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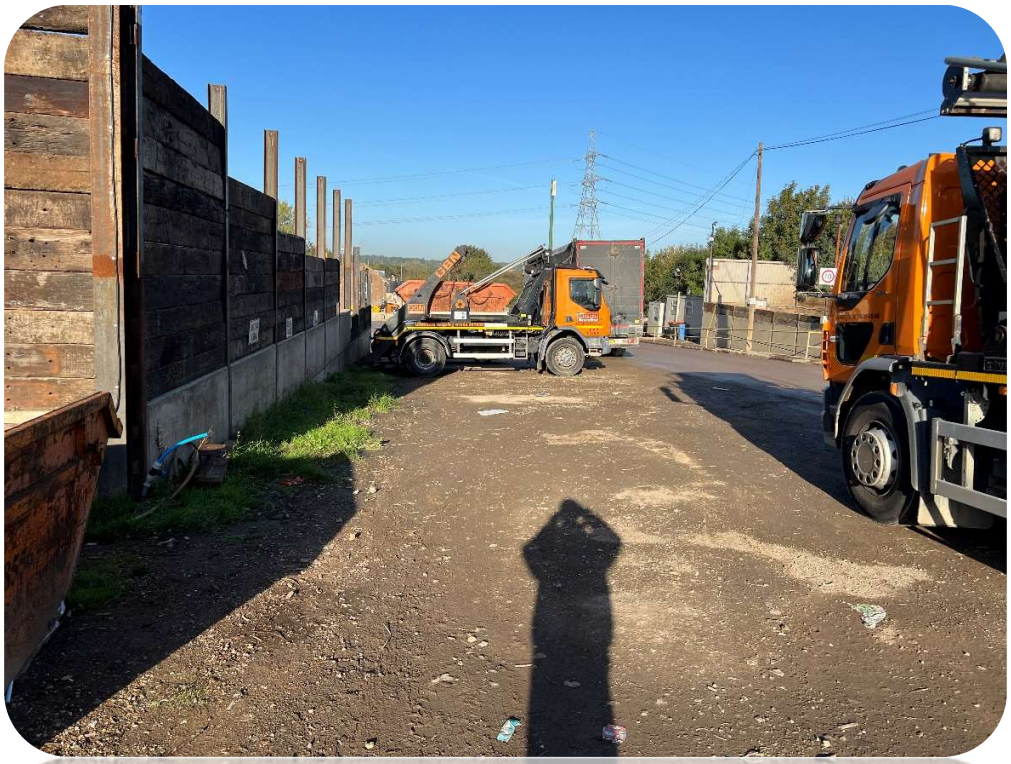
GEOTECHNICAL REPORT

Site Address:	Uxbridge Skip Hire, Skip Lane, Harvil Road, Harefields, Hillingdon, UB9 6JL
Report Date:	December 2022
Project No.:	17766
Prepared for:	GBN Services Ltd



SECTION 1 INTRODUCTION

1.1 In accordance with your instructions, we visited the above site during November 2022.

1.2 The purpose of our visit was to carry out an investigation into the subsoil conditions in order to assess the suitability of the site for the assessment of the existing site condition and consider the proposed development of additional structures.

1.3 The comments and opinions expressed are based purely on the conditions encountered and the subsequent laboratory testing. The locations of the excavations have been assessed on site.

1.4 Some special condition may be present on site that, to date, has not been encountered within the scope of the site investigation works and therefore will not have been taken into account within this report.

1.5 All ground water recordings or their absence relate to short term observations and do not allow for fluctuations due to seasonal or other effects.

SECTION 2 DESCRIPTION OF SITE

2.1 The site is formed by an existing commercial skip site which forms a waste recycling centre. The site area has multiple uses including parking areas, offices, waste segregation areas and storage areas. Additionally, a workshop area is in place. The site slopes generally from the main road through to the rear of the site.

2.2 The site is surrounded by railway land and open land.

SECTION 3 FIELDWORK

3.1 In order to assess the site, the proposals have been made to assess both the shallow and deeper soils profiles in order to enable the design of potentially traditional foundations or piled foundations should this option become unviable. In order to complete these works, the following site investigation works were implemented.

- 14 No Dynamic Competitor Rig boreholes were sunk to a depths of between 0.50-3.00 meters deep. – 11th October 2022, 10th November 2022 and 11th November 2022.
- Standpipes have been installed WS1, WS7 & WS11 to depths of 3.00 metres.
- Geotechnical Laboratory Testing – October 2022 & November 2022.

3.2 The location of these works is indicated on the site plan-forming appendix one.

3.3 The various strata encountered were noted and are recorded on the borehole logs forming appendix two.

3.4 Full ranges of samples were recovered as noted and retained for subsequent laboratory testing.

SECTION 4 LABORATORY TESTING

4.1 All samples were tested in accordance with BS:1377:1990, methods for test for civil engineering purposes.

4.2 Selected samples were recovered to determine their Atterberg Limits, Particle Size Distribution Testing, Hand Penetrometer testing, Soluble Sulphate value and pH

4.3 The results of this laboratory testing are enclosed and form appendix three

SECTION 5 SITE INFORMATION

5.1 The site has been reviewed and we can confirm that the geology within the site is as follows :-

Table 1 Geological Profile

Stratum	*Description*	*Depth, Range*	*Thickness, Range*
Made Ground	Hardcore brick FILL with crushed concrete and sandy brick infill.	1.80-3.00m+	1.80-3.00m+
	Black Clinker FILL	1.20-2.00m	1.00m
	Brick & Concrete Hardcore FILL	2.70m	1.50m
LONDON CLAY	Firm brown grey mottled CLAY	3.00m+	0.30-1.20m
	Firm to stiff light brown mottled grey slightly silty CLAY	3.00m+	2.50m+
Ground Water:	Perched water was identified at a depth of 2.00 metres within WS3. No long term monitoring has been completed to date.		

SECTION 6 RESULTS

6.1 By inspection of the borehole logs and from a visual assessment of the samples recovered, a scheme of laboratory testing has been undertaken. The results are enclosed within appendix three and prove the following:

6.2 Laboratory testing has been undertaken in accordance with BS 1377:1990, (Methods for Tests for Soils for Civil Engineering Purposes), the results of which are enclosed.

6.3 Hand Penetrometer tests have been undertaken disturbed samples recovered from the site works. From the information gathered, it is recorded that cohesion values of between 66-150+ kN/m² were achieved.

6.4 Atterberg Limits tests proved the clay soils to be of intermediate to very high plasticity, (PI=26-51%), which indicates a high susceptibility to movement associated with moisture content change.

6.5 A measurement of the potential desiccation has been completed using Driscoll's Method of Desiccation Analysis which uses a comparison of moisture content profiles measures against the liquid limit measured in the Atterberg test. This makes an assumption of the state of the soil moisture content against the state of the soil in its liquid state to assess desiccation. Driscoll make a comparison that the soils would likely be in a state of slight desiccation if the moisture content of the soil was less than 0.5 multiplied by the liquid limit state of the soil, (slight desiccation being a level of desiccation at which overburden pressure may influence), and significant desiccation if the moisture content of the soil was less than 0.4 multiplied by the liquid limit, (significant desiccation being a level which would be un-natural to reduce to and therefore influenced by surrounding trees or vegetation).

6.6 Utilizing this method of assessment, it can be seen that significant desiccation is identified at depths of between 2.00-3.00 metres in WS1, at 2.00 metres in WS9 and at 1.00m in WS11 which would indicate that the underlying clay soils have been impacted on by the presence of the surrounding trees and vegetation to such an extent as to excessively dry out the soil. The materials identified as Significantly desiccated are not suitable for founding on and as such, would suggest that foundations must as a simple rule of thumb, extend to depths in excess of 3.00 metres.

6.10 Included within the laboratory testing was sulphate analysis, which can determine the use of sulphate resisting cement within the foundation design for the development. The results are enclosed and prove the classification in accordance with ACEC to be DS-2/AC-1S.

SECTION 7 CONCLUSIONS

7.1 Any new foundations should be seated at a depth of as a minimum, 0.90 meters below the site level to overcome the impact of weathering. In order for foundations to be seated in materials suitable for the proposed foundations, factors will influence the design which are as follows, (although, this list is not exhaustive) :-

- Any new foundations should be seated in a uniform geotechnical material with regards possible volume change, future movements and differential settlements based on variable soils.
- Depth of made ground
- Allowable bearing capacity.
- The proposed development.
- Groundwater.
- Trees.
- Topography, and
- Solution Features.

7.2 Any new foundations should be taken to depths in excess of the influence of any surrounding trees or vegetation, (recently removed, existing or proposed). An assessment has been recorded as to the depth of the existing root system within the site. This cannot be utilized across the site due to limited observations and as such, a guideline should be used to determine the depth of foundations required in order to overcome the influence of any surrounding vegetation.

7.3 As a result, we would suggest that any new foundations should be taken to a minimum depth of 1.00m. The use of NHBC Chapter 4.2, (Building Near Trees), should be incorporated in the design of any foundations, which dictates species, clay type and, ultimately, foundation depth. This is only a guideline that should be implemented as a method of costing the substructure within the development. The depth of any root systems within the subsoil will dictate the actual in-situ depth of any foundations across the site. It is envisaged that NHBC Chapter 4.2 will provide a reasonable assessment of actual foundation depths.

7.4 Where trees are to be removed or have recently been removed from the site in order to provide new landscaping or to enable the development to take place, the existing height of the trees and vegetation to be/or that has been removed should be used in assessing the proposed foundation depths local to those specific trees.

7.5 Where trees are to remain and will undergo some degree of growth to reach maturity, the mature height of the tree should be used within NHBC Chapter 4.20m.

7.6 Based on the geology identified at the site, it is recorded that the upper soils have been adversely affected by surrounding trees and vegetation to such an extent as to over dry the soils to depth. This factor alone would suggest that any new foundations should be taken to depths in excess of the influence of trees or surrounding vegetation, beyond any significant desiccation as identified within this report and to depths where the allowable bearing capacity of the soils is suitably strong to support the loadings of the proposed structure.

7.7 An additional factor which would promote a potential design floor when considering a conventional foundation forms the presence of made ground to depths of up to 3.00 metres deep. Based on this, it may be viable to support a traditional foundation where depths of made ground are not excessive and the influence of trees is minimal.

7.8 Considering the presence of significant desiccation and likely increased depths of tree influence based on highly shrinkable clay, the increased depth of made ground, we would suggest that a system of piles and ground beams would form the optimum foundation solution for the site. The depth of piles can be calculated using the parameters defined within this report, (to include both the SPT N-Values shown in Appendix 2 and Strengths provided in Appendix 3) and a structural engineers calculations in respect to loading of the proposed structure. The information within this report could be sent to a piling contractor who would be able to provide bespoke design parameters based on the information provided and costs of associated works to develop those piles.

7.9 Considering the desiccated state of the soils within the upper geology, we would suggest that the upper 3–4 metres should be sleeved to avoid heave potential and enable a stable design.

7.10 Protection against heave and shrinkage should be included in any design in accordance with NHBC Chapter 4.2, (Building Near Trees) and include in any pile and also ground beam design.

7.11 A suspended floor should be included in any design guide where foundation depths exceed 1.50 metres due to the influence of trees or where made ground or compressible soil is in place to depths in excess of 0.60 metres unless it can be proven that these made ground is of a uniform density and consistency across the build.

7.12 All foundations should be designed by a suitably qualified engineer with regard loading for the proposed structure.

I hope the foregoing is sufficient for your requirements, although please do not hesitate to contact us should require any further information regarding the above.

Yours Faithfully

C.S.Gray M.Sc
Contract Engineer

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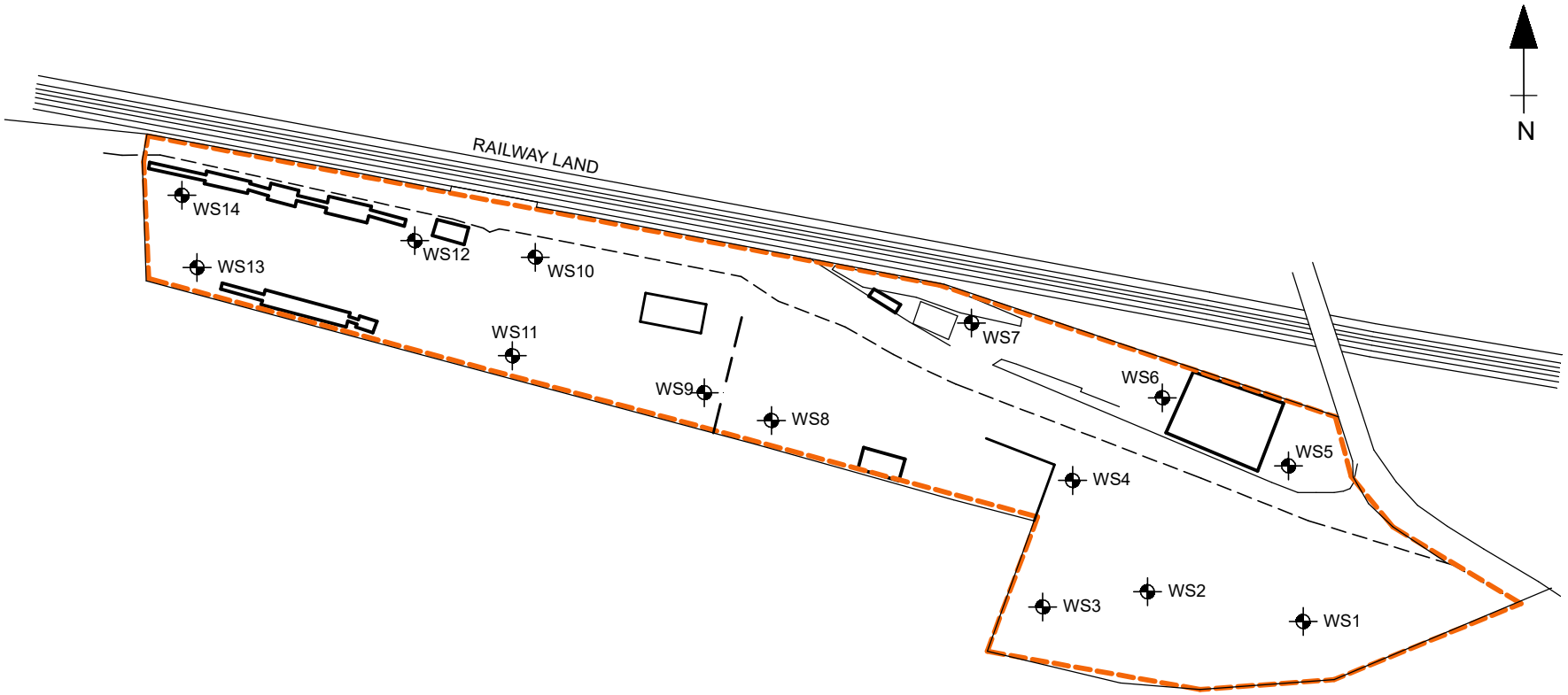
EXISTING SITE PLAN



Not to Scale
Sketch No. : GEO / 17766 / 01 / 01

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Window Sample One

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
MADE GROUND - Hardcore brick FILL with crushed concrete with sandy brick infill.		1.80	1.80		1	U	GL - 1.00			Bentonite Seal; Solid Pipework	
					2	U	1.00-2.00			50 mmø Slotted Pipework; Pea Shingle	1.00
Firm to stiff light brown mottled grey slightly silty CLAY		2.40	0.60		3	U	2.00 - 3.00				
Firm to stiff orange brown slightly silty CLAY		3.00	0.60								
Borehole Complete at 3.00m											

Remarks

Key : U - Undisturbed Sample (100mm diameter) | B - Bulk Sample | - Water Struck | D - Disturbed Sample | - Water Standing | W - Water Sample | T - Chemical Tub | N - SPT N-Value | V - Vane Test, (kN.m²)

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Window Sample Two

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
MADE GROUND - Hardcore brick FILL with crushed concrete with sandy brick infill.			3.00		1	U	GL - 1.00				
					2	U	1.00-2.00				1.00
					3	U	2.00 - 3.00				
Borehole Complete at 3.00m		3.00									

1.0
2.0
3.0

Remarks

Key : U - Undisturbed Sample (100mm diameter) | B - Bulk Sample | - Water Struck | D - Disturbed Sample | - Water Standing | W - Water Sample | T - Chemical Tub | N - SPT N-Value | V - Vane Test, (kN.m²)

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Window Sample Three

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
MADE GROUND - Hardcore brick FILL with crushed concrete with sandy brick infill.					1	U	GL - 1.00				
1.0					2	U	1.00-2.00				1.00
			2.10	Perched water at 2.00 metres							
2.0					3	U	2.00 - 3.00				
		2.10									
Firm Brown Grey Mottled Clay			0.90								
3.0 Borehole Complete at 3.00m		3.00									

Remarks

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Window Sample Four

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
MADE GROUND - Hardcore brick FILL with crushed concrete with sandy brick infill.					1	U	GL - 1.00				
					2	U	1.00-2.00				1.00
			2.10								
		2.10									
Borehole Complete at 2.10m CONCRETE OBSTRUCTION											

1.0
2.0
3.0

Remarks

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Window Sample Five

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
Concrete cored		0.20	0.20	DRY	1	U	GL - 1.00				
Made ground black clinker FILL		1.20	1.00		2	U	1.00-2.00				1.00
Made ground: brick and concrete hardcore FILL		2.70	1.50		3	U	2.00 - 3.00				
Firm to stiff brown CLAY											
Borehole Complete at 3.00m		3.00	0.30								

1.0
2.0
3.0

Remarks

Key : U - Undisturbed Sample (100mm diameter) | B - Bulk Sample | - Water Struck | D - Disturbed Sample | - Water Standing | W - Water Sample | T - Chemical Tub | N - SPT N-Value | V - Vane Test, (kN.m²)

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Window Sample Six

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
Concrete		0.20	0.20	DRY	1	U	GL - 1.00				
Made ground hardcore FILL		0.80	0.60								
Firm to stiff brown mottled grey slightly silty CLAY			2.20		2	U	1.00-2.00				1.00
					3	U	2.00 - 3.00				
Borehole Complete at 3.00m		3.00									

Remarks

Key : U - Undisturbed Sample (100mm diameter) | B - Bulk Sample | - Water Struck | D - Disturbed Sample | - Water Standing | W - Water Sample | T - Chemical Tub | N - SPT N-Value | V - Vane Test, (kN.m²)

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Window Sample Seven

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
Concrete		0.25	0.25	DRY	1	U	GL - 1.00				
Made ground hardcore FILL		1.40	1.15		2	U	1.00-1.40				1.00
Borehole Complete at 1.40m No further progress											

1.0
2.0
3.0

Remarks

Key : U - Undisturbed Sample (100mm diameter) | B - Bulk Sample | - Water Struck | D - Disturbed Sample | - Water Standing | W - Water Sample | T - Chemical Tub | N - SPT N-Value | V - Vane Test, (kN.m²)

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Window Sample Eight

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
Concrete		0.25	0.25	DRY	1	U	GL - 1.00				
Made ground hardcore FILL		0.60	0.35								
Stiff firm green grey mottled CLAY		1.10	0.50		2	U	1.00-2.00				1.00
Stiff firm brown grey mottled CLAY			1.90		3	U	2.00 - 3.00				
Borehole Complete at 3.00m		3.00									

Remarks

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Window Sample Nine

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
Concrete		0.15	0.15	DRY	1	U	GL - 1.00			Bentonite Seal; Solid Pipework	
Made ground hardcore concrete FILL		0.60	0.45								
Firm to stiff brown mottled grey CLAY			2.40		2	U	1.00-2.00			50 mmø Slotted Pipework; Pea Shingle	1.00
					3	U	2.00 - 3.00				
Borehole Complete at 3.00m		3.00									

Remarks

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Window Sample Ten

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
Concrete		0.15	0.15	DRY	1	U	GL - 1.00			Bentonite Seal; Solid Pipework	
Made ground hardcore clay FILL		0.80	0.65								
Firm to stiff grey brown slightly silty CLAY		1.00	0.20		2	U	1.00-2.00				1.00
Firm to stiff brown mottled grey CLAY		3.00	2.00		3	U	2.00 - 3.00			50 mmø Slotted Pipework; Pea Shingle	
Borehole Complete at 3.00m											

Remarks

Key : U - Undisturbed Sample (100mm diameter) | B - Bulk Sample | - Water Struck | D - Disturbed Sample | - Water Standing | W - Water Sample | T - Chemical Tub | N - SPT N-Value | V - Vane Test, (kN.m²)

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Window Sample Eleven

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
Concrete		0.37	0.37	DRY	1	U	GL - 1.00				1.00
Made ground hardcore clay FILL		0.50	0.13								
Firm to stiff grey brown silty CLAY		1.10	0.60		2	U	1.00-2.00				
Firm to stiff brown mottled grey CLAY			1.90		3	U	2.00 - 3.00				
Borehole Complete at 3.00m		3.00									

Remarks

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Window Sample Twelve

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
Concrete		0.29	0.29	DRY	1	U	GL - 1.00				
Made ground hardcore FILL		0.90	0.61								
1.0 Made ground orange clay FILL with rare clinker		2.20	1.30		2	U	1.00-2.00				1.00
2.0 Firm to stiff brown mottled grey CLAY		3.00	0.80		3	U	2.00 - 3.00				
3.0 Borehole Complete at 3.00m											

Remarks

Key : U - Undisturbed Sample (100mm diameter) | B - Bulk Sample | - Water Struck | D - Disturbed Sample | - Water Standing | W - Water Sample | T - Chemical Tub | N - SPT N-Value | V - Vane Test, (kN.m²)

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Window Sample Thirteen

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
Concrete			0.45	DRY	1	U	GL - 0.50				
		0.45									
Made ground concrete FILL		0.50	0.05								
Borehole Complete at 0.50m No further progress											

1.0
2.0
3.0

Remarks

Key : U - Undisturbed Sample (100mm diameter) | B - Bulk Sample | - Water Struck | D - Disturbed Sample | - Water Standing | W - Water Sample | T - Chemical Tub | N - SPT N-Value | V - Vane Test, (kN.m²)

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Appendix No 2
Sheet No 14
Job No 17766
Date Nov 2022

Uxbridge Skip Hire, Skip Lane, Harvil Road, Harefields, Hillingdon UB9 6JL

Window Sample Fourteen

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
Concrete		0.47	0.47	DRY	1	U	GL - 1.00				
Made ground hardcore FILL		1.00	0.53								1.00
Made Ground Clinker FILL		2.00	1.00		2	U	1.00-2.00				
Firm to stiff brown mottled grey CLAY		3.00	1.00		3	U	2.00 - 3.00				
Borehole Complete at 0.50m											

1.0
2.0
3.0

Remarks

Key : U - Undisturbed Sample (100mm diameter) | B - Bulk Sample | - Water Struck | D - Disturbed Sample | - Water Standing | W - Water Sample | T - Chemical Tub | N - SPT N-Value | V - Vane Test, (kN.m²)

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APPENDIX	3
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LOCATION Uxbridge Skip HIre, Skip Lane, Harvil Road, Harefields, Hillingdon, UB9 6JL

HAND PENETROMETER STRENGTH TEST RESULTS

Excavation Location Number	Depth (m)	Sample	Natural Moisture Content (%)	Hand Penotrometer (Undrained)	Estimated Allowable Bearing Capacity (kN/m²)	Notes
WS1	2.00	U2	26	72	144	
WS1	3.00	U3	24	63	126	
WS3	3.00	U3	27	45	90	
WS6	1.00	U1	36	54	108	
WS6	2.00	U2	29	75	150	
WS6	3.00	U3	22	90	150+	
WS9	1.00	U1	28	75	150	
WS9	2.00	U2	18	150+	150+	
WS9	3.00	U3	21	150+	150+	
WS11	1.00	U1	32	69	138	
WS11	2.00	U2	20	120	150+	
WS11	3.00	U3	13	150+	150+	
WS14	1.00	U1				
WS14	2.00	U2	33	45	90	
WS14	3.00	U3	36	33	66	

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ATTERBERG LIMITS TEST DATA

Excavation Location Number	Depth (m)	Sample	Natural Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Group Symbol	Ammended Plasticity Index (%)	Desiccation Profile	Percentage Retained on 425 Micron Sieve (%)
WS1	2.00	U2	26	77	29	48	CV	48	Significant	0
WS1	3.00	U3	24	75	28	47	CV	47	Significant	0
WS3	3.00	U3	27	47	20	27	CI	26	No	2
WS6	1.00	U1	36	79	30	49	CV	49	Slight	0
WS6	2.00	U2	29							
WS6	3.00	U3	22	46	19	27	CI	27	Slight	0
WS9	1.00	U1	28							
WS9	2.00	U2	18	63	28	35	MH/CV	34	Significant	3
WS9	3.00	U3	21							
WS11	1.00	U1	32	82	30	52	CV	51	Significant	2
WS11	2.00	U2	20							
WS11	3.00	U3	13							
WS14	1.00	U1								
WS14	2.00	U2	33							
WS14	3.00	U3	36	71	28	43	CV	43	No	1

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SULPHATE ANALYSIS

Excavation Location Number	Depth (m)	Sample	Concentrations of Soluble Sulphate			Classification	pH
			Soil		Groundwater		
			Total SO4 (%)	SO4 in 2:1 Water:soil (g/l)			
WS6	1.00	U1		0.34		DS-1 / AC-1s	7.99
WS14	3.00	U3		0.53		DS-2 / AC-1s	8.12