casing Depth (m)	Water Depth (m)	Remarks

SPT								
Top Depth (m)	Test Type	Casing Depth (m)	Water Depth (m)	Self Weight Penetration (mm)	Reported Result (N Value)	Hammer Serial No.	Energy Ratio %	Remarks
1.20	S	1.20		0	N=14 (2,3/4,4,3,3)	AR2499	70	
2.00	S	2.00		0	N=4 (1,1/1,1,1,1)	AR2499	70	
3.00	S	3.00	2.00	0	N=4 (1,1/1,1,1,1)	AR2499	70	
4.00	S	4.00	2.00	0	N=4 (2,2/1,1,1,1)	AR2499	70	
5.00	S	5.00	1.00	0	N=4 (1,1/1,1,1,1)	AR2499	70	
6.00	S	6.00		0	N=26 (5,5/6,6,7,7)	AR2499	70	
7.50	S	7.50	6.50	0	N=16 (4,3/4,4,4,4)	AR2499	70	
9.00	S	9.00		0	N=23 (5,5/6,6,6,5)	AR2499	70	
12.00	S	10.50		0	N=28 (5,6/7,7,7,7)	AR2499	70	
15.00	S	10.50		0	N=39 (5,7/9,10,10,10)	AR2499	70	
16.50	S	10.50		0	N=36 (6,7/8,9,9,10)	AR2499	70	
18.00	S	10.50		0	N=40 (5,5/10,10,9,11)	AR2499	70	
19.50	S	10.50		0	N=46 (5,6/10,12,12,12)	AR2499	70	

Water Strikes and Details							
Depth Strike (m)	Date Time	Depth Casing (m)	Depth Sealed (m)	Remarks	Time Elapsed (mins)	Water Depth (m)	Remarks
6.50	25/07/2024 00:00:00	6.00			20	5.00	
3.00	25/07/2024 00:00:00	3.00			20	2.00	

Backfill Details				Chiselling Details				
Depth Top (m)	Depth Base (m)	Material	Remarks	From (m)	To (m)	Start (Date / Time)	Duration (hh:mm)	Remarks
0.00 3.00	3.00 20.00	Bentonite Gravel Backfill						

Installation Details						Pipe Construction				
Distance	Point Ref.	Type	Top of Response Zone (m)	Base of Response Zone (m)	Pipe Ref.	Pipe Reference	Depth Top (m)	Depth Base (m)	Diameter (mm)	Pipe Type
20.00	BH03	SP	3.00	20.00	BH03	BH03	0.00	3.00	50	PLAIN
						BH03	3.00	20.00	50	SLOTTED

Fall Height (mm)	750	Cone Diameter (mm)	50.5	Abort Reason Groundwater at 2.89m on completion of borehole. Dynamic probe carried out from base of borehole to 11mbgl.	
Hammer Mass (kg)	63.5	Final Depth (m bgl)	5.45		
Probe Type	DPSH-B				
Status:	FINAL	Log Print Date and Time:	25/09/2024 03:06	Log Approval by:	JNR

				Start - End Date:		Project ID:		Hole Type:		WLS01							
				29/07/2024		J15721		WLS+DP		Sheet 2 of 2							
Client:		Glanville Consultants Ltd				Co-ordinates:		Level (m AOD)		Logger:							
						E 390129 - N 413367		126.11		VF							
Project Name:		Molesworth Street, Rochdale				Location:		Rochdale, OL16 1TL									
Probe Blows/100mm and SPT N-Values										Torque (Nm)	Water Strikes	Depth (m)	Level (m AOD)	Legend	Description		
0	5	10	15	20	25	30	35	40	45	50							
													11				
													12				
													13				
													14				
													15				
													16				
													17				
													18				
													19				
													20				
Fall Height (mm)		750		Cone Diameter (mm)		50.5		Abort Reason									
Hammer Mass (kg)		63.5		Final Depth (m bgl)		5.45		Groundwater at 2.89m on completion of borehole.									
Probe Type		DPSH-B						Dynamic probe carried out from base of borehole to 11mbgl.									
Status:		FINAL		Log Print Date and Time:		25/09/2024 03:06		Log Approval by:		JNR							

JNR

	Start - End Date:	Project ID:	Hole Type:	WLS01a
	29/07/2024	J15721	WLS	Sheet 1 of 1

Depth Related Hole Information									
Top Depth (m)	Base Depth (m)	Hole Type	Start Date	End Date	Crew	Plant Used	Contractor	Logged By	Remarks
0.00	0.55	IP	29/07/2024	29/07/2024	OS	Hand Dug	STL	VF	

Hole Diameter			Casing Diameter		
Hole Diameter (mm)	Depth to Base (m)	Remarks	Casing Diameter (mm)	Depth to Base (m)	Remarks

Dynamic Sample Drill Run Information						
Run No.	Top Depth (m)	Base Depth (m)	Duration	Hole Diameter (mm)	Sample Recovery (%)	Remarks

Project Specific Time Related Remarks				Drilling Progress by Time				
Date Time Start	Date Time End	Duration	Remarks	Date Time	Depth (m)	Casing Depth (m)	Water Depth (m)	Remarks

SPT								
Top Depth (m)	Test Type	Casing Depth (m)	Water Depth (m)	Self Weight Penetration (mm)	Reported Result (N Value)	Hammer Serial No.	Energy Ratio %	Remarks

Water Strikes and Details							
Depth Strike (m)	Date Time	Depth Casing (m)	Depth Sealed (m)	Remarks	Time Elapsed (mins)	Water Depth (m)	Remarks

Installation Details						Pipe Construction				
Distance	Point Ref.	Type	Top of Response Zone (m)	Base of Response Zone (m)	Pipe Ref.	Pipe Reference	Depth Top (m)	Depth Base (m)	Diameter (mm)	Pipe Type

Backfill Details			
Depth Top	Depth Base	Material	Remarks
0.00 0.12	0.12 0.55	Blacktop Gravel Backfill	

Status:	FINAL	Log Print Date and Time:	25/09/2024 03:06	Log Approved By:	JNR
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Fall Height (mm)	500	Cone Diameter (mm)	50.5	Abort Reason Groundwater at 4.11m on completion of borehole. Dynamic probe carried out from base of borehole to 14.5mbgl.	
Hammer Mass (kg)	63.5	Final Depth (m bgl)	6.45		
Probe Type	DPSH-B				
Status:	FINAL	Log Print Date and Time:	25/09/2024 03:06	Log Approval by:	JNR



Southern Testing ST Consult

Start - End Date:

29/07/2024

Project ID:

J15721

Hole Type:

WLS+DP

WLS02

Sheet 2 of 2

Client:

Glanville Consultants Ltd

Co-ordinates:

E 390147 - N 413373

Level (m AOD)

126.97

Logger:

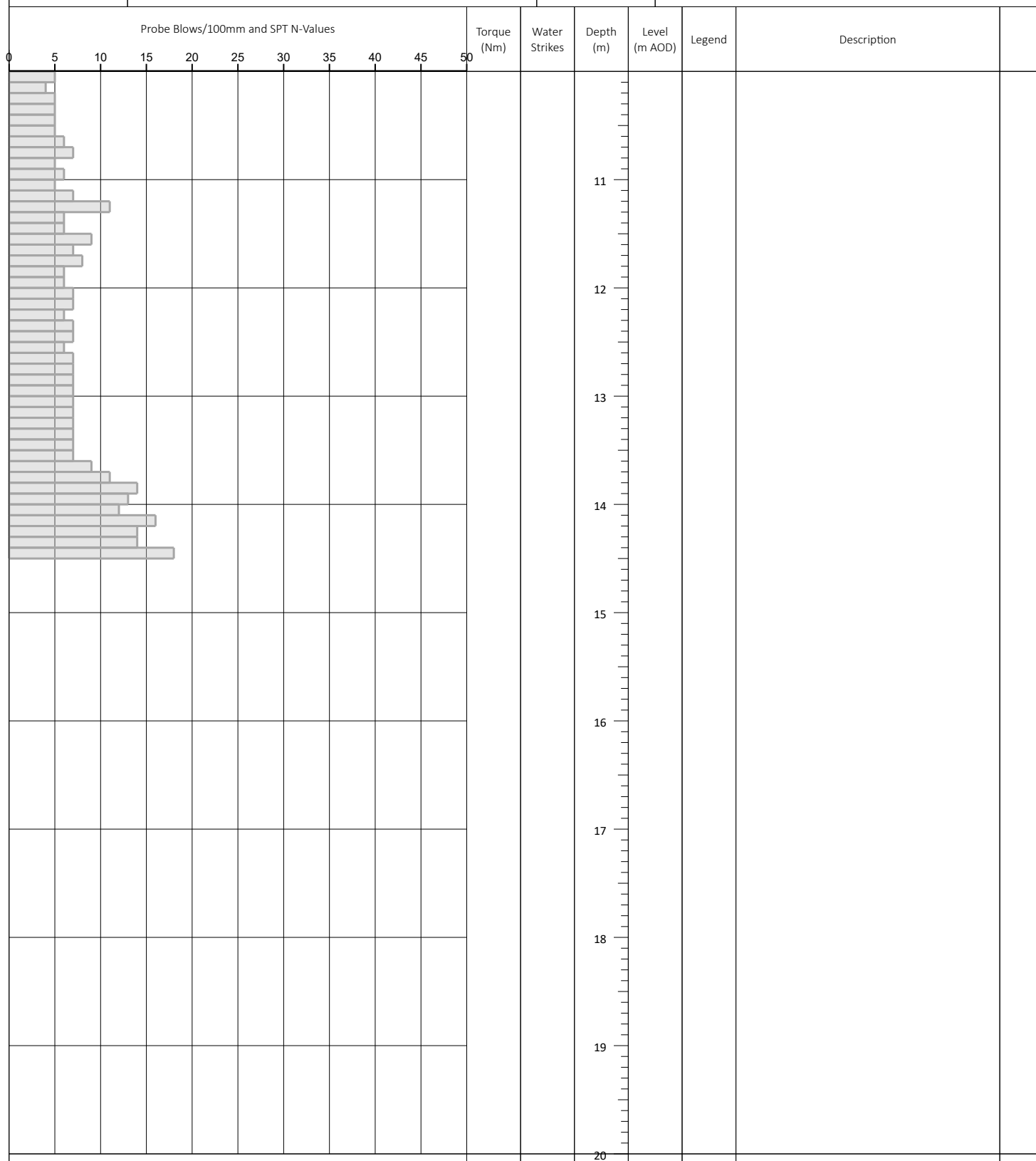
VF

Project Name:

Molesworth Street, Rochdale

Location:

Rochdale, OL16 1TL

[illegible]

500

Cone Diameter (mm)

50.5

Abort Reason

Hammer Mass (kg)

63.5

Final Depth (m bgl)

6.45

Groundwater at 4.11m on completion of borehole.

Dynamic probe carried out from base of borehole to 14.5mbgl.

Probe Type	DPSH-B
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Status:

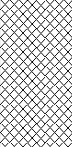
FINAL

Log Print Date and Time:	
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25/09/2024 03:06

Log Approval by:

JNR

				Start - End Date:		Project ID:		Hole Type:		WLS03					
				29/07/2024		J15721		WLS		Sheet 1 of 1					
Client:		Glanville Consultants Ltd				Co-ordinates:			Level (m AOD)		Logger:				
						E 390160 - N 413361			128.90		VF				
Project Name:		Molesworth Street, Rochdale				Location:		Rochdale, OL16 1TL							
Well	Water Strikes	Samples and Insitu Testing			Progress		Depth (m)	Level (m AOD)	Legend	Stratum Description					
		Depth (m)	Type/Fl	Results	Runs										
						0.11	(0.11) 128.79		BLACKTOP SURFACING				1		
							(0.34)		Grey, sandy GRAVEL of fine to coarse angular to subangular concrete and limestone. Sand is fine to coarse grained.						
						0.45	128.45		MADE GROUND						
		0.60	ES								Very loose, greyish brown, very sandy GRAVEL of fine to coarse angular to subangular concrete, clinker and blacktop. Sand is fine to coarse grained.				2
											MADE GROUND				
		1.00	D SPT	N=0 (1,0/0,0,0,0)			(1.05)		From 1.0m, very gravelly SAND/very sandy GRAVEL.						
		1.60	ES								Loose, dark brown/black, silty gravelly fine to medium SAND. Gravel consists of fine to coarse angular to subangular brick, concrete, limestone and glass.				3
											MADE GROUND				
		2.00	SPT	N=7 (1,1/2,2,2,1)			(0.90)		Soft to firm, dark brown, very sandy gravelly CLAY. Sand is fine to medium grained. Gravel consists of fine to coarse flint, brick and clinker.						
		2.50	HP	UCS(kPa)=140			2.40	126.50		MADE GROUND				4	
		2.75	HP	UCS(kPa)=110											
		3.00	HP SPT	UCS(kPa)=80 N=5 (2,1/1,1,1,2)			(1.10)		Loose, greyish brown, clayey to very clayey fine to medium SAND.						
		3.25	HP	UCS(kPa)=120							ALLUVIUM				5
		3.50	HP	UCS(kPa)=150			3.50	125.40							
		4.00	SPT	N=8 (2,2/2,1,3,2)			(0.95)								
							4.45	124.45		End of Borehole at 4.45m					
		Remarks:													
Borehole dry on completion.															
Status:		FINAL		Log Print Date and Time:		25/09/2024 03:06		Log Approved By:		JNR					

	Start - End Date:	Project ID:	Hole Type:	WLS03
	29/07/2024	J15721	WLS	Sheet 1 of 1

Depth Related Hole Information									
Top Depth (m)	Base Depth (m)	Hole Type	Start Date	End Date	Crew	Plant Used	Contractor	Logged By	Remarks
0.00 1.00	1.00 4.45	IP WLS	29/07/2024 29/07/2024	29/07/2024 29/07/2024	OS/GC OS/GC	Hand Dug Premier Rig	STL STL	VF VF	

Hole Diameter			Casing Diameter		
Hole Diameter (mm)	Depth to Base (m)	Remarks	Casing Diameter (mm)	Depth to Base (m)	Remarks

Dynamic Sample Drill Run Information						
Run No.	Top Depth (m)	Base Depth (m)	Duration	Hole Diameter (mm)	Sample Recovery (%)	Remarks

Project Specific Time Related Remarks				Drilling Progress by Time				
Date Time Start	Date Time End	Duration	Remarks	Date Time	Depth (m)	Casing Depth (m)	Water Depth (m)	Remarks

SPT								
Top Depth (m)	Test Type	Casing Depth (m)	Water Depth (m)	Self Weight Penetration (mm)	Reported Result (N Value)	Hammer Serial No.	Energy Ratio %	Remarks
1.00	S			0	N=0 (1,0/0,0,0,0)	E1PREM	92	
2.00	S			0	N=7 (1,1/2,2,2,1)	E1PREM	92	
3.00	S			0	N=5 (2,1/1,1,1,2)	E1PREM	92	
4.00	S			0	N=8 (2,2/1,3,2)	E1PREM	92	

Water Strikes and Details							
Depth Strike (m)	Date Time	Depth Casing (m)	Depth Sealed (m)	Remarks	Time Elapsed (mins)	Water Depth (m)	Remarks

Installation Details						Pipe Construction				
Distance	Point Ref.	Type	Top of Response Zone (m)	Base of Response Zone (m)	Pipe Ref.	Pipe Reference	Depth Top (m)	Depth Base (m)	Diameter (mm)	Pipe Type

Backfill Details			
Depth Top	Depth Base	Material	Remarks
0.00 0.10	0.10 4.45	Bentonite Arisings	

Status:	FINAL	Log Print Date and Time:	25/09/2024 03:06	Log Approved By:	JNR
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	Start - End Date:	Project ID:	Hole Type:	WLS04
	30/07/2024	J15721	WLS	Sheet 1 of 1

Depth Related Hole Information									
Top Depth (m)	Base Depth (m)	Hole Type	Start Date	End Date	Crew	Plant Used	Contractor	Logged By	Remarks
0.00 1.00	1.00 3.45	IP WLS	30/07/2024 30/07/2024	30/07/2024 30/07/2024	OS/GC OS/GC	Hand Dug Premier Rig	STL STL	VF VF	

Hole Diameter			Casing Diameter		
Hole Diameter (mm)	Depth to Base (m)	Remarks	Casing Diameter (mm)	Depth to Base (m)	Remarks

Dynamic Sample Drill Run Information						
Run No.	Top Depth (m)	Base Depth (m)	Duration	Hole Diameter (mm)	Sample Recovery (%)	Remarks

Project Specific Time Related Remarks				Drilling Progress by Time				
Date Time Start	Date Time End	Duration	Remarks	Date Time	Depth (m)	Casing Depth (m)	Water Depth (m)	Remarks

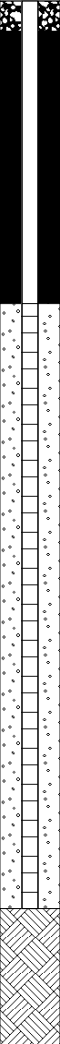
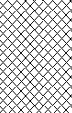
SPT								
Top Depth (m)	Test Type	Casing Depth (m)	Water Depth (m)	Self Weight Penetration (mm)	Reported Result (N Value)	Hammer Serial No.	Energy Ratio %	Remarks
1.00 2.00 3.00	S S S			0 0 0	N=0 (1,1/0,0,0,0) N=2 (1,1/0,0,0,2) N=11 (2,3/3,3,3,2)	E1PREM E1PREM E1PREM	92 92 92	

Water Strikes and Details							
Depth Strike (m)	Date Time	Depth Casing (m)	Depth Sealed (m)	Remarks	Time Elapsed (mins)	Water Depth (m)	Remarks

Installation Details						Pipe Construction				
Distance	Point Ref.	Type	Top of Response Zone (m)	Base of Response Zone (m)	Pipe Ref.	Pipe Reference	Depth Top (m)	Depth Base (m)	Diameter (mm)	Pipe Type

Backfill Details			
Depth Top	Depth Base	Material	Remarks
0.00 0.10	0.10 3.45	Blacktop Arisings	

Status:	FINAL	Log Print Date and Time:	25/09/2024 03:06	Log Approved By:	JNR
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					Start - End Date:		Project ID:		Hole Type:		WLS05	
					30/07/2024		J15721		WLS		Sheet 1 of 1	
Client:		Glanville Consultants Ltd					Co-ordinates:		Level (m AOD)		Logger:	
							E 390111 - N 413340		127.59		VF	
Project Name:		Molesworth Street, Rochdale					Location:		Rochdale, OL16 1TL			
Well	Water Strikes	Samples and Insitu Testing			Progress		Depth (m)	Level (m AOD)	Legend	Stratum Description		
		Depth (m)	Type/Fl	Results	Runs							
		0.20	ES			0.12	(0.12) 127.47		BLACKTOP SURFACING		1	
		0.50	ES			0.40	(0.28) 127.19		Dark brown, very gravelly fine to coarse SAND with occasional roots/rootlets. Gravel consists of fine to coarse angular to subangular brick, concrete, limestone, blacktop and rare plastic.			
		1.00	D SPT	N=4 (1,0/1,1,1,1)		0.80	(0.40) 126.79		MADE GROUND Dark brown, gravelly fine to medium SAND with slightly clayey to clayey patches. Gravel consists of fine to coarse angular brick.			
		1.50	D							ALLUVIUM		2
		2.00	SPT	N=0 (0,0/0,0,0,0)			(2.65)		From 2.0m, dark greyish brown.			
		2.50	D									
		3.00	SPT	N=3 (0,0/0,1,0,2)								3
						3.45	124.14		End of Borehole at 3.45m		4	
											5	
Remarks:												
Water at 2.74m on completion of borehole. Falling head soakage test carried out within borehole.												
Status:		FINAL			Log Print Date and Time:		25/09/2024 03:06		Log Approved By:		JNR	

	Start - End Date:	Project ID:	Hole Type:	WLS05
	30/07/2024	J15721	WLS	Sheet 1 of 1

Depth Related Hole Information									
Top Depth (m)	Base Depth (m)	Hole Type	Start Date	End Date	Crew	Plant Used	Contractor	Logged By	Remarks
0.00 1.00	1.00 3.45	IP WLS	30/07/2024 30/07/2024	30/07/2024 30/07/2024	OS/GC OS/GC	Hand Dug Premier Rig	ST ST	VF VF	

Hole Diameter			Casing Diameter		
Hole Diameter (mm)	Depth to Base (m)	Remarks	Casing Diameter (mm)	Depth to Base (m)	Remarks

Dynamic Sample Drill Run Information						
Run No.	Top Depth (m)	Base Depth (m)	Duration	Hole Diameter (mm)	Sample Recovery (%)	Remarks

Project Specific Time Related Remarks				Drilling Progress by Time				
Date Time Start	Date Time End	Duration	Remarks	Date Time	Depth (m)	Casing Depth (m)	Water Depth (m)	Remarks

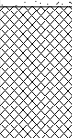
SPT								
Top Depth (m)	Test Type	Casing Depth (m)	Water Depth (m)	Self Weight Penetration (mm)	Reported Result (N Value)	Hammer Serial No.	Energy Ratio %	Remarks
1.00 2.00 3.00	S S S			0 0 0	N=4 (1,0/1,1,1,1) N=0 (0,0/0,0,0,0) N=3 (0,0/0,1,0,2)	E1PREM E1PREM E1PREM	92 92 92	

Water Strikes and Details							
Depth Strike (m)	Date Time	Depth Casing (m)	Depth Sealed (m)	Remarks	Time Elapsed (mins)	Water Depth (m)	Remarks

Installation Details						Pipe Construction				
Distance	Point Ref.	Type	Top of Response Zone (m)	Base of Response Zone (m)	Pipe Ref.	Pipe Reference	Depth Top (m)	Depth Base (m)	Diameter (mm)	Pipe Type
3.00	WLS05	SP	1.00	3.00	WLS05	WLS05 WLS05	0.00 1.00	1.00 3.00	50 50	PLAIN SLOTTED

Backfill Details			
Depth Top	Depth Base	Material	Remarks
0.00 0.10 1.00 3.00	0.10 1.00 3.00 3.45	Blacktop Bentonite Gravel Backfill Arisings	

Status:	FINAL	Log Print Date and Time:	25/09/2024 03:06	Log Approved By:	JNR
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				Start - End Date:		Project ID:	Hole Type:	WLS06			
				31/07/2024		J15721	WLS	Sheet 1 of 1			
Client:		Glanville Consultants Ltd				Co-ordinates:		Level (m AOD)	Logger:		
						E 390092 - N 413335		127.99	VF		
Project Name:		Molesworth Street, Rochdale				Location:		Rochdale, OL16 1TL			
Well	Water Strikes	Samples and Insitu Testing			Progress	Depth (m)	Level (m AOD)	Legend	Stratum Description		
		Depth (m)	Type/Fl	Results	Runs						
		0.15				0.15	(0.15)		BLACKTOP SURFACING		
							127.84				
							(0.15)				
		0.30				0.30	127.69		CONCRETE		
		0.50	D ES						Dark brown/black, silty sandy gravelly organic CLAY. Sand is fine to coarse grained. Gravel consists of fine to coarse angular to subangular brick, concrete, clinker, glass and rare yellow painted brick. MADE GROUND		
		1.00	SPT	N=37 (8,10/8,11,12,6)					Red BRICK recovered as a red very sandy fine to coarse angular GRAVEL and COBBLES. MADE GROUND	1	
		1.80					126.99				
							(0.80)				
2.00	ES SPT	N=15 (2,4/4,4,3)					Loose to medium dense, yellowish brown, very gravelly fine to coarse SAND. Gravel consists of fine to coarse angular to subangular sandstone, brick and slate. MADE GROUND	2			
2.50	D						Firm dark grey, silty CLAY. ALLUVIUM				
2.70	HP	UCS(kPa)=100									
3.00	HP SPT	UCS(kPa)=130 N=5 (1,1/1,2,1,1)						3			
3.50	D										
4.00	SPT	N=5 (1,1/1,1,1,2)						4			
4.45											
End of Borehole at 4.45m											5
Remarks:											
Water at base on completion of borehole.											
Status:		FINAL		Log Print Date and Time:		25/09/2024 03:06		Log Approved By:		JNR	

	Start - End Date:	Project ID:	Hole Type:	WLS06
	31/07/2024	J15721	WLS	Sheet 1 of 1

Depth Related Hole Information									
Top Depth (m)	Base Depth (m)	Hole Type	Start Date	End Date	Crew	Plant Used	Contractor	Logged By	Remarks
0.00 1.00	1.00 4.45	IP WLS	31/07/2024 31/07/2024	31/07/2024 31/07/2024	OS/GC OS/GC	Hand Dug Premier Rig	STL STL	VF VF	

Hole Diameter			Casing Diameter		
Hole Diameter (mm)	Depth to Base (m)	Remarks	Casing Diameter (mm)	Depth to Base (m)	Remarks

Dynamic Sample Drill Run Information						
Run No.	Top Depth (m)	Base Depth (m)	Duration	Hole Diameter (mm)	Sample Recovery (%)	Remarks

Project Specific Time Related Remarks				Drilling Progress by Time				
Date Time Start	Date Time End	Duration	Remarks	Date Time	Depth (m)	Casing Depth (m)	Water Depth (m)	Remarks

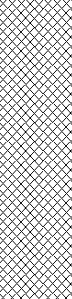
SPT								
Top Depth (m)	Test Type	Casing Depth (m)	Water Depth (m)	Self Weight Penetration (mm)	Reported Result (N Value)	Hammer Serial No.	Energy Ratio %	Remarks
1.00	S			0	N=37 (8,10/8,11,12,6)	E1PREM	92	
2.00	S			0	N=15 (2,4/4,4,4,3)	E1PREM	92	
3.00	S			0	N=5 (1,1/1,2,1,1)	E1PREM	92	
4.00	S			0	N=5 (1,1/1,1,1,2)	E1PREM	92	

Water Strikes and Details							
Depth Strike (m)	Date Time	Depth Casing (m)	Depth Sealed (m)	Remarks	Time Elapsed (mins)	Water Depth (m)	Remarks

Installation Details						Pipe Construction				
Distance	Point Ref.	Type	Top of Response Zone (m)	Base of Response Zone (m)	Pipe Ref.	Pipe Reference	Depth Top (m)	Depth Base (m)	Diameter (mm)	Pipe Type

Backfill Details			
Depth Top	Depth Base	Material	Remarks
0.00 0.15	0.15 4.45	Blacktop Arisings	

Status:	FINAL	Log Print Date and Time:	25/09/2024 03:06	Log Approved By:	JNR
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					Start - End Date:		Project ID:		Hole Type:		WLS06a	
					30/07/2024		J15721		WLS		Sheet 1 of 1	
Client:		Glanville Consultants Ltd					Co-ordinates:		Level (m AOD)		Logger:	
							E 390093 - N 413331		128.19		VF	
Project Name:		Molesworth Street, Rochdale					Location:		Rochdale, OL16 1TL			
Well	Water Strikes	Samples and Insitu Testing			Progress		Depth (m)	Level (m AOD)	Legend	Stratum Description		
		Depth (m)	Type/Fl	Results	Runs							
						0.15	(0.15) 128.04		BLACKTOP SURFACING		1	
							(1.00)		Dark brown, very gravelly slightly cobbly fine to coarse SAND. Gravel consists of fine to coarse angular to subangular brick, slate, concrete, ceramic and glass. MADE GROUND			
						1.15	127.04		SPT at 1m refused on brick.			
									End of Borehole at 1.15m		2	
											3	
											4	
											5	
Remarks:												
Obstruction at 1.15m, unable to progress further. Borehole terminated and relocated. No groundwater encountered.												
Status:		FINAL			Log Print Date and Time:		25/09/2024 03:06		Log Approved By:		JNR	

	Start - End Date:	Project ID:	Hole Type:	WLS06a
	30/07/2024	J15721	WLS	Sheet 1 of 1

Depth Related Hole Information									
Top Depth (m)	Base Depth (m)	Hole Type	Start Date	End Date	Crew	Plant Used	Contractor	Logged By	Remarks
0.00 1.00	1.00 1.15	IP WLS	30/07/2024 30/07/2024	30/07/2024 30/07/2024	OS/GC OS/GC	Hand Dug Premier Rig	ST ST	VF VF	

Hole Diameter			Casing Diameter		
Hole Diameter (mm)	Depth to Base (m)	Remarks	Casing Diameter (mm)	Depth to Base (m)	Remarks

Dynamic Sample Drill Run Information						
Run No.	Top Depth (m)	Base Depth (m)	Duration	Hole Diameter (mm)	Sample Recovery (%)	Remarks

Project Specific Time Related Remarks				Drilling Progress by Time				
Date Time Start	Date Time End	Duration	Remarks	Date Time	Depth (m)	Casing Depth (m)	Water Depth (m)	Remarks

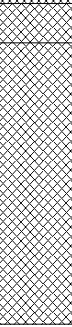
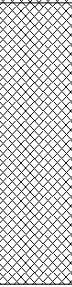
SPT								
Top Depth (m)	Test Type	Casing Depth (m)	Water Depth (m)	Self Weight Penetration (mm)	Reported Result (N Value)	Hammer Serial No.	Energy Ratio %	Remarks

Water Strikes and Details							
Depth Strike (m)	Date Time	Depth Casing (m)	Depth Sealed (m)	Remarks	Time Elapsed (mins)	Water Depth (m)	Remarks

Installation Details						Pipe Construction				
Distance	Point Ref.	Type	Top of Response Zone (m)	Base of Response Zone (m)	Pipe Ref.	Pipe Reference	Depth Top (m)	Depth Base (m)	Diameter (mm)	Pipe Type

Backfill Details			
Depth Top	Depth Base	Material	Remarks
0.00 0.15	0.15 1.15	Blacktop Arisings	

Status:	FINAL	Log Print Date and Time:	25/09/2024 03:06	Log Approved By:	JNR
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						Start - End Date:		Project ID:		Hole Type:		WLS06b	
						30/07/2024		J15721		WLS		Sheet 1 of 1	
Client:		Glanville Consultants Ltd				Co-ordinates:		Level (m AOD)		Logger:			
						E 390093 - N 413332		128.21		VF			
Project Name:		Molesworth Street, Rochdale				Location:		Rochdale, OL16 1TL					
Well	Water Strikes	Samples and Insitu Testing			Progress		Depth (m)	Level (m AOD)	Legend	Stratum Description			
		Depth (m)	Type/Fl	Results	Runs								
						0.17	(0.17) 128.04		BLACKTOP SURFACING		1		
						0.30	(0.13) 127.91		Grey, very gravelly slightly sandy CLAY with occasional cobbles of sandstone and brick. Gravel consists of fine to coarse angular to subangular brick, limestone and concrete. MADE GROUND				
							(0.93)		Dark brown/black, gravelly fine to coarse SAND with clayey patches. Gravel consists of fine to coarse angular brick, limestone, concrete and glass. MADE GROUND				
									SPT at 1m refused on brick.				
						1.23	126.98		End of Borehole at 1.23m				
											2		
											3		
											4		
											5		
Remarks:													
Obstruction at 1.23m, unable to progress further. Borehole terminated and relocated. No groundwater encountered.													
Status:		FINAL		Log Print Date and Time:		25/09/2024 03:06		Log Approved By:		JNR			

	Start - End Date:	Project ID:	Hole Type:	WLS06b
	30/07/2024	J15721	WLS	Sheet 1 of 1

Depth Related Hole Information									
Top Depth (m)	Base Depth (m)	Hole Type	Start Date	End Date	Crew	Plant Used	Contractor	Logged By	Remarks
0.00 1.00	1.00 1.23	IP WLS	30/07/2024 30/07/2024	30/07/2024 30/07/2024	OS/GC OS/GC	Hand Dug Premier Rig	STL STL	VF VF	

Hole Diameter			Casing Diameter		
Hole Diameter (mm)	Depth to Base (m)	Remarks	Casing Diameter (mm)	Depth to Base (m)	Remarks

Dynamic Sample Drill Run Information						
Run No.	Top Depth (m)	Base Depth (m)	Duration	Hole Diameter (mm)	Sample Recovery (%)	Remarks

Project Specific Time Related Remarks				Drilling Progress by Time				
Date Time Start	Date Time End	Duration	Remarks	Date Time	Depth (m)	Casing Depth (m)	Water Depth (m)	Remarks

SPT								
Top Depth (m)	Test Type	Casing Depth (m)	Water Depth (m)	Self Weight Penetration (mm)	Reported Result (N Value)	Hammer Serial No.	Energy Ratio %	Remarks

Water Strikes and Details							
Depth Strike (m)	Date Time	Depth Casing (m)	Depth Sealed (m)	Remarks	Time Elapsed (mins)	Water Depth (m)	Remarks

Installation Details						Pipe Construction				
Distance	Point Ref.	Type	Top of Response Zone (m)	Base of Response Zone (m)	Pipe Ref.	Pipe Reference	Depth Top (m)	Depth Base (m)	Diameter (mm)	Pipe Type

Backfill Details			
Depth Top	Depth Base	Material	Remarks
0.00 0.15	0.15 1.23	Blacktop Arisings	

Status:	FINAL	Log Print Date and Time:	25/09/2024 03:06	Log Approved By:	JNR
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Depth Related Hole Information									
Top Depth (m)	Base Depth (m)	Hole Type	Start Date	End Date	Crew	Plant Used	Contractor	Logged By	Remarks
0.00	0.23	IP	31/07/2024	31/07/2024	OS/GC	Hand Dug	STL	VF	

Hole Diameter			Casing Diameter		
Hole Diameter (mm)	Depth to Base (m)	Remarks	Casing Diameter (mm)	Depth to Base (m)	Remarks

Dynamic Sample Drill Run Information						
Run No.	Top Depth (m)	Base Depth (m)	Duration	Hole Diameter (mm)	Sample Recovery (%)	Remarks

Project Specific Time Related Remarks				Drilling Progress by Time				
Date Time Start	Date Time End	Duration	Remarks	Date Time	Depth (m)	Casing Depth (m)	Water Depth (m)	Remarks

SPT								
Top Depth (m)	Test Type	Casing Depth (m)	Water Depth (m)	Self Weight Penetration (mm)	Reported Result (N Value)	Hammer Serial No.	Energy Ratio %	Remarks

Water Strikes and Details							
Depth Strike (m)	Date Time	Depth Casing (m)	Depth Sealed (m)	Remarks	Time Elapsed (mins)	Water Depth (m)	Remarks

Installation Details						Pipe Construction				
Distance	Point Ref.	Type	Top of Response Zone (m)	Base of Response Zone (m)	Pipe Ref.	Pipe Reference	Depth Top (m)	Depth Base (m)	Diameter (mm)	Pipe Type

Backfill Details			
Depth Top	Depth Base	Material	Remarks
0.00 0.05	0.05 0.23	Blacktop Concrete	

	Start - End Date:	Project ID:	Hole Type:	WLS07b
	31/07/2024	J15721	WLS	Sheet 1 of 1

Depth Related Hole Information									
Top Depth (m)	Base Depth (m)	Hole Type	Start Date	End Date	Crew	Plant Used	Contractor	Logged By	Remarks
0.00	0.25	IP	31/07/2024	31/07/2024	OS/GC	Hand Dug	STL	VF	

Hole Diameter			Casing Diameter		
Hole Diameter (mm)	Depth to Base (m)	Remarks	Casing Diameter (mm)	Depth to Base (m)	Remarks

Dynamic Sample Drill Run Information						
Run No.	Top Depth (m)	Base Depth (m)	Duration	Hole Diameter (mm)	Sample Recovery (%)	Remarks

Project Specific Time Related Remarks				Drilling Progress by Time				
Date Time Start	Date Time End	Duration	Remarks	Date Time	Depth (m)	Casing Depth (m)	Water Depth (m)	Remarks

SPT								
Top Depth (m)	Test Type	Casing Depth (m)	Water Depth (m)	Self Weight Penetration (mm)	Reported Result (N Value)	Hammer Serial No.	Energy Ratio %	Remarks

Water Strikes and Details							
Depth Strike (m)	Date Time	Depth Casing (m)	Depth Sealed (m)	Remarks	Time Elapsed (mins)	Water Depth (m)	Remarks

Installation Details						Pipe Construction				
Distance	Point Ref.	Type	Top of Response Zone (m)	Base of Response Zone (m)	Pipe Ref.	Pipe Reference	Depth Top (m)	Depth Base (m)	Diameter (mm)	Pipe Type

Backfill Details			
Depth Top	Depth Base	Material	Remarks
0.00 0.05	0.05 0.25	Blacktop Concrete	

Status:	FINAL	Log Print Date and Time:	25/09/2024 03:06	Log Approved By:	JNR
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					Start - End Date:		Project ID:		Hole Type:		WLS07c	
					31/07/2024		J15721		WLS		Sheet 1 of 1	
Client:		Glanville Consultants Ltd					Co-ordinates:		Level (m AOD)		Logger:	
							E 390094 - N 413351		124.10		VF	
Project Name:		Molesworth Street, Rochdale					Location:		Rochdale, OL16 1TL			
Well	Water Strikes	Samples and Insitu Testing			Progress		Depth (m)	Level (m AOD)	Legend	Stratum Description		
		Depth (m)	Type/Fl	Results	Runs							
						0.05	124.05		BLACKTOP SURFACE		1	
							(0.15)		CONCRETE			
						0.20	123.90		End of Borehole at 0.20m			
											2	
											3	
											4	
											5	
Remarks:												
Concrete slab at encountered at 0.20m. Borehole terminated and relocated.												
Status:		FINAL			Log Print Date and Time:		25/09/2024 03:06		Log Approved By:		JNR	

	Start - End Date:	Project ID:	Hole Type:	WLS07c
	31/07/2024	J15721	WLS	Sheet 1 of 1

Depth Related Hole Information									
Top Depth (m)	Base Depth (m)	Hole Type	Start Date	End Date	Crew	Plant Used	Contractor	Logged By	Remarks
0.00	0.20	IP	31/07/2024	31/07/2024	OS/GC	Hand Dug	STL	VF	

Hole Diameter			Casing Diameter		
Hole Diameter (mm)	Depth to Base (m)	Remarks	Casing Diameter (mm)	Depth to Base (m)	Remarks

Dynamic Sample Drill Run Information						
Run No.	Top Depth (m)	Base Depth (m)	Duration	Hole Diameter (mm)	Sample Recovery (%)	Remarks

Project Specific Time Related Remarks				Drilling Progress by Time				
Date Time Start	Date Time End	Duration	Remarks	Date Time	Depth (m)	Casing Depth (m)	Water Depth (m)	Remarks

SPT								
Top Depth (m)	Test Type	Casing Depth (m)	Water Depth (m)	Self Weight Penetration (mm)	Reported Result (N Value)	Hammer Serial No.	Energy Ratio %	Remarks

Water Strikes and Details							
Depth Strike (m)	Date Time	Depth Casing (m)	Depth Sealed (m)	Remarks	Time Elapsed (mins)	Water Depth (m)	Remarks

Installation Details						Pipe Construction				
Distance	Point Ref.	Type	Top of Response Zone (m)	Base of Response Zone (m)	Pipe Ref.	Pipe Reference	Depth Top (m)	Depth Base (m)	Diameter (mm)	Pipe Type

Backfill Details			
Depth Top	Depth Base	Material	Remarks
0.00 0.05	0.05 0.20	Blacktop Concrete	

Status:	FINAL	Log Print Date and Time:	25/09/2024 03:06	Log Approved By:	JNR
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Rochdale, OL16 1TL

Status:	FINAL	Log Print Date and Time:	25/09/2024 03:06	Log Approved By:	JNR
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	Start - End Date:	Project ID:	Hole Type:	WLS08
	31/07/2024	J15721	WLS	Sheet 1 of 1

Depth Related Hole Information									
Top Depth (m)	Base Depth (m)	Hole Type	Start Date	End Date	Crew	Plant Used	Contractor	Logged By	Remarks
0.00 1.00	1.00 3.45	IP WLS	31/07/2024 31/07/2024	31/07/2024 31/07/2024	OS/GC OS/GC	Hand Dug Premier Rig	ST STL	VF VF	

Hole Diameter			Casing Diameter		
Hole Diameter (mm)	Depth to Base (m)	Remarks	Casing Diameter (mm)	Depth to Base (m)	Remarks

Dynamic Sample Drill Run Information						
Run No.	Top Depth (m)	Base Depth (m)	Duration	Hole Diameter (mm)	Sample Recovery (%)	Remarks

Project Specific Time Related Remarks				Drilling Progress by Time				
Date Time Start	Date Time End	Duration	Remarks	Date Time	Depth (m)	Casing Depth (m)	Water Depth (m)	Remarks

SPT								
Top Depth (m)	Test Type	Casing Depth (m)	Water Depth (m)	Self Weight Penetration (mm)	Reported Result (N Value)	Hammer Serial No.	Energy Ratio %	Remarks
1.00 2.00 3.00	S S S			0 0 0	N=0 (0,0/0,0,0,0) N=7 (1,0/1,2,2,2) N=8 (2,2/2,2,2,2)	E1PREM E1PREM E1PREM	92 92 92	

Water Strikes and Details							
Depth Strike (m)	Date Time	Depth Casing (m)	Depth Sealed (m)	Remarks	Time Elapsed (mins)	Water Depth (m)	Remarks

Installation Details						Pipe Construction				
Distance	Point Ref.	Type	Top of Response Zone (m)	Base of Response Zone (m)	Pipe Ref.	Pipe Reference	Depth Top (m)	Depth Base (m)	Diameter (mm)	Pipe Type

Backfill Details			
Depth Top	Depth Base	Material	Remarks

Status:	FINAL	Log Print Date and Time:	25/09/2024 03:06	Log Approved By:	JNR
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				Start - End Date:		Project ID:		Hole Type:		WLS09	
				31/07/2024		J15721		WLS		Sheet 1 of 1	
Client:		Glanville Consultants Ltd				Co-ordinates:		Level (m AOD)		Logger:	
						E 390132 - N 413384		125.85		VF	
Project Name:		Molesworth Street, Rochdale				Location:		Rochdale, OL16 1TL			
Well	Water Strikes	Samples and Insitu Testing			Progress		Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type/Fl	Results	Runs						
		0.30	ES			0.10	(0.10)		BLACKTOP SURFACING	1	
							125.75		Brown, sandy very gravelly CLAY. Gravel consists of fine to coarse angular limestone, brick and concrete. MADE GROUND		
		0.50				0.50	125.35		Red BRICK recovered as a very sandy GRAVEL and COBBLES. MADE GROUND		
							(0.30)				
		1.00	ES SPT	N=3 (3,1/0,1,1,1)		0.80	125.05		Dark brown and red, very sandy GRAVEL of fine to coarse angular brick and concrete. Sand is fine to coarse grained. MADE GROUND		
							(0.30)				
		1.30	D			1.10	124.75		Soft, brown, silty slightly sandy slightly gravelly CLAY. Sand is fine to coarse grained. Gravel consists of fine to coarse angular to subangular brick and clinker. MADE GROUND		
							(0.60)				
		2.00	SPT	N=24 (3,7/7,8,5,4)		1.70	124.15		Medium dense, dark brown/black, gravelly ashy fine to coarse SAND. Gravel consists of fine to coarse angular clinker and brick. MADE GROUND		
							(1.10)				
3.00	HP SPT	UCS(kPa)=50 N=2 (1,1/1,0,1,0)		2.80	123.05		Soft, greyish brown, very sandy CLAY ALLUVIUM				
					(0.65)						
					3.45	122.40		End of Borehole at 3.45m	5		
Remarks:											
Borehole dry on completion.											
Status:		FINAL		Log Print Date and Time:		25/09/2024 03:06		Log Approved By:		JNR	

	Start - End Date:	Project ID:	Hole Type:	WLS09
	31/07/2024	J15721	WLS	Sheet 1 of 1

Depth Related Hole Information									
Top Depth (m)	Base Depth (m)	Hole Type	Start Date	End Date	Crew	Plant Used	Contractor	Logged By	Remarks
0.00 1.00	1.00 3.45	IP WLS	31/07/2024 31/07/2024	31/07/2024 31/07/2024	OS/GC OS/GC	Hand Dug Premier Rig	STL ST	VF VF	

Hole Diameter			Casing Diameter		
Hole Diameter (mm)	Depth to Base (m)	Remarks	Casing Diameter (mm)	Depth to Base (m)	Remarks

Dynamic Sample Drill Run Information						
Run No.	Top Depth (m)	Base Depth (m)	Duration	Hole Diameter (mm)	Sample Recovery (%)	Remarks

Project Specific Time Related Remarks				Drilling Progress by Time				
Date Time Start	Date Time End	Duration	Remarks	Date Time	Depth (m)	Casing Depth (m)	Water Depth (m)	Remarks

SPT								
Top Depth (m)	Test Type	Casing Depth (m)	Water Depth (m)	Self Weight Penetration (mm)	Reported Result (N Value)	Hammer Serial No.	Energy Ratio %	Remarks
1.00 2.00 3.00	S S S			0 0 0	N=3 (3,1/0,1,1,1) N=24 (3,7/7,8,5,4) N=2 (1,1/1,0,1,0)	E1PREM E1PREM E1PREM	92 92 92	

Water Strikes and Details							
Depth Strike (m)	Date Time	Depth Casing (m)	Depth Sealed (m)	Remarks	Time Elapsed (mins)	Water Depth (m)	Remarks

Installation Details						Pipe Construction				
Distance	Point Ref.	Type	Top of Response Zone (m)	Base of Response Zone (m)	Pipe Ref.	Pipe Reference	Depth Top (m)	Depth Base (m)	Diameter (mm)	Pipe Type

Backfill Details			
Depth Top	Depth Base	Material	Remarks
0.00 0.10	0.10 3.45	Blacktop Arisings	

Status:	FINAL	Log Print Date and Time:	25/09/2024 03:06	Log Approved By:	JNR
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Key to Exploratory Hole Logs, Plans and Sections

Backfill Symbols		Pipe Symbols		Principal Soil Types		Principal Rock Types		Drilling Records	
Arisings		Plain Pipe		Topsoil		Mudstone		Water Strike	
Concrete		Slotted Pipe		Made Ground		Claystone		Depth Water Rose	
Blacktop		Piezometer		Clay		Siltstone		Total Core Recovery (%) [TCR]	
Bentonite		Piezometer Tip		Silt		Sandstone		Solid Core Recovery (%) [SCR]	
Gravel Filter		Filter Tip		Sand		Limestone		Rock Quality Index (%) RQD]	
Sand Filter		Extensometer		Gravel		Chalk		Fracture Index (fractures / m) [FI]	
		Inclinometers		Peat					

All soil and rock descriptions are in general accordance with BS5930 2015, BS EN ISO 14688-1:2002+A1:2013 and BS EN ISO 14689-1:2003. Chalk descriptions are also based on CIRIA C574 and "Logging the Chalk – R.N. Mortimer 2015". The Geology Code is only provided where a positive identification of the sample strata has been made.

Location / Method Identifiers		In-situ Test Location / Method	
BH	Borehole (undefined)	DP	Dynamic Probe
CP	Cable Percussive	CPT	Cone Penetration Test
RC	Rotary Core	CBR	In-situ CBR Test
RO	Rotary Open Hole	DCP	CBR using Dynamic Cone Penetrometer
ODC	Rotary Odex/Symmetrix drilling cased	CBRT	CBR using TRL Probe
CP+RC	Cable Percussive to Rotary Core	PB	Plate Bearing Test
SNC	Sonic	SPT (S)	Standard Penetration Test (Split Barrel Sampler)
CFA	Continuous Flight Auger	SPT (C)	Standard Penetration Test (Solid Cone)
FA	Flight Auger	N	SPT Result
VC	Vibro Core	-/-	Blows/Penetration (mm) after seating drive
WLS+RC	Windowless (Dynamic) Sampler to Rotary Core	-*/-	Total Blows / Penetration (mm)
WLS	Windowless Sampler	()	Extrapolated Value
WS	Window Sampler	PPT	Perth Penetration (In-House Method - Equivalent N Value)
HA	Hand Auger	HP / UCS	Strength from Hand Penetrometer (kN/m ²)
C	Road / Pavement Core	IVN	Strength from Hand Vane ((kN/m ²) P = peak, R = residual
IP	Inspection Pit (Hand Excavation)	PID	Photo Ionisation Detector (ppm)
TP	Trial Pit (Machine Excavated)	MEXE	Mexi-Cone CBR (%)
OP	Observation Pit (Supported Excavation Hand or Machine)		

Samples / Test Type	
B	Bulk Sample
BLK	Block Sample
C	Core Sample
CBRS	CBR Mould Sample
D	Small Disturbed Sample
ES	Environmental Sample (Soil)
EW	Environmental Sample (Water)
GS	Environmental Sample (Gas)

Samples / Test Type	
SPTLS	Standard Penetration Test Split Barrel Sample
TW	Thin Wall Push In Sample (e.g. Shelby Sampler)
U	Undisturbed Open Drive Sample (blows to take)
UT	Thin Wall Undisturbed Open Drive Sample (blows to take)
W	Water Sample (Geotechnical)
SP	Sample from Stockpile
P	Piston Sample
AMAL	Amalgamated Sample

APPENDIX B

**Field Sampling and In-Situ
Test Methods and Results**

B

Soil and Rock Descriptions

All soil and rock descriptions are in general accordance with BS5930 Ref [4].

Anthropogenic soils ('made ground' or 'fill') describe materials which have been placed by man and can be divided into those composed of reworked natural soils and those composed of or containing man-made materials. 'Fill' is used to describe material placed in a controlled manner and 'made ground' is used to describe materials placed without strict engineering control.

The classification of materials such as topsoil is based on visual description only and should not be interpreted to mean that the material complies with criteria used in BS 3882 Ref [18].

The geology code is only provided on logs where a positive identification of the sample strata has been made.

Inspection Pit

Inspection pits are hand excavated from the surface (maximum depth 1.2 – 1.5m) using appropriate tools to locate and avoid existing buried services at exploratory hole positions. They are also regularly used as part of investigations on existing structures to expose and determine foundation detail.

Dynamic Sampling - Windowless

Windowless samplers are designed for taking disturbed, continuous soil samples to depths up to 10 metres (depending on ground conditions). The samplers comprise steel tubes of about 50-100mm diameter with a rigid plastic liner (no window) and are driven into the ground with a sliding hammer mounted on a tracked purpose-designed soil sampling rig. After driving and extracting the sampler from the ground, the plastic liner is extracted together with the enclosed soil sample. The sample can then either be extracted, split and sub-sampled or plastic end caps may be fitted, the tube labelled and transported for future examination and sub-sampling.

Soil samples are disturbed by the driving process with both techniques and can be regarded as being between Class 5 up to Class 3 samples at best (in favourable ground).

The major advantage of using windowless samplers is that the plastic liner greatly reduces the possibility of cross-contamination between successive samples.

An equivalent in-situ test to the Standard Penetration Test can be carried out with the windowless sampler rig.

Standard Penetration Test (SPT)

The Standard Penetration Test (SPT) is specified in BS EN ISO 22476-3 Ref [19]. In this test, an open-ended tube is driven into the ground by blows from a free-falling hammer (with specified sizes, weights and distances).

The tube is seated by driving to a penetration of 150mm, or by 25 blows, whichever occurs first. It is then driven for a maximum of a further 300mm and the number of blows is termed the penetration resistance (N). If 300mm penetration cannot be achieved in 50 blows, the test drive is terminated and penetration depth is recorded.

When testing in gravels, a conical end piece is attached to the tube. The test is then called an SPT(C).

A classification of relative density descriptions as used on borehole logs, based upon uncorrected SPT N values, is given within BS5930 Ref [4] and set out as follows:

Classification based on uncorrected SPT N Value	Term
0 - 4	Very Loose
4 - 10	Loose
10 – 30	Medium Dense
30 – 50	Dense
Over 50	Very Dense

Hand Penetrometer Test

The handheld soil penetrometer consists of a spring loaded and calibrated plunger which is forced into cohesive soil. A reading of unconfined compression strength (equal to twice cohesion) is given on a calibrated scale. The average of a set of three readings shall be recorded.

In common with other hand methods of strength assessment it does not give an accurate indication of bearing capacity in stiff or fissured soils, because of the small test area.

Dynamic Cone Penetrometer (DCP) CBR Test (Modified)

The dynamic cone CBR test uses light portable equipment and is used to provide a continuous record of the penetration resistance of each layer in the ground for a depth of a metre from the surface. The penetration resistance provides a measure from which CBR values may be calculated.

In the test a 22 mm diameter 60° cone is driven into the ground to a depth of up to one metre by a 9.09 kg weight, freely falling over 600 mm. The number of blows is recorded for each successive 50mm penetration increment.

A plot of the cumulative number of blows versus depth penetrated is drawn. This plot usually takes the form of a series of straight lines, the slopes of which are measured and expressed as penetration in mm per blow. It is the practice of this laboratory to adopt the lower of two values derived from formulae established by Kleyn & Van Heerden Ref [20]

$$CBR = 10^{(2.632 - 1.28 \log_{10} (mm / blow))}$$

& TRL Ref [21]

$$CBR = 10^{(2.48 - 1.057 \log_{10} (mm / blow))}$$

The test is an adaptation of the Perth Penetrometer Test developed for the granular soils in Perth West Australia in the 1960s, and in the UK by this laboratory since 1973. It is similar to the TRL dynamic cone penetrometer. Local experience by this laboratory has shown in UK conditions it has been found to give consistent results for granular soils.

Dynamic Penetration Tests

Dynamic Penetration tests are undertaken as specified within BS EN ISO 22476-2 Ref [22].

In the test a steel cone is driven into the ground using successive blows from a heavy hammer, with the object of determining a continuous record of the driving resistance.

The hammer is released automatically and falls freely over the drop height and strikes a solid steel anvil protected where necessary by a thin plastic damping disc. The rods in the ground are rotated after each metre penetration and the torque required to do so is recorded.

Blow counts are determined for each 100 mm penetration and recorded as the N10 values. A plot of N10 values versus depth is prepared for each probe test.

The DPSH-B Penetrometer complies with BS EN ISO 22476-2, as detailed below.

- Driving Cone : 90°
- Diameter : 50 mm
- Rods : 35 mm flush coupled
- Hammer : 63.5 kg
- Hammer Drop : 750 mm

Disturbed Samples

Disturbed samples were taken from exploratory holes in general accordance with BS 5930 [4] and BS EN ISO 22475-1 Ref [23] as required and stored in appropriately labelled containers. Details of the type, size and depth of sample will be recorded within the exploratory hole record. Such samples can be regarded as being between Class 5 up to Class 3 quality depending upon their method of sampling.

Open-tube Samples

Open-tube samples were taken within cohesive soils in general accordance with BS 5930 [4] and BS EN ISO 22475-1 Ref [23]. Details of the type, size and depth of sample will be recorded within the exploratory hole record. The open-tube samples were sealed with wax and had end caps fitted before transport from site. Open tube samples are typically of Class 2 or Class 1 quality depending upon the soil type, sampling technique and sampler used.

Environmental Samples

Environmental samples were taken from the boreholes at regular intervals in the made ground and natural soils as indicated on the exploratory hole logs. The sampling strategy was in general accordance with BS10175 Ref [5] and BS ISO 18400 Refs [24], [25], [26], [27] & [28].

These samples were collected and stored in glass jars or plastic pots and transferred to the laboratory in cool boxes as appropriate to the proposed laboratory testing.

Monitoring Well

A groundwater and/or ground gas monitoring well consists of a perforated pipe, which is installed in the ground. The standpipe is typically 50mm nominal in diameter and is installed in a lined borehole. It is perforated from the base with a sand/gravel surround through the soil horizon of interest to an appropriate depth below ground level. Above this there is a bentonite seal with solid pipework and is provided with an end cap or a gas valve at the top as appropriate.

Gas monitoring is carried out via the gas tap. Water sampling/purging can be undertaken by removing the gas tap and bung.

The well is usually completed at the surface with a flush cast iron cover or raised lockable cover.

Groundwater Samples

Groundwater samples were taken from exploratory holes as indicated on the logs. These samples were collected in glass or teflon bottles and transferred to the laboratory in cool boxes as appropriate to the proposed laboratory testing.

Monitoring wells were purged prior to sampling, removing a minimum of three times the volume of water in the well.

Groundwater Monitoring – Dip Meter

The dip meter is used to measure standing water levels within boreholes. The probe is lowered into the borehole until the meter detects the groundwater with an audible 'beep'. The level is then read from the tape.

In-situ Permeability Tests (after BS EN ISO 22282)

Testing within boreholes can either be a variable head test (falling or rising head) where the hydraulic pressure within the borehole during the test is either increased or lowered or a constant head where the hydraulic pressure is held constant. During boring when the required depth for testing has been reached, the borehole casing is withdrawn by one metre and the borehole cleaned out if necessary. Testing can alternatively be undertaken within a piezometer sealed into the strata of interest.

Detailed guidance for such tests are given within BS EN ISO 22282 Ref [29], and are summarised below.

- **Falling Head Test** - the borehole is filled with water and the head loss is then recorded either until the level falls to the standing water level (or until dry), or a maximum two-hour period.
- **Rising Head Test** - where a standing water level is established, the groundwater is pumped to reduce the head and then the rise in water level is recorded against time.
- **Constant Head Test** - the borehole is filled to a specified level and water is then pumped in, or discharged from a bowser, to maintain that level. The quantities of water used are recorded at regular intervals and a steady rate of flow is determined. In some cases where the borehole acceptance is very high, it may not be possible to achieve a steady state, and the quantity of water delivered to the borehole is averaged out over the test period.

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

ARCHWAY ENGINEERING UK LTD
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX5 9JP

SPT Hammer Ref: AR2499
Test Date: 04/01/2024
Report Date: 04/01/2024
File Name: AR2499 (2).spt
Test Operator: CM

Instrumented Rod Data

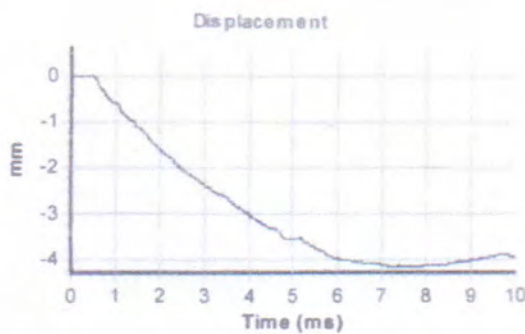
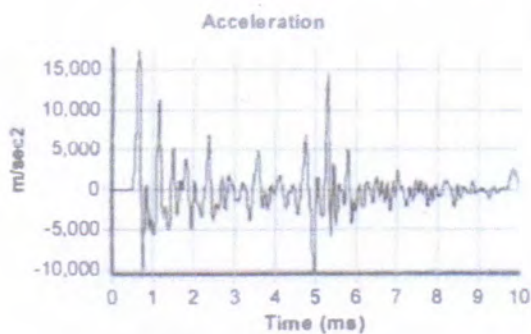
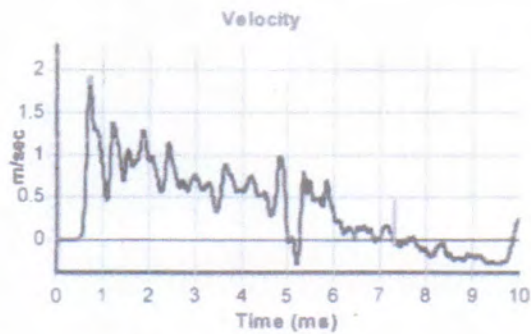
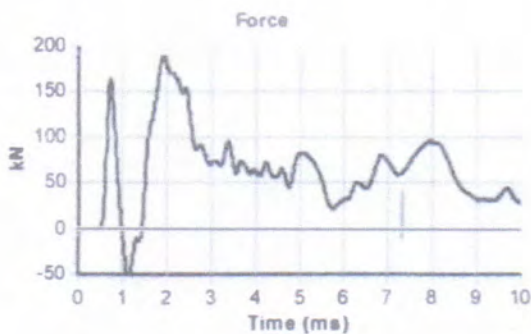
Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.0
Assumed Modulus E_a (GPa): 200
Accelerometer No.1:
Accelerometer No.2:

SPT Hammer Information

Hammer Mass m (kg): 63.5
Falling Height h (mm): 760
SPT String Length L (m): 10.0

Comments / Location

VC - 83450



Calculations

Area of Rod A (mm^2): 905
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 332

Energy Ratio E_r (%): **70**

Signed: J.LOCK

Title: FITTER

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Southern Testing
Unit 11
Charlwoods Road
East Grinstead
West Sussex
RH19 2HU

SPT Hammer Ref: E1PREM.
Test Date: 15/05/2024
Report Date: 15/05/2024
File Name: E1PREM..spt
Test Operator: BOB

Instrumented Rod Data

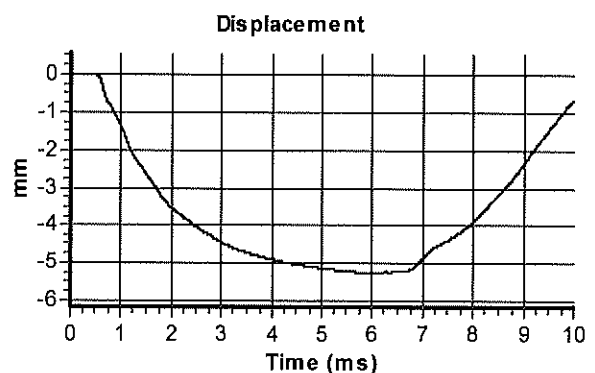
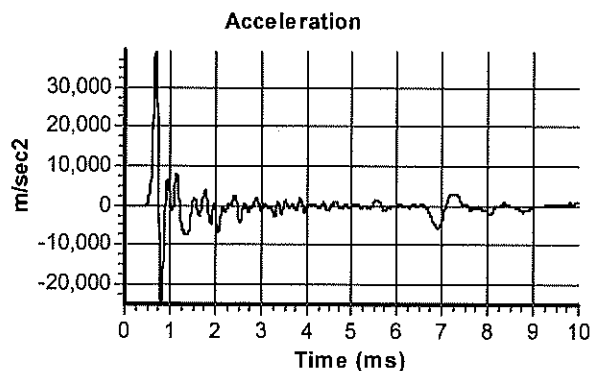
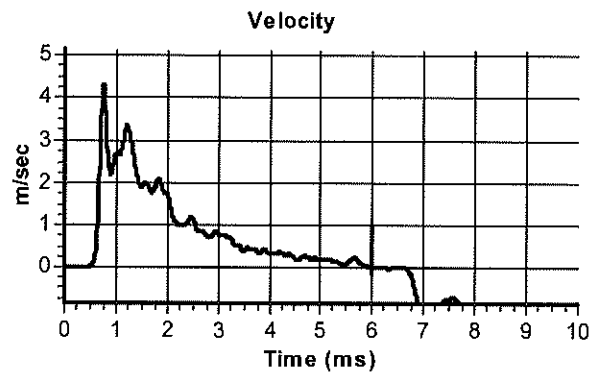
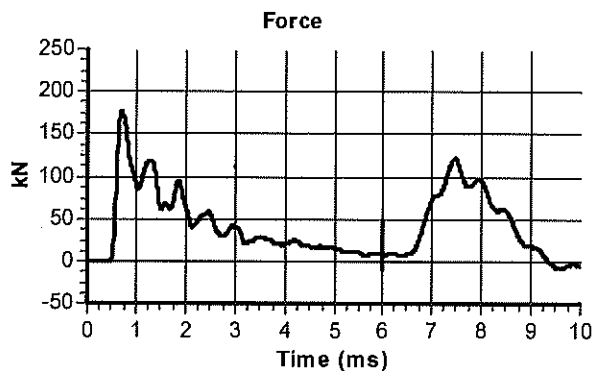
Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.4
Assumed Modulus E_a (GPa): 208
Accelerometer No.1: 73547
Accelerometer No.2: 64789

SPT Hammer Information

Hammer Mass m (kg): 63.5
Falling Height h (mm): 760
SPT String Length L (m): 14.7

Comments / Location

CHARLSWOOD



Calculations

Area of Rod A (mm²): 957
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 433

Energy Ratio E_r (%): **92**

Signed: Bob Stewart
Title: Technician

The recommended calibration interval is 12 months

Project:	Molesworth Street, Rochdale	Project ID:	J15721	Figure: SPT1
Client:	Glanville Consultants Ltd	Project Engineer:	VF	

STANDARD PENETRATION TEST (SPT) RESULTS																	* Note: N60 correction for energy delivered to rods only. Energy loss due to length of rods and overburden pressure not considered.		
Location ID	Test Depth (m bgl)	Test Type	SPT Hammer Ref.	Energy Ratio %	Seating Blows/Penetration				Main Test Blows/Penetration								N Value	N60 *	Reported Result
					SB1	SP1	SB2	SP2	MB1	MP1	MB2	MP2	MB3	MP3	MB4	MP4			
BH01	1.20	S	AR2499	70	3	75	3	75	4	75	3	75	3	75	3	75	13	15	N=13 (3,3/4,3,3,3)
BH01	2.00	S	AR2499	70	0	75	1	75	0	75	0	75	0	75	0	75	0	0	N=0 (0,1/0,0,0,0)
BH01	3.00	S	AR2499	70	1	75	1	75	1	75	1	75	1	75	1	75	4	5	N=4 (1,1/1,1,1,1)
BH01	4.00	S	AR2499	70	2	75	2	75	3	75	3	75	3	75	3	75	12	14	N=12 (2,2/3,3,3,3)
BH01	5.00	S	AR2499	70	3	75	3	75	3	75	3	75	2	75	3	75	11	13	N=11 (3,3/3,3,2,3)
BH01	6.00	S	AR2499	70	3	75	3	75	4	75	3	75	3	75	3	75	13	15	N=13 (3,3/4,3,3,3)
BH01	7.50	S	AR2499	70	4	75	5	75	5	75	4	75	5	75	6	75	20	23	N=20 (4,5/5,4,5,6)
BH01	10.50	S	AR2499	70	5	75	6	75	7	75	7	75	8	75	8	75	30	35	N=30 (5,6/7,7,8,8)
BH01	13.50	S	AR2499	70	5	75	7	75	7	75	8	75	8	75	9	75	32	37	N=32 (5,7/7,8,8,9)
BH01	16.50	S	AR2499	70	5	75	7	75	8	75	9	75	10	75	12	75	39	46	N=39 (5,7/8,9,10,12)
BH01	18.00	S	AR2499	70	6	75	7	75	8	75	10	75	12	75	12	75	42	49	N=42 (6,7/8,10,12,12)
BH02	1.20	S	AR2499	70	3	75	2	75	2	75	1	75	1	75	1	75	5	6	N=5 (3,2/2,1,1,1)
BH02	3.00	S	AR2499	70	0	75	0	75	0	75	0	75	0	75	0	75	0	0	N=0 (0,0/0,0,0,0)
BH02	4.00	S	AR2499	70	2	75	3	75	3	75	2	75	3	75	3	75	11	13	N=11 (2,3/3,2,3,3)
BH02	5.00	S	AR2499	70	2	75	3	75	3	75	3	75	3	75	3	75	12	14	N=12 (2,3/3,3,3,3)
BH02	6.00	S	AR2499	70	1	75	1	75	1	75	1	75	1	75	1	75	4	5	N=4 (1,1/1,1,1,1)
BH02	9.00	S	AR2499	70	5	75	7	75	9	75	11	75	14	75	13	75	47	55	N=47 (5,7/9,11,14,13)
BH02	10.50	S	AR2499	70	4	75	4	75	6	75	7	75	7	75	9	75	29	34	N=29 (4,4/6,7,7,9)
BH02	13.50	S	AR2499	70	5	75	7	75	7	75	9	75	10	75	10	75	36	42	N=36 (5,7/7,9,10,10)
BH02	15.00	S	AR2499	70	5	75	6	75	7	75	9	75	10	75	10	75	36	42	N=36 (5,6/7,9,10,10)
BH02	16.50	S	AR2499	70	7	75	8	75	8	75	8	75	9	75	11	75	36	42	N=36 (7,8/8,8,9,11)
BH02	18.00	S	AR2499	70	8	75	8	75	9	75	9	75	10	75	12	75	40	47	N=40 (8,8/9,9,10,12)
BH02	19.50	S	AR2499	70	5	75	5	75	8	75	10	75	9	75	12	75	39	46	N=39 (5,5/8,10,9,12)
BH03	1.20	S	AR2499	70	2	75	3	75	4	75	4	75	3	75	3	75	14	16	N=14 (2,3/4,4,3,3)
BH03	2.00	S	AR2499	70	1	75	1	75	1	75	1	75	1	75	1	75	4	5	N=4 (1,1/1,1,1,1)
BH03	3.00	S	AR2499	70	1	75	1	75	1	75	1	75	1	75	1	75	4	5	N=4 (1,1/1,1,1,1)
BH03	4.00	S	AR2499	70	2	75	2	75	1	75	1	75	1	75	1	75	4	5	N=4 (2,2/1,1,1,1)
BH03	5.00	S	AR2499	70	1	75	1	75	1	75	1	75	1	75	1	75	4	5	N=4 (1,1/1,1,1,1)
BH03	6.00	S	AR2499	70	5	75	5	75	6	75	6	75	7	75	7	75	26	30	N=26 (5,5/6,6,7,7)

Project:	Molesworth Street, Rochdale	Project ID:	J15721	Figure: SPT1
Client:	Glanville Consultants Ltd	Project Engineer:	VF	

STANDARD PENETRATION TEST (SPT) RESULTS																	* Note: N60 correction for energy delivered to rods only. Energy loss due to length of rods and overburden pressure not considered.		
Location ID	Test Depth (m bgl)	Test Type	SPT Hammer Ref.	Energy Ratio %	Seating Blows/Penetration				Main Test Blows/Penetration								N Value	N60 *	Reported Result
					SB1	SP1	SB2	SP2	MB1	MP1	MB2	MP2	MB3	MP3	MB4	MP4			
BH03	7.50	S	AR2499	70	4	75	3	75	4	75	4	75	4	75	4	75	16	19	N=16 (4,3/4,4,4,4)
BH03	9.00	S	AR2499	70	5	75	5	75	6	75	6	75	6	75	5	75	23	27	N=23 (5,5/6,6,6,5)
BH03	12.00	S	AR2499	70	5	75	6	75	7	75	7	75	7	75	7	75	28	33	N=28 (5,6/7,7,7,7)
BH03	15.00	S	AR2499	70	5	75	7	75	9	75	10	75	10	75	10	75	39	46	N=39 (5,7/9,10,10,10)
BH03	16.50	S	AR2499	70	6	75	7	75	8	75	9	75	9	75	10	75	36	42	N=36 (6,7/8,9,9,10)
BH03	18.00	S	AR2499	70	5	75	5	75	10	75	10	75	9	75	11	75	40	47	N=40 (5,5/10,10,9,11)
BH03	19.50	S	AR2499	70	5	75	6	75	10	75	12	75	12	75	12	75	46	54	N=46 (5,6/10,12,12,12)
WLS01	1.00	S	E1PREM	92	2	75	1	75	1	75	1	75	3	75	4	75	9	14	N=9 (2,1/1,1,3,4)
WLS01	2.00	S	E1PREM	92	1	75	0	75	1	75	0	75	1	75	0	75	2	3	N=2 (1,0/1,0,1,0)
WLS01	3.00	S	E1PREM	92	0	75	0	75	0	75	0	75	1	75	0	75	1	2	N=1 (0,0/0,0,1,0)
WLS01	4.00	S	E1PREM	92	0	75	0	75	0	75	1	75	1	75	1	75	3	5	N=3 (0,0/0,1,1,1)
WLS01	5.00	S	E1PREM	92	1	75	2	75	3	75	2	75	3	75	4	75	12	18	N=12 (1,2/3,2,3,4)
WLS02	1.00	S	E1PREM	92	5	75	8	75	10	75	9	75	9	75	10	75	38	58	N=38 (5,8/10,9,9,10)
WLS02	2.00	S	E1PREM	92	4	75	5	75	6	75	6	75	5	75	6	75	23	35	N=23 (4,5/6,6,5,6)
WLS02	3.00	S	E1PREM	92	1	75	0	75	0	75	1	75	0	75	1	75	2	3	N=2 (1,0/0,1,0,1)
WLS02	4.00	S	E1PREM	92	0	75	0	75	0	75	1	75	1	75	1	75	3	5	N=3 (0,0/0,1,1,1)
WLS02	5.00	S	E1PREM	92	1	75	1	75	1	75	1	75	1	75	1	75	4	6	N=4 (1,1/1,1,1,1)
WLS02	6.00	S	E1PREM	92	1	75	1	75	1	75	1	75	1	75	1	75	4	6	N=4 (1,1/1,1,1,1)
WLS03	1.00	S	E1PREM	92	1	75	0	75	0	75	0	75	0	75	0	75	0	0	N=0 (1,0/0,0,0,0)
WLS03	2.00	S	E1PREM	92	1	75	1	75	2	75	2	75	2	75	1	75	7	11	N=7 (1,1/2,2,2,1)
WLS03	3.00	S	E1PREM	92	2	75	1	75	1	75	1	75	1	75	2	75	5	8	N=5 (2,1/1,1,1,2)
WLS03	4.00	S	E1PREM	92	2	75	2	75	2	75	1	75	3	75	2	75	8	12	N=8 (2,2/2,1,3,2)
WLS04	1.00	S	E1PREM	92	1	75	1	75	0	75	0	75	0	75	0	75	0	0	N=0 (1,1/0,0,0,0)
WLS04	2.00	S	E1PREM	92	1	75	1	75	0	75	0	75	0	75	2	75	2	3	N=2 (1,1/0,0,0,2)
WLS04	3.00	S	E1PREM	92	2	75	3	75	3	75	3	75	3	75	2	75	11	17	N=11 (2,3/3,3,3,2)
WLS05	1.00	S	E1PREM	92	1	75	0	75	1	75	1	75	1	75	1	75	4	6	N=4 (1,0/1,1,1,1)
WLS05	2.00	S	E1PREM	92	0	75	0	75	0	75	0	75	0	75	0	75	0	0	N=0 (0,0/0,0,0,0)
WLS05	3.00	S	E1PREM	92	0	75	0	75	0	75	1	75	0	75	2	75	3	5	N=3 (0,0/0,1,0,2)
WLS06	1.00	S	E1PREM	92	8	75	10	75	8	75	11	75	12	75	6	75	37	57	N=37 (8,10/8,11,12,6)

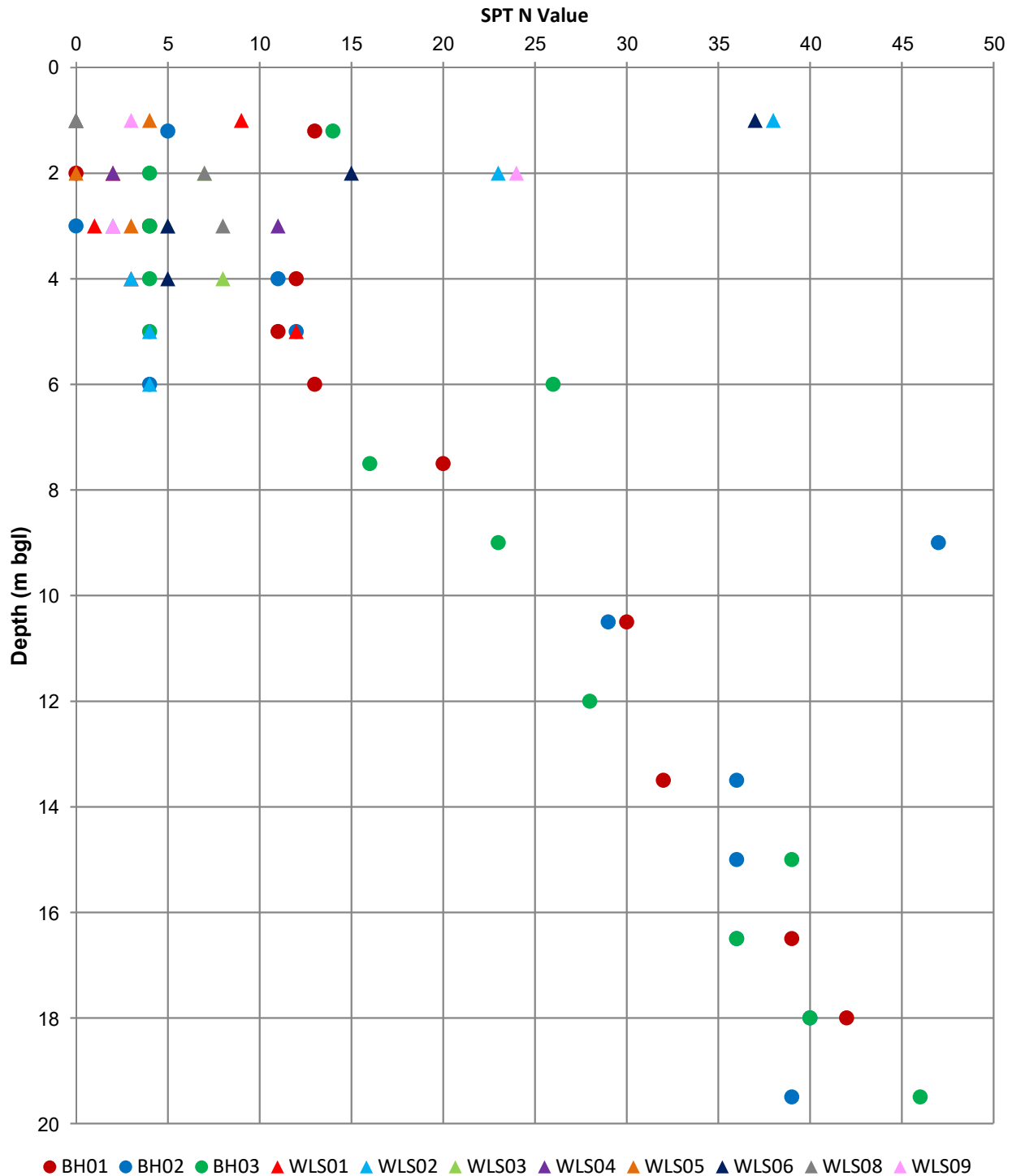
Project:	Molesworth Street, Rochdale	Project ID:	J15721	Figure: SPT1
Client:	Glanville Consultants Ltd	Project Engineer:	VF	

STANDARD PENETRATION TEST (SPT) RESULTS																	* Note: N60 correction for energy delivered to rods only. Energy loss due to length of rods and overburden pressure not considered.		
Location ID	Test Depth (m bgl)	Test Type	SPT Hammer Ref.	Energy Ratio %	Seating Blows/Penetration				Main Test Blows/Penetration								N Value	N60 *	Reported Result
					SB1	SP1	SB2	SP2	MB1	MP1	MB2	MP2	MB3	MP3	MB4	MP4			
WLS06	2.00	S	E1PREM	92	2	75	4	75	4	75	4	75	4	75	3	75	15	23	N=15 (2,4/4,4,3)
WLS06	3.00	S	E1PREM	92	1	75	1	75	1	75	2	75	1	75	1	75	5	8	N=5 (1,1/1,2,1,1)
WLS06	4.00	S	E1PREM	92	1	75	1	75	1	75	1	75	1	75	2	75	5	8	N=5 (1,1/1,1,1,2)
WLS08	1.00	S	E1PREM	92	0	75	0	75	0	75	0	75	0	75	0	75	0	0	N=0 (0,0/0,0,0,0)
WLS08	2.00	S	E1PREM	92	1	75	0	75	1	75	2	75	2	75	2	75	7	11	N=7 (1,0/1,2,2,2)
WLS08	3.00	S	E1PREM	92	2	75	2	75	2	75	2	75	2	75	2	75	8	12	N=8 (2,2/2,2,2,2)
WLS09	1.00	S	E1PREM	92	3	75	1	75	0	75	1	75	1	75	1	75	3	5	N=3 (3,1/0,1,1,1)
WLS09	2.00	S	E1PREM	92	3	75	7	75	7	75	8	75	5	75	4	75	24	37	N=24 (3,7/7,8,5,4)
WLS09	3.00	S	E1PREM	92	1	75	1	75	1	75	0	75	1	75	0	75	2	3	N=2 (1,1/1,0,1,0)



Project ID:	J15721	Project Title:	Molesworth Street, Rochdale
Client:	Glanville Consultants Ltd	Location:	Rochdale, OL16 1TL

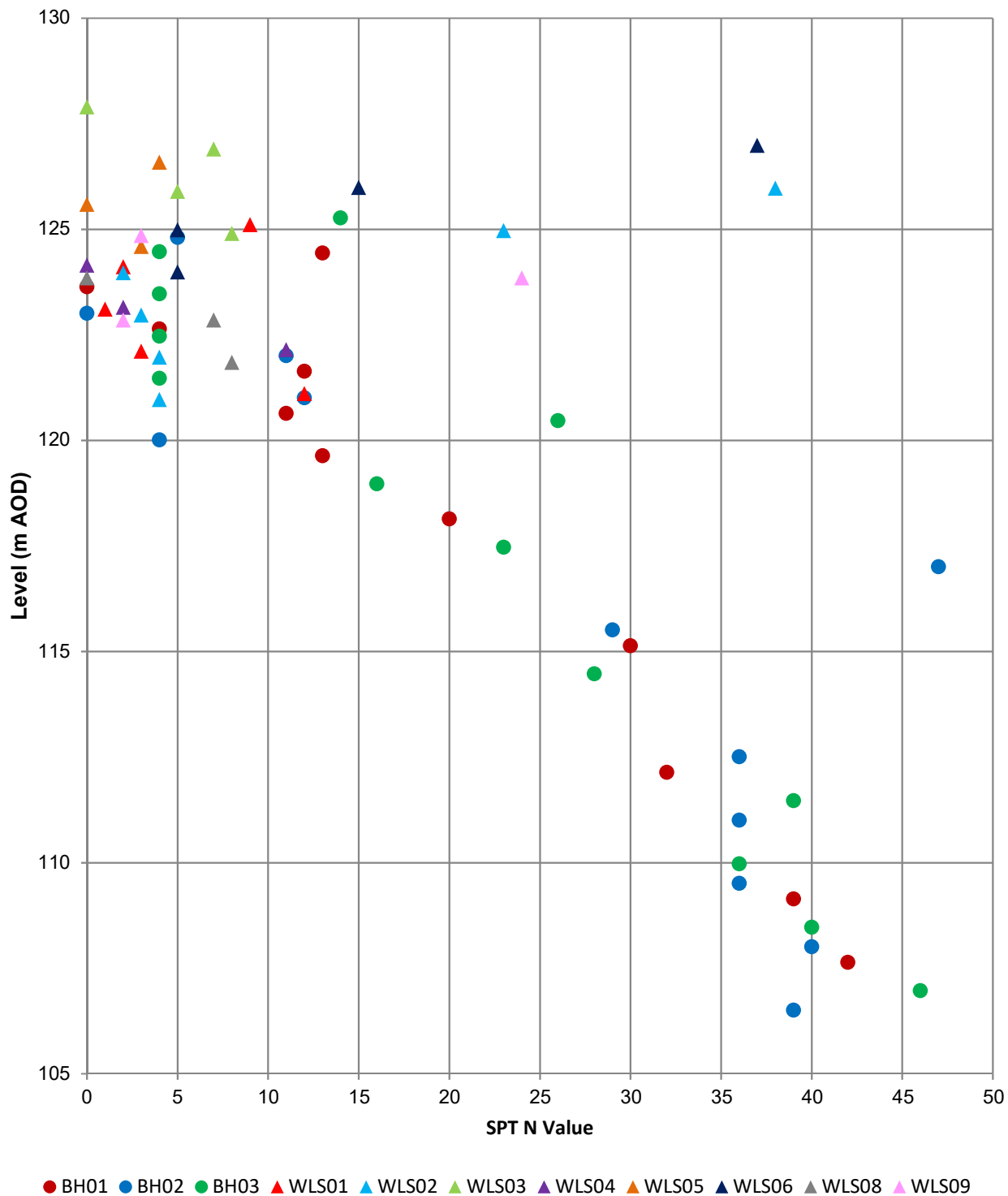
SPT N Value vs Depth (m bgl)





Project ID:	J15721	Project Title:	Molesworth Street, Rochdale
Client:	Glanville Consultants Ltd	Location:	Rochdale, OL16 1TL

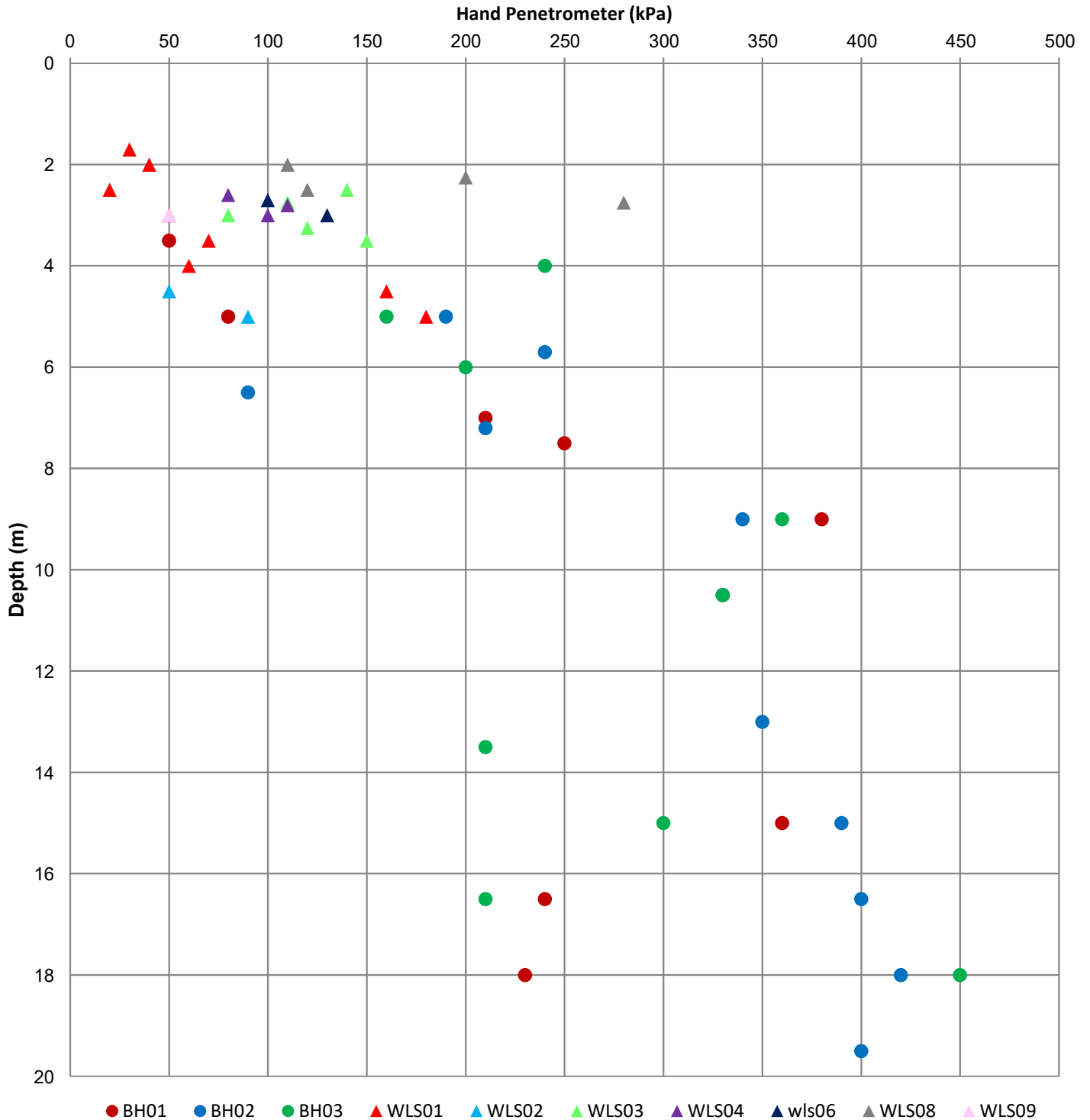
SPT N Value vs Level (m AOD)





Project ID:	J15721	Project Title:	Molesworth Street, Rochdale
Client:	Glanville Consultants Ltd	Location:	Rochdale, OL16 1TL

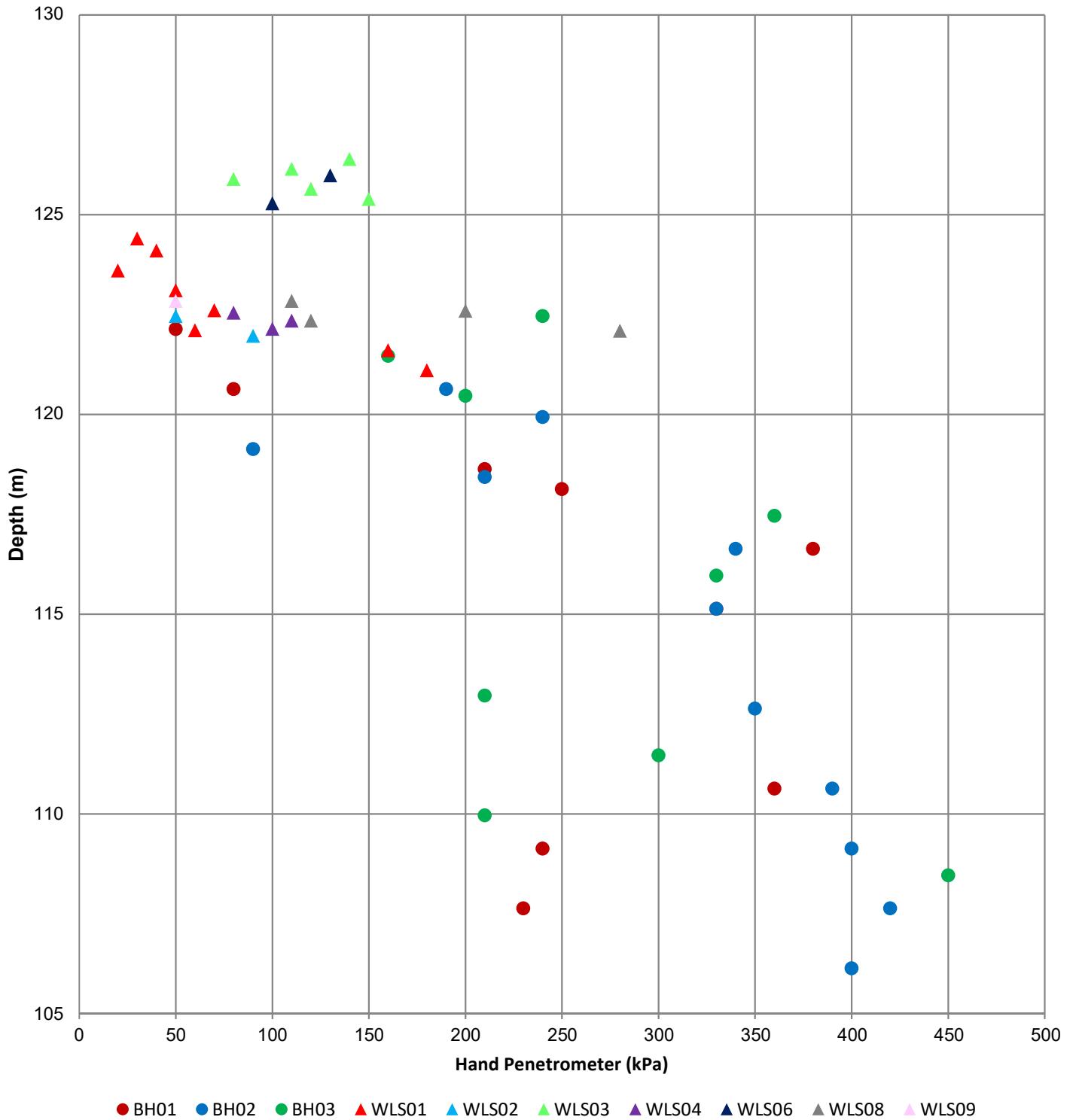
Hand Penetrometer vs Depth (mbgl)





Project ID:	J15721	Project Title:	Molesworth Street, Rochdale
Client:	Glanville Consultants Ltd	Location:	Rochdale, OL16 1TL

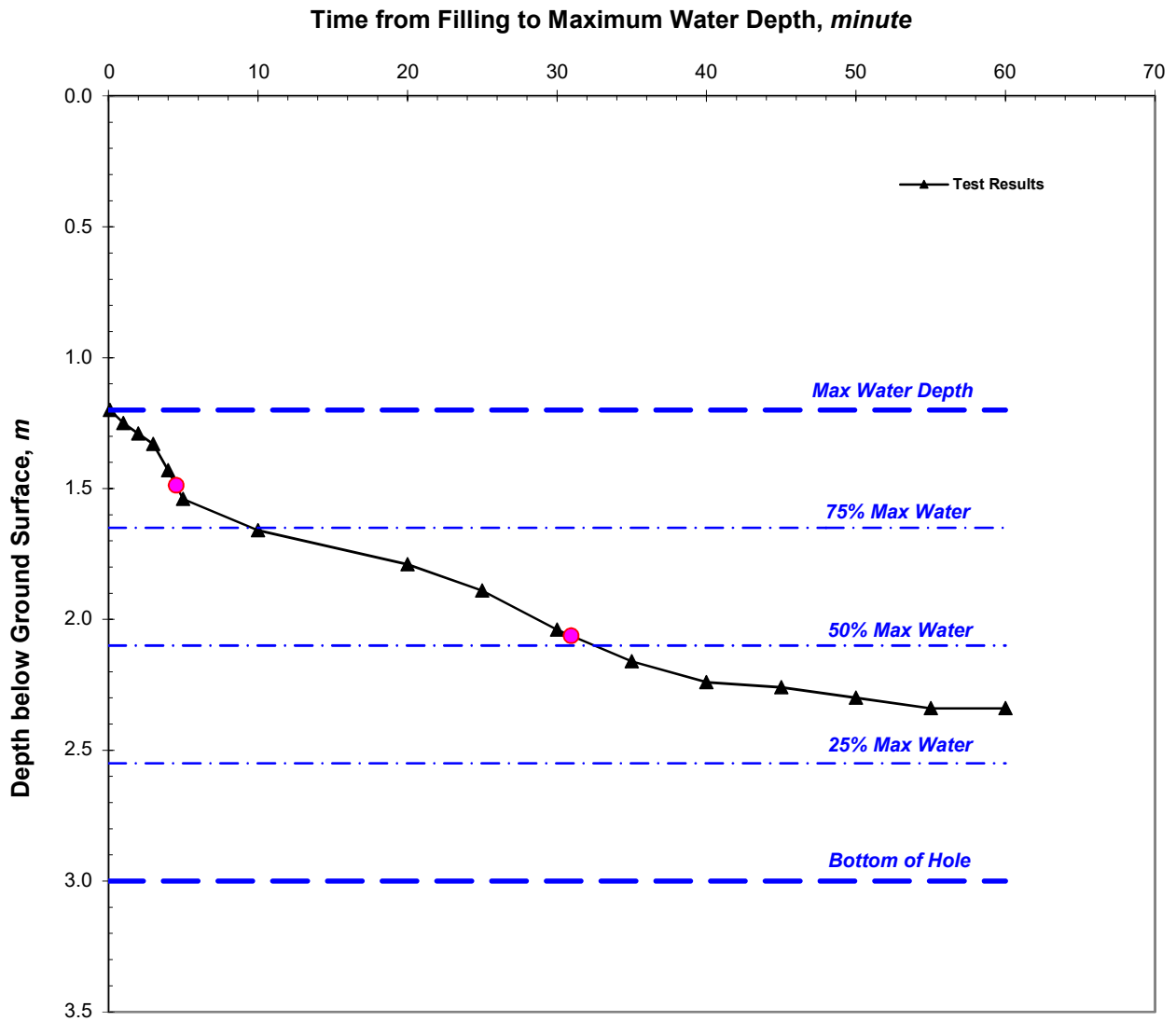
Hand Penetrometer vs Level (mAOD)



Preliminary Falling-Head Soakage Test

Test Hole No: WLS05

Test No: Test No 1 (Initial)



Diameter of Borehole, m	0.100	Depth to Water at Start of Test, m	1.200
Depth to End of Borehole Casing, m		Max Water Dropdown during Test, m	1.140
Depth to Borehole Base, m	3.000	Total Soakage Test Time, min	60.0
Depth to Top of Permeable Soils, m		Mean Internal Discharge Area, m ²	0.393
Depth to Groundwater Surface, m	2.350	Discharge Rate, litre/min	0.081
Depth to Top of Granular Fill, m	1.000	Soakage Rate, litre/m ² /min	0.207
Voids Assumed within Borehole, %	48%	BRE Soil Infiltration Rate, m/sec	3.45E-06

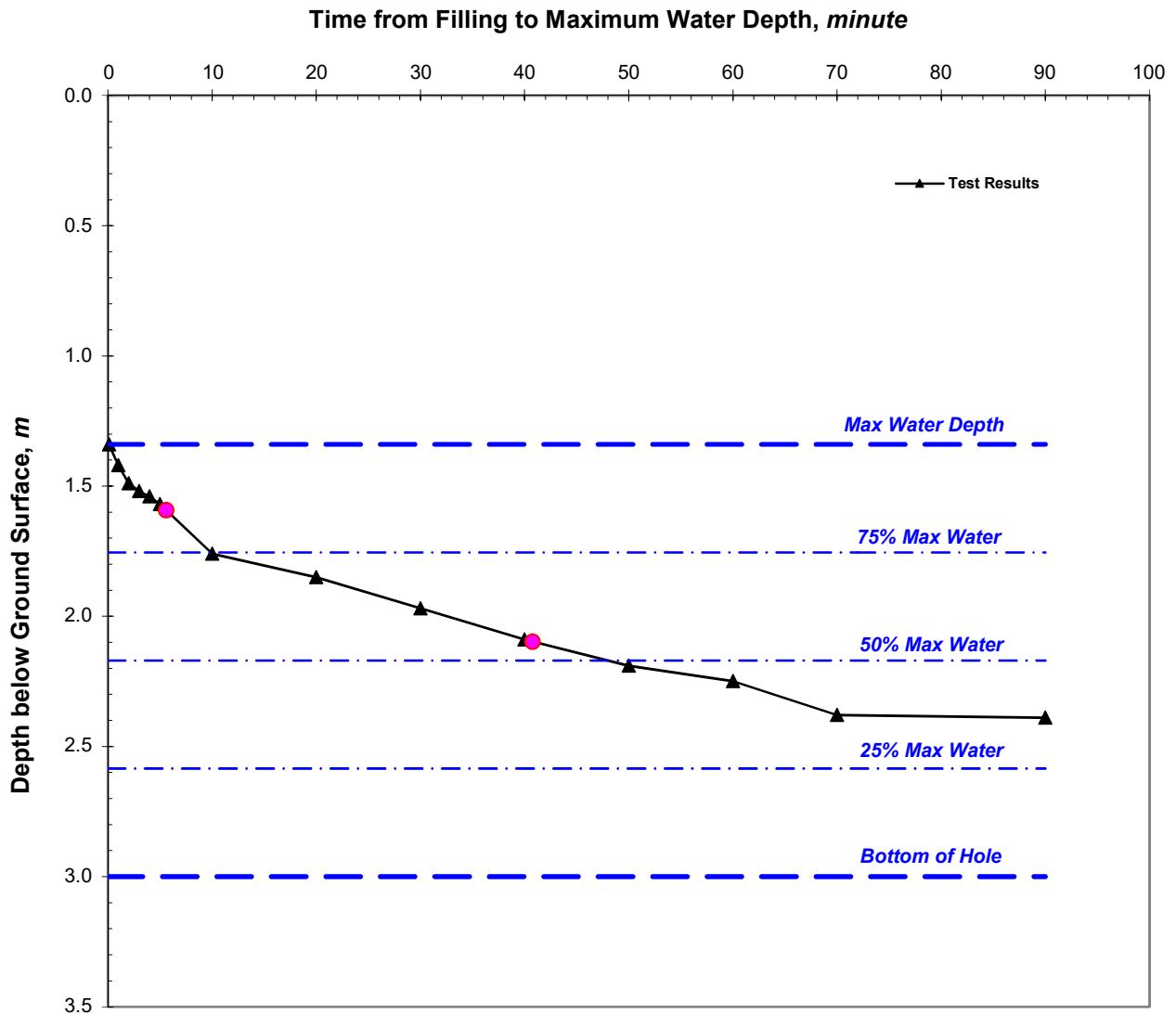
Comments: Groundwater at 2.35m at start of test.
Water level fell to 50% -- 25% max water depth, calculations were based on actual fall of water level achieved.
Result not compliant with BRE365 requirement since water did not fall to 25% max water depth.

Client: Glanville Consultants Ltd	Job No: J15721	Test Date: 30/Jul/2024
Site: Molesworth Street, Rochdale, OL16 1TL	Tested By: OS/GC	Engineer: VF
		Fig. S1

Preliminary Falling-Head Soakage Test

Test Hole No: WLS05

Test No: Test No 2 (Repeated)



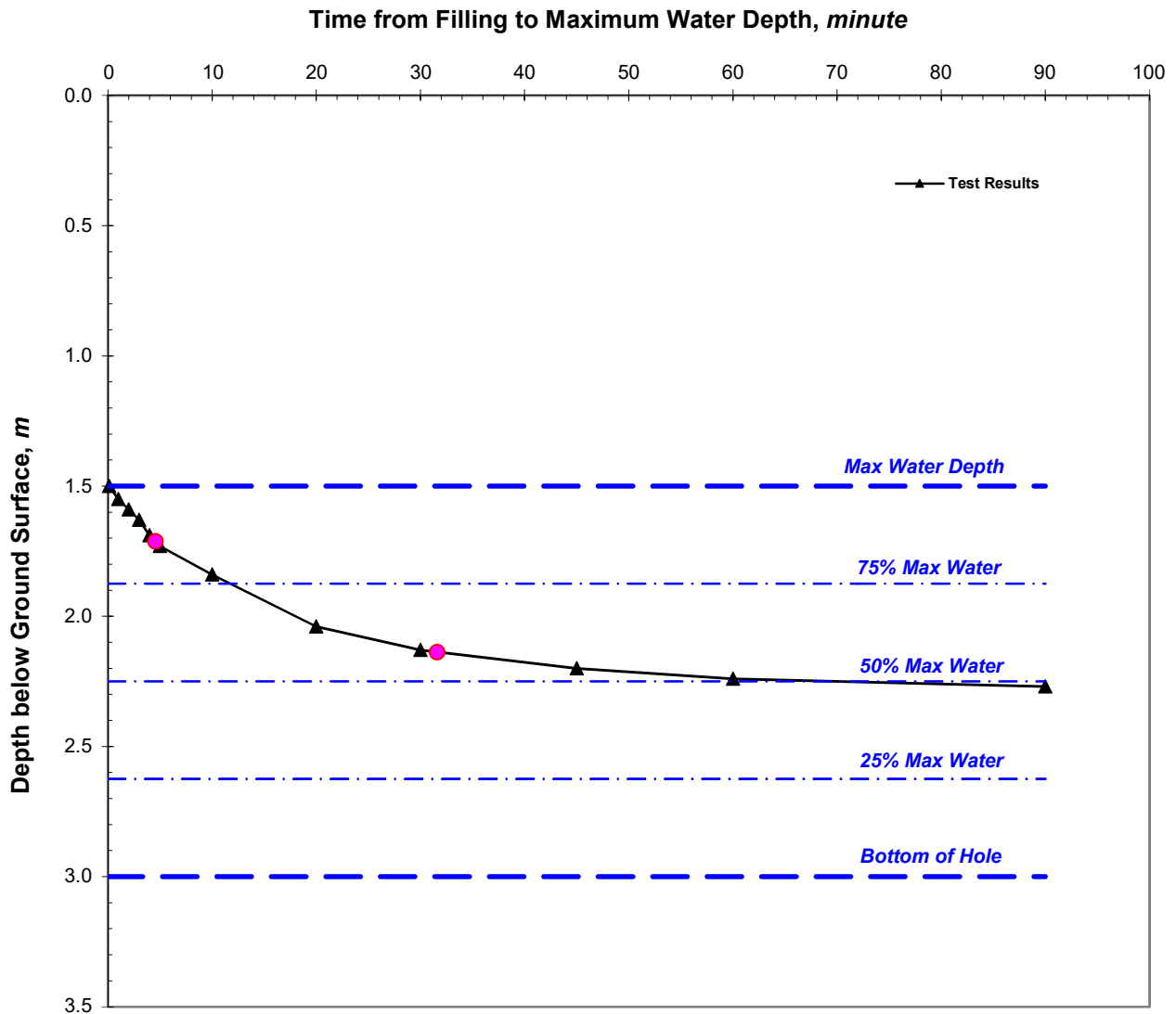
Diameter of Borehole, m	0.100	Depth to Water at Start of Test, m	1.340
Depth to End of Borehole Casing, m		Max Water Dropdown during Test, m	1.050
Depth to Borehole Base, m	3.000	Total Soakage Test Time, min	90.0
Depth to Top of Permeable Soils, m		Mean Internal Discharge Area, m ²	0.371
Depth to Groundwater Surface, m	2.350	Discharge Rate, litre/min	0.054
Depth to Top of Granular Fill, m	1.000	Soakage Rate, litre/m ² /min	0.145
Voids Assumed within Borehole, %	48%	BRE Soil Infiltration Rate, m/sec	2.41E-06

Comments: Water at 2.34m at start of test.
Water level fell to 50% -- 25% max water depth, calculations were based on actual fall of water level achieved.
Result not compliant with BRE365 requirement since water did not fall to 25% max water depth.

Client: Glanville Consultants Ltd	Job No: J15721	Test Date: 30/Jul/2024
Site: Molesworth Street, Rochdale, OL16 1TL	Tested By: OS/GC	Engineer: VF
		Fig. S2

Preliminary Falling-Head Soakage Test

Test Hole No: WLS05
Test No: Test No 3 (Repeated)



Diameter of Borehole, m	0.100	Depth to Water at Start of Test, m	1.500
Depth to End of Borehole Casing, m		Max Water Dropdown during Test, m	0.770
Depth to Borehole Base, m	3.000	Total Soakage Test Time, min	90.0
Depth to Top of Permeable Soils, m		Mean Internal Discharge Area, m ²	0.346
Depth to Groundwater Surface, m	2.350	Discharge Rate, litre/min	0.059
Depth to Top of Granular Fill, m	1.000	Soakage Rate, litre/m ² /min	0.170
Voids Assumed within Borehole, %	48%	BRE Soil Infiltration Rate, m/sec	2.83E-06

Comments: Water at 2.4m at start of test.
Water level fell to 50% -- 25% max water depth, calculations were based on actual fall of water level achieved.
Result not compliant with BRE365 requirement since water did not fall to 25% max water depth.

Client: Glanville Consultants Ltd	Job No: J15721	Test Date: 31/Jul/2024
Site: Molesworth Street, Rochdale, OL16 1TL	Tested By: OS/GC	Engineer: VF
		Fig. S3

Dynamic Cone Penetrometer (DCP) Test Results

Test No: DCP01

Chainage:

Tested By: OS/GC

Start Layer:

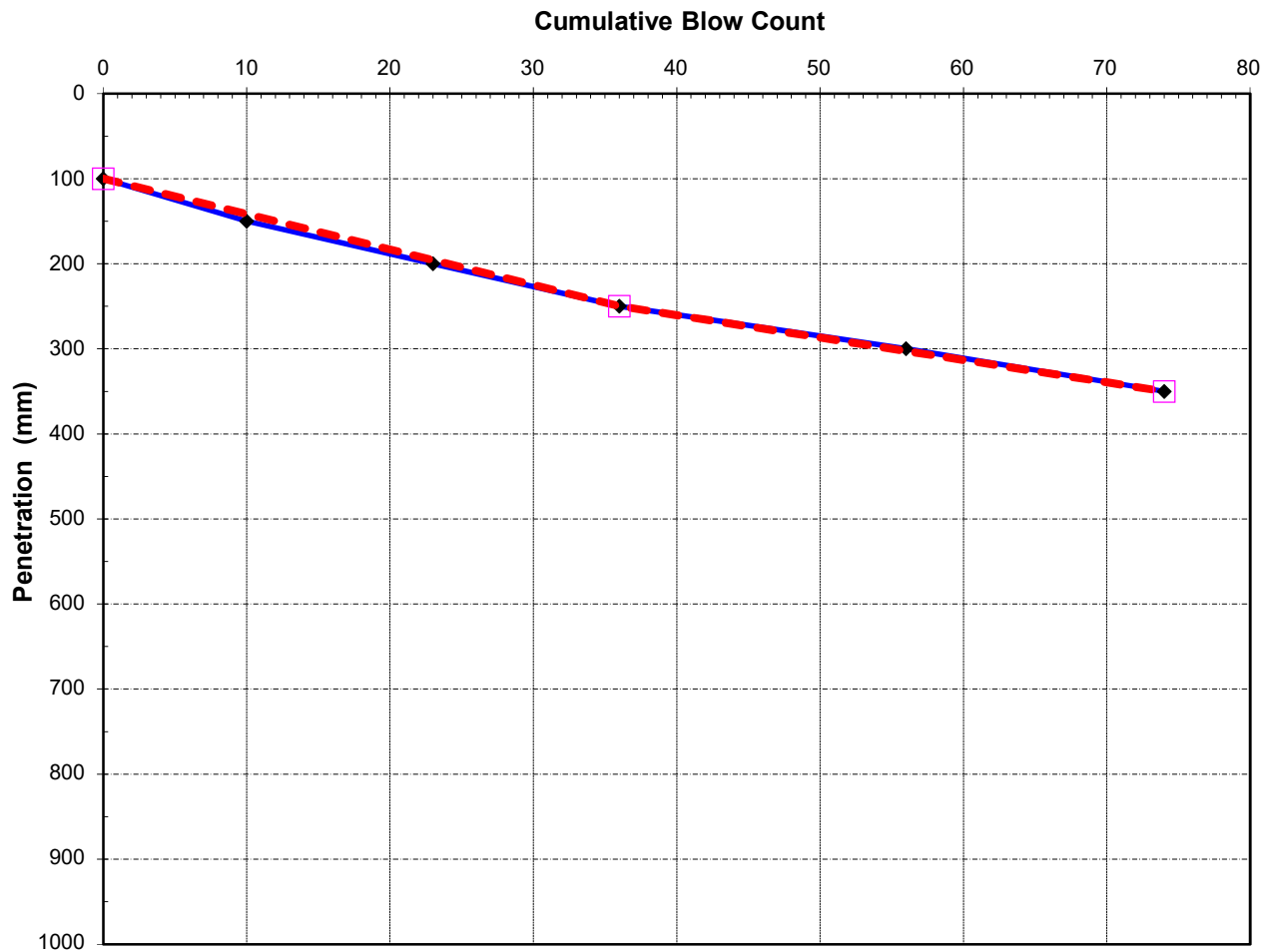
Checked By: VF

Soil Condition:

Test Date: 29-Jul-24

Notes: DCP refused at 0.4m

Perth Cone CBR Penetration vs Cumulative Blow Count



Evaluated CBR Values from DCP Test Results

Layer No	From (mm)	To (mm)	Depth (mm)	Blow Count	No. of Blows	DCP mm/blow	CBR %	Soil Type	Remarks
1	100	250	150	36	36	4.2	67		
2	250	350	100	74	38	2.6	109		
3	350	350	0	74	0	0.0	0.0		

Client: Glanville Consultants Ltd

Job No: J15721

Site: Molesworth Street, Rochdale, OL16 1TL

Date: 25/09/2024

Fig. DCP01

Dynamic Cone Penetrometer (DCP) Test Results

Test No: DCP02

Chainage:

Tested By: OS/GC

Start Layer:

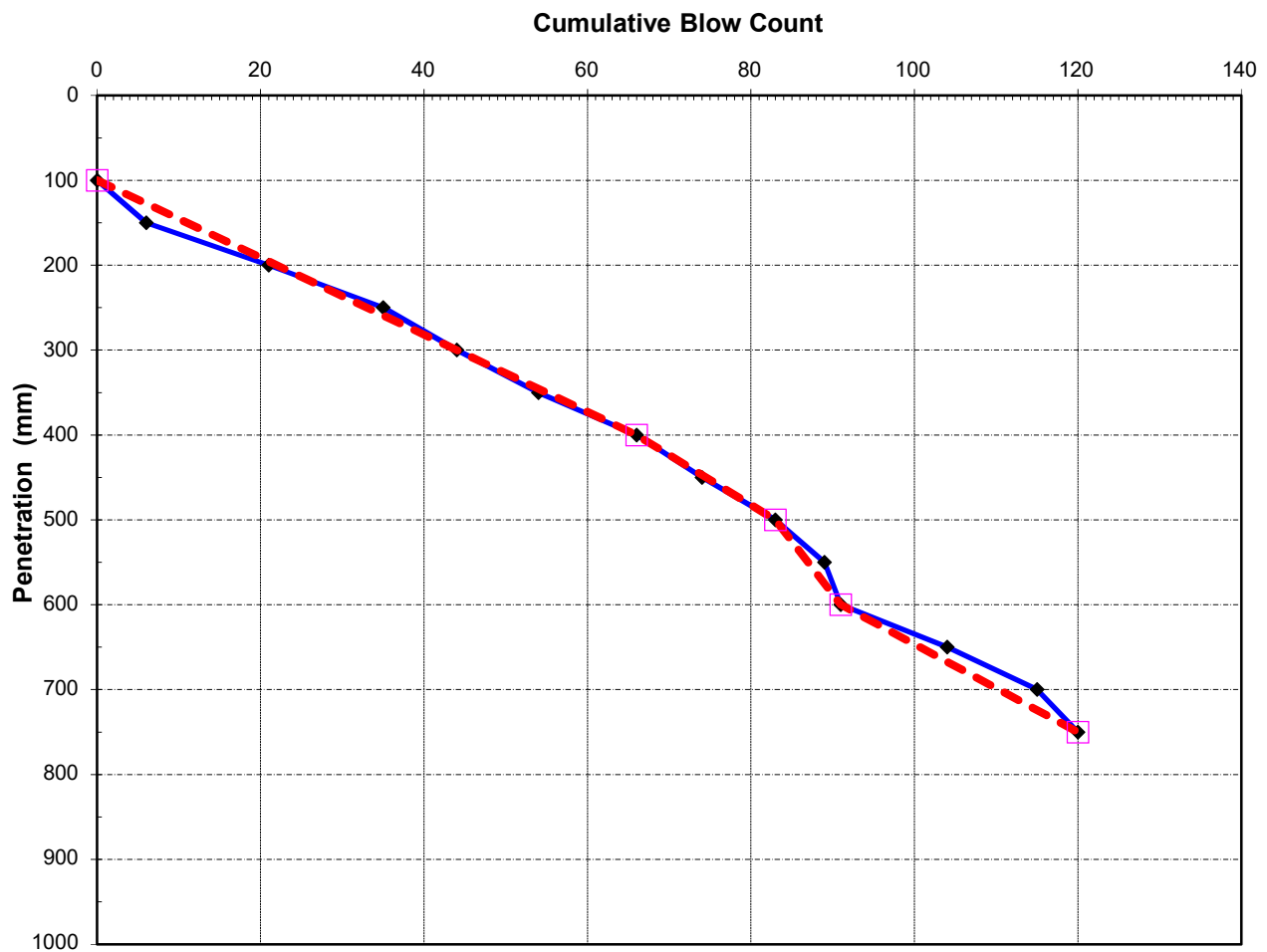
Checked By: VF

Soil Condition:

Test Date: 29-Jul-24

Notes: DCP refused at 0.8m

Perth Cone CBR Penetration vs Cumulative Blow Count



Evaluated CBR Values from DCP Test Results

Layer No	From (mm)	To (mm)	Depth (mm)	Blow Count	No. of Blows	DCP mm/blow	CBR %	Soil Type	Remarks
1	100	400	300	66	66	4.5	61		
2	400	500	100	83	17	5.9	44		
3	500	600	100	91	8	12.5	17		
4	600	750	150	120	29	5.2	52		

Client: Glanville Consultants Ltd

Job No: J15721

Site: Molesworth Street, Rochdale, OL16 1TL

Date: 25/09/2024

Fig. DCP02

Dynamic Cone Penetrometer (DCP) Test Results

Test No: DCP03

Chainage:

Tested By: OS/GC

Start Layer:

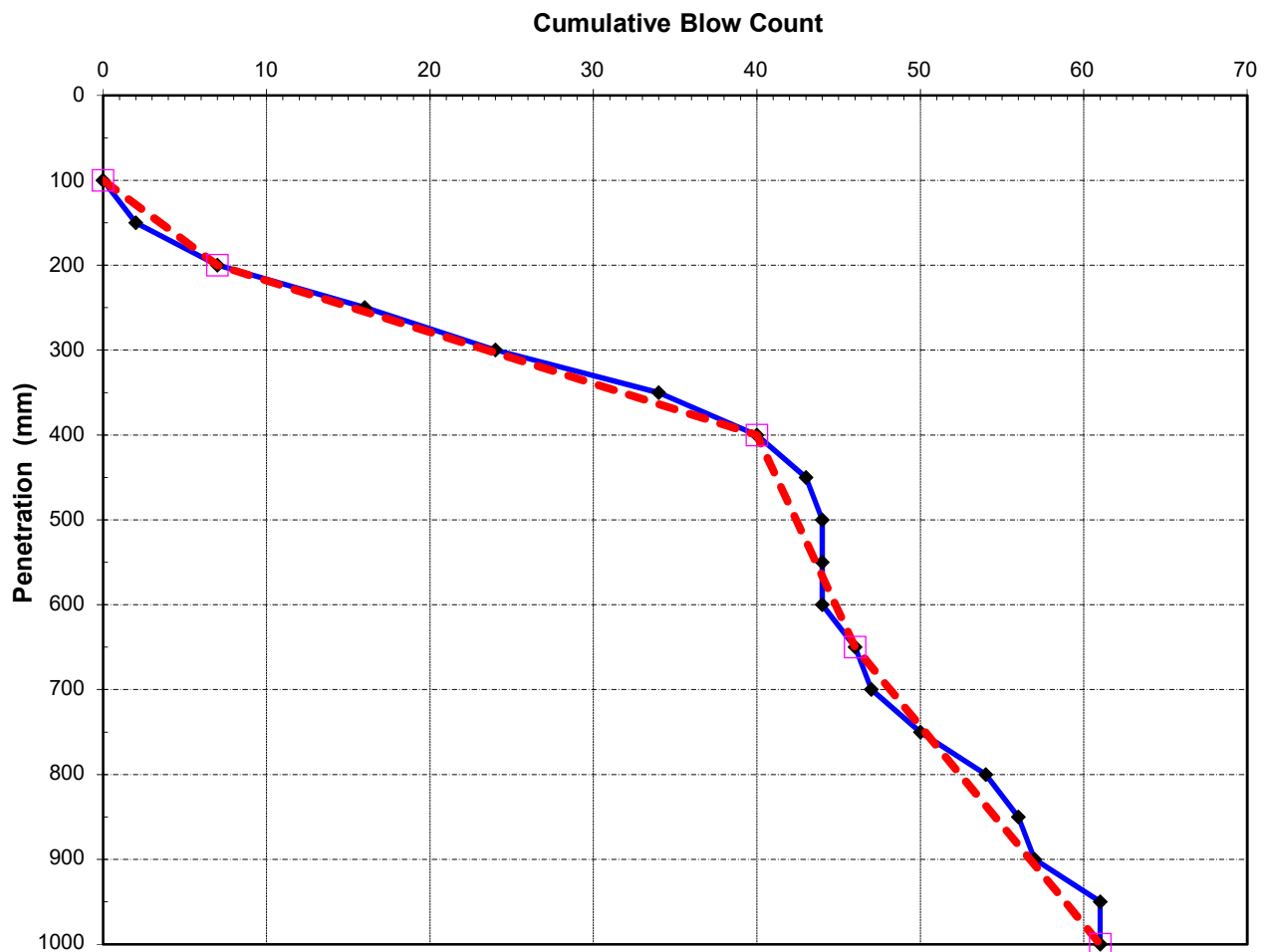
Checked By: VF

Soil Condition:

Test Date: 29-Jul-24

Notes:

Perth Cone CBR Penetration vs Cumulative Blow Count



Evaluated CBR Values from DCP Test Results

Layer No	From (mm)	To (mm)	Depth (mm)	Blow Count	No. of Blows	DCP mm/blow	CBR %	Soil Type	Remarks
1	100	200	100	7	7	14.3	14		
2	200	400	200	40	33	6.1	43		
3	400	650	250	46	6	41.7	3.6		
4	650	1000	350	61	15	23.3	7.6		

Client: Glanville Consultants Ltd

Job No: J15721

Site: Molesworth Street, Rochdale, OL16 1TL

Date: 25/09/2024

Fig. DCP03