

Gorton Phase 2 Car Park

Phase 2 Ground Investigation (Pre-Demolition)

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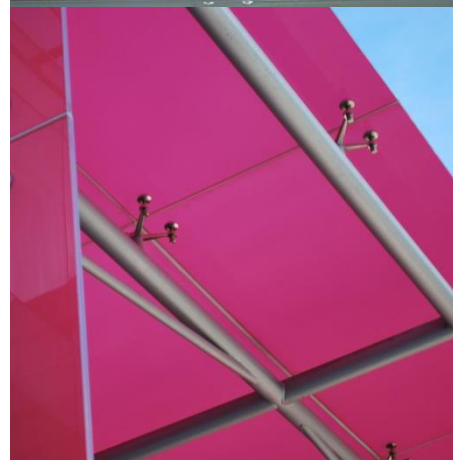
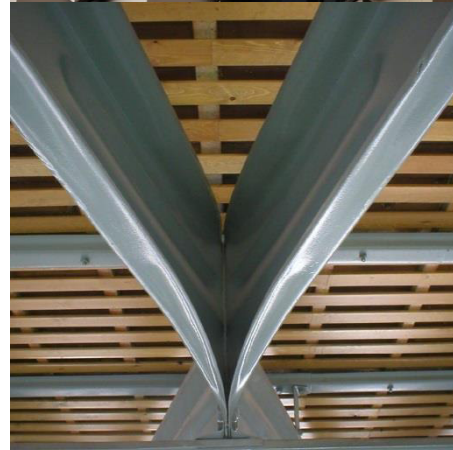
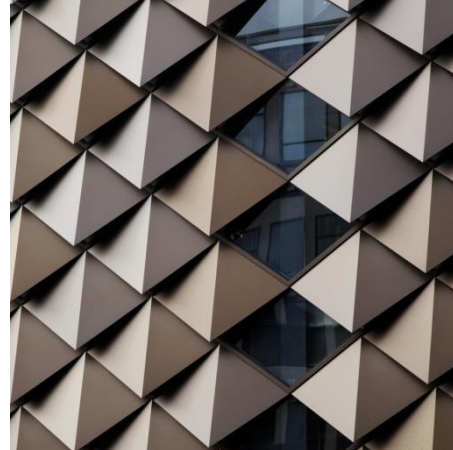
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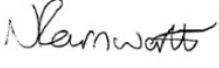
Site Address: Gorton Library, Garratt Way, Manchester, M18 8HE

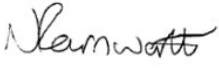


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Executive Summary

Appointment	In November 2022 Curtins were instructed by Morgan Sindall to undertake a pre demolition Phase 2 Ground Investigation of the existing Gorton Library site, Gorton, Manchester, M18 8HE. The site is centred on SJ 388590, 396260 and covers an area of approximately 0.29 Ha. The aim of the ground investigation is to characterise the geo-environmental and geotechnical conditions prior to the demolition of the current library building proposed and the replacement of a hardstanding carpark.
Current Site Status	The site currently comprises of the Gorton Library building with associated hardstanding and landscaping within the west and south of the site. Garratt Way is located south of the site.
Summary of Phase 1	Historical mapping shows that the site was undeveloped with some terrace housing surrounding the site. By 1908 Gorton has undergone development with housing and roads surrounding the site including some industrial development. 1980s Gorton library constructed onsite and the demolition of terrace housing followed by new residential properties built surrounding the site. Currently, the surrounding area is mostly occupied by residential building with areas of public open space. BGS mapping indicates underlying superficial deposits are indicated to comprise glacial till underlain by bedrock noted as the Chester Formation. The site is underlain by a Secondary A Aquifer within the bedrock formation and a Secondary Undifferentiated Aquifer within the superficial deposits. The nearest surface water feature is the Gore Brook 340m south. There are no water abstractions points recorded within 1km of the site. A Very Low risk was identified to surface waters and groundwaters from leaching and migration of potential contamination from site soils. Primary potential risks to be investigated during this report, as well as establishing ground conditions for geotechnical design, drainage and risks to human health from Made Ground soils.
Fieldworks Undertaken	The ground investigation works were undertaken between 10th and 11th November 2022 and comprised of three window sample boreholes, four foundation hand pits, two soakaways and five CBRs. Selected soil samples were subject to chemical and geotechnical analysis.
Encountered Ground Conditions	Surface coverings include either topsoil or Made Ground encountered from ground level of the exploratory holes to depths of between 0.17 to 0.25m bgl. Topsoil comprised of grass over a dark brown slightly gravelly, very silty clay with frequent rootlets. Made Ground surface covering comprised of either a grey concrete flag or gravel to 0.05m bgl. Made Ground deposits were encountered in all exploratory holes underlying the surface cover, ranging in thickness between 0.60 to 1.30m bgl. Made Ground comprised both granular and cohesive deposits. Granular Made Ground was recorded as brown and grey very sandy gravel with cobbles. Cohesive Made Ground was described as a black silty, very gravelly clay with cobbles. Made Ground was underlain by glacial till comprising cohesive material. Cohesive deposits were encountered as a firm brown mottled grey silty gravelly clay. Underlined by a firm brown slightly silty, slightly gravelly clay. Local deposits of soft black slightly gravelly, silty clay was encountered within two positions. The base of the glacial till was not encountered and is presumed to be deeper than 5.45m bgl. No obstructions were encountered during the site investigation. However relic foundation from the demolition of the current library building onsite is anticipated. Groundwater was encountered within HP03 at 0.60m bgl during the ground investigation. This is thought to be perched water within the Made Ground.
Environmental Laboratory Testing	With respect to the proposed 'Commercial' end-use, GACs for human health, no exceedances have been recorded. Asbestos was not identified onsite or during laboratory analysis.
Ground Contamination	A Low risk rating is identified to end-users and construction workers from direct contact, inhalation and ingestion of contaminants within Made Ground soils on site. Site to be covered by predominantly hardstanding breaking any SPR linkage. A Very Low risk is identified to the underlying Secondary Undifferentiated Aquifer and nearby Gore Brook watercourse. No evidence of gross contamination was identified in site soils.

Geotechnical Assessment	Due to the proposed demolition of the current building and replacement of a hardstanding carpark, a foundation design is not required. Soakaway tests have confirmed the cohesive deposits are not considered suitable for the efficient use of soakaways. CBR values ranged from 1.9 to 9.2 % with three of these results indicating a surface modulus lower than 30MPa and therefore unsuitable to support the construction of a pavement foundation and improvement is required. . Laboratory test results indicate a Design Sulphate Class for concrete may be taken as DS-1 and ACEC class of AC-1 for the Made Ground and natural soils.
Recommendations	Based on the findings of the ground investigation, the following recommendations are made: 1) Characterise shallow soils beneath existing building footprint following demolition through trial pits with sampling and chemical analysis of shallow soils to confirm risk rating herein. 2) Due to the variability of the CBR results it is recommended that post demolition and at formation level, additional CBR tests are undertaken to identify areas requiring improvement (where the surface modulus is <30MPa) and to determine an appropriate design subgrade surface modulus. 3) It is recommended that construction workers are provided with appropriate PPE and sanitary facilities. 4) Should unexpected contamination be observed during construction advice should be obtained from a Geo-environmental Engineer.

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1.0 Introduction

1.1 Project Background

In November 2022 Curtins were instructed by Morgan Sindall to undertake a pre-demolition Phase 2 Ground Investigation of the existing Gorton Library site, Gorton, Manchester, M18 8HE. The site is centred at the approximate National Grid Reference SJ 388590, 396260 and is approximately 0.29 Ha in size. A site location plan is presented on *Figure 2.1*.

It is understood that demolition of the current library building is proposed and it will be replaced by a hardstanding car park.

1.2 Scope of Services

A scope for the intrusive ground investigation was developed with the following aims:

- i) Support the associated planning application and support discharge of relevant pre-commencement contaminated land planning conditions; and
- ii) Obtain geotechnical information and characterise shallow site soils for foundation design for the proposed structures.

Specifically, the Phase 2 Ground Investigation Report is intended to:

- a) Determine the risk of the proposed end-user being adversely impacted by potential contamination in shallow site soils that may be present on the site due to its known current, recent and historical use;
- b) Determine if there is a risk to the end-user from soil gases including methane, carbon dioxide, carbon monoxide and hydrogen sulphide;
- c) Characterise site wide natural soils; and
- d) Provide recommendations for the design of foundations and building ground floor slabs.

Detailed flood risk assessment, ecology, archaeological studies and waste classification of soils for off-site disposal are outside of the scope of this report.

2.0 Phase 1 Preliminary Site Assessment Summary

A Phase 1 Preliminary Risk Assessment report was undertaken by Curtins in November 2022 (Ref. 1). A summary of the findings of this report, comprising current site setting, history, geology and hydrogeology/hydrology is presented within this Section. This Phase 2 report must be read in conjunction with the Phase 1 Preliminary Risk Assessment Report.

2.1 Current Setting

The site is located in Gorton off Garratt Way. The Gorton Library building with associated areas of hardstanding surrounding the perimeter of the building. Additionally landscaped areas are present in the west and south of the site boundary.

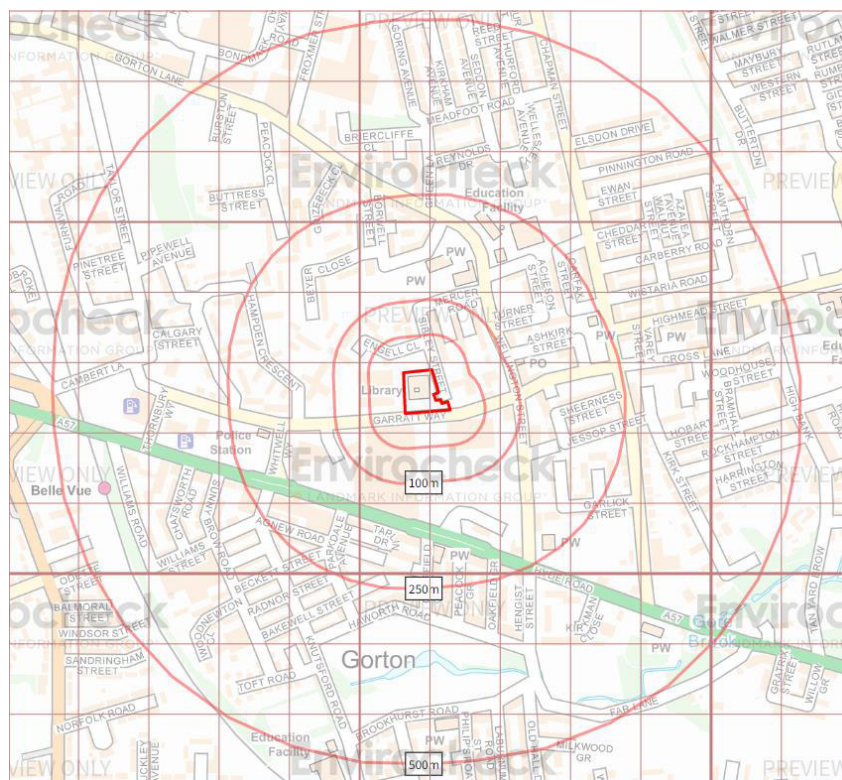


Figure 2.1 – Site Location Plan (site boundary shown in red)
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2.2 Previous Site Use

Historical earliest available mapping, the development site and surrounding area is largely undeveloped with a small number of terraced houses recorded in the surrounding area. By 1908, Gorton has undergone significant development with recorded terraced houses and roads now recorded on site and in the surrounding area. Additionally, by this time industrial works are recorded in the surrounding area.

By the 1980s, the site has undergone significant development and the terraced houses have been demolished and the Gorton Library building is constructed on site. Terraced houses in the surrounding area are also demolished at this time and are replaced with new residential properties. The current site is largely unchanged and occupied by Gorton Library. Currently, the surrounding area is mostly occupied by residential building with areas of public open space.

2.3 Published Geology

A review of British Geological Survey (BGS) map, 1:50,000 Scale, Solid and Drift Editions, Manchester, Sheet 085, 2010, indicates the following geological sequence:

- Glacial Till; and
- Chester Formation.

There are no BGS recorded faults onsite or within 1000m of the site boundary. There are several BGS recorded boreholes on site. However only four of these are available and are summarised in *Table 2.3* below.

Table 2.3 – Historical Borehole Record from Surrounding Area

Borehole Ref.	Location (Easting, Northing)	Details (depth to top of strata/lithology/thickness)	
SJ89NE1182	183m southwest (388350, 396170)	1.40m bgl 2.00m bgl 7.00m bgl 7.00m bgl	Brick FILL (1.40m) Firm grey/brown silty CLAY with occasional pebbles (0.60m) Stiff brown silty CLAY with occasional pebbles and sand inclusions (5.00m) borehole termination
SJ89NE1181	102m south (388550, 396120)	1.20m bgl 7.00m bgl 7.00m bgl	Brick FILL (1.20m) Firm to stiff brown silty CLAY with occasional pebbles (5.80m) borehole termination
SJ89NE1183	173m southeast (388590, 396060)	1.30m bgl 8.00m bgl 8.00m bgl	Cinder and brick FILL (1.30m) Very stiff to hard brown silty CLAY with pebbles (6.70m) borehole terminated
SJ89NE1178	182m southwest (380300, 388080)	1.00m bgl 2.60m bgl 7.00m bgl 7.00m bgl	Brick FILL (1.00m) Firm brown silty CLAY with occasional pebbles (1.60m) Stiff brown silty CLAY with occasional pebbles and sand inclusions (4.40m) Band of soft brown silty clay at 5.00m borehole terminated

2.3.1 Made Ground Deposits

The BGS maps do not indicate Made Ground on site, however the site's history of construction suggests that Made Ground is likely to be present underlying the site.

2.3.2 Superficial Deposits

Glacial Till deposits comprising a heterogenous mix of clay, sand, gravel and boulders in varying size. Local boreholes indicate cohesive superficial deposits to be approximately between 2-8m bgl under Made Ground deposits.

2.3.3 Bedrock Deposits

Bedrock deposits are present as the Chester Formation, comprising of pebbly sandstones with mudstone. Local boreholes do not indicate where bedrock is.

2.3.4 Mining and Quarrying

The site is located within a coal mining reporting area; however, is not within a development high-risk area and the nearest coal mining features (shafts, outcrops, etc.) are not within 1km of the site. Therefore, risk to the development from historic coal mining is **Low** and has not been considered further.

There are no recorded BGS mineral sites within 500m of the site.

2.3.5 Other Pertinent Geological Existing Geological Records

The Envirocheck report confirmed that there is a no hazard to very low risk from the following ground stability hazards on the site; collapsible ground, compressible ground, ground dissolution, landslide ground, running sands and shrinking or swelling clay.

UK Radon Mapping confirms the site is situated in area where less than 1% of homes are above the radon action level. Radon protection measures are therefore not considered necessary within the proposed development. However, where the new development incorporates a basement the advice of a specialist Radon assessor must be obtained.

2.4 Hydrogeology and Hydrology

Environment Agency data indicates that the geological sequence underlying the site has the following hydrogeological characteristics:

Table 2.4 – Geological/Hydrogeological Succession

Geology	Associated Hydrogeological Classification
Made Ground deposits are not indicated to be present however, given phases of development on-site it is likely such deposits are present	N/A
Glacial Till Deposits ¹	Secondary Undifferentiated Aquifer ²
Chester Formation – Sandstone and Mudstone ³	Secondary A Aquifer ⁴

Notes:

1. Unsorted and unstratified drift, generally over consolidated, 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)
2. These layers have not been assigned to either category A or B rock type due to their variable characteristics. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
3. Conglomerates and reddish brown, cross-bedded, pebbly sandstones with subordinate beds of red-brown mudstone. The conglomerates have a reddish brown sandy matrix and consist mainly of pebbles of brown or purple quartzite, with quartz conglomerate and vein quartz. The formation generally fines upwards, from dominantly conglomerates at the base, to interbedded conglomerates and sandstones, with sandstone and pebbly sandstone predominant in the upper part, and rare mudstones. The formation has subordinate lenticular beds of reddish brown mudstone or siltstone throughout; these are more common in Cumbria.
4. Principal aquifers provide significant quantities of drinking water, and water for business needs. They may also support rivers, lakes and wetlands.

The nearest surface water feature is the Gore Brook approximately 340m south of the site.

There are six recorded pollution incidents to controlled waters occurred within 500m of the site in the past 30 years. All incidents are classified as a Category 3 (minor) incident.

There are no surface water abstractions within 1km of the site.

There is one active discharge consent within 500m of the site. The nearest entry is located 492m southeast operated by United Utilities Water Limited for public sewage: storm sewage overflow.

2.5 Landfill

There are no BGS recorded landfill or active licensed wastes management facilities sites within 500m of the site.

There are two historically recorded infilled land (water) within 100m of the site. The nearest entry is recorded 76m north and 77m northwest of the site dated 1895 and 1848 respectively.

2.6 Unexploded Ordnance (UXO) Risk Assessment

Risk mapping for UXO's has placed the site in a moderate-risk area. Areas designated as moderate risk are those that show a high density of bombing hits (15-49 bombs per 1000 acres).

A review of the available historic mapping shows no ruins on or within 250m of the site. No buildings or areas of development are suddenly demolished in post-war mapping. Additionally, review of available bomb damage mapping for Gorton, Manchester shows no ruins on site or within the surrounding area.

During WWII and the years immediately following the site was occupied by terrace properties.

Furthermore, the site has undergone significant demolition and redevelopment during the 1970's and 1980's when the current site layout was established. This occupancy of the site during the war period and phases of redevelopment increases the possibility that if UXO was present on site it would have been recorded, found or removed during previous construction works.

Therefore, the likelihood of encountering UXO on site as part of the ground investigation is Low, and on this basis no further action is considered to be required for Curtins ground investigation works.

2.7 Summary of Phase 1 PCSM

A summary of potential pollutant linkages at the development site identified in the previous Phase 1 reports (Ref. 1) is presented in *Table 2.7*, were identified as requiring further investigation to enable the safe redevelopment of the site.

Table 2.7 – Preliminary Conceptual Site Model

Source	Pathway	Receptor	Risk
On-site Sources - Uncontrolled deposition of Made Ground associated with the construction/demolition onsite associated with terraced housing and current library building. Off-site Sources - Potential contamination associated with the former industries, warehouses and depots. Albeit noting industry typically >100m from site.	Direct contact, ingestion, inhalation (dust and vapours)	End-user of site (Carpark staff and visitors)	Moderate/ Low
	Horizontal and vertical migration of contaminants through superficial soils	Groundwater (Principal Aquifer in bedrock)	Low
		Groundwater (Secondary Undifferentiated Aquifer in Glacial Till)	
		Surface Water (Gore Brook 340m south)	Low
Production of ground generating gases from Made Ground or natural deposits containing organic/putrescible content.	Vertical and horizontal migration through existing service corridors and the underlying superficial deposits	End-user of site (Carpark staff and visitors)	Moderate/ Low

The risk from ground generating gases migrating into airspaces and impacting end users was assessed as Moderate/Low initially. However, with further consideration of development plans and the Conceptual Site Model, due to the proposed development being a car park there are no indoor air spaces for ground gases to build up and hence no potential contaminant linkage is present.

Contractors undertaking intrusive works should undertake their own risk assessments with respect to ground gas in confined spaces.

Potential contaminants of concern associated with the sources identified within the previous report include but are not limited to: broad range aliphatic and aromatic hydrocarbons present within any fuel oils; polycyclic aromatic hydrocarbons (PAHs); inorganic compounds including heavy metals and asbestos present in discarded building materials.

Potential contaminants associated with the airborne dust/particulates include but are not limited to: polycyclic aromatic hydrocarbons and inorganic compounds including toxic metals that are also accounted for by potential onsite contaminants of concern.

3.0 Phase 2 Investigation Scope of Works

Site investigation works were undertaken by Curtins between 10th and 11th November 2022.

The scope of the ground investigation was designed in general accordance with current UK guidance including:

- LCRM (Ref. 2);
- British Standard (BS) 10175:2011 + A2:2017 (Ref. 3);
- BS 5930:2015 + A1:2020 (Ref. 4); and
- BS EN1997: Part 2:2007 Eurocode 7 (Ref. 5).

The scope and rationale are summarised in *Table 3.0*.

Table 3.0 – *Scope and Rationale of Fieldwork Undertaken*

Exploratory Hole Type	Exploratory Hole Reference	Exploratory Hole Depth (m bgl)	Rationale
Window Sample Boreholes	WS01 WS02 WS03	5.45 5.45 5.45	Confirm shallow ground conditions. Collect soil samples for chemical and geotechnical testing. Undertake in-situ testing.
Foundation Hand Pits	HP01 HP02 HP03 HP04	0.61 1.05 0.77 1.00	Confirm shallow ground conditions Identify size, type and bearing stratum of existing building foundations and existing monument foundations.
California Bearing Ratio Tests (CBRs)	CBR1 CBR2 CBR3 CBR4 CBR5	0.30 0.30 0.30 0.30 0.30	Obtain California Bearing Ratio tests to aid design of new roadways and hardstanding.
Soakaway Tests	SA1 SA2	1.90 2.00	Confirm ground conditions Determine suitability of soils for infiltration drainage design.

For information regarding the location of the exploratory hole locations, refer to Curtins drawing ref. 070452-CUR-00-XX-DR-GE-80008-P05 within *Appendix A*.

3.1 Soil Logging and Sampling

Exploratory borehole arisings were logged on site by a qualified Engineer. All exploratory holes were logged in accordance with the requirements of BS5930:2015 + A1:2020 (Ref. 4) including recording observed visual and olfactory indications of contamination.

Exploratory hole logs are provided in *Appendix B*.

3.2 Monitoring Well Installations

Due to the proposed development being a car park there are no indoor air spaces for ground gases to build up and hence no potential contaminant linkage is present, therefore gas monitoring installs were not placed within the window samples boreholes.

4.0 Laboratory Analysis

4.1 Geo-environmental Analysis

Representative soil samples were selected for laboratory chemical analysis, based on field observations and to provide information about the encountered ground conditions.

A total of 7 No. Made Ground samples and 1 No. natural soil sample was selected for chemical testing. Soil samples were placed in laboratory provided containers and stored in cool boxes prior to being transported to the nominated laboratory under the laboratory's chain of custody documentation. The laboratory selected by Curtins for chemical and geotechnical analysis was Envirolab Ltd (UKAS and MCERTS accredited). Geotechnical analysis was sub-contracted to Ian Farmers Associates, a UKAS accredited laboratory.

Given the lack of any obvious sources of potential contamination the sampling positions were generally located in a non-targeted, systematic array, in accessible areas beneath the proposed development footprint, to give adequate and representative coverage of the sites proposed end use and the immediate environmental setting, concentrated in the near surface deposits.

4.1.1 Soil Analysis

The source material of contaminants of concern potentially present on the site was considered to include, amongst others; organic matter, ash and fill, hydrocarbons (e.g. fuel/oils), polycyclic aromatic hydrocarbons (PAHs), heavy metals and asbestos. The extent of the above is captured by the broad environmental testing suites listed in *Table 4.1.1*.

Table 4.1.1 – Environmental Chemistry Analysis Suite: Soils

Suite Ref.	Analyte	Limit of Detection
Soils Suite	Asbestos Screen	-
	pH Value	0.1 pH
	2:1 Water Soluble Sulphate	0.01 g/l
	Soil Organic Matter (SOM)	0.4% w/w
	Arsenic, Chromium, Chromium VI, Copper, Lead, Nickel, Selenium	0.20 - 1 mg/kg
	Zinc	0.5 mg/kg
	Boron (water soluble)	0.4 mg/kg
	Cadmium	0.1 mg/kg
	Mercury	0.1 mg/kg
	Cyanide (total)	0.5 mg/kg

Suite Ref.	Analyte	Limit of Detection
	Phenols (screen)	0.3 mg/kg
	PAHs (USEPA 16)	0.1 mg/kg
	TPH (Aro/Alk Split)	1 mg/kg

A total of 8 No. soil samples were obtained from the boreholes and tested for Curtins Suite A. 7 No. samples were obtained from the Made Ground, and 1 No. sample was obtained from the natural soils.

Copies of the environmental chemistry testing certificates are presented in *Appendix C*.

4.1.2 Groundwater Analysis

No water samples were obtained as the CSM from the Phase 1 concluded a risk to groundwater and surface water is low.

4.2 Geotechnical Testing

Soil samples for testing were prepared in accordance with BS1377: Part 1:2016 (Ref. 6). The undertaken geotechnical testing is summarised in *Table 4.2*.

Table 4.2 – Geotechnical Testing

Test Type	Quantity	Standard
In Situ Testing		
Standard Penetration Test (SPT)	15	BS 5930:2015 + A1:2020, Clause 41
Laboratory Testing (General Testing - Foundation Design)		
Atterberg Limit	4	BS 1377 1990, Part 2 (clause 4.5, 5.3 & 5.4)
Moisture Content	6	BS 1377 1990, Part 2
Water Soluble Sulphate	8	ISO 17025 MCERTS
pH Value	8	ISO 17025 MCERTS
Remoulded CBR by 2.5kg Rammer	2	BS 1377-4:1990 (clause 7(2))

The results of the geotechnical testing are summarised in *Section 6.0* of this report.

Copies of the geotechnical testing certificates can be referred to in *Appendix D*.

5.0 Encountered Ground Conditions

The ground conditions across the site, determined during the ground investigation works generally comprised of topsoil at the surface of all window sample locations and HP04 only. Within the remaining foundation hand pit locations either a concrete paving flag or Made Ground gravel was encountered within overlying granular and cohesive Made Ground. Cohesive Glacial Till was recorded beneath the Made Ground. Granular Glacial Till and Bedrock were not encountered.

5.1 Encountered Ground Conditions

A summary of the ground conditions encountered during the Curtins site investigation works is presented below, with detailed information presented on the exploratory hole logs which can be referred to in *Appendix B*.

Table 5.1 – Summary of Ground Conditions Encountered

Stratum	Depth to top of strata, m bgl	Recorded Thickness (m)		Description
		Min	Max	
Topsoil	0.00	0.17	0.25	Grass over a dark brown slightly gravelly, very silty clay with frequent rootlets. Gravel of sandstone and siltstone.
Made Ground	0.00 – 0.25	0.61 ¹	1.06	Paving Flag; Dark brown/black very gravelly clay. Gravel of brick, sandstone and siltstone; Brown/black slightly silty, sandy, very clayey gravel or very gravelly clay with occasional cobbles. Gravel of brick, glass, clinker, concrete, tar and sandstone. Cobbles of brick.
Glacial Till (cohesive)	0.80 – 0.90	0.10 ¹	4.55 ¹	(Locally) Soft black slightly gravelly, silty CLAY Firm brown mottled grey silty gravelly CLAY <i>Overlying</i> Firm brown slightly silty, slightly gravelly CLAY

1 – Thickness not proved

5.2 Made Ground

Made Ground was encountered in all exploratory hole locations on site, to a maximum depth of between 0.61 to 1.06m bgl. Made Ground was deepest in WS02 located at the west of the site however the base of the Made Ground was not determined in HP01 and HP03.

The Made Ground comprised various compositions, details of which are noted below and within the Exploratory Hole Logs in *Appendix B*.

5.2.1 Topsoil/Surface Covering

Topsoil was identified within all locations window sample locations and HP04 from ground level to depths between 0.17 to 0.25m bgl. The topsoil was described as dark brown slightly gravelly, very silty clay with frequent rootlets.

No topsoil was encountered within the three-foundation hand dug trial pits (HP01 to HP03) which are located next to the building. Surface coverings were recorded as either a grey concrete paving flag with a thickness of 0.05m underlain by a sub-base of sand (HP02 and HP03). Made Ground surface gravel was encountered to a depth of 0.05m bgl within HP01 comprising rounded decorative gravel.

5.2.2 Granular Made Ground

Granular Made Ground was encountered within two exploratory boreholes (HP02 and HP04) at various depths and was generally identified as gravels with cobbles and sand inclusions. Granular Made Ground was identified to depths of between 0.80m and 0.90m bgl. The granular Made Ground was found beneath the surface covering.

Within HP02 these deposits were described as a brown/black slightly silty, sandy, very clayey gravel with occasional cobbles from 0.10 to 0.80m bgl. Deposits within HP04 were described as a brown and grey very sandy gravel overlying a black/brown sandy, silty, very clayey gravel to 0.90m bgl.

5.2.3 Cohesive Made Ground

Cohesive Made Ground was encountered in WS01 to WS03, HP01 and HP03 and was encountered under the granular Made Ground or surface coverings to a depths of 0.60 to 1.30m bgl.

The cohesive Made Ground was described as generally a dark brown very gravelly, silty clay with occasional cobbles. Locally cohesive deposits were encountered as either a black silty, very gravelly clay with occasional cobbles (HP03) or a dark brown/black very gravelly clay (HP01).

5.3 Glacial Till

Glacial Till was encountered underlying Made Ground where the base of the Made Ground was identified.

Glacial Till deposits encountered comprised cohesive material. The base of the Glacial Till was not identified during the ground investigation. Granular Glacial Till was not encountered during the site investigation.

Cohesive Glacial Till was identified from 0.80m to 0.90m bgl, to a depth of between 1.00 to 5.45m bgl.

The cohesive Glacial Till was described as a firm brown mottled grey silty gravelly clay. This was underlain by a firm brown slightly silty, slightly gravelly clay.

Locally soft black slightly gravelly, silty clay was encountered within HP02 at 0.80 to 1.05m bgl and within WS02 at 1.30 to 1.40m bgl. Firm clay was encountered underlying this in WS02 whilst the base of the soft clay was not encountered in HP02.

5.4 Observed Potential Contamination

No potential visual or olfactory evidence of gross or mobile phase contamination was observed during the intrusive investigation works.

Ash/clinker was observed within the Made Ground soils along with other anthropogenic materials.

5.5 Obstructions Encountered

No obstructions were encountered during the intrusive investigation works.

5.6 Groundwater

Groundwater was encountered within HP03 only during the ground investigation at 0.60m bgl which is thought to be perched water on top of the concrete foundation.

5.7 Existing Structures Foundations

Four hand dug foundation pits were undertaken. Three of these were along the northern, eastern and southern walls of the building. A fourth-hand pit was undertaken against a monument in the southwest corner of the site.

The findings are summarised and detailed within Table 5.7 below there are also hand pit drawings and logs enclosed with *Appendix B*.

Table 5.7 – Summary of Hand Dug Foundation Pits Encountered

Hand Pit Location	Purpose of Hand Pit Location	Foundation Encountered
HP01	Identify type and extent of foundations on the Eastern side of existing library building	Concrete foundation encountered at 0.60m bgl projects more than 1.20m from the wall. Thickness of the foundation and edge of foundation was not able to be found due to access limitations.
HP02	Identify type and extent of foundations on Northern side of existing library building	Concrete foundation encountered 0.60m bgl to 0.80m bgl with a thickness of 0.20m. The foundation projects 0.15m from the wall.

Hand Pit Location	Purpose of Hand Pit Location	Foundation Encountered
HP03	Identify type and extent of foundations on the Southern side of existing library building	Concrete foundation encountered at 0.60m bgl and projects 0.69m from the wall. Thickness of the foundation is more than 0.17m thick, unable to confirm the base of the foundation due to water ingress in the hand pit.
HP04	Identify type and extent of foundations on the Northern side of existing monument	Concrete foundation encountered from the surface to 0.20m bgl. The foundation is underlined by a Made Ground gravel to 0.90m bgl and then natural clay from 0.90m bgl.

6.0 Ground Model

6.1 Made Ground

Made Ground was encountered in all exploratory hole locations, from ground level to a maximum depth between 0.80m and 1.30m bgl, where the base of Made Ground has been encountered.

The geotechnical test results recorded within the Made Ground are summarised in *Table 6.1* below.

Table 6.1 – Summary of Made Ground Geotechnical Test Results

Parameter	No. of Tests	Results
Laboratory Tests - General		
pH	7	Min: 7.72 Max: 8.71 Average: 8.33
Water Soluble Sulphate (mg/l)	7	Min: 1 Max: 60 Average: 20.3
Moisture Content (%)	2	13 and 22
Remoulded CBR (%)	2	Min: 5.4 Max: 12

CBR values are further discussed in Section 9.5.

6.2 Glacial Till

The Made Ground was underlain by Glacial Till deposits and typically recorded as cohesive material described as a firm brown mottled grey silty gravelly clay which overly a firm brown slightly silty, slightly gravelly clay. Granular Glacial Till was not encountered during the site investigation.

The geotechnical test results recorded within the cohesive Glacial Till deposits are summarised in *Table 6.2*.

Table 6.2 – Summary of geotechnical test results – Glacial Till

Parameter	No. of Tests	Results
In-Situ Tests		
SPT 'N' Value ⁽²⁾ – Cohesive	15	Min: 5 Max: 30
Laboratory Tests - General		
Atterberg Test	Liquid Limit (%) ⁽¹⁾	Min: 34 Max: 47 Average: 40
	Plastic Limit (%) ⁽¹⁾	Min: 15 Max: 22

Parameter		No. of Tests	Results
			Average: 19
	Plasticity Index (%) ⁽¹⁾	4	Min: 19 Max: 25 Average: 22
	Modified Plasticity Index (%) ⁽³⁾	4	Min: 18.24 Max: 23.5 Average: 20
Moisture Content (%)		6	Min: 15 Max: 24 Average: 19
pH		5	Min: 7.3 Max: 9.23 Average: 8.3
Water Soluble Sulphate (mg/l)		5	Min: 2 Max: 46 Average: 31.6

(1) Excludes non-plastic test results

(2) Only includes SPTs tests in which full penetration was achieved.

(3) Modified plasticity index is the plasticity of components <425µm

Four Atterberg Tests were undertaken in the cohesive material indicating the soils behave as intermediate plasticity clays with a medium volume change potential in accordance with guidance from NHBC Standards Chapter 4.2 (2023) (Ref. 7). These results of the Atterberg Limits are presented on *Figure 6.2.1a*.

A total of fifteen SPT 'N' values were recorded in cohesive Glacial Till, ranging from between 5 and 30, where full penetration was met (no SPT refusals were noted). The SPT N results are presented on *Figure 6.2.1b*.

A moderately conservative Undrained Shear Strength, C_u , of cohesive soils can be estimated from the correlation between Plasticity Index (PI) and SPT N values (Ref. 8) using Equation 1:

$$C_u = f_1 \times \text{SPT N} \quad \text{Equation 1}$$

Where:

C_u is the Undrained Shear Strength

f_1 is the Stroud Factor determined from *Figure 1.5* (Ref. 9)

SPT N is Characteristic Standard Penetration Test Result

Using an f_1 factor of 5.5 for an average plasticity index of 22%, C_u values ranging between 27.5 kPa and 165 kPa are derived. The majority of the derived results indicate medium to high strength clay. One result indicates low strength clay at 1.2m bgl (WS02) but this increase to very high strength clay at 3m bgl. Generally, the strength of clay increases in strength with an increase in depth to 3m bgl and then seems to decrease slightly in strength from 3 to 4m bgl, see *Figure 6.2.1c*.

A moderately conservative unit weight of between 18 kN/m³ is deemed appropriate for medium to high strength cohesive soils in accordance with BS 8002:2015 (Ref. 10).

A moderately conservative Coefficient of Consolidation, M_v , of the cohesive soils can be estimated from the correlation between Plasticity Indices (PI) and SPT N values (Ref. 8) described by Equation 2:

$$M_v = 1 / (f_2 \times \text{SPT } N) \quad \text{Equation 2}$$

Where:

M_v is the coefficient of consolidation

f_2 is the Stroud Factor determined from Figure 1.5 (Ref. 9)

SPT N is Characteristic Standard Penetration Test Result

Using an f_2 factor of 0.55 for an average plasticity index of 22%, M_v values typically range between 0.06061 and 0.36364 m^2/MN . The results are variable, indicating a low to medium compressibility clay with one sample at 1.2m bgl (WS02) indicating a high compressibility. The values are presented in Figure 6.2.1d.

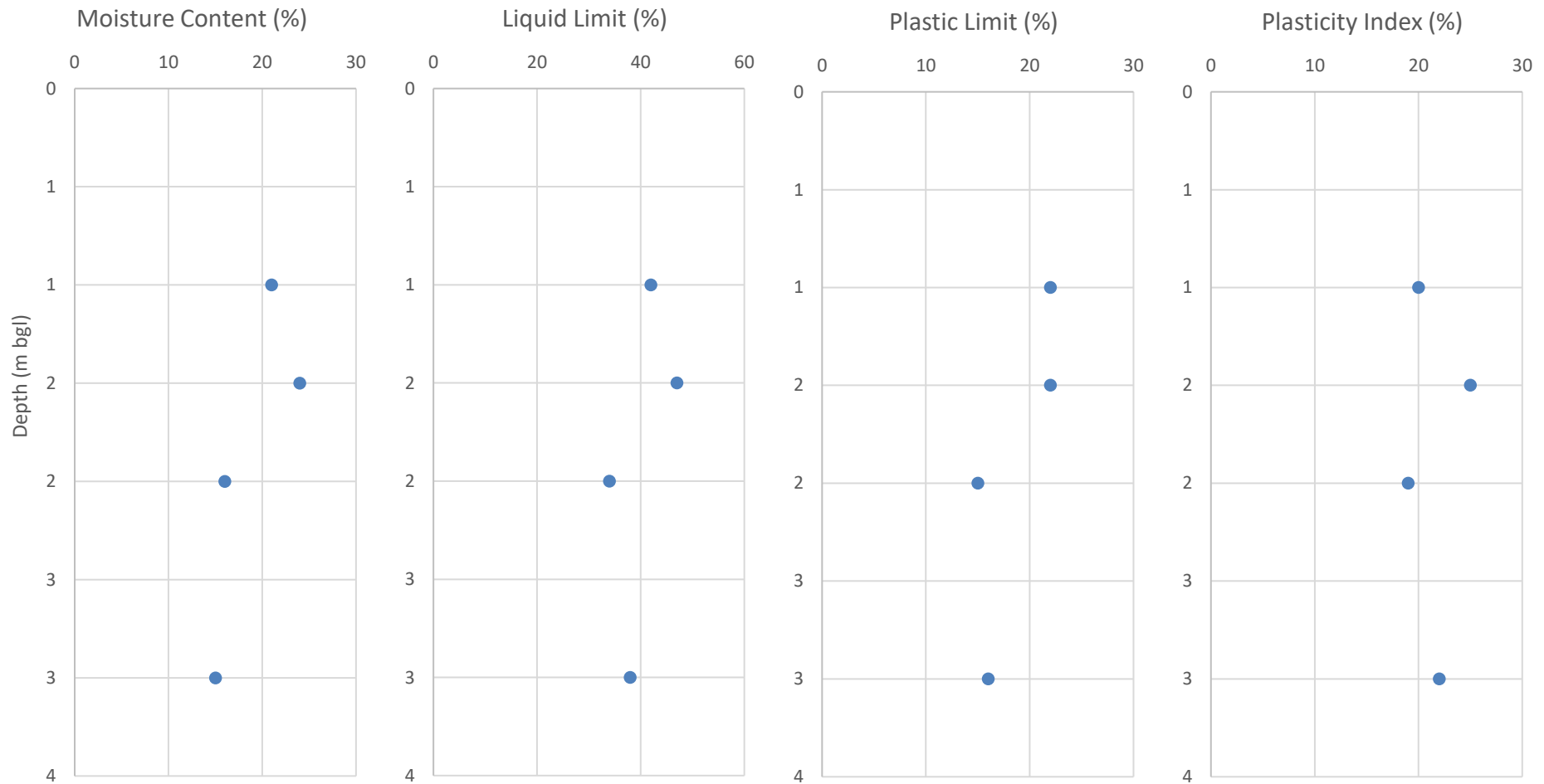


Figure 6.2.1a – Summary of Atterberg Test Results vs Depth

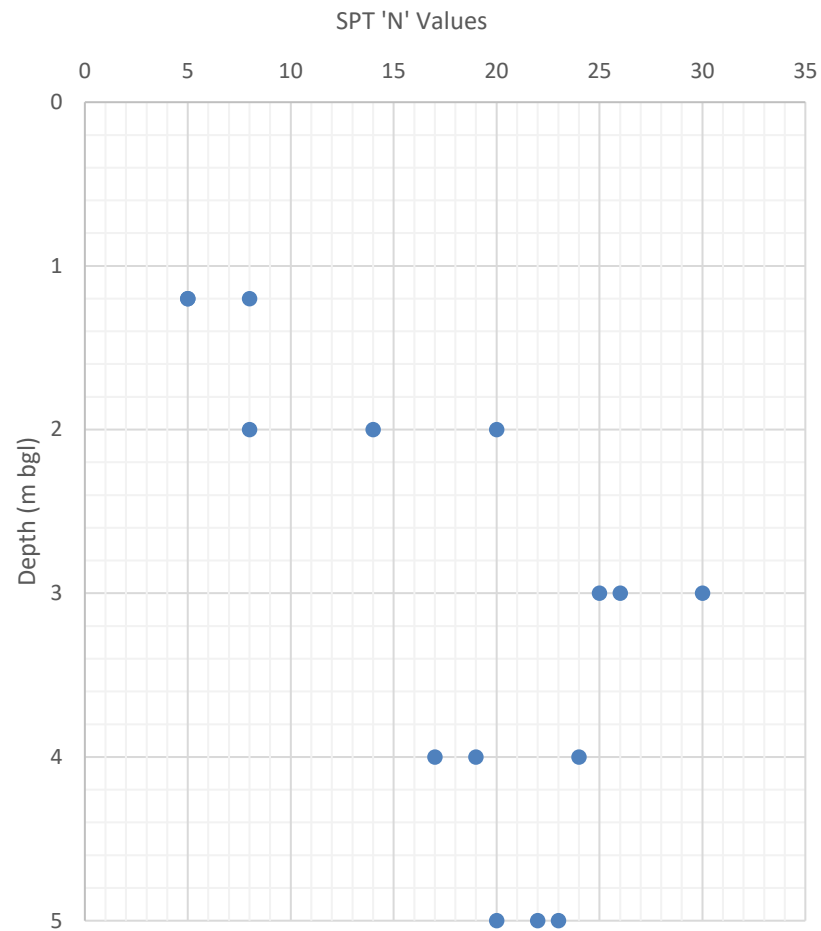


Figure 6.2.1b – Standard Penetration Test vs. Depth - Cohesive

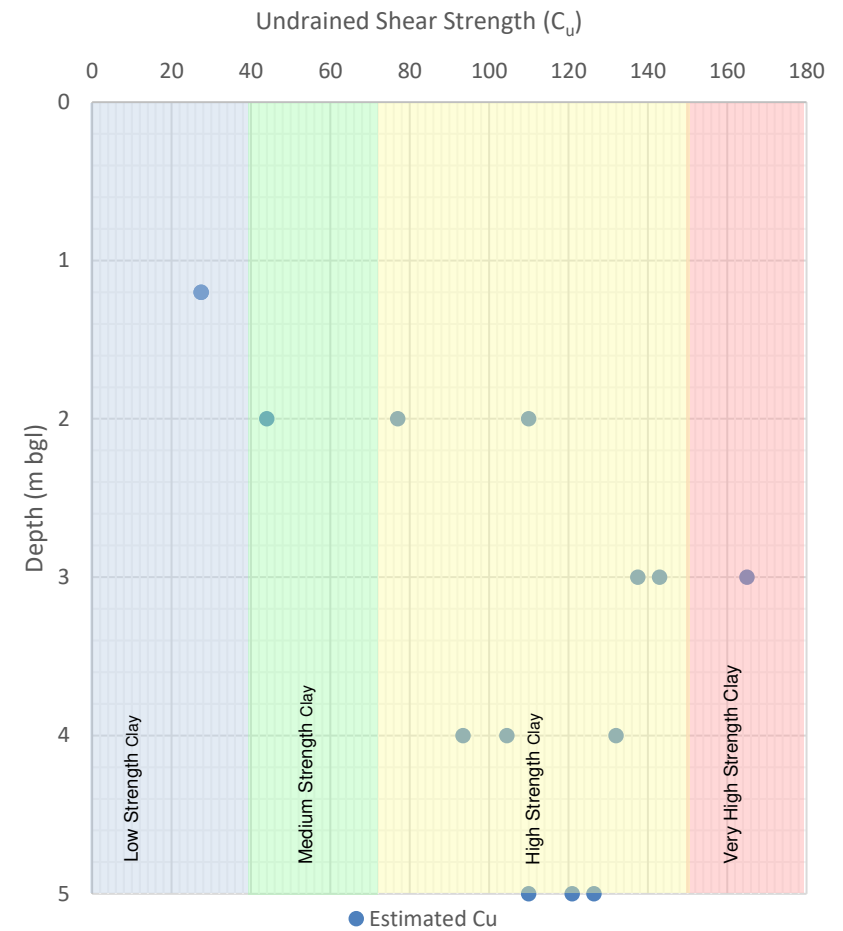


Figure 6.2.1c – Derived Undrained Shear Strength vs Depth

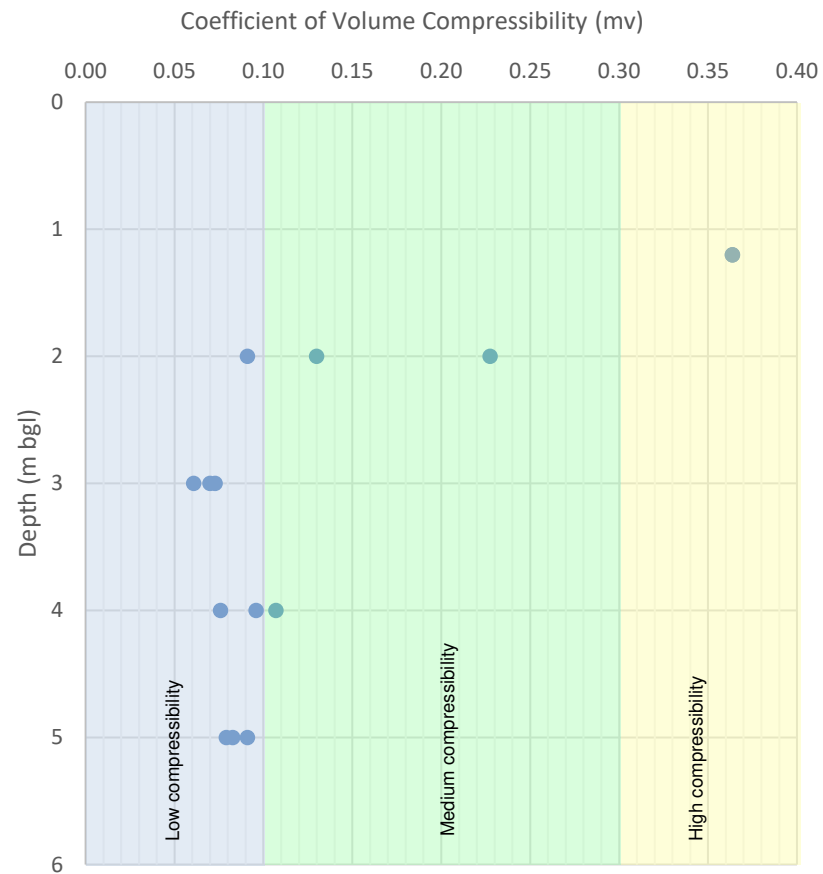


Figure 6.2.1d – Estimated Volume Compressibility Coefficients (Mv) vs Depth

6.3 Aggressive Ground Conditions

The classification of the site in terms of concrete in aggressive ground is based on the guidance provided in Table C2 of the Building Research Establishment (BRE) Special Digest 1, 3rd edition of 2005 (Ref. 11). A summary of the results obtained as a part of the ground investigation are summarised in *Table 6.3a* below.

Table 6.3a –Aggressive Chemical Environment for Concrete (ACEC) Site Classification

Stratum	Test Type	Range
Made Ground	pH	7.72 – 8.71
	Water Soluble Sulphate (mg/l)	1 – 60
Glacial Till	pH	7.3 – 9.23
	Water Soluble Sulphate (mg/l)	2 – 46

Table 6.3b –Aggressive Chemical Environment for Concrete (ACEC) Site Classification

Stratum	Design Sulphate Class	ACEC Class ⁽¹⁾
Made Ground	DS-1	AC-1
Glacial Till	DS-1	AC-1

(1) ACEC assessment was based on the *mobile* groundwater condition for a *brownfield* scheme area.

In these conditions, and as a preliminary assessment it is considered that deterioration of buried concrete due to sulphate or acid attack is unlikely to occur. The preliminary design of buried concrete, based on the Curtins ground investigation, according to Table C2 of BRE Special Digest 1:2005 should be Class DS-1 (AC-1) conditions assuming mobile groundwater.

6.4 Soakaways

Two soakaway tests (SA1 and SA2) were undertaken in accordance with BRE 365. The results of the soakaway test are discussed in *Section 9.7* and presented for referral in *Appendix D*.

7.0 Ground Contamination Assessment

This section of the report includes the assessment of the potential contamination, solid, liquid and gas, identified on the subject site which may present a risk to the proposed end users, associated utilities and the wider environment.

In guidance published by the Environment Agency, the risk to human health or controlled waters is determined through an assessment of pollutant linkages between a source of contamination (within the ground or groundwater either on or off site) and a sensitive receptor such as end users of the site, building materials, edible plants grown in gardens or groundwater abstracted for drinking. This is termed a source-pathway-receptor relationship. The same model is applied to the assessment of risk arising from ground gases as detailed within BS8576:2013 (Ref. 12).

These models have a common approach, which is one of a tiered assessment. At each stage of the assessment further detail can be applied to the conceptual site model to provide a detailed interpretation on a site by site basis. As part of the planning process this approach is adopted to establish either if the site is 'suitable for use' or whether additional work or else remedial work is required for the site to be deemed so.

The sub-sections hereafter therefore incorporate the first tier (Tier 1) of this approach otherwise referred to as the Generic Quantitative Risk Assessment (GQRA). The GQRA builds on the qualitative risk assessment presented in the Phase 1 Desk Study (Ref. 1) conjunction with observations made during the ground investigation and is based solely on the results of the chemical and other testing data obtained as part of Curtins ground investigation. The GQRA is used to build/refine the Conceptual Site Model (CSM) for the site as detailed and presented in *Section 8.0* of this report.

The following sections present more detail on the risk assessment methodology rationale for the main receptors.

7.1 Human Health GQRA

Detailed guidance on human health risk assessment is available within several documents, published by both the Environment Agency and Defra. Guidance includes Contaminated Land Exposure Assessment (CLEA) v1.071 model (Ref. 13) Report SC050021/SR2: Human Health Toxicological Assessment of Contaminants in Soil (Ref. 14) and Report SC059921/SR3: Updated Technical Background to the CLEA Model (Ref. 15).

A generic quantitative risk assessment (GQRA) has been carried out for the Potential Contaminant Linkages (PCLs) investigated by screening of soil contamination data against relevant Generic Assessment Criteria (GAC) where available, including:

- i) **Soil Guideline Values (SGVs):** These have been published by the Environment Agency and are trigger values for screening out low risk areas of land contamination. SGV's give an indication of representative average concentrations of chemicals in soil, below which long-term health risks

are likely to be minimal. SGVs have been published for several contaminants including arsenic, cadmium, mercury, nickel, selenium, BTEX, phenols and dioxins, furans and dioxin-like PCB substances for land uses including residential, allotments and commercial. The SGVs have been developed for a sandy loam soil with 6% soil organic matter (SOM) content;

- ii) **Supplementary Screening Values (SSVs):** In addition to the SGVs developed by the EA, other third-party organisations have derived SSVs for a wider range of contaminants and land uses using the CLEA Model. Curtins have adopted these numbers where applicable, including those developed by Atkins AtriskSoil™, the LQM/CIEH Suitable for Use Levels (S4UL) and EIC/AGS/CL:AIRE published thresholds;
- iii) **Category 4 Screening Levels (C4SLs):** In March 2014 Defra published C4SLs for arsenic, benzene, benzo(a)pyrene, cadmium, hexavalent chromium and lead. These values were derived to support the revised Part 2A Statutory Guidance issued in 2012 (Ref. 16) in which four categories of contaminated land are included, ranging from Category 1 (significant/high risk) to Category 4 (low risk). C4SLs are not representative of significant possibility of significant harm (SPoSH) and are low risk levels which, and therefore where the C4SLs are not exceeded, land can be demonstrated to be in Category 4 and cannot be determined as contaminated land.

7.1.1 Adopted Soil Human Health GACs Screening Methodology

The use of the site, noted as the redevelopment of Gorton Library into a car park, has been compared against the *Commercial* end use scenario, and so the assessment has been undertaken against the following GACs, in order of preference for the development:

1. Environment Agency Soil Guideline Values,
2. CL:AIRE, AGS, EIC. Soil Generic Assessment Criteria for Human Health Risk Assessments,
3. LQM/CIEH 2015 S4ULs for Human Health Risk Assessment, and
4. DEFRA Category 4 Screening Levels.

The soil organic matter (SOM) content has an influence on the volatilisation of organic contaminants (i.e. the higher the SOM, the lower the volatilisation rate and therefore inhalation exposure risk). Soil organic matter (SOM) values for the Made Ground site soils ranged from 4.3% to 17.1% and the natural site soil had a SOM of 3%.

With consideration for a calculated geometric average, Made Ground soils determine a SOM of 6.9% while the natural soil SOM was 3%. As such, a comparison against Tier 1 Thresholds for a conservative SOM of 6% for Made Ground and 2.5% for natural soils for a Commercial end-use.

The adopted GAC's are listed in *Appendix E*.

7.1.2 Generic Assessment Criteria Screening of Soil Laboratory Results

The results of the environmental testing can be referred to in *Appendix C*, with testing undertaken on a total of eight soil samples.

With respect to the proposed end use of the site, no exceedances were recorded with respect to *Commercial* end-use.

No suspected asbestos containing materials (ACMs) were identified in the exploratory hole logs. Four soil samples were screened for asbestos. No asbestos was identified.

8.0 Revised Conceptual Site Model

The Preliminary Conceptual Site Model (PCSM) presented in the Phase 1 Report (Ref.1) and discussed in *Section 2.7* of this report has been revised following the GQRA in *Section 7.0* above. The Revised Conceptual Site Model (CSM) is summarised in the table overleaf.

The CSM details the source-pathway-receptor linkages or potential pollutant linkages (PPL) that have been identified as relevant for the site. The GQRA details the associated level of risk relating to these potential pollutant linkages.

The CSM follows the framework outlined within CIRIA C552 (Ref. 17) which is summarised within *Appendix F*.

The 'risk rating' within the CSM refers to the risk that the source, pathway, receptor linkage or PPL is complete. Unless specifically stated it does not necessarily refer to an immediate risk and is intended to be used as a tool to assess the necessity for further assessment/investigation.

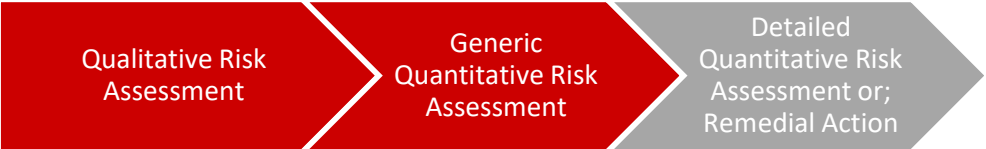
Risks presented by Mining are discussed and assessed within *Section 2.3.4*.

Risks presented by Unexploded Ordnance are discussed and assessed in *Section 2.6*.

Under current health and safety legislation, employers are required to carry out their own appropriate risk assessments and mitigation to protect themselves and their employees, other human receptors and the environment from potential contamination. Such risks must be adequately mitigated by law, specifically the Construction Design Management (CDM) Regulations, 2015 (Ref. 18) which require that potential risks to human health and the environment from construction activities are appropriately identified and all necessary steps taken to eliminate / manage that risk.

It has been assumed that any future construction works on site will be undertaken in compliance with these requirements.

Reference should be given to the environmental testing results discussed within *Section 7.0* and presented within *Appendix C*.



- The table below represents the Second stage in the land quality risk assessment process; the Revised Conceptual Site Model following the Quantitative Risk Assessment.
- For a development site to be deemed ‘suitable for use’ the level of risk needs to be brought down to acceptable levels, i.e. low to very low risk. The purpose of each stage of risk assessment is ultimately to establish if there is a requirement for additional levels of assessment to be made to have sufficient confidence to support a risk characterisation or management decision, e.g. remedial action.

Conceptual Site Model			Generic Qualitative Risk Assessment			Comments	Action
Identified Source	Pathway(s)	Receptor(s)	Consequence	Likelihood of Occurrence	Risk Rating		
On-site Sources • Uncontrolled deposition of Made Ground associated with the construction/demolition onsite associated with terraced housing and current library building. Off-site Sources • Potential contamination associated with the former industries, warehouses and depots. Albeit noting industry typically >100m from site.	Direct contact and dermal uptake, soil and dust ingestion, dust and migration inhalation	Site end-users (Carpark staff and visitors)	Medium Human Health Risk	Unlikely	Low	No exceedance within the environmental chemical analysis with respect to a ‘Commercial’ end use scenario. No asbestos containing materials or fibres have been identified. No visual or olfactory evidence of contamination was noted in shallow site soils. Site to be covered by predominantly hardstanding breaking any SPR linkage. Its noted that large part of the site remains uncharacterised due to the existing building location.	Characterise shallow soils beneath existing building footprint following demolition through trial pits with sampling and analysis of shallow soils to confirm risk rating herein. Construction workers to be provided with appropriate PPE and sanitary facilities.
	Direct contact and dermal uptake, soil and dust ingestion, dust and migration inhalation	Construction and maintenance workers					
	Vertical and horizontal migration through superficial deposits	Controlled Waters (Groundwater) Secondary Undifferentiated Aquifer (Superficial) Secondary A Aquifer (Bedrock)	Mild Pollution of non-sensitive water resources	Unlikely	Very Low	It is considered unlikely that contaminants will migrate vertically into the bedrock aquifer.	No further action required
	Horizontal migration over and through the superficial deposits (soils)	Controlled Waters (Surface Water) Nearest surface water feature is the Gore Brook 340m south. No surface water abstraction points within 1km.	Mild Pollution of non-sensitive water resources	Unlikely	Very Low	Considering the distance from the site to the nearest surface water receptor and the limited potential for significant contamination within the Made Ground, this pathway is considered unlikely.	No further action required

9.0 Engineering Assessment and Recommendations

9.1 Introduction

This section will assess the relevant geotechnical issues for the proposed construction of a hardstanding car park.

The engineering assessment considers drainage and pavement design for the site. Proposed levels for the car park have not yet been provided. It should be noted that detail may change in the development of designs beyond the issue of this Phase 2 Report and the Construction Designer should satisfy themselves regarding the adequacy of their design and proposed approach to construction by reference to the on-going project design proposals, the ground investigation information and their own examination of the site.

9.2 Summary of Ground Conditions

The ground conditions on site generally comprised a surface covering of topsoil, paving flag or decorative gravel, overlying predominantly granular Made Ground to depths between 0.80–0.9m bgl with cohesive Made Ground encountered locally to depths between 0.60m–1.30m bgl.

Made Ground was underlain by cohesive Glacial Till to depths between 1.00 to 5.45m bgl. Cohesive Glacial Till was described as a firm brown mottled grey silty gravelly clay. Underlined by a firm brown slightly silty, slightly gravelly clay. A soft black slightly gravelly, silty clay was encountered locally with firm clay underlying.

Groundwater was encountered within HP03 only during the ground investigation at 0.60m bgl.

It is noted that no ground investigation has been undertaken under the existing Library building to date.

9.3 Geotechnical Considerations

9.3.1 Presence of Existing Services

The presence of existing services may require capping and/or diversion associated with the development, which should be managed through the appropriate utility suppliers during the demolition and construction phase. The Principal Contractor should ensure that appropriate mitigation measures are put in place during the demolition and construction phase.

9.3.2 Obstructions

No obstructions were recorded during the ground investigation. Where demolition works are proposed, floor slabs, foundations and other near surface obstructions should be grubbed out to avoid forming hard spots.

Consideration should be given, in liaison with the Principal Contractor, to re-use of former foundations/concrete obstructions via crushing, appropriate testing (environmental and geotechnical), screening and re-use on site as capping or fill to structures in accordance with Series 600 of the Specification for Highways Works (SHW) to reduce export/import costs.

9.4 Excavations

Based on observations on site, together with the results of in-situ and laboratory tests, it is considered that excavations to <1.20m bgl should stand unsupported in the short term. Side support for safety purposes should of course be provided to all excavations which appear unstable, and those >1.20m deep, in accordance with Health and Safety Regulations.

Suitable side slope angles must be checked and provided by a suitably qualified temporary works contractor for any excavations.

Groundwater may be encountered as seepages in shallow excavations for foundations or services as perched water present. It is considered that groundwater inflows, if encountered, may be controlled by pumping from sumps.

Excavation through layers of Made Ground and Glacial Till encountered across the site should be feasible using conventional site plant.

9.5 Chemical Attack on Buried Concrete

The site has been classified in accordance with BRE Special Digest (Ref. 11) and laboratory testing undertaken accordingly in *Section 6.3*.

In the consideration of sulphate attack on buried concrete, reference has been made to BRE SD1 (2005 Ed), which classifies the site as a brownfield site with a mobile groundwater conditions the results of the concrete classification tests received have indicated a DS-1, AC-1 classification for the Made Ground, and natural soils.

9.6 Pavement Foundations

The subgrade is likely to comprise predominantly granular Made Ground to depths between 0.80–0.90m bgl with cohesive Made Ground encountered locally to depths between 0.60m–1.30m bgl.

For the purpose of pavement foundation design and in accordance with CD 225 Design for new pavement foundations (Rev 1 April 2020) the subgrade surface modulus (E) should be determined for each subgrade.

Five CBR Tests were undertaken on site, the results are summarised in *Table 9.6a*. For CBR values in the range of 2 to 12 % the following equation can be used to estimate the short and/or long-term subgrade surface modulus (E):

$$E = 17.6 (\text{CBR})^{0.64}$$

Where E is the estimated subgrade surface modulus (MPa) and CBR is the CBR of the subgrade.

Estimated values for E are also shown in the table.

Table 9.6a – In-situ CBR Test Results and Estimated Subgrade Surface Modulus

Exploratory Hole Location	Depth of Test	Average CBR Value (%)	Estimated subgrade surface modulus (MPa)	Comments
CBR1	0.30	2.2	29.15	See Note 1
CBR2	0.30	1.9	26.54	See Note 1
CBR3	0.30	9.2	72.83	-
CBR4	0.30	6.6	58.89	-
CBR5	0.30	2.0	27.43	See Note 1

1. Surface modulus lower than 30MPa are unsuitable to support the construction of a pavement foundation and improvement is required.

CD 225 states that a surface modulus lower than 30MPa is unsuitable to support the construction of a pavement foundation and improvement is required. Of the in-situ CBR tests undertaken, 60% of the results have a surface modulus < 30MPa. Improvement of the subgrade can be achieved through excavation of between 500 to 1000mm of subgrade and replacement with a granular fill, the use of geogrids/geotextiles or soil stabilisation. In addition to this foundations built on a subgrade surface modulus ≤ 50MPa have a relatively high risk of structural rutting during the construction if the foundation does not incorporate a capping layer.

Due to the variability of the results it is recommended that post demolition and at formation level, additional CBR tests are undertaken to identify areas requiring improvement (where the surface modulus is < 30MPa) and to determine an appropriate design subgrade surface modulus.

For the purpose of preliminary design we can assume a design subgrade surface modulus of 30MPa (capping layer required). By using the procedures in CD 622 the following capping and sub-base thicknesses would apply for a design subgrade surface modulus of 30MPa (multi-layer) and Foundation Class 2.

Table 9.6b – Capping thicknesses for a design subgrade surface modulus of 30MPa

Foundation Class	Capping Layer Stiffness (MPa)	Capping Thickness (mm)
Class 2	75	420

Table 9.7c – Sub-base thicknesses for a design subgrade surface modulus of 30MPa

Foundation Class	Sub-base Layer Stiffness (MPa)	Sub-base Thickness (mm)
Class 2	120	370
Class 2	150	220

The thickness of the sub-base and capping is dependant on the subgrade surface modulus. Additional CBR tests post demolition may demonstrate that the areas with a subgrade surface modulus lower than 30MPa are isolated, and improvement may only be required locally. CBR3 and CBR4 have estimated subgrade surface modulus's greater than 50MPa, and this may be a more representative design value for the site (therefore thinner capping and sub-base layers), however further testing is required to verify this statement.

9.7 Soakaway Tests

Two soakaway tests (SA1 and SA2) were undertaken within the east and west of the site, within the cohesive Glacial Till deposits in trial pits taken to depths of 1.90 and 2.00m bgl respectively. These were carried out by Structural Soils and are enclosed within *Appendix D*.

The Infiltration Test results are typically calculated using *Equation 5*.

$$\text{Soil Infiltration Rate } f = \frac{V_{p75-25}}{a_{s50} \cdot t_{p75-25}} \quad \text{[Equation 5]}$$

Where:

V_{p75-25} is the effective storage volume of water in the soakage trial pit between 75% and 25% effective storage depth

a_{s50} is the internal surface area of the soakage trial pit up to 50% effective storage depth and including the base area

t_{p75-25} is the time for the water level to fall from 75% to 25% effective storage depth.

The results obtained are summarised in *Table 9.7*.

Table 9.7 – Soakaway Test Results

Location	Strata Test Conducted In	Water filled to (m bgl)	Base of Trial Pit (m bgl)	V_{p75-25} (m ³)	a_{s50} (m ²)	t_{p75-25} (seconds)	Infiltration Rate (m/s)
SA1	Silty gravelly CLAY	0.95	1.90	0.3339	2.5910	Not achieved ¹	Test Failed
SA2	Made Ground to 1.30m bgl Gravelly silty CLAY	0.75	2.00	0.4572	3.3235	32657	4.21×10^{-6}

¹ Unable to calculate infiltration rate due to insufficient drop in water level therefore test failed.

Within SA2 relatively fast infiltration was recorded initially (approximately 200mm drop in water level in 30 minutes) however beyond 30 minutes the drop in water level reduced to approximately 100mm over 90 minutes. After 120 minutes, no further drop in water level was observed. The initial fast drop in water level is likely to be associated with water filling open unsaturated voids within the Made Ground. This is confirmed as the drop in water level stopped when it had reached 1.27m bgl which is approximately where the base of the Made Ground is encountered before the cohesive Glacial Till as shown in *Table 9.7* above.

Based on the observed soakaway tests and calculated infiltration rate, soakaways are unlikely to be an efficient drainage technique at the site.

10.0 Conclusions & Recommendations

10.1 Conclusions

A revised tabulated revised Conceptual Site Model has been derived following the findings on the Generic Quantitative Risk Assessment risk assessment and is presented in *Section 7.0*.

10.1.1 Ground Contamination

A **Low** risk rating has been identified to proposed end-users and construction workers from direct contact, inhalation and ingestion of contaminants within Made Ground soils. This is due to no exceedances were recorded with respect to Commercial end-use. No asbestos containing materials or fibres have been identified. It is however noted that a significant area of the site beneath the existing building remains uncharacterised. It's recommended that further investigation, soil sampling and chemical analysis is undertaken post demolition to confirm the risk rating herein.

The site is to be covered by predominantly by hardstanding therefore breaking any SPR linkages.

10.1.2 Controlled Waters

The Phase 1 assessed a Low risk to groundwaters and surface water receptors. No evidence of gross contamination was identified in site soils.

10.2 Recommendations

Based on the findings of the ground investigation, the following recommendations are made:

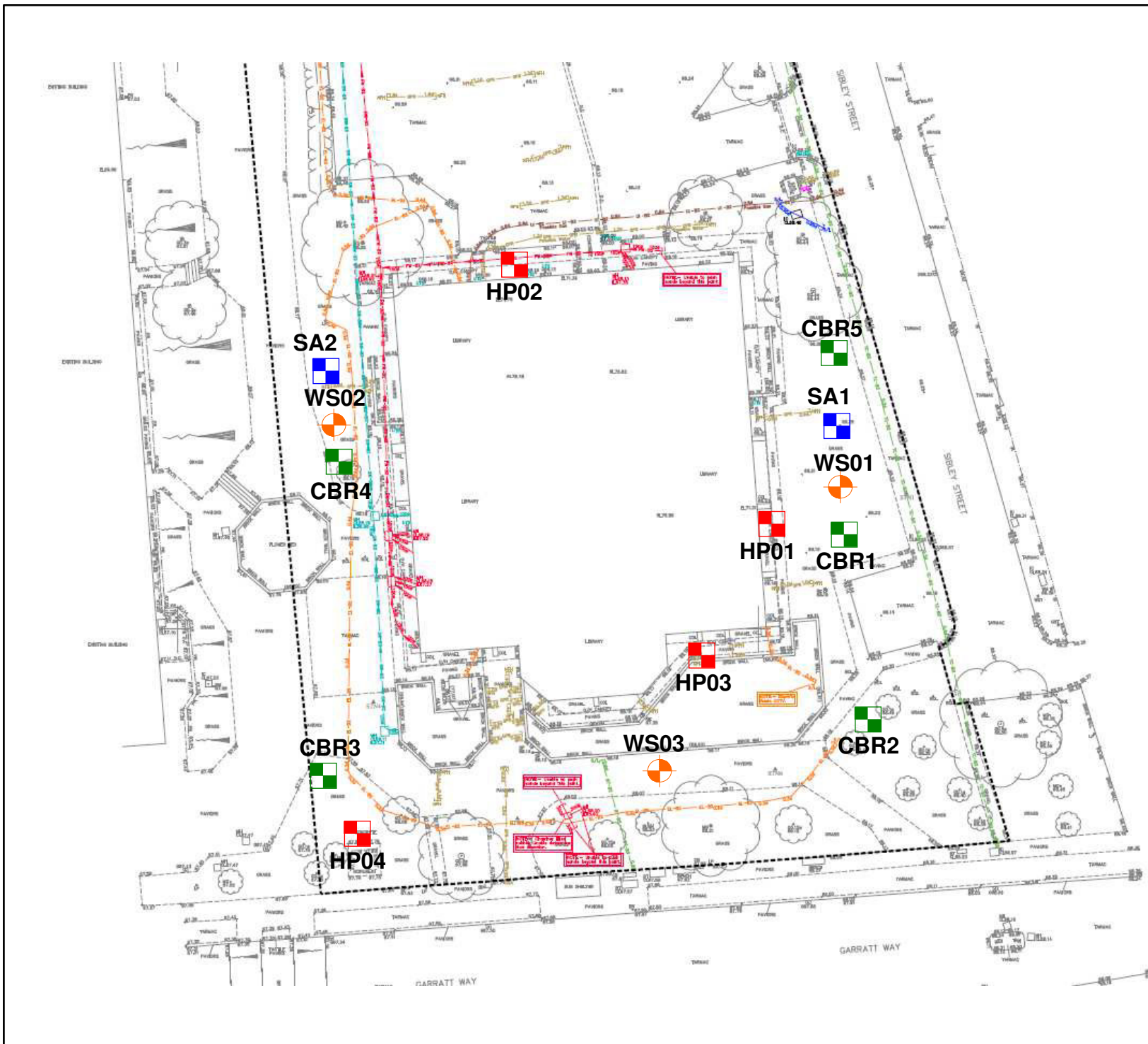
- 1) Characterise shallow soils beneath existing building footprint following demolition through trial pits with sampling and chemical analysis of shallow soils to confirm risk rating herein.
- 2) Due to the variability of the CBR results it is recommended that post demolition and at formation level, additional CBR tests are undertaken to identify areas requiring improvement (where the surface modulus is <30MPa) and to determine an appropriate design subgrade surface modulus.
- 3) It is recommended that construction workers are provided with appropriate PPE and sanitary facilities.
- 4) Should unexpected contamination be observed during construction advice should be obtained from a Geo-environmental Engineer.

11.0 References

1. **Curtins**, Phase 1 Preliminary Risk Assessment for *Gorton Phase 2 Car Park*, ref 070452-CUR-00-XX-RP-GE-00001-P01 dated November 2022.
2. **Environment Agency**. (2020) Land Contamination Risk Management (LCRM).
3. **British Standards Institution**. (2011) Investigation of Potentially Contaminated Sites: Code of Practice (report no. BS10175:2011+A2:2017).
4. **British Standards Institution BSI**. (2015+2000) Code of Practice for Site Investigations (report no. BS5930).
5. **British Standards Institution**. (2006) *Eurocode 7: Geotechnical Design* (report no. BS EN 1997).
6. **British Standard**. (2016) Methods of test for soils for civil engineering purposes. General requirements and sample preparation (report no. BS1377-1).
7. **NHBC Standards** (2021) Chapter 4.2
8. **M J Tomlinson** (2001) Foundation Design and Construction
9. **Stroud, M. a. B. F.** (1975) The Standard Penetration Test and the Engineering Properties of Glacial Materials
10. **British Standard**. (2015) Code of Practice for Earth Retaining Structures (report no. BS8002:2015)
11. **Building Research Establishment**. (2005) BRE Special Digest 1, 'Concrete in Aggressive Ground'. 2005.
12. **British Standards Institution**. (2013) *Guidance on Investigations for Ground Gas, Permanent Gas and Volatile Organic Compounds (VOCs)* (report no.BS8576:2013).
13. **Environment Agency**. (2014) *Contaminated Land Exposure (CLEA) Tool* (version 1.06).
14. **Environment Agency**. (2009) *Human Health Toxicological Assessment of Contaminants in Soil* (report no. SC050021/SR2)
15. **Environment Agency**. (2009) *Updated Technical Background to the CLEA Model* (report no.SC050021/SR3).
16. **Department of Environment Food and Rural Affairs (DEFRA)**. (2012) Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (report no. PB13735).
17. **CIRIA C552**. (2001) Contaminated Land Risk Assessment. A Guide to Good Practice.
18. **CITB**. (2015) Construction (Design and Management) Regulations.

Appendix A – Drawings

- Curtins (2022), 070452-CUR-00-XX-DR-GE-80008-P05, Borehole Location Plan.
- Architect's Proposed Development Plans, dated 13/07/22, GLP-IBI-WS-00-DR-A-100-004.



-  WINDOW SAMPLE BOREHOLE
-  HAND EXCAVATED FOUNDATION PIT
-  SOAKAWAY TEST
-  CALIFORNIA BEARING RATIO TEST (CBR)

Rev:	Description:	Date:	By:	Chkd:
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Structures - Civils - Environmental - Infrastructure - Transport Planning - Sustainability - Expert Advisory Services
Birmingham - Bristol - Cardiff - Douglas - Edinburgh - Kendal - Leeds - Liverpool - London - Manchester - Nottingham

Status:

INFORMATION

Project:

GORTON LIBRARY

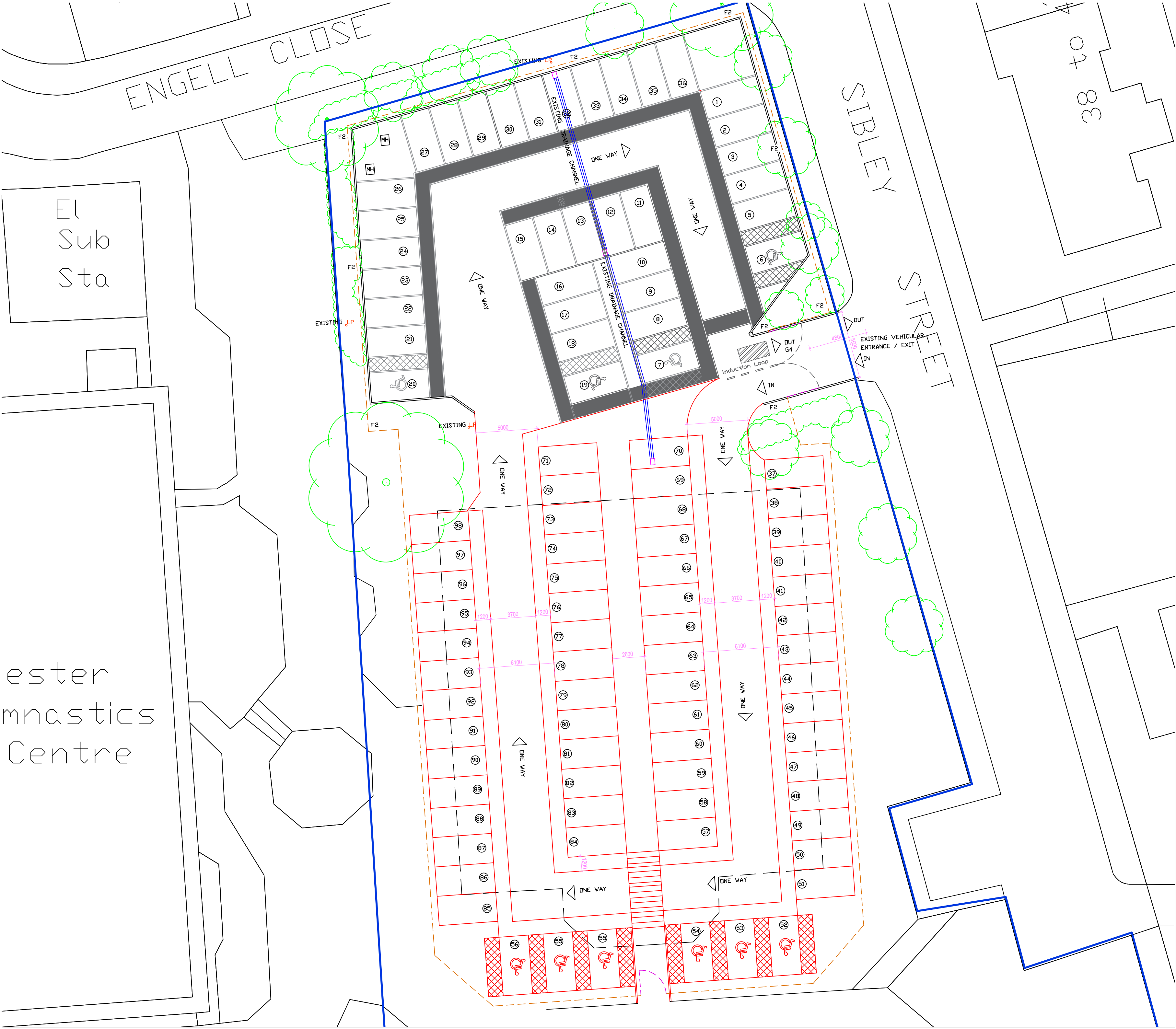
Drg Title:

EXPLORATORY HOLE LOCATION PLAN

Scale:	Size:	First Issue:	Drawn:	Checked:
NTS	A3	13/12/2022	RBJ	NF

Drg No:	Rev:
070452-CUR-00-XX-DR-GE-80008	P05

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Notes:

- This drawing is copyright.
- Do not scale dimensions from this drawing.
- All discrepancies on this drawing are to be reported to the architect.
- Do not modify any element of this drawing.
- Use drawing only for purpose(s) issued.

North Sign / Key Plan

NORTH





EXISTING GORTON LIBRARY LAND OWNERSHIP SITE BOUNDARY

The following external model files are included within this drawing:

Rev	Date	Revision Notes	Dn	Rv
Client / Contractor				



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Project

GORTON_LIBRARY_CAR_PARK_PHASE_2

Drawing Title

PROPOSED_SITE_PLAN

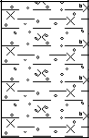
Job Number	Date	Scale@A2
50786	13/07/22	1:200
Status	Purpose	
PRELIMINARY	COMMENT	

Drawing Number	Revision
GLP-IBI-WS-00-DR-A-100-004	

Appendix B – Exploratory Hole Logs

					Borehole Log		Borehole No. WS01 Sheet 1 of 2	
Project Name: Gorton Library				Project No. 070452		Co-ords: -		Hole Type WS
Location: Gorton				Level:		Scale 1:25		
Client: Morgan Sindall				Dates: 10/11/2022 - 10/11/2022		Logged By RBJ		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.40	ES		0.25			Grass over TOPSOIL: Dark brown slightly gravelly, very silty clay with frequent rootlets. Gravel is fine to medium and sub-angular to sub-rounded of sandstone and siltstone.
					0.90			MADE GROUND: Dark brown very gravelly, silty clay with occasional cobbles. Gravel is medium to coarse and angular to sub-rounded of brick, clinker, sandstone and siltstone. Cobbles of angular brick.
		1.20		N=8 (1,2/1,2,2,3)				Firm brown mottled grey silty gravelly CLAY. Gravel is medium to coarse and sub-angular to sub-rounded of siltstone, sandstone and rare coal.
		2.00 2.00 - 2.45	D	N=20 (2,3/5,5,6,4)				
		3.00		N=26 (3,5/6,7,6,7)	2.70			Firm brown slightly silty, slightly gravelly CLAY. Gravel is fine to medium and rounded to sub-rounded of mudstone, siltstone and sandstone.
		4.00		N=17 (3,3/4,4,5,5)				
		5.00		N=22 (3,3/4,5,6,7)				
Continued on next sheet								

Remarks Hand excavated service pit to 1.20m bgl. No groundwater encountered.	
---	--

					Borehole Log			Borehole No. WS01 Sheet 2 of 2		
Project Name: Gorton Library					Project No. 070452		Co-ords: -		Hole Type WS	
Location: Gorton					Level:		Scale 1:25		Logged By RBJ	
Client: Morgan Sindall					Dates: 10/11/2022 - 10/11/2022					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					5.45			End of borehole at 5.45 m		
									6	
									7	
									8	
									9	
									10	
Remarks Hand excavated service pit to 1.20m bgl. No groundwater encountered.										

					Borehole Log		Borehole No. WS02 Sheet 1 of 2	
Project Name: Gorton Library				Project No. 070452		Co-ords: -		Hole Type WS
Location: Gorton				Level:		Scale 1:25		
Client: Morgan Sindall				Dates: 10/11/2022 - 10/11/2022		Logged By RBJ		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.24			Grass over TOPSOIL: Dark brown slightly gravelly, very silty clay with frequent rootlets. Gravel is fine to medium and sub-angular to sub-rounded of sandstone and siltstone.
		1.20		N=5 (1,0/1,1,2,1)				MADE GROUND: Dark brown very gravelly, silty clay with occasional cobbles. Gravel is medium to coarse and angular to sub-rounded of brick, clinker, sandstone and siltstone. Cobbles of angular brick.
		1.35	ES		1.30			Soft black slightly gravelly, silty CLAY. Gravel fine to medium and sub-angular of coal.
		1.50	D		1.40			Firm brown mottled grey silty gravelly CLAY. Gravel is medium to coarse and sub-angular to sub-rounded of siltstone, sandstone and rare coal.
		2.00		N=14 (1,2/3,4,4,3)				Firm brown slightly silty, slightly gravelly CLAY. Gravel is fine to medium and rounded to sub-rounded of mudstone, siltstone and sandstone.
		3.00	D		2.90			
		3.00		N=30 (3,5/7,8,8,7)				
		4.00		N=24 (3,4/5,6,6,6)				
		5.00		N=23 (3,4/5,6,6,6)				

Continued on next sheet

1

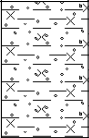
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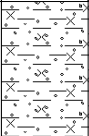
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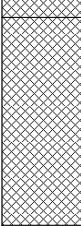
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5

Remarks
 Hand excavated service pit to 1.20m bgl. No groundwater encountered.

					Borehole Log			Borehole No. WS02 Sheet 2 of 2		
Project Name: Gorton Library					Project No. 070452		Co-ords: -		Hole Type WS	
Location: Gorton					Level:			Scale 1:25		
Client: Morgan Sindall					Dates: 10/11/2022 - 10/11/2022			Logged By RBJ		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					5.45			End of borehole at 5.45 m		
									6	
									7	
									8	
									9	
									10	
Remarks Hand excavated service pit to 1.20m bgl. No groundwater encountered.										

					Borehole Log			Borehole No. WS03 Sheet 2 of 2		
Project Name: Gorton Library					Project No. 070452		Co-ords: -		Hole Type WS	
Location: Gorton					Level:			Scale 1:25		
Client: Morgan Sindall					Dates: 10/11/2022 - 10/11/2022			Logged By RBJ		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					5.45			End of borehole at 5.45 m		
									6	
									7	
									8	
									9	
									10	
Remarks Hand excavated service pit to 1.20m bgl. No groundwater encountered.										

				Trial Pit Log			Trialpit No HP01 Sheet 1 of 1		
Project Name: Gorton Library				Project No. 070452		Co-ords: - Level:		Date 11/11/2022	
Location: Gorton				Client: Morgan Sindall		Dimensions (m): Depth 0.61		Scale 1:20	
		Logged RBJ							
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.20	ES		0.05			MADE GROUND: Grey medium well rounded pea gravel. MADE GROUND: Dark brown/black very gravelly clay. Gravel is medium to coarse and sub-angular to sub-rounded of brick, sandstone and siltstone.		
				0.60 0.61			MADE GROUND: Grey concrete. End of pit at 0.61 m		
							1		
							2		
							3		
							4		
Remarks: Foundation hand pit to 0.61m bgl. Hand pit terminated due to spacial restrictions. Refer to foundation hand pit drawing HP01. No groundwater encountered.									
Stability: Stable.									



				Trial Pit Log			Trialpit No HP04 Sheet 1 of 1		
Project Name: Gorton Library				Project No. 070452		Co-ords: - Level:		Date 11/11/2022	
Location: Gorton				Client: Morgan Sindall		Dimensions (m): Depth 1.00		Scale 1:20	
		Logged RBJ							
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.65	ES		0.23			Grass over TOPSOIL: Dark brown slightly gravelly, very silty clay with frequent rootlets. Gravel is fine to medium and sub-angular to sub-rounded of sandstone and siltstone.		
				0.55			MADE GROUND: Brown and grey very sandy gravel. Sand is fine to medium and gravel is medium to coarse and angular to sub-angular of limestone and concrete.		
				0.90			MADE GROUND: Black/brown sandy, silty, very clayey gravel. Gravel is medium to coarse and angular to sub-angular of brick, clinker, sandstone and siltstone.		
				1.00			Firm brown mottled grey silty gravelly CLAY. Gravel is medium to coarse and sub-angular to sub-rounded of siltstone, sandstone and rare coal.		
							End of pit at 1.00 m		
Remarks: Foundation hand pit to 1.00m bgl. Refer to foundation hand pit drawing HP04. No groundwater encountered.									
Stability: Stable.									



070452-CUR-00-XX-DR-GE-002-V01

Gorton Library

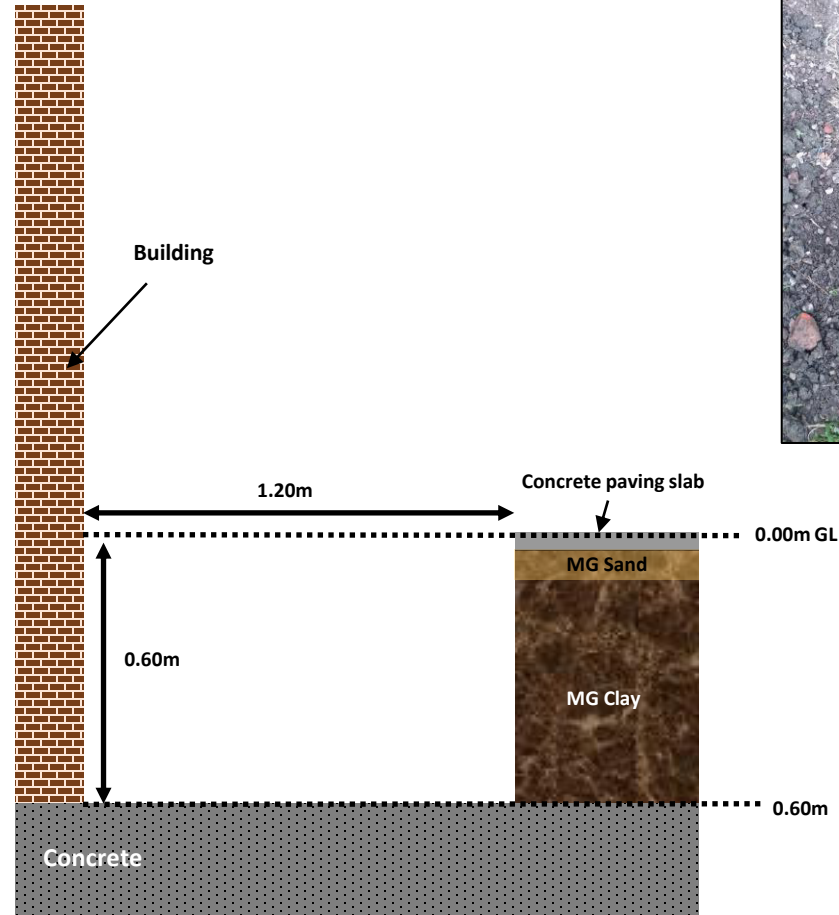
Foundation Pit Cross Sectional Sketches

HP01

Comments:

Not to scale.

- Hand pit terminated at 0.60m bgl on concrete.
- Groundwater not encountered.
- Concrete foundation encountered at 0.60m bgl.
- Concrete foundation extends more than 1.20m away from building (measured from face of wall, not face of column).
- Base/thickness of concrete foundation not identified due to restrictions preventing extension of trial pit.
- Further detailed information in log HP01.



070452-CUR-00-XX-DR-GE-002-V01

Gorton Library

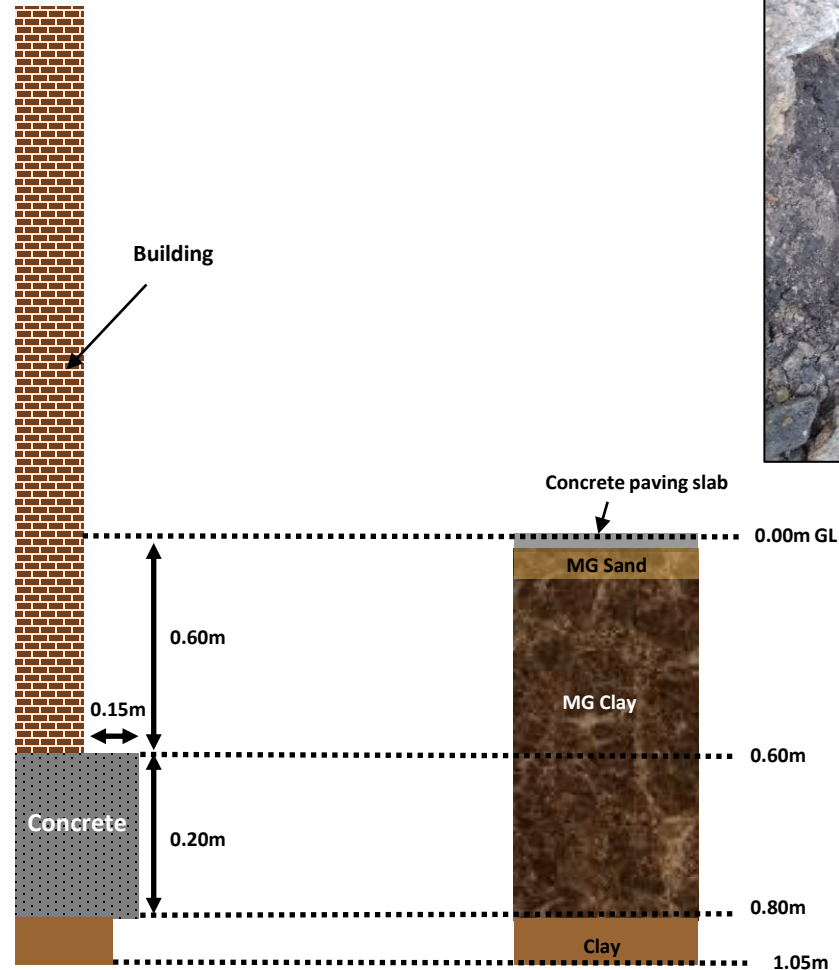
Foundation Pit Cross Sectional Sketches

HP02

Comments:

Not to scale.

- Hand pit terminated at 1.05m bgl in natural clay.
- Groundwater not encountered.
- Concrete foundation extends 0.15m away from building wall.
- Concrete foundation encountered at 0.60m bgl and the base of concrete slab identified at 0.80m bgl with a thickness of 0.20m.
- Further detailed information in log HP02.



070452-CUR-00-XX-DR-GE-002-V01

Gorton Library

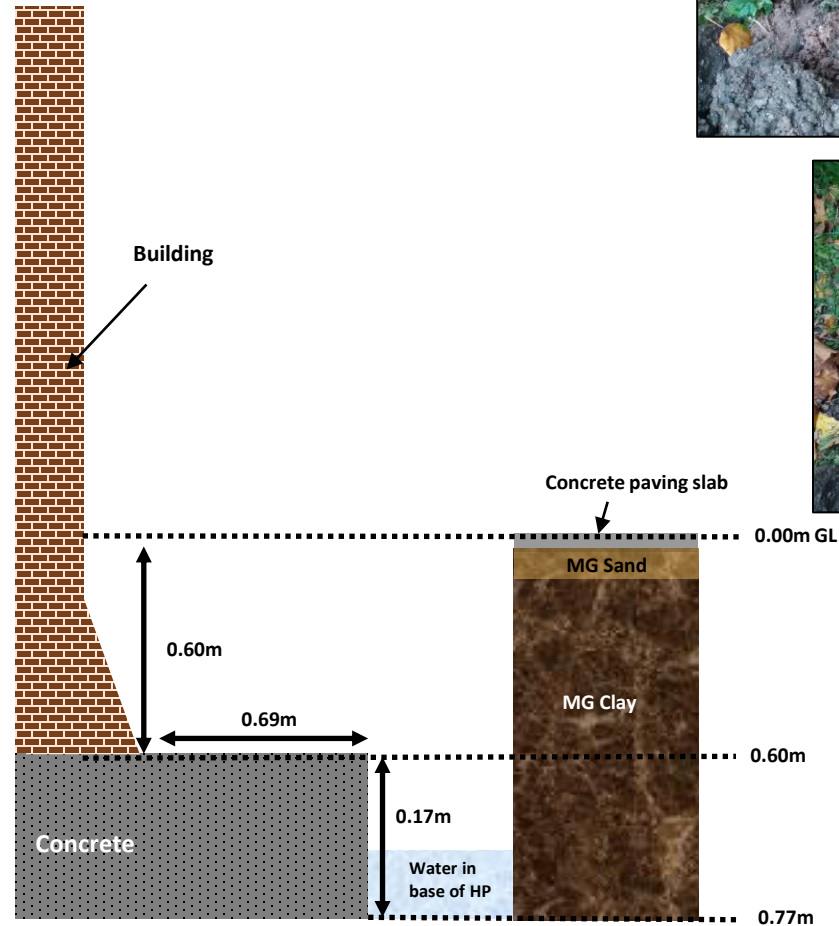
Foundation Pit Cross Sectional Sketches

HP03

Comments:

Not to scale.

- Hand pit terminated at 0.77m bgl in Made Ground due to water in the base of hand pit.
- Groundwater was encountered at 0.60m bgl.
- Concrete foundation projects 0.69m from building wall.
- Concrete foundation encountered at 0.60m bgl and the base of concrete foundation identified at 0.77m bgl with a thickness of 0.17m bgl.
- Further detailed information in log HP03.



070452-CUR-00-XX-DR-GE-002-V01

Gorton Library

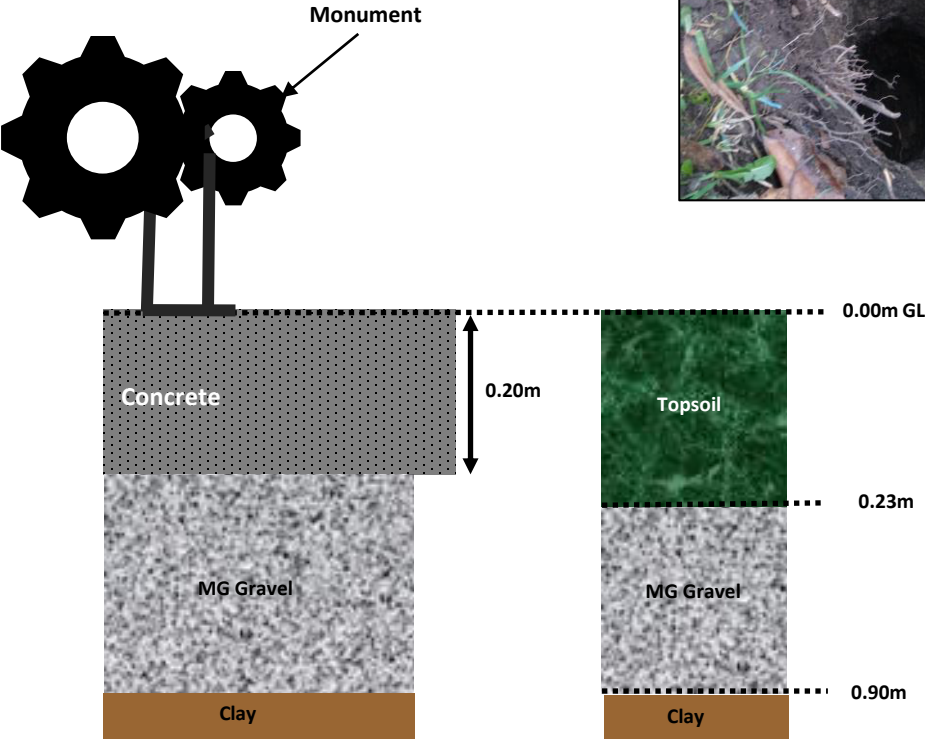
Foundation Pit Cross Sectional Sketches

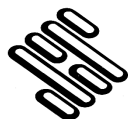
HP04

Comments:

Not to scale.

- Hand pit terminated at 1.00m bgl in natural clay.
- Groundwater not encountered.
- Concrete foundation encountered at ground level, extending to 0.20m bgl, formed on Made Ground.
- Further detailed information in log HP04.





STRUCTURAL SOILS LTD
INSITU TESTING REPORT



1774

Report No. 785332.R01(00)

Date 16-November-2022 Contract Gorton Library, Manchester

Client Curtins Consulting Limited
Address 51-55 TITHEBARN STREET
LIVERPOOL
L2 2SB

For the Attention of Niall Farnworth

Order received	08-November-2022	Client Reference	B070452
Testing Started	10-November-2022	Client Order No.	1769
Testing Completed	11-November-2022	Instruction Type	Written

Tests marked 'Not UKAS Accredited' in this report are not included in the UKAS Accreditation Schedule for our Laboratory.

UKAS Accredited Tests

* 5 no. Insitu CBR Test in accordance with BS1377:Part 9:1990.

Not - UKAS Tests:

* 2 no. Soakaway Testing to BRE Digest 365
Please note that 3 fills in each pit was not achievable due to time constraints/ground conditions

The results represent the ground conditions at the specified locations and depths at the time of testing.

Please Note: Remaining samples will be retained for a period of one month from today and will then be disposed of.
Test were undertaken on samples 'as received' unless otherwise stated.
Opinions and interpretations expressed in this report are outside the scope of accreditation for this laboratory.

Structural Soils Ltd, The Potteries, Pottery Street, Castleford, WF10 1NJ Tel.01977552255. e-mail matthew.doran@soils.co.uk

TESTING VERIFICATION CERTIFICATE



1774

The test results included in this report are certified as:-

ISSUE STATUS: **FINAL**

In accordance with the Structural Soils Ltd Laboratory Quality Management System, results sheets and summaries of results issued by the laboratory are checked by an approved signatory. The integrity of the test data and results are ensured by control of the computer system employed by the laboratory as part of the Software Verification Program as detailed in the Laboratory Quality Manual.

This testing verification certificate covers all testing compiled on or before the following datetime: **16/11/2022 09:48:49**.

Testing reported after this date is not covered by this Verification Certificate.

Approved Signatory
Matthew Doran (Site Testing Manager (North))

(Head Office)
Bristol Laboratory
Unit 1A, Princess Street
Bedminster
Bristol
BS 3 4AG

Castleford Laboratory
The Potteries, Pottery Street
Castleford
West Yorkshire
WF10 1NJ

Hemel Laboratory
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Tonbridge Laboratory
Anerley Court, Half Moon Lane
Hildenborough
Tonbridge
TN11 9HU



**STRUCTURAL
SOILS LTD**

Contract:

Gorton Library, Manchester

Job No:

785332



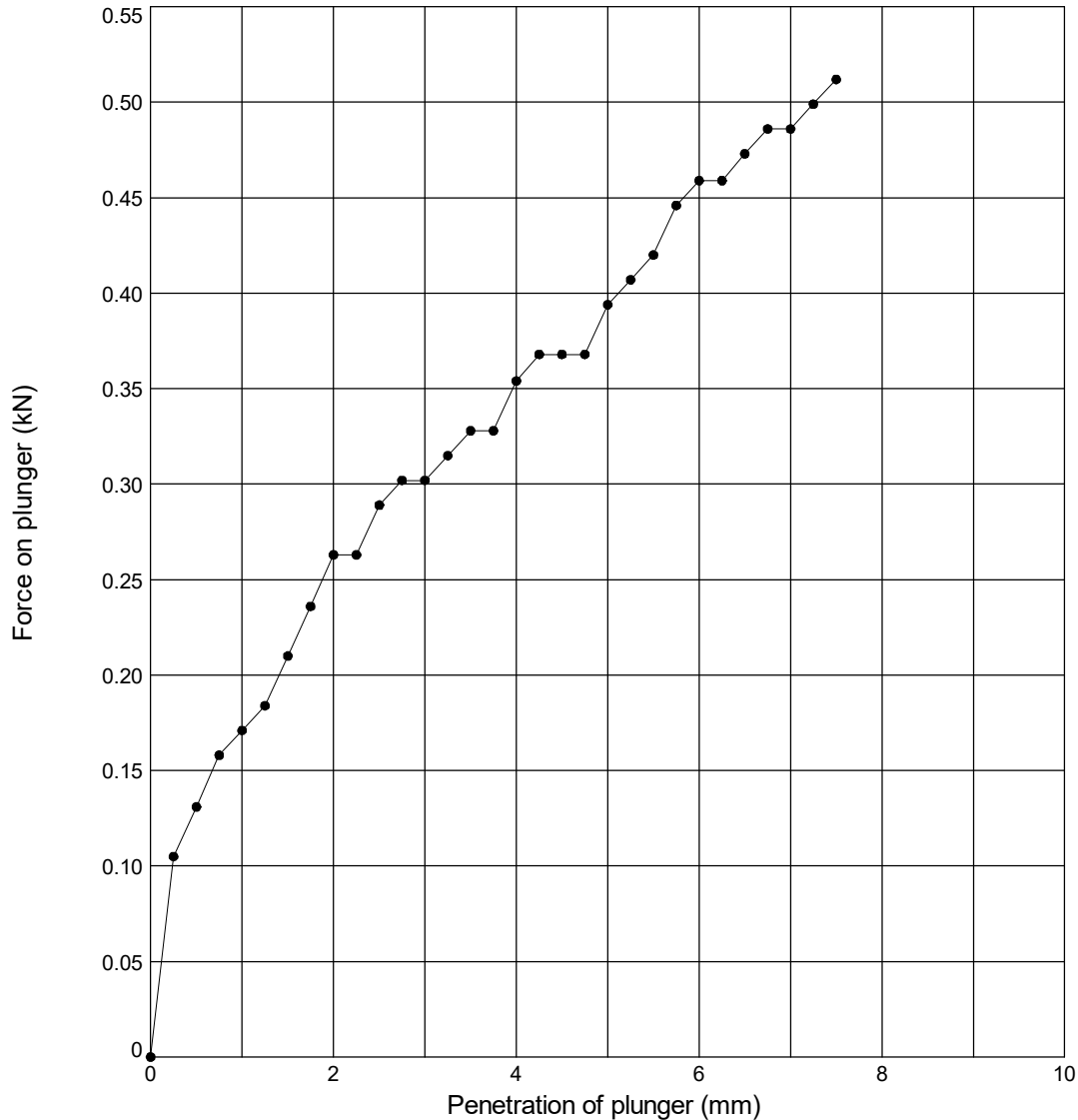
IN SITU CALIFORNIA BEARING RATIO TEST

In accordance with BS1377:Part 9:1990

Position Ref: **CBR1**

Depth (m): **0.30**

Date: **11/11/22**



Test Details	Test Conditions	Test Results
Kentledge : Toyota Hilux Surcharge (kg) : 4.52 Surcharge Pressure (kPa) : 1	Weather : Overcast Temperature (°C) : 14	CBR Value (%) : 2.2 Moisture Content (%) : 29
Sample Description	Test Notes	
Gravelly silty clay with occasional cobbles.	Estimated particles >20 mm (%) : 0 Size and position of particles >20mm in relation to the plunger : Unknown	

 STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By		Date
	<i>K. Limacher</i>	KATIE LIMACHER	16/11/22
	Contract	Contract Ref:	
	Gorton Library, Manchester	785332	
			

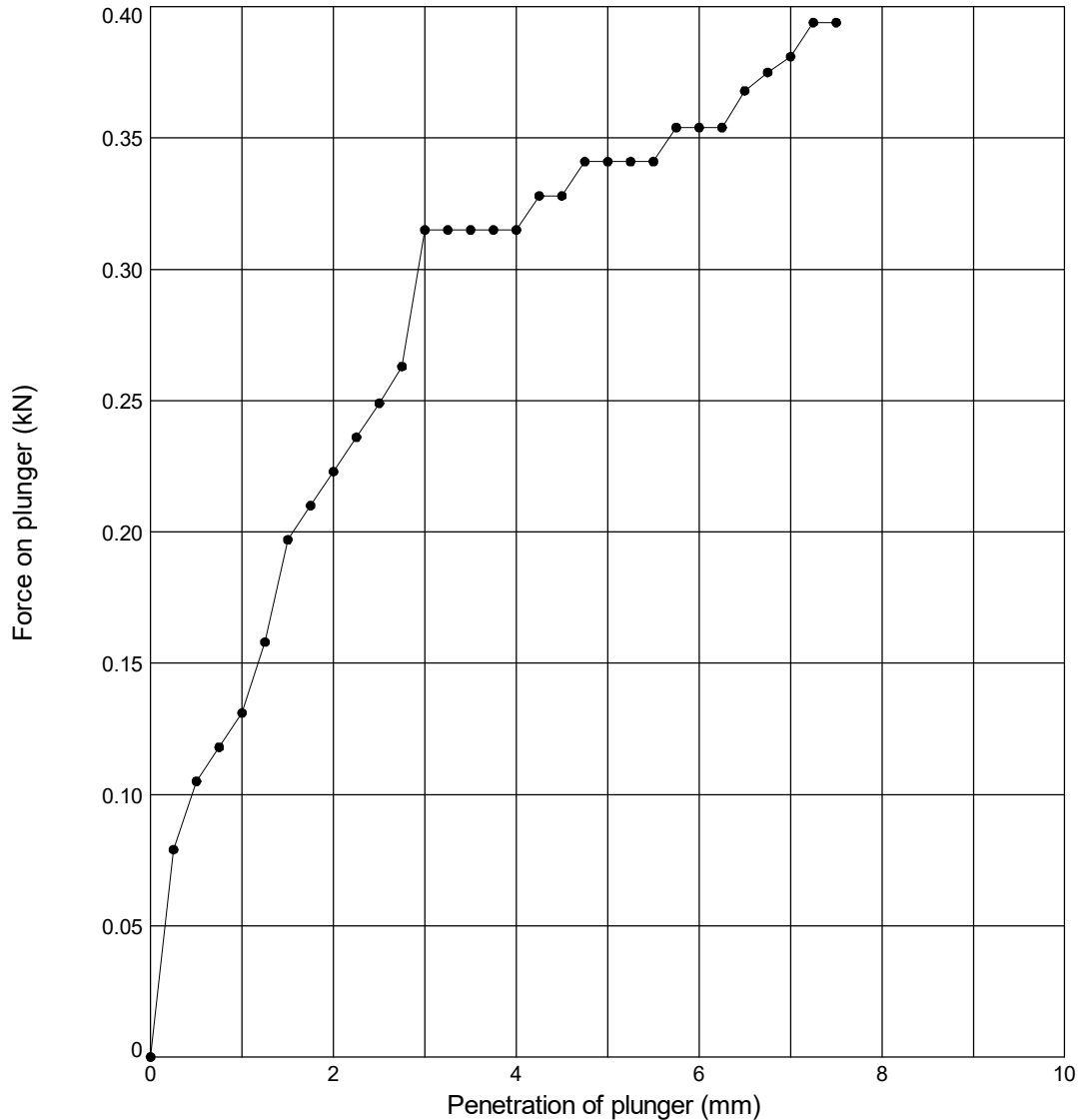
IN SITU CALIFORNIA BEARING RATIO TEST

In accordance with BS1377:Part 9:1990

Position Ref: **CBR2**

Depth (m): **0.30**

Date: **11/11/22**



Test Details	Test Conditions	Test Results
Kentledge : Toyota Hilux Surcharge (kg) : 4.52 Surcharge Pressure (kPa) : 1	Weather : Overcast Temperature (°C) : 14	CBR Value (%) : 1.9 Moisture Content (%) : 20
Sample Description	Test Notes	
Gravelly silty clay with occasional cobbles.	Estimated particles >20 mm (%) : 0 Size and position of particles >20mm in relation to the plunger : Unknown	

 STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By		Date
	<i>K. Limacher</i>	KATIE LIMACHER	16/11/22
	Contract	Contract Ref:	
	Gorton Library, Manchester	785332	
			

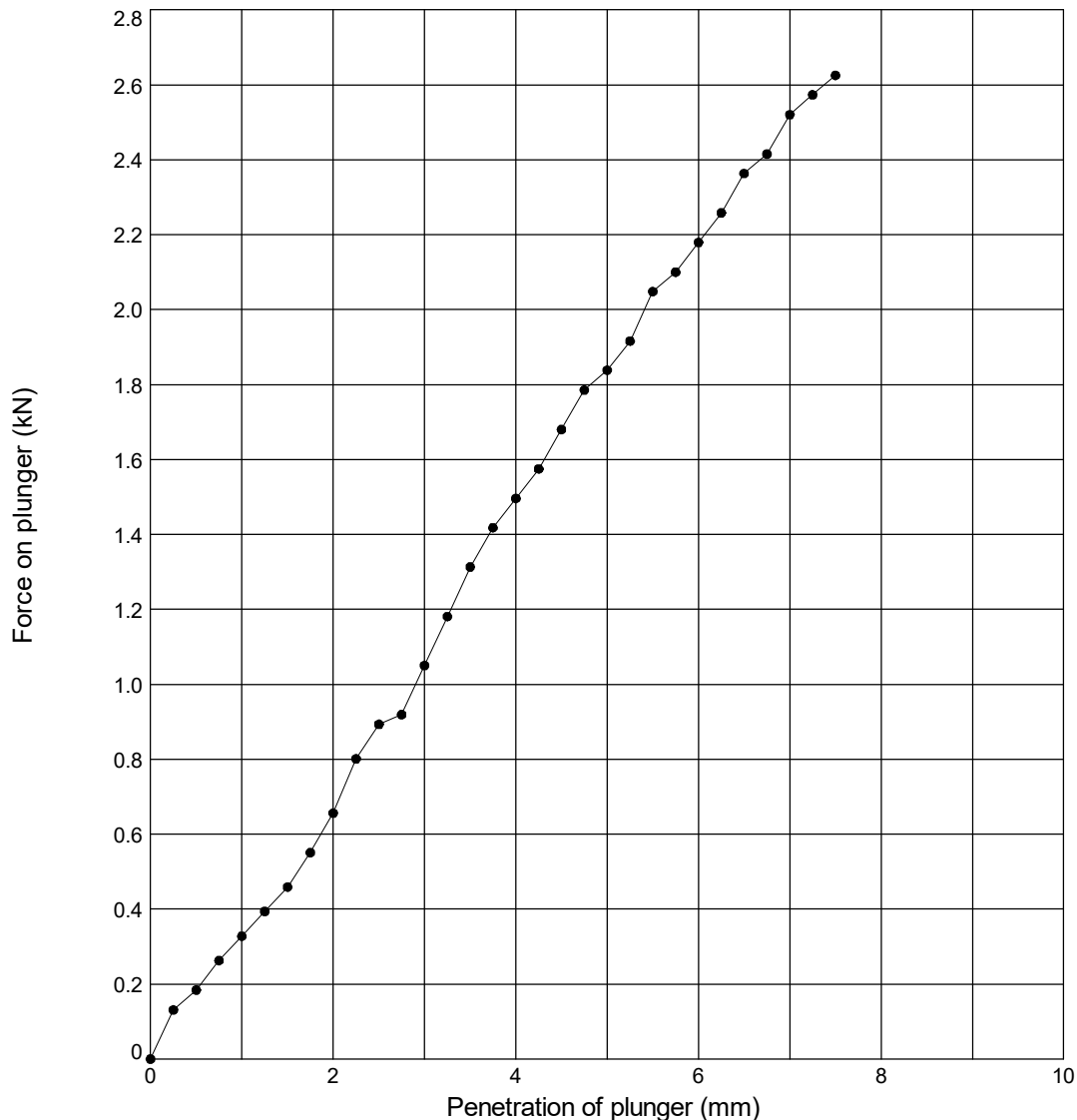
IN SITU CALIFORNIA BEARING RATIO TEST

In accordance with BS1377:Part 9:1990

Position Ref: **CBR3**

Depth (m): **0.30**

Date: **10/11/22**



Test Details	Test Conditions	Test Results
Kentledge : Toyota Hilux Surcharge (kg) : 4.52 Surcharge Pressure (kPa) : 1	Weather : Overcast Temperature (°C) : 10	CBR Value (%) : 9.2 Moisture Content (%) : 11
Sample Description	Test Notes	
Gravelly silty clay with occasional cobbles.	Estimated particles >20 mm (%) : 0 Size and position of particles >20mm in relation to the plunger : Unknown	

 STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By		Date
	<i>K. Limacher</i>	KATIE LIMACHER	16/11/22
	Contract	Contract Ref:	
	Gorton Library, Manchester	785332	
			

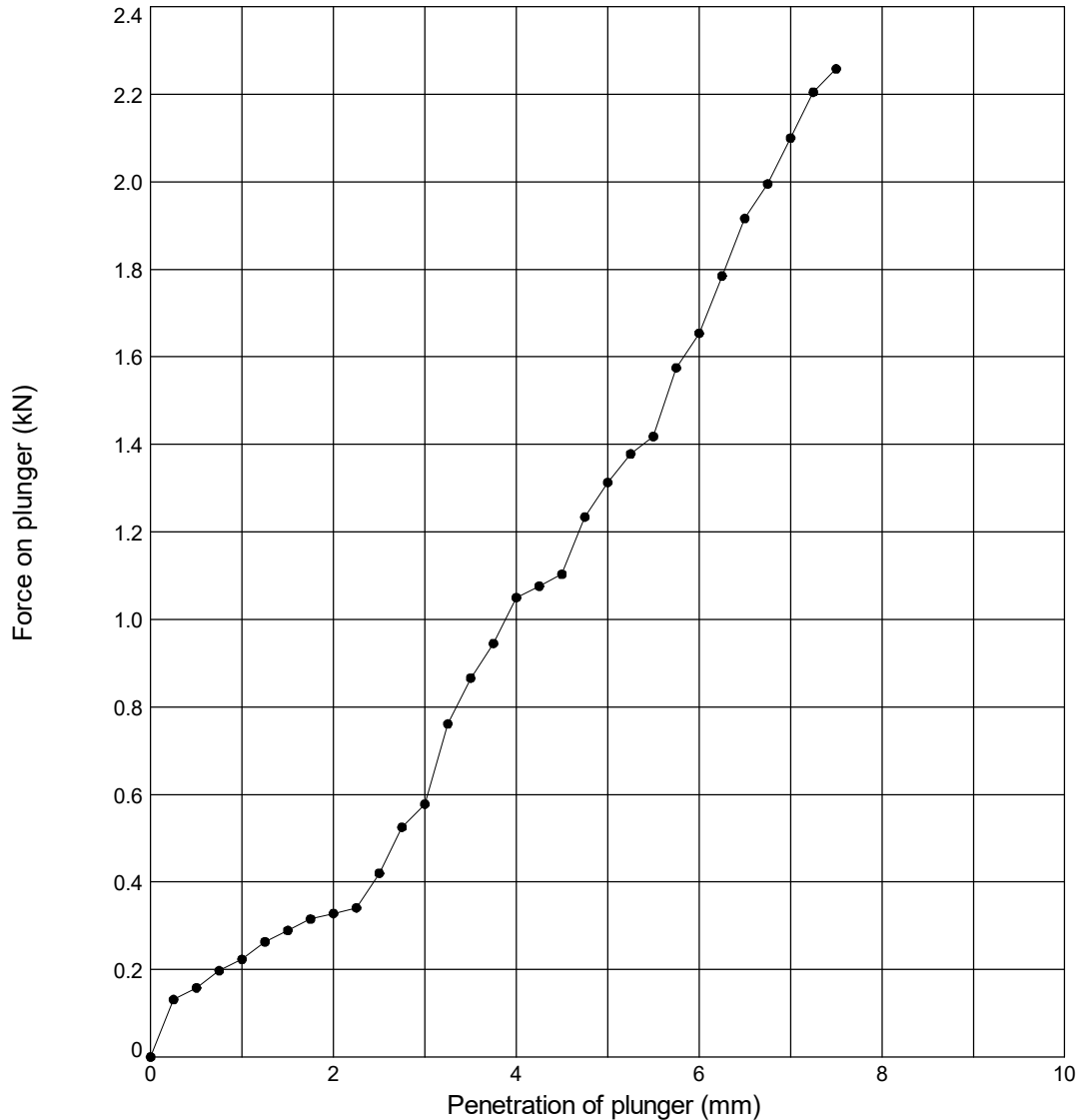
IN SITU CALIFORNIA BEARING RATIO TEST

In accordance with BS1377:Part 9:1990

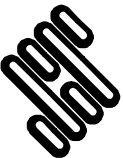
Position Ref: **CBR4**

Depth (m): **0.30**

Date: **11/11/22**



Test Details	Test Conditions	Test Results
Kentledge : Toyota Hilux Surcharge (kg) : 4.52 Surcharge Pressure (kPa) : 1	Weather : Overcast Temperature (°C) : 14	CBR Value (%) : 6.6 Moisture Content (%) : 12
Sample Description	Test Notes	
Gravelly silty clay with occasional cobbles.	Estimated particles >20 mm (%) : 0 Size and position of particles >20mm in relation to the plunger : Unknown	

 STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By		Date
	<i>K. Limacher</i>	KATIE LIMACHER	16/11/22
	Contract	Contract Ref:	
	Gorton Library, Manchester	785332	
			

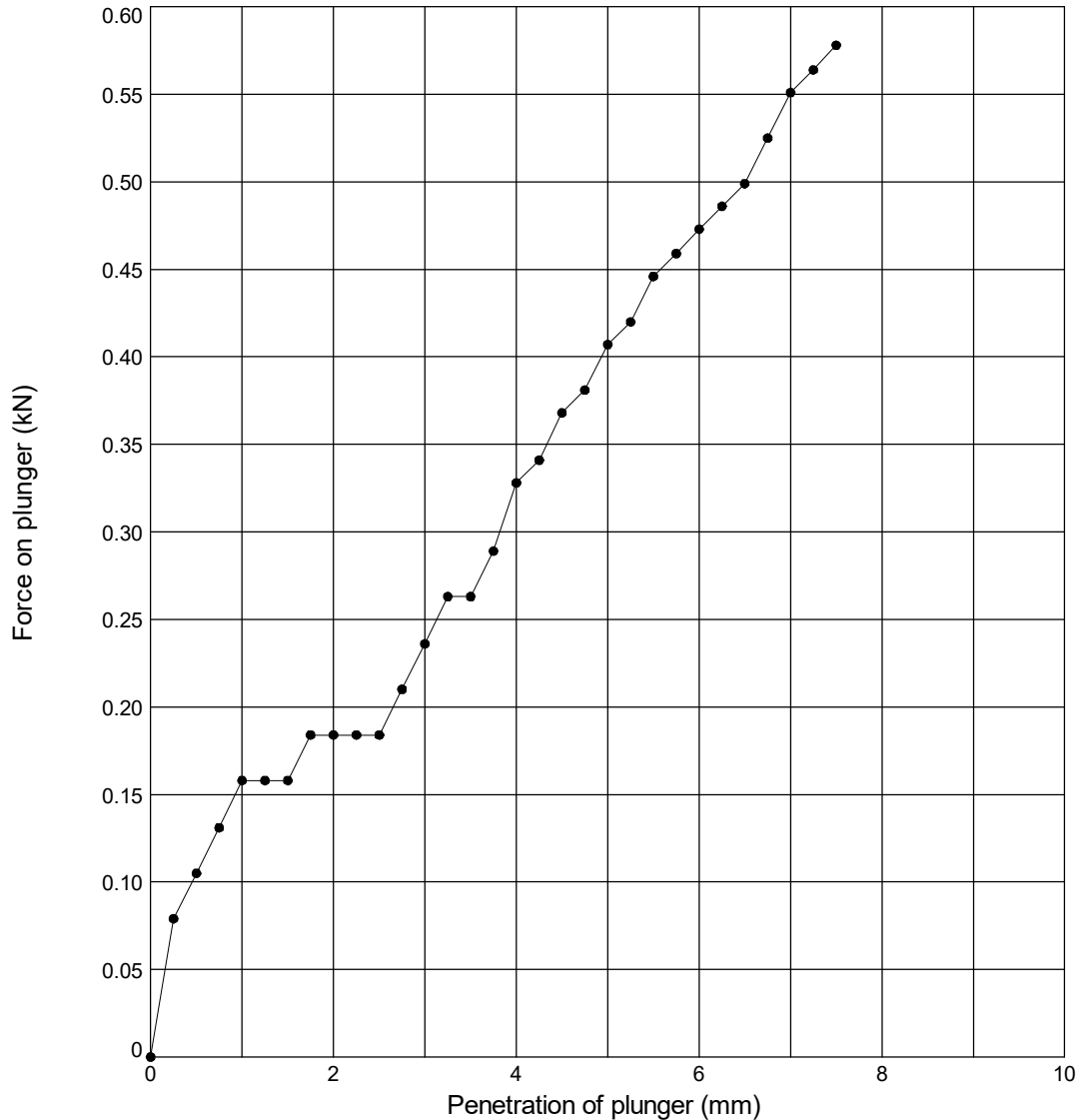
IN SITU CALIFORNIA BEARING RATIO TEST

In accordance with BS1377:Part 9:1990

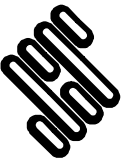
Position Ref: **CBR5**

Depth (m): **0.30**

Date: **11/11/22**



Test Details	Test Conditions	Test Results
Kentledge : Toyota Hilux Surcharge (kg) : 4.52 Surcharge Pressure (kPa) : 1	Weather : Overcast Temperature (°C) : 14	CBR Value (%) : 2.0 Moisture Content (%) : 39
Sample Description	Test Notes	
Gravelly silty clay with occasional cobbles.	Estimated particles >20 mm (%) : 0 Size and position of particles >20mm in relation to the plunger : Unknown	

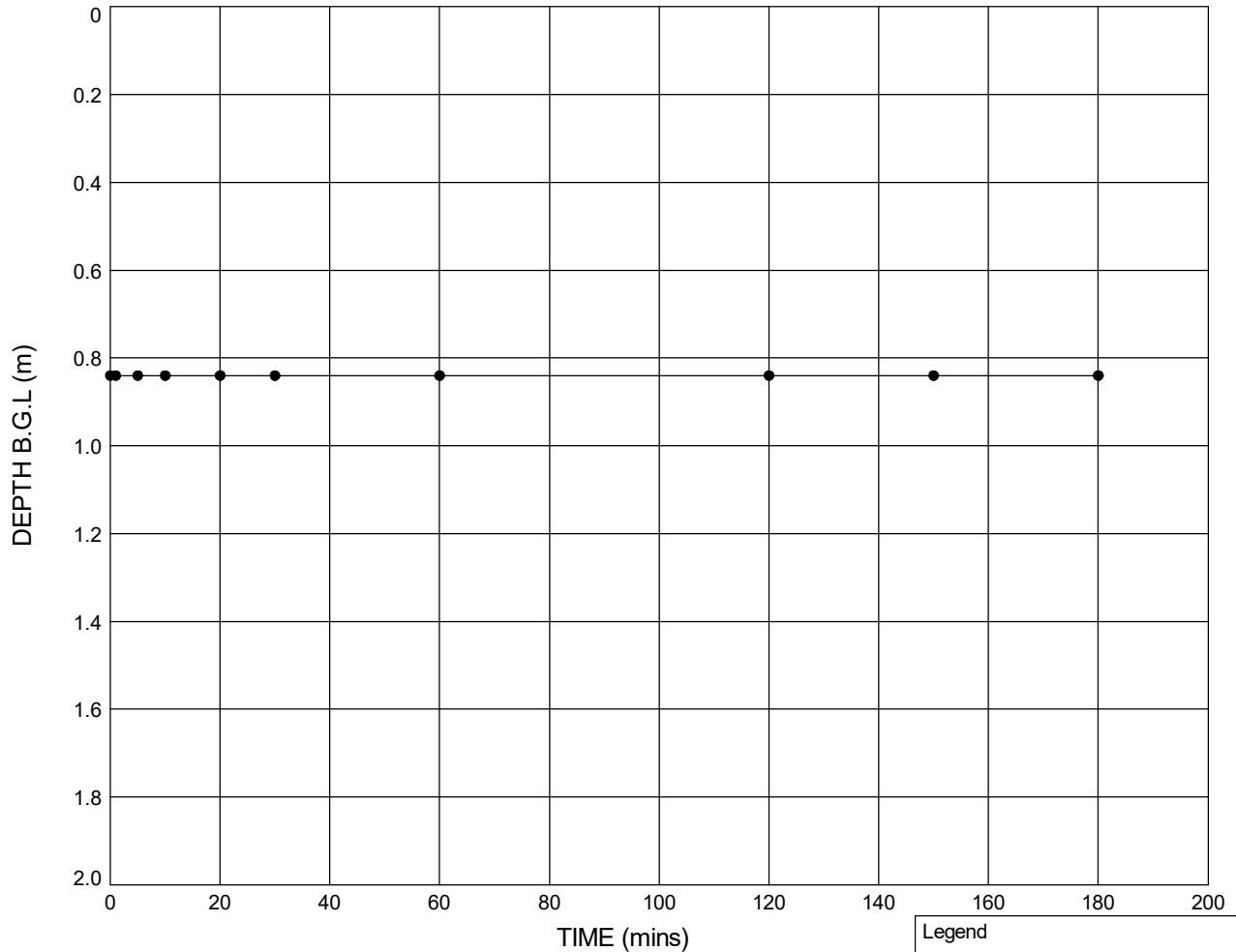
 STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By		Date
	<i>K. Limacher</i>	KATIE LIMACHER	16/11/22
	Contract	Contract Ref:	
	Gorton Library, Manchester	785332	
			

FULL SCALE SOAKAWAY TEST

In accordance with BRE Digest 365

Soakaway Test - Position ID : **SA1**

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



Test 1

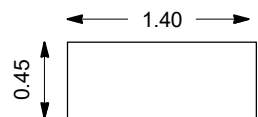
Pit start depth: = **1.90** m
 Pit final depth: = **1.90** m
 Effective depth, D_e = **1.06** m
 Effective storage volume, V_{p75-25} = **0.3339** m³
 Surface area, a_{s50} = **2.5910** m²
 Time, t_{p75-25} = **N/A** secs
 Infiltration rate, f = **N/A** m/s

Notes: Test 1 - Unable to calculate infiltration rate due to insufficient drop in water level.

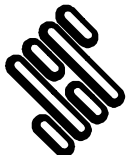
Legend

● Test 1 (10.11.22)

Plan (Not to scale)



No Bearing Taken



STRUCTURAL SOILS
 The Potteries
 Pottery Street
 Castleford
 W. Yorkshire WF10 1NJ

Compiled By

K. Flincher

Date

16/11/22

Checked By

M. Daw

Date

16/11/22

Contract

Gorton Library, Manchester

Contract Ref:

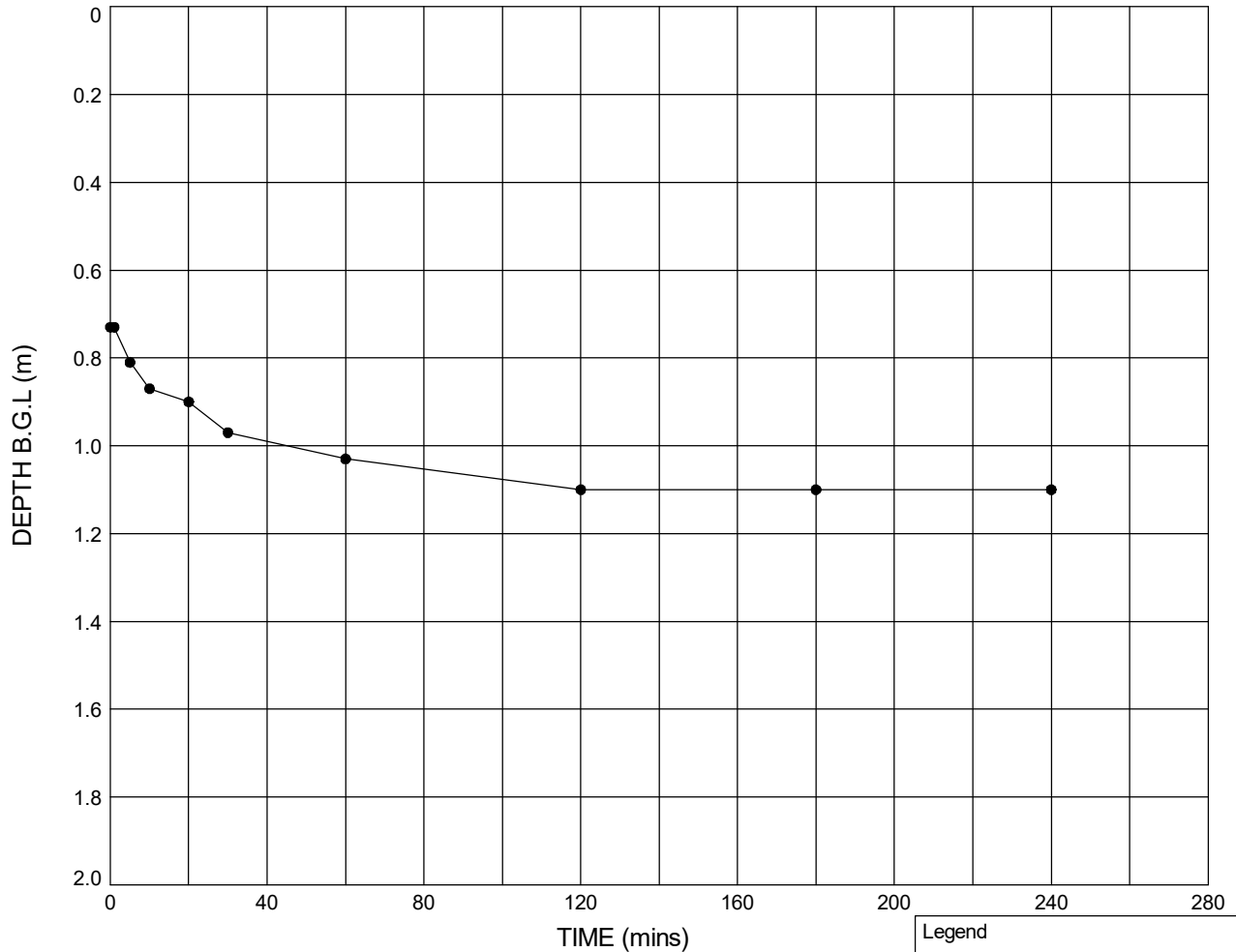
785332

FULL SCALE SOAKAWAY TEST

Non-standard test

Soakaway Test - Position ID : **SA2**

Plot of Depth of Water Below Ground Level Against Time



Test 1

Pit start depth: = **2.00** m

Pit final depth: = **2.00** m

Effective depth, D_e = **1.27** m

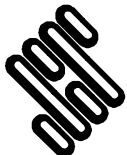
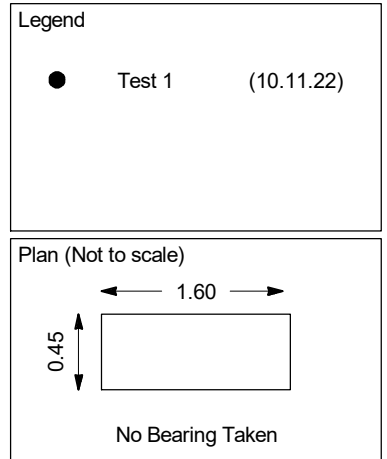
Effective storage volume, V_{p75-25} = **0.4572** m³

Surface area, a_{s50} = **3.3235** m²

Time, t_{p75-25} = **32657** secs

Infiltration rate, f = **4.21×10^{-6}** m/s

Please note test data was extrapolated to obtain t_{p75-25} .



STRUCTURAL SOILS
The Potteries
Pottery Street
Castleford
W. Yorkshire WF10 1NJ

Compiled By	Date	Checked By	Date
<i>K. Fletcher</i>	16/11/22	<i>M. Daw</i>	16/11/22
Contract		Contract Ref:	
Gorton Library, Manchester		785332	

Appendix C – Chemical Laboratory Testing Results

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 22/11216
Issue Number: 1

Date: 21 November, 2022

Client: Curtins Consulting (Manchester)
Merchant Exchange
17-19 Whitworth Street
Manchester
UK
M1 5WG

Project Manager: EBMA/Niall Farnworth/Rebecca Baksh-Jones
Project Name: Gorton Library
Project Ref: B070452
Order No: 1901
Date Samples Received: 12/11/22
Date Instructions Received: 15/11/22
Date Analysis Completed: 21/11/22

Approved by:



Richard Wong
Client Manager

Envirolab Job Number: 22/11216

Client Project Name: Gorton Library

Client Project Ref: B070452

Lab Sample ID	22/11216/1	22/11216/2	22/11216/3	22/11216/4	22/11216/5	22/11216/6	22/11216/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS02	WS02	WS03	HP01	HP02	HP03			
Depth to Top	0.40	0.30	1.35	0.60	0.20	0.50	0.15			
Depth To Bottom										
Date Sampled	10-Nov-22	10-Nov-22	10-Nov-22	10-Nov-22	10-Nov-22	11-Nov-22	11-Nov-22			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4AE	4ABE	6AE	4AE	4AE	4A	6AE			
% Stones >10mm _A	1.4	1.2	<0.1	12.8	12.5	11.7	6.2	% w/w	0.1	A-T-044
pH _D ^{M#}	8.09	8.27	8.13	7.72	8.71	8.24	8.57	pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	<0.01	0.60	0.02	0.16	0.02	0.58	0.03	g/l	0.01	A-T-026s
Cyanide (total) _A ^{M#}	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	0.2	A-T-050s
Organic Matter _D ^{M#}	8.2	5.5	3.0	17.1	4.4	4.3	6.0	% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	20	23	6	26	7	14	11	mg/kg	1	A-T-024s
Boron (water soluble) _D	<1.0	1.3	1.5	<1.0	<1.0	<1.0	<1.0	mg/kg	1	A-T-027s
Cadmium _D ^{M#}	0.9	<0.5	<0.5	1.1	0.5	0.6	0.7	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	158	57	24	119	50	47	69	mg/kg	1	A-T-024s
Chromium _D ^{M#}	43	18	19	16	21	12	17	mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-040s
Lead _D ^{M#}	187	115	41	145	152	88	224	mg/kg	1	A-T-024s
Mercury _D	0.20	<0.17	<0.17	<0.17	0.45	1.63	0.89	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	25	19	16	35	19	13	21	mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1	<1	<1	<1	2	<1	mg/kg	1	A-T-024s
Zinc _D ^{M#}	244	64	39	71	90	214	119	mg/kg	5	A-T-024s

Envirolab Job Number: 22/11216

Client Project Name: Gorton Library

Client Project Ref: B070452

Lab Sample ID	22/11216/1	22/11216/2	22/11216/3	22/11216/4	22/11216/5	22/11216/6	22/11216/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS02	WS02	WS03	HP01	HP02	HP03			
Depth to Top	0.40	0.30	1.35	0.60	0.20	0.50	0.15			
Depth To Bottom										
Date Sampled	10-Nov-22	10-Nov-22	10-Nov-22	10-Nov-22	10-Nov-22	11-Nov-22	11-Nov-22			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4AE	4ABE	6AE	4AE	4AE	4A	6AE			
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	NAD	NAD	NAD	NAD	NAD	NAD	NAD			A-T-045
Asbestos Matrix (visual) _D	-	-	-	-	-	-	-			A-T-045
Asbestos Matrix (microscope) _D	-	-	-	-	-	-	-			A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A	N/A	N/A	N/A	N/A			A-T-045

Envirolab Job Number: 22/11216

Client Project Name: Gorton Library

Client Project Ref: B070452

Lab Sample ID	22/11216/1	22/11216/2	22/11216/3	22/11216/4	22/11216/5	22/11216/6	22/11216/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS02	WS02	WS03	HP01	HP02	HP03			
Depth to Top	0.40	0.30	1.35	0.60	0.20	0.50	0.15			
Depth To Bottom										
Date Sampled	10-Nov-22	10-Nov-22	10-Nov-22	10-Nov-22	10-Nov-22	11-Nov-22	11-Nov-22			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4AE	4ABE	6AE	4AE	4AE	4A	6AE			
PAH-16MS										
Acenaphthene _A ^{M#}	1.31	0.41	<0.01	10.8	0.41	0.12	0.10	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	0.04	<0.01	<0.01	0.19	<0.01	0.01	<0.01	mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	1.15	0.15	<0.02	15.6	0.34	0.16	0.07	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	2.52	0.26	<0.04	20.9	0.89	0.51	0.09	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	1.94	0.21	<0.04	15.2	0.77	0.38	0.08	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	2.35	0.26	<0.05	16.6	0.88	0.58	0.09	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	0.83	0.11	<0.05	5.35	0.38	0.22	<0.05	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	0.70	0.09	<0.07	5.92	0.28	0.18	<0.07	mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	2.99	0.37	<0.06	25.6	1.02	0.68	0.14	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	0.20	<0.04	<0.04	1.32	0.09	<0.04	<0.04	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	8.19	0.79	<0.08	71.1	2.38	1.72	0.41	mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	0.89	0.19	<0.01	7.55	0.21	0.10	0.07	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	0.83	0.09	<0.03	6.48	0.39	0.22	0.03	mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	0.91	0.31	<0.03	3.06	0.09	0.07	0.06	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	7.45	1.24	<0.03	82.6	1.94	0.92	0.41	mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	7.49	0.73	<0.07	56.2	2.07	1.47	0.38	mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	39.8	5.21	<0.08	344	12.1	7.34	1.93	mg/kg	0.01	A-T-019s

Envirolab Job Number: 22/11216

Client Project Name: Gorton Library

Client Project Ref: B070452

Lab Sample ID	22/11216/1	22/11216/2	22/11216/3	22/11216/4	22/11216/5	22/11216/6	22/11216/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS02	WS02	WS03	HP01	HP02	HP03			
Depth to Top	0.40	0.30	1.35	0.60	0.20	0.50	0.15			
Depth To Bottom										
Date Sampled	10-Nov-22	10-Nov-22	10-Nov-22	10-Nov-22	10-Nov-22	11-Nov-22	11-Nov-22			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4AE	4ABE	6AE	4AE	4AE	4A	6AE			
TPH CWG with Clean Up										
Ali >C5-C6 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1	<1	<1	<20	<1	<1	<1	mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	<1	<1	<20	<1	<1	<1	mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	4	<1	<1	33	<1	1	3	mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	6	1	<1	49	3	7	14	mg/kg	1	A-T-055s
Ali >C21-C35 _A ^{M#}	25	5	6	185	16	45	19	mg/kg	1	A-T-055s
Total Aliphatics _A	35	6	6	267	20	53	36	mg/kg	1	Calc-As Recd
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	2	2	1	<20	2	2	2	mg/kg	1	A-T-055s
Aro >C10-C12 _A	2	8	<1	26	<1	2	1	mg/kg	1	A-T-055s
Aro >C12-C16 _A	19	28	2	344	8	19	7	mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	58	45	4	1660	29	99	20	mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	145	76	6	3330	79	470	41	mg/kg	1	A-T-055s
Total Aromatics _A	226	160	13	5350	119	592	71	mg/kg	1	Calc-As Recd
TPH (Ali & Aro >C5-C35) _A	261	166	19	5630	139	645	107	mg/kg	1	Calc-As Recd
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s

Envirolab Job Number: 22/11216/8

Client Project Name: Gorton Library

Client Project Ref: B070452

Lab Sample ID	22/11216/8							Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	HP04									
Depth to Top	0.65									
Depth To Bottom										
Date Sampled	11-Nov-22									
Sample Type	Soil - ES									
Sample Matrix Code	4AB									
% Stones >10mm _A	24.0							% w/w	0.1	A-T-044
pH _D ^{M#}	8.71							pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.02							g/l	0.01	A-T-026s
Cyanide (total) _A ^{M#}	<1							mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC _A	<0.2							mg/kg	0.2	A-T-050s
Organic Matter _D ^{M#}	8.7							% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	9							mg/kg	1	A-T-024s
Boron (water soluble) _D	<1.0							mg/kg	1	A-T-027s
Cadmium _D ^{M#}	0.6							mg/kg	0.5	A-T-024s
Copper _D ^{M#}	88							mg/kg	1	A-T-024s
Chromium _D ^{M#}	15							mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1							mg/kg	1	A-T-040s
Lead _D ^{M#}	91							mg/kg	1	A-T-024s
Mercury _D	0.94							mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	23							mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1							mg/kg	1	A-T-024s
Zinc _D ^{M#}	160							mg/kg	5	A-T-024s

Envirolab Job Number: 22/11216/8

Client Project Name: Gorton Library

Client Project Ref: B070452

Lab Sample ID	22/11216/8							Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	HP04									
Depth to Top	0.65									
Depth To Bottom										
Date Sampled	11-Nov-22									
Sample Type	Soil - ES									
Sample Matrix Code	4AB									
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	NAD									A-T-045
Asbestos Matrix (visual) _D	-									A-T-045
Asbestos Matrix (microscope) _D	-									A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A									A-T-045

Envirolab Job Number: 22/11216

Client Project Name: Gorton Library

Client Project Ref: B070452

Lab Sample ID	22/11216/8							Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	HP04									
Depth to Top	0.65									
Depth To Bottom										
Date Sampled	11-Nov-22									
Sample Type	Soil - ES									
Sample Matrix Code	4AB									
PAH-16MS										
Acenaphthene _A ^{M#}	0.59							mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	0.03							mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	0.59							mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	2.66							mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	2.82							mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	3.15							mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	1.35							mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	0.99							mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	2.90							mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	0.26							mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	6.54							mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	0.31							mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	1.39							mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	0.20							mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	3.18							mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	6.03							mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	33							mg/kg	0.01	A-T-019s

Envirolab Job Number: 22/11216/8

Client Project Name: Gorton Library

Client Project Ref: B070452

Lab Sample ID	22/11216/8									
Client Sample No										
Client Sample ID	HP04									
Depth to Top	0.65									
Depth To Bottom										
Date Sampled	11-Nov-22									
Sample Type	Soil - ES									
Sample Matrix Code	4AB									
TPH CWG with Clean Up										
Ali >C5-C6 _A [#]	<0.01							mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01							mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1							mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1							mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	3							mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	4							mg/kg	1	A-T-055s
Ali >C21-C35 _A ^{M#}	16							mg/kg	1	A-T-055s
Total Aliphatics _A	23							mg/kg	1	Calc-As Recd
Aro >C5-C7 _A [#]	<0.01							mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01							mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	2							mg/kg	1	A-T-055s
Aro >C10-C12 _A	2							mg/kg	1	A-T-055s
Aro >C12-C16 _A	14							mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	70							mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	211							mg/kg	1	A-T-055s
Total Aromatics _A	298							mg/kg	1	Calc-As Recd
TPH (Ali & Aro >C5-C35) _A	321							mg/kg	1	Calc-As Recd
BTEX - Benzene _A [#]	<0.01							mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01							mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01							mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01							mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01							mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01							mg/kg	0.01	A-T-022s

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample, 9 = INCINERATOR ASH.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Subscript "A" indicates analysis has dependant options against results. Testing dependant on results appear in the comments area of your sample receipt.

EPH CWG results have humics mathematically subtracted through instrument calculation

TPH results "with Cleanup" indicates results cleaned up with Silica during extraction

EPH CWG GCxGC ID from TPH CWG

Where we have identified humic substances in any ID's from TPH CWG with Clean Up please note that the concentration of these humic substances is not included in the quantified results and are included in the ID for information.

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client:	Curtins Consulting (Manchester), Merchant Exchange, 17-19 Whitworth Street , Manchester, UK, M1 5WG	Project No:	22/11216
Project:	Gorton Library	Date Received:	15/11/2022 (am)
Clients Project No:	B070452	Cool Box Temperatures (°C):	10.2 & 13.2

NO DEVIATIONS IDENTIFIED with respect to sampling dates or containers received.

Note: If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3 (for water samples $5 \pm 3^{\circ}\text{C}$), ISO 18400-105:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Envirolab Analysis Dates

Lab Sample ID	22/11216/1	22/11216/2	22/11216/3	22/11216/4	22/11216/5	22/11216/6	22/11216/7	22/11216/8
Client Sample No								
Client Sample ID/Depth	WS01 0.40m	WS02 0.30m	WS02 1.35m	WS03 0.60m	HP01 0.20m	HP02 0.50m	HP03 0.15m	HP04 0.65m
Date Sampled	10/11/22	10/11/22	10/11/22	10/11/22	10/11/22	11/11/22	11/11/22	11/11/22
A-T-019s	17/11/2022	17/11/2022	17/11/2022	17/11/2022	17/11/2022	17/11/2022	17/11/2022	17/11/2022
A-T-022s	18/11/2022	18/11/2022	18/11/2022	18/11/2022	18/11/2022	18/11/2022	18/11/2022	18/11/2022
A-T-024s	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022
A-T-026s	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022
A-T-027s	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022
A-T-031s	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022
A-T-032 OM	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022
A-T-040s	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022	21/11/2022
A-T-042sTCN	17/11/2022	17/11/2022	17/11/2022	17/11/2022	17/11/2022	17/11/2022	17/11/2022	17/11/2022
A-T-044	18/11/2022	18/11/2022	18/11/2022	18/11/2022	18/11/2022	18/11/2022	18/11/2022	18/11/2022
A-T-045	16/11/2022	16/11/2022	16/11/2022	16/11/2022	16/11/2022	16/11/2022	16/11/2022	16/11/2022
A-T-050s	17/11/2022	17/11/2022	17/11/2022	17/11/2022	17/11/2022	17/11/2022	17/11/2022	17/11/2022
A-T-055s	17/11/2022	17/11/2022	17/11/2022	17/11/2022	17/11/2022	17/11/2022	17/11/2022	17/11/2022
Calc-As Recd	18/11/2022	18/11/2022	18/11/2022	18/11/2022	18/11/2022	18/11/2022	18/11/2022	18/11/2022

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

Appendix D – Geotechnical Laboratory Testing Results

F.A.O.

Final Test Report - 2281278 / 1

Site: Gorton
Job Number: 2281278
Originating Client: Envirolab
Originating Reference: 22/11220
Date Sampled: Not Given
Date Scheduled: 16/11/2022
Date Testing Started: 18/11/2022
Date Testing Finished: 01/12/2022

Previous Reports		Amendments	Date Issued

Amendments:

Authorised By:



Tim Robinson
Quality Supervisor

Report Issue Date: 02/12/2022

Page. 1

Page: 2

Borehole / Trial Pit	Depth (m)	Sample	Natural Moisture Content %	Natural - Stones removed by hand Sieved - Washed on 425 µm sieve			Liquid Limit %	Plastic Limit %	Plasticity Index %	Liquidity Index	Class	Description / Remarks
				Natural / Sieved	Percentage Passing %	Moisture Content %						
HP02	1.00	B	21	Natural	99	21	42	22	20	-0.04	CI	Brown silty CLAY
WS01	2.00	D	16	Natural	96	16	34	15	19	0.07	CL	Brown silty CLAY
WS02	1.50	D	23	Natural	94	24	47	22	25	0.08	CI	Brown silty CLAY
WS03	3.00	D	14	Natural	92	15	38	16	22	-0.06	CI	Brown slightly gravelly, silty CLAY



1464

Results reported relate only to the samples tested.

Site: Gorton
Client: Envirolab

Job Number: 2281278

Page: 3

Determination of California Bearing Ratio (CBR)

Borehole / Trial Pit	Depth (m)	Sample	% Passing 20mm Sieve	Description
HP02	0.40	B	84.90%	Brown silty, gravelly SAND

Specimen Preparation
Condition
Details

Recompacted with specified standard effort using 2.5kg rammer

Soaking details

Period of soaking

Time to surface

Amount of swell recorded

Dry density after soaking

Not soaked

days

days

mm

Mg/m3

Initial Specimen details

Bulk density

2.12 Mg/m3

Dry density

1.88 Mg/m3

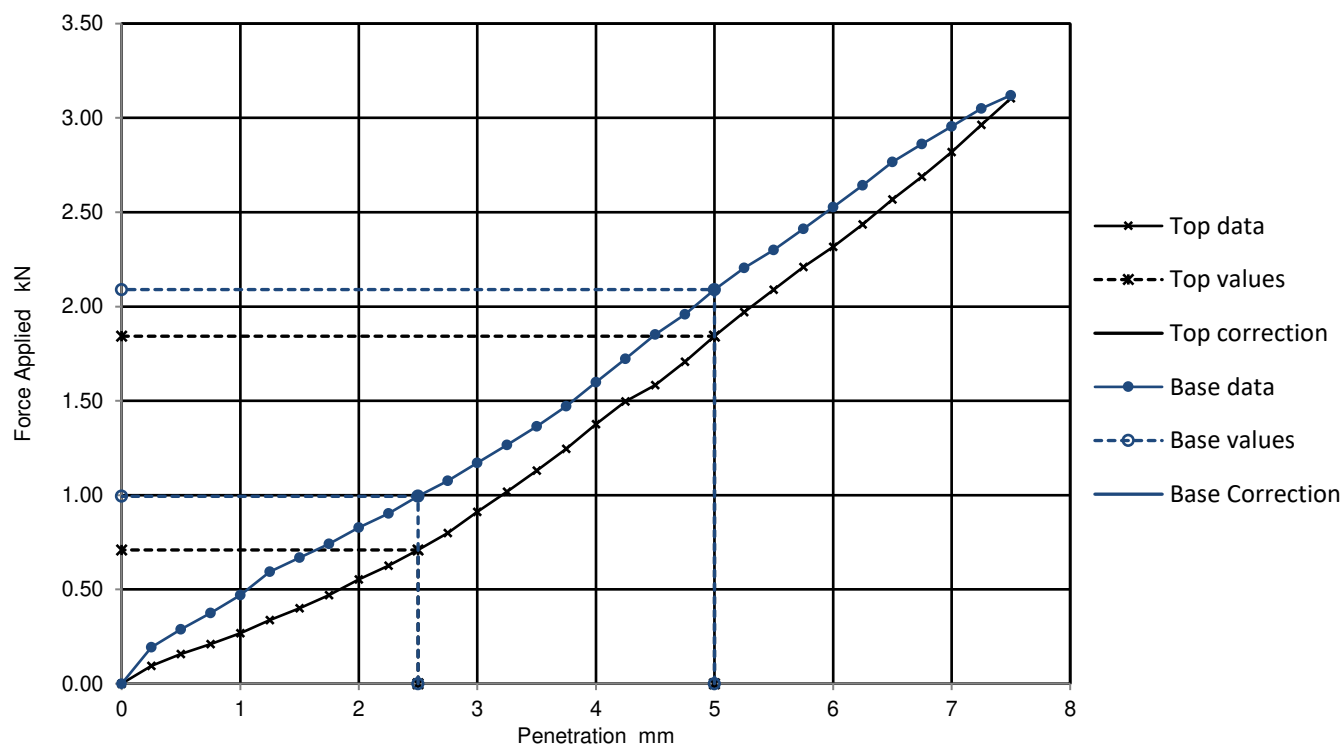
Moisture content

13 %

Surcharge applied

4.2 kg

3 kPa

Force v Penetration Plots

RESULTS

	Curve correction applied	CBR Values, %			
		2.5mm	5mm	Highest	Average
TOP	No	5.4	9.2	9.2	9.8
BASE	No	7.5	10	10	

Moisture Content %
16
15

Approved
Tim Robinson

Method of Preparation: BS1377 : Part 4 : 1990, clause 7.2, Recompacted with specified standard effort using 2.5kg rammer

Method of Test: BS1377 : Part 4 : 1990, clause 7.4, Penetration test procedure to determine California Bearing Ratio (CBR)

Remarks:

Result reported relates only to the sample tested.

Site: Gorton

Job Number: 2281278

Client: Envirolab

Page: 4

Determination of California Bearing Ratio (CBR)

Borehole / Trial Pit	Depth (m)	Sample	% Passing 20mm Sieve	Description
WS03	0.50	B	92.50%	Brown silty, clayey, gravelly SAND

Specimen Preparation
Condition
Details

Recompacted with specified standard effort using 2.5kg rammer

Soaking details

Period of soaking

Time to surface

Amount of swell recorded

Dry density after soaking

Not soaked

days

days

mm

Mg/m3

Initial Specimen details

Bulk density

1.85 Mg/m3

Dry density

1.52 Mg/m3

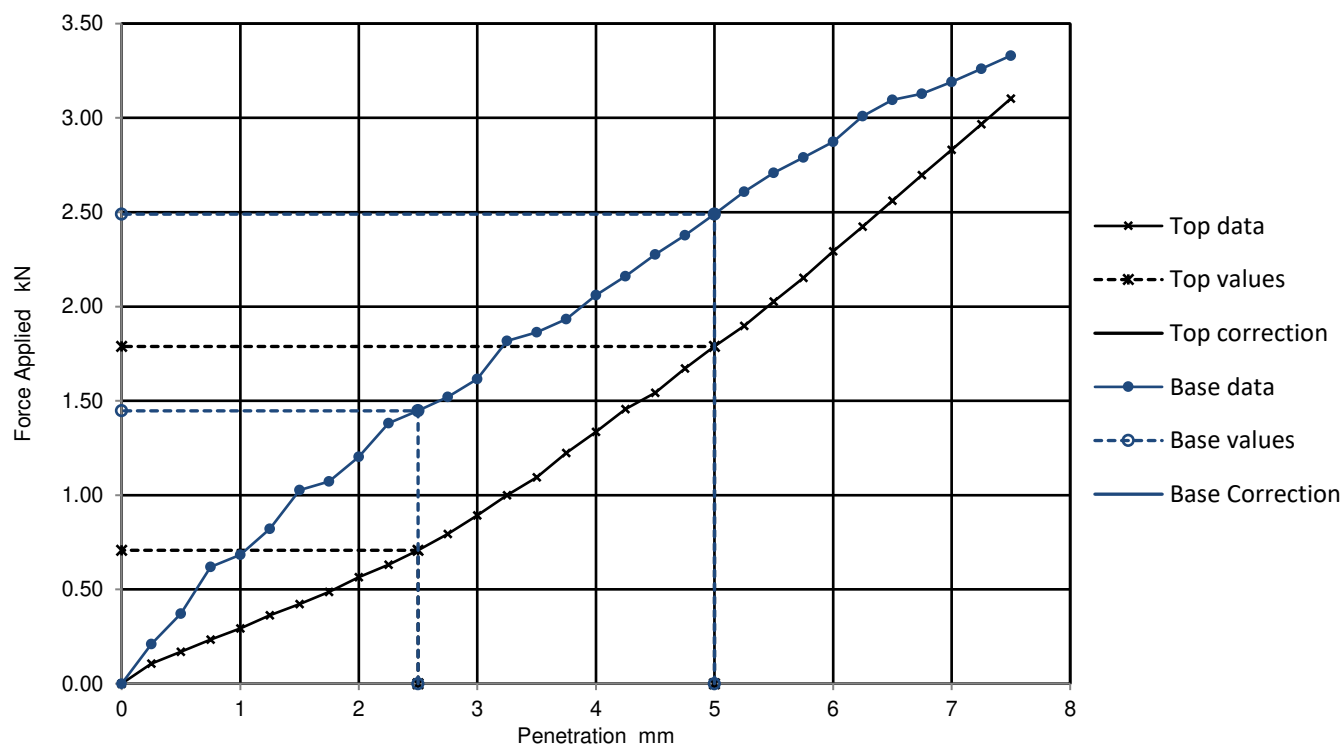
Moisture content

22 %

Surcharge applied

4.2 kg

3 kPa

Force v Penetration Plots

RESULTS

	Curve correction applied	CBR Values, %			
		2.5mm	5mm	Highest	Average
TOP	No	5.4	8.9	8.9	
BASE	No	11	12	12	

Moisture Content %
24
23

Approved
Tim Robinson

Method of Preparation: BS1377 : Part 4 : 1990, clause 7.2, Recompacted with specified standard effort using 2.5kg rammer

Method of Test: BS1377 : Part 4 : 1990, clause 7.4, Penetration test procedure to determine California Bearing Ratio (CBR)

Remarks:

Result reported relates only to the sample tested.



Final Test Report - 2281278 / 1

Site: Gorton
Job Number: 2281278
Originating Client: Envirolab

All opinions and interpretations contained within this report are outside of our Scope of Accreditation.

This test report shall not be reproduced, except in full and only with the written permission of Ian Farmer Associates Ltd.

Samples will be retained for 28 days from date of issue of the final test report before being disposed of, unless we receive written instruction to the contrary.

Report Issue Date: 02/12/2022

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 22/11220
Issue Number: 1

Date: 05 December, 2022

Client: Curtins Consulting (Manchester)
Merchant Exchange
17-19 Whitworth Street
Manchester
UK
M1 5WG

Project Manager: Niall Farnworth/Rebecca Baksh-Jones
Project Name: Gorton Library
Project Ref: B070452
Order No: 1902
Date Samples Received: 12/11/22
Date Instructions Received: 15/11/22
Date Analysis Completed: 05/12/22

Approved by:



Richard Wong
Client Manager

Envirolab Job Number: 22/11220

Client Project Name: Gorton Library

Client Project Ref: B070452

Lab Sample ID	22/11220/1	22/11220/2	22/11220/3	22/11220/4	22/11220/5	22/11220/6		Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS02	WS02	WS03	HP02	WS03				
Depth to Top	2.00	1.50	3.00	1.00	0.40	0.50				
Depth To Bottom	2.45		3.45	1.45						
Date Sampled	10-Nov-22	10-Nov-22	10-Nov-22	10-Nov-22	11-Nov-22	10-Nov-22				
Sample Type	Soil - D	Soil - D	Soil - D	Soil - D	Soil - B	Soil - B				
Sample Matrix Code	3	6A	3	6A						
% Stones >10mm _A	<0.1	<0.1	<0.1	<0.1	-	-		% w/w	0.1	A-T-044
pH BRE _D ^{M#}	8.86	8.00	9.23	7.30	-	-		pH	0.01	A-T-031s
Sulphate BRE (water sol 2:1) _D ^{M#}	31	39	40	46	-	-		mg/l	10	A-T-026s
Sulphate BRE (acid sol) _D ^{M#}	0.05	0.02	0.03	0.03	-	-		% w/w	0.02	A-T-028s
Sulphur BRE (total) _D	0.03	0.03	0.02	0.06	-	-		% w/w	0.01	A-T-024s
(1.02) Item 2a 4 Point Liquid & Plastic Limit by Cone Penetrometer _A	Appended	Appended	Appended	Appended	-	-				Subcon IFA
(1.01) Item 1a Moisture Content of Soil (Oven Dried Method) _A	Appended	Appended	Appended	Appended	-	-				Subcon IFA
(3.04b) Item 24 CBR remoulded by 2.5kg Rammer BS 1377-4:1990 Clause 7 _A	-	-	-	-	Appended	Appended				Subcon IFA

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample, 9 = INCINERATOR ASH.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Subscript "A" indicates analysis has dependant options against results. Testing dependant on results appear in the comments area of your sample receipt.

EPH CWG results have humics mathematically subtracted through instrument calculation

TPH results "with Cleanup" indicates results cleaned up with Silica during extraction

EPH CWG GCxGC ID from TPH CWG

Where we have identified humic substances in any ID's from TPH CWG with Clean Up please note that the concentration of these

humic substances is not included in the quantified results and are included in the ID for information.

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client:	Curtins Consulting (Manchester), Merchant Exchange, 17-19 Whitworth Street , Manchester, UK, M1 5WG	Project No:	22/11220
Project:	Gorton Library	Date Received:	15/11/2022 (am)
Clients Project No:	B070452	Cool Box Temperatures (°C):	10.2

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Envirolab Analysis Dates

Lab Sample ID	22/11220/1	22/11220/2	22/11220/3	22/11220/4	22/11220/5	22/11220/6
Client Sample No						
Client Sample ID/Depth	WS01 2.00-2.45m	WS02 1.50m	WS02 3.00-3.45m	WS03 1.00-1.45m	HP02 0.40m	WS03 0.50m
Date Sampled	10/11/22	10/11/22	10/11/22	10/11/22	11/11/22	10/11/22
A-T-024s	21/11/2022	21/11/2022	21/11/2022	21/11/2022		
A-T-026s	18/11/2022	18/11/2022	18/11/2022	18/11/2022		
A-T-028s	21/11/2022	21/11/2022	21/11/2022	21/11/2022		
A-T-031s	18/11/2022	18/11/2022	18/11/2022	18/11/2022		
A-T-044	18/11/2022	18/11/2022	18/11/2022	18/11/2022		

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

Appendix E – GAC Screening Thresholds

- Curtins GAC Tier 1 Thresholds

Appendix F – Risk Assessment Methodology

The site-specific risk assessment, presented in this report, follows the principle of establishing whether there is a viable linkage between a contaminant source to a potential receptor, via an exposure pathway.

The risk assessment corresponds with the total site area and incorporates both descriptive (qualitative) and, where available, numerical (quantitative) lines of evidence.

Risk assessment is the process of collating known information on a hazard or set of hazards to estimate actual or potential risk to receptors. The receptor may be humans, a water resource, a sensitive local ecosystem or future construction materials. Receptors can be connected to the source by one or several exposure pathways such as direct contact for example. Risks are generally managed by isolating the receptor or intercepting the exposure pathway or by isolating or removing the hazard.

Without the three essential components of a source, pathway and receptor there can be no risk. Therefore, the presence of contaminant source on a site does not necessarily mean there is a risk.

The risk assessment considers the likelihood of an event taking place (accounting for the presence of the source and receptor and the viability of the exposure pathway) in conjunction with the severity of the potential consequence (accounting for the potential severity of the hazard and the sensitivity of the receptor).

In the risk assessment, the consequence of the hazard has been classified as severe or medium or mild or minor and the probability (likelihood) of the circumstances occurring classified as high likelihood or likely or low likelihood or unlikely.

The consequences and probabilities are subsequently cross-correlated to give a qualitative estimation of the risk using Department of the Environment risk classifications as detailed in the table below and as referenced in CIRIA C552.

		Consequence			
		Severe	Medium	Mild	Minor
Probability (Likelihood)	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

In accordance with DoE guidance, the following categorisation of **consequence** has been developed.

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to an ecosystem or organisation forming part of such ecosystem.	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied).
Medium	Chronic damage to Human Health. Pollution of sensitive water resources. A significant change in an ecosystem or organism forming part of such ecosystem.	Concentration of a contaminant from site exceeds the generic or site-specific assessment criteria. Leaching of contaminants from a site to a Principal or Secondary A aquifer. Death of a species within a designated nature reserve. Lesser toxic and asphyxiate effects
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services. Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater (inc. Secondary B aquifers). Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc). Easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discoloration of concrete.

In accordance with DoE guidance, the following categorisation of **probability** has been developed.

Classification	Definition
High Likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

In accordance with DoE guidance, the following categorisation of **risk** has been developed.

Classification	Definition
Very High Risk	There is a <i>high probability</i> that <i>severe harm</i> could arise to a designated receptor from an identified hazard at the site without appropriate further action.
High Risk	<i>Harm is likely to arise</i> to a designated receptor from an identified hazard at the site without appropriate further action.
Moderate Risk	<i>It is possible</i> that without appropriate further action <i>harm could arise</i> to a designated receptor. It is relatively <i>unlikely</i> that any such harm would be <i>severe</i> , and if any harm were to occur it is <i>more likely</i> that such harm would be <i>relatively mild</i> .
Low Risk	<i>It is possible</i> that <i>harm could arise</i> to a designated receptor from an identified hazard. It is <i>likely</i> that, at worst, if any harm was realised any effects would be <i>mild</i> .
Very Low Risk	The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor.

The term 'risk' in this instance refers to the risk that the source, pathway, receptor linkage for a given source of contamination is complete. It does not refer to immediate risk to individuals or features present on the site from potential contaminants and is intended to be used as a tool to assess the necessity of further investigation.

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