

GEOTECHNICAL REPORT

Site Address:	Monks Green Farm Mangrove Lane Brickendon Hertford, Herts SG13 8QL
Report Date:	December 2023
Project No.:	18625
Prepared for:	Monks Green Farm Ltd



SECTION 1 INTRODUCTION

- 1.1 In accordance with your instructions, we visited the above site during November 2023.
- 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 Conversion of an agricultural building to two separate C3 residential units, containing 4 x 1 bed units and 1 x 5 bed unit with associated extra parking and communal gardens.
- 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 Unless otherwise stated, all groundwater recordings relate to short term observations and do not take into account fluctuations in elevation due to seasonal, tidal or other effects. It is possible that fluctuations in the groundwater elevation may have an impact on the proposed design and as such, it is recommended that long term monitoring is undertaken to obtain accurate information relevant to the proposed design in terms of the ground water level.

SECTION 2 DESCRIPTION OF SITE

- 2.1 The site is formed by a large barn in place, formed by a metal clad structure with corrugate metal roof. The floor within the barn was a concrete slab in a good state of repair. At the time of the walk over the building was sectioned into three sections, within the south and north there is storage in place. in the central section there is a gym area in place. Within the north east of the barn there is a small plant room in place.
- 2.2 The site is surrounded by To the north of the site area there are residential dwelling in place form the farm house and cottages with garden area. To the west of the site area there are additional barns and buildings in place formally the farm area, but currently in use as light industrial units and storage with yard areas. To the south of the site area there is a fenced in area where large gas tanks area recorded in place. To the south of the west of the site area well established woodland is recorded in place.

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. In order to complete these works, the following site investigation works were implemented.

- 5 No Competitor Rig Windowless Sampler borehole sunk to a maximum depth of 3.00 meters - Date of Works – November 2023.
- Chemical Sampling and Testing recovered from samples and sent to analytical chemist, (report date 24/11/23).
- Geotechnical Laboratory Testing – November & December 2023.

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**

<i>Stratum</i>	<i>Description</i>	<i>Depth, Range (m)</i>	<i>Thickness, Range (m)</i>
MADE GROUND	Brick and gravel FILL	0.40m	0.30m
	Loose to compact brown silty clayey topsoil FILL	0.30m	0.30m
	Firm brown clay FILL rare fine brick and flint gravel	0.70 – 1.25m	0.60 - 0.95m
SUPERFICIAL DEPOSITS / LOWESTOFT FORMATION	Soft grey moderately silty CLAY	0.60m	0.20m
	Soft to firm brown mottled dark grey organic CLAY	0.60+ - 0.90m	0.20m
	Medium dense grey slightly claybound GRAVEL	1.80 – 2.70+m	0.60 – 2.10m
	Firm to stiff brown sandy CLAY with occasional flint gravel	2.00m	1.10m
	Firm to stiff mottled brown and grey CLAY	3.00+m	0.30 + – 1.00+m
Water	Window sampler two recorded a slight seepage at 2.00 metres. To date, no long-term monitoring had been completed.		

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 90-150+ kN/m² were achieved.
- 6.6 SPT N-Values have been completed within the boreholes completed at the site. It is confirmed within the borehole logs forming appendix two of this report that SPT N-Values of between 7-46 were achieved. This would indicated an approximate allowable bearing capacity of between 70 kN/m² to 460 kN/m² would be recognized. If groundwater is present within close proximity to the proposed founding depths, any allowable bearing capacity identified as a result of calculations undertaken as a result of the site investigation should be halved.

- Where groundwater has been identified, as a measurement, as the proposed width of the foundation below the proposed depth of the foundation, any allowable bearing capacity should be halved.
- 6.7 Atterberg Limits tests proved the clay soils to be of intermediate to very high plasticity, (PI=14-48 %), which indicates a high susceptibility to movement associated with moisture content change.
- 6.8 A measurement of the potential desiccation has been completed using Driscoll's Method of Desiccation Analysis which uses a comparison of moisture content profiles measured 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).
- 6.9 Utilizing this method of assessment, it can be seen that no obvious signs of desiccation have been recorded within the site. This does not suggest that the existing tree presence has not impacted the underlying clay soils across the site at some locations where the proposed development is to take place, just that where we have drilled boreholes and tested has not revealed any obvious signs of desiccation.
- 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- 1 /AC-1S.
- 6.11 Particle Size Distribution Testing has been completed on the made ground at the site in order to assess the granular content of the soils. Based on the information gained, we can confirm that the soils tested contained less than 35% fines and as such, can be considered non shrinkable when subjected to moisture content change.

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 Trees are present on site and as such, the influence of those trees needs to be taken into account. As such, we can confirm the following :-

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.

As a result, we would suggest that any new foundations should be taken to a minimum depth of 0.90m. 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.

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.

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 are entirely variable which include both clay soils and granular soils. The impact of this on the proposed foundations will form differential settlements and potential future movements. In order to overcome this, reinforcement must be included in the design of any new foundations in order to combat this differential settlement and movement. This should be designed by a suitably qualified structural engineer.

- 7.7 Where clay soils are identified, section 7.2 must be followed.
- 7.8 The allowable bearing capacity of the subsoil has been measured in-situ and also externally in the laboratory through hand penetrometer methodology. This has revealed the safe working and long term load capacity of the soils and should be used for design purposes. As this varies across the site, it may be prudent to adopt the lowest appreciable value for design purposes, although, this will not form value engineering. Considering the granular soils identified, where groundwater has been recorded, any allowable bearing capacity will need to be halved to allow for moisture displacement during the test process in fine grained soils.
- 7.9 Should the above cause foundation depths to be excessive and therefore uneconomical, a system of piles and ground beams should be used. 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.
- 7.10 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 meters due to the influence of trees or where made ground or compressible soil is in place to depths in excess of 0.60 meters unless it can be proven that these made ground is of a uniform density and consistency across the build.
- 7.11 All foundations should be designed by a suitably qualified structural engineer in terms of the proposed project and all aspects of the ground, groundwater, loadings of the proposed structure etc. Should any elements of this report be unclear, consultation with ourselves should be sought to clarify any elements prior to a final design being made. The final decision in terms of foundation options should be made by a structural engineer with a full working knowledge of the site and site conditions.

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



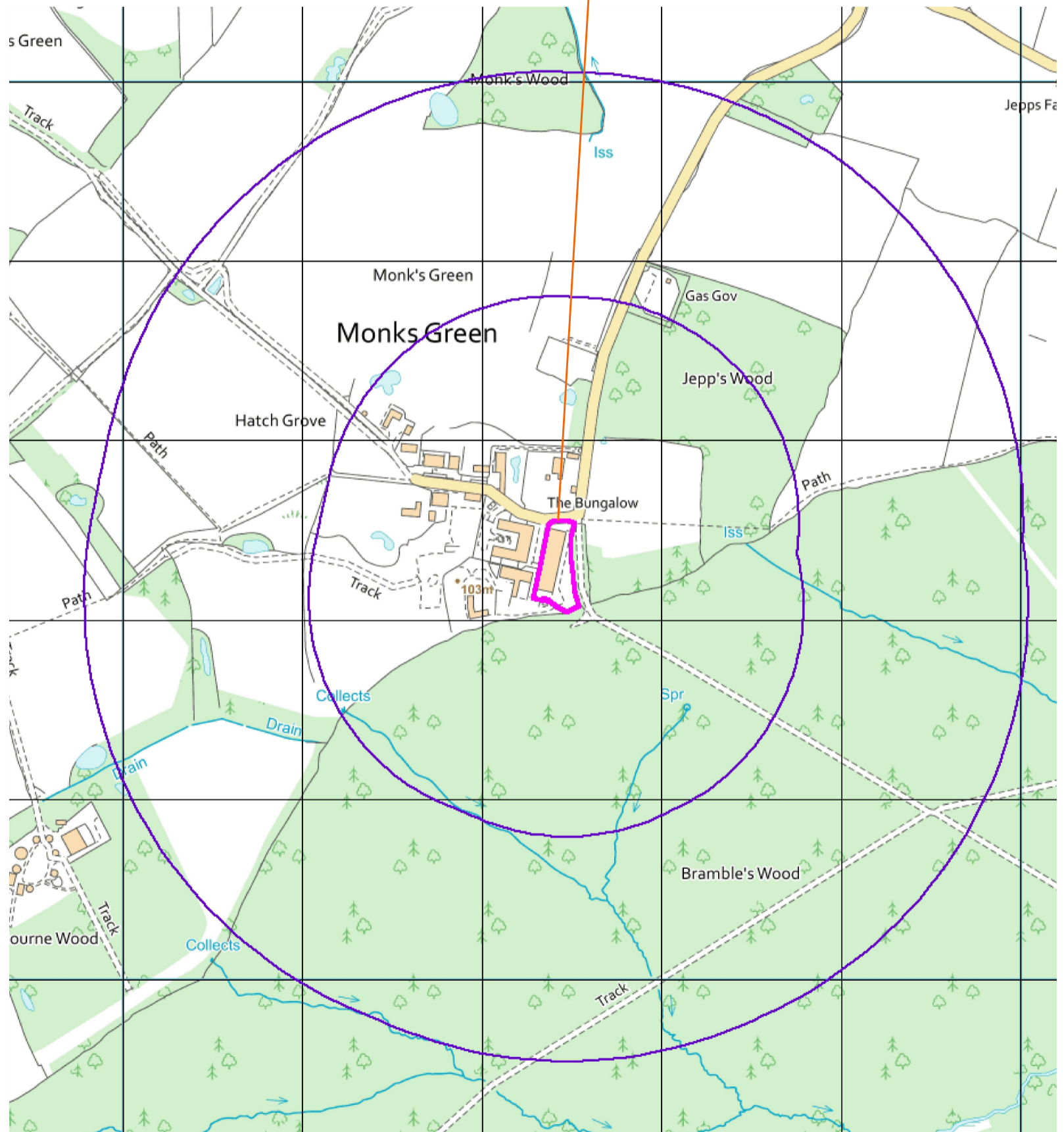
C.S.Gray M.Sc
Managing Director

Monks Green Farm Mangrove Lane Brickendon Hertford, Herts SG13 8QL

Location Plan

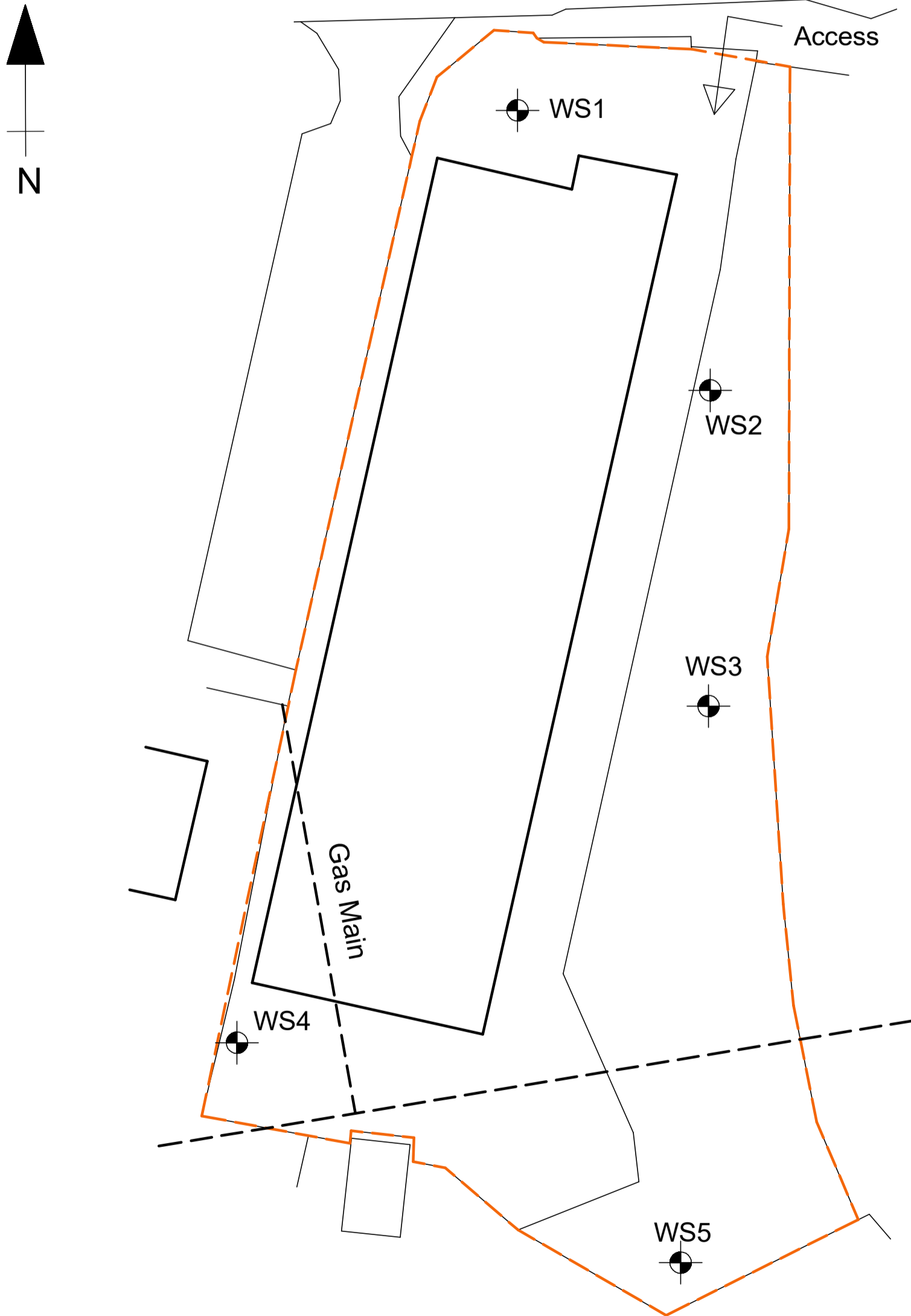


Site Plan



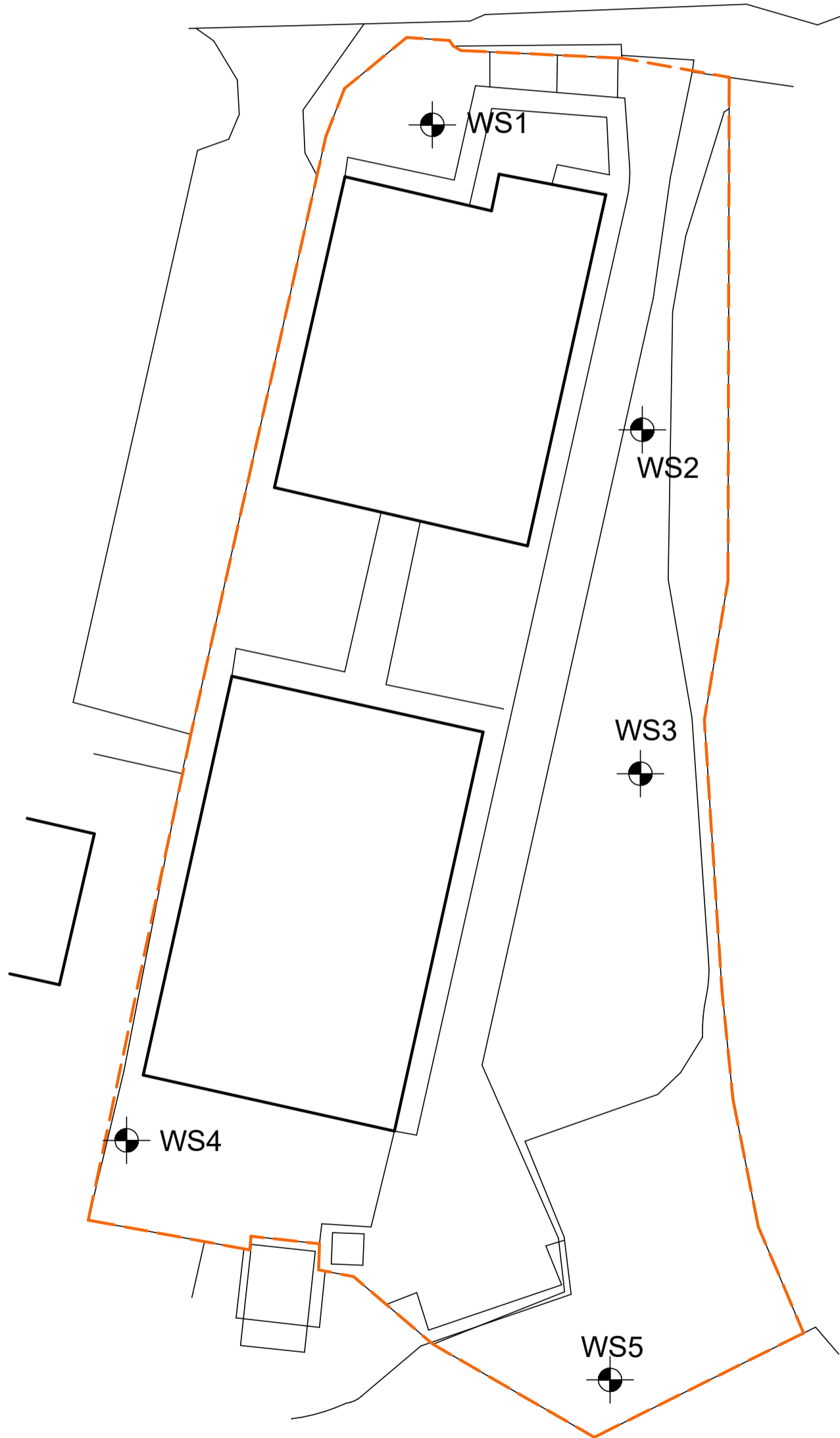
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Existing Site Plan



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Proposed Site Plan




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Window Sample One

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples			S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)	
					No	Type	Depth (m)					
Concrete		0.10	0.10	DRY	1	U	GL - 1.00					
Brick and gravel FILL		0.40	0.30									
Soft grey moderately silty CLAY		0.60	0.20									
Medium dense grey slightly claybound GRAVEL			2.10			2	U	1.00-2.00	N=32			1.00
		2.70				3	U	2.00 - 3.00	N=46			
Firm to stiff mottled brown and grey CLAY			0.30									
Borehole Complete at 3.00m		3.00					3.00	N=20				

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			S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
					No	Type	Depth (m)				
Loose brown topsoil FILL		0.10	0.10	Slight Seepage ▼ 2.00	1	U	GL - 1.00				
Firm brown clay FILL rare fine brick and flint gravel			0.80								
		0.90									
Firm brown mottled grey CLAY			0.30			2	U	1.00-2.00			1.00
		1.20									
Medium dense brown slightly claybound GRAVEL			0.60								
		1.80									
Firm to stiff orange brown mottled grey slightly claybound SAND & GRAVEL			1.20								
					3	U	2.00 - 3.00	N=30			
Borehole Complete at 3.00m		3.00					3.00	N=24			

Remarks

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Window Sample Three

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples			S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
					No	Type	Depth (m)				
Loose brown topsoil FILL		0.10	0.10	DRY	1	U	GL - 1.00				
Firm brown clay FILL rare fine brick and flint gravel		0.70	0.60								
Soft to firm brown mottled dark grey organic CLAY		0.90	0.20								
Firm to stiff brown sandy CLAY with occasional flint gravel		2.00	1.10								
Firm brown mottled grey slightly silty CLAY		2.00	1.00		2	U	1.00-2.00	N=7			1.00
Borehole Complete at 3.00m		3.00			3	U	2.00 - 3.00	N=12			
		3.00					3.00	N=17			


Remarks


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Window Sample Four

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples			S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
					No	Type	Depth (m)				
Concrete		0.10	0.10	DRY							
Compact crushed brick and concrete clayey FILL		0.40	0.30		1	T	0.20				
Soft to firm brown mottled dark grey slightly organic slightly silty CLAY		0.60	0.20								
Borehole Complete at 0.60m					1	T	0.60				

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 Five

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples			S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
					No	Type	Depth (m)				
Loose to compact brown silty clayey topsoil FILL		0.30	0.30	DRY	1	T	0.20				
Compact brown sandy clayey FILL with brick and concrete fragments		1.25	0.95		2	T	0.60				
Firm brown sandy CLAY with occasional flint gravel		1.50	0.25		3	T	1.25				
Borehole Complete at 1.50m											

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

SHEET

JOB NUMBER

DATE

3

1

18625

Nov-23

Geotechnical Assessments | Environmental Assessments | Desktop Studies | Contamination Analysis

LOCATION Monks Green Farm Mangrove Lane Brickendon Hertford, Herts SG13 8QL

HAND PENETROMETER STRENGTH TEST RESULTS

Excavation Location Number	Depth (m)	Sample	Natural Moisture Content (%)	Hand Penetrometer (Undrained)	Estimated Allowable Bearing Capacity (kN/m ²)	Notes
WS1	3.00	U	28	120	150+	
WS2	1.00	U	24	75	150	
WS3	1.00	U	16	90	150+	
WS3	1.50	U	21	45	90	
WS3	2.00	U	20	54	108	
WS3	2.50	U	31	75	150	
WS3	3.00	U	31	78	150+	



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APPENDIX

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2

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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	3.00	U	28	77	29	48	CV	48	Slight	0
WS2	1.00	U	24	54	23	31	MH	24	Slight	22
WS3	1.00	U	16	34	15	19	CV	14	Slight	28
WS3	1.50	U	21						Slight	
WS3	2.00	U	20	50	19	31	MI/MH	21	Slight	32
WS3	2.50	U	31						Slight	
WS3	3.00	U	31	75	29	46	CV	46	Slight	0



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APPENDIX 3
SHEET 3
JOB NUMBER 18625
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Geotechnical Assessments | Environmental Assessments | Desktop Studies | Contamination Analysis

LOCATION Monks Green Farm Mangrove Lane Brickendon Hertford, Herts SG13 8QL

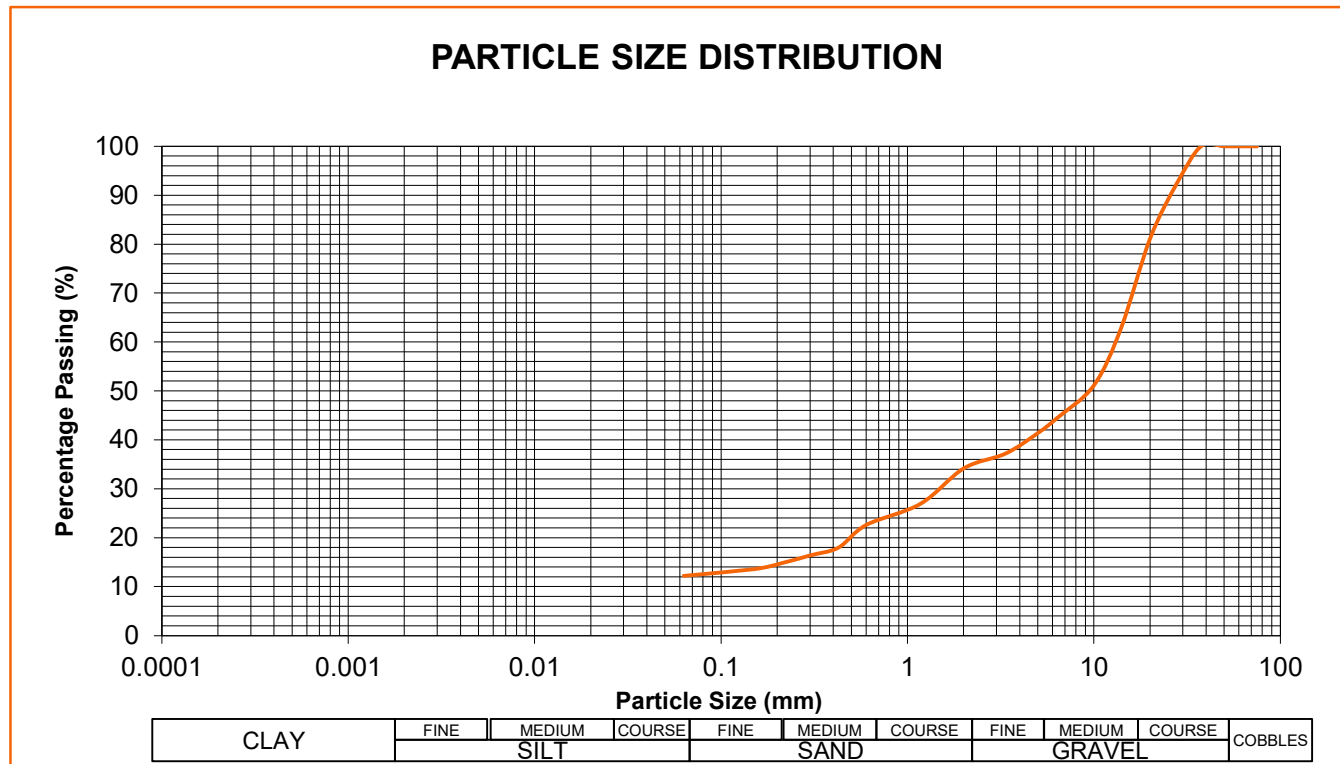
SULPHATE ANALYSIS

Excavation Location Number	Depth (m)	Sample	Concentrations of Soluble Sulphate			Classification	pH
			Soil		Groundwater		
			Total SO4 (%)	SO4 in 2:1 Water:soil (g/l)			
WS2	1.00	U		0.21		DS-1 / AC-1s	7.68
WS3	2.00	U		0.36		DS-1 / AC-1s	7.98

LOCATION Monks Green Farm Mangrove Lane Brickendon Hertford, Herts SG13 8QL

 Location : **WS1** Depth : **2.00 m** Sample No: **U** Initial Mass: **500 g**

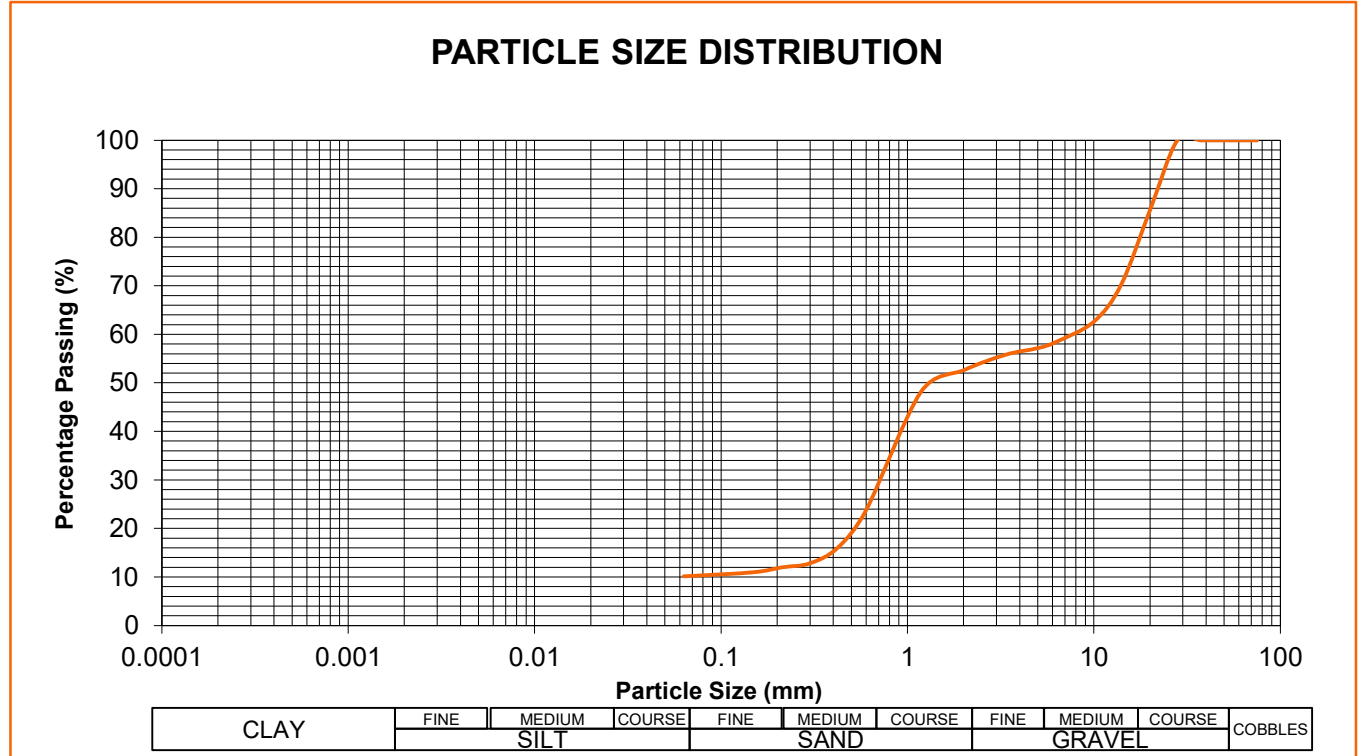
Sieve Size (mm)	Weight Retained (g)	Percent Retained (%)	Total Passing (%)
75	0	0	100
63	0	0	100
50	0	0	100
37.50	0	0	100
28.00	37	7	93
20.00	57	11	81
14.00	91	18	63
10.00	59	12	51
6.30	34	7	44
5.00	15	3	41
3.35	21	4	37
2.00	15	3	34
1.180	36	7	27
0.600	22	4	23
0.425	23	5	18
0.300	8	2	16
0.212	8	2	15
0.150	6	1	14
0.063	7	1	12


 Fines (%) = **12** Sands (%) = **22** Gravels (%) = **66** Cobbles (%) = **0**
British Standard Sieve Test 5930:2015 as Per Test 7a

LOCATION Monks Green Farm Mangrove Lane Brickendon Hertford, Herts SG13 8QL

Location : **WS2** Depth : **1.50 m** Sample No: **U** Initial Mass: **600 g**

Sieve Size (mm)	Weight Retained (g)	Percent Retained (%)	Total Passing (%)
75	0	0	100
63	0	0	100
50	0	0	100
37.50	0	0	100
28.00	0	0	100
20.00	86	14	86
14.00	92	15	70
10.00	46	8	63
6.30	25	4	59
5.00	8	1	57
3.35	8	1	56
2.00	19	3	53
1.180	27	5	48
0.600	146	24	24
0.425	46	8	16
0.300	20	3	13
0.212	5	1	12
0.150	6	1	11
0.063	5	1	10



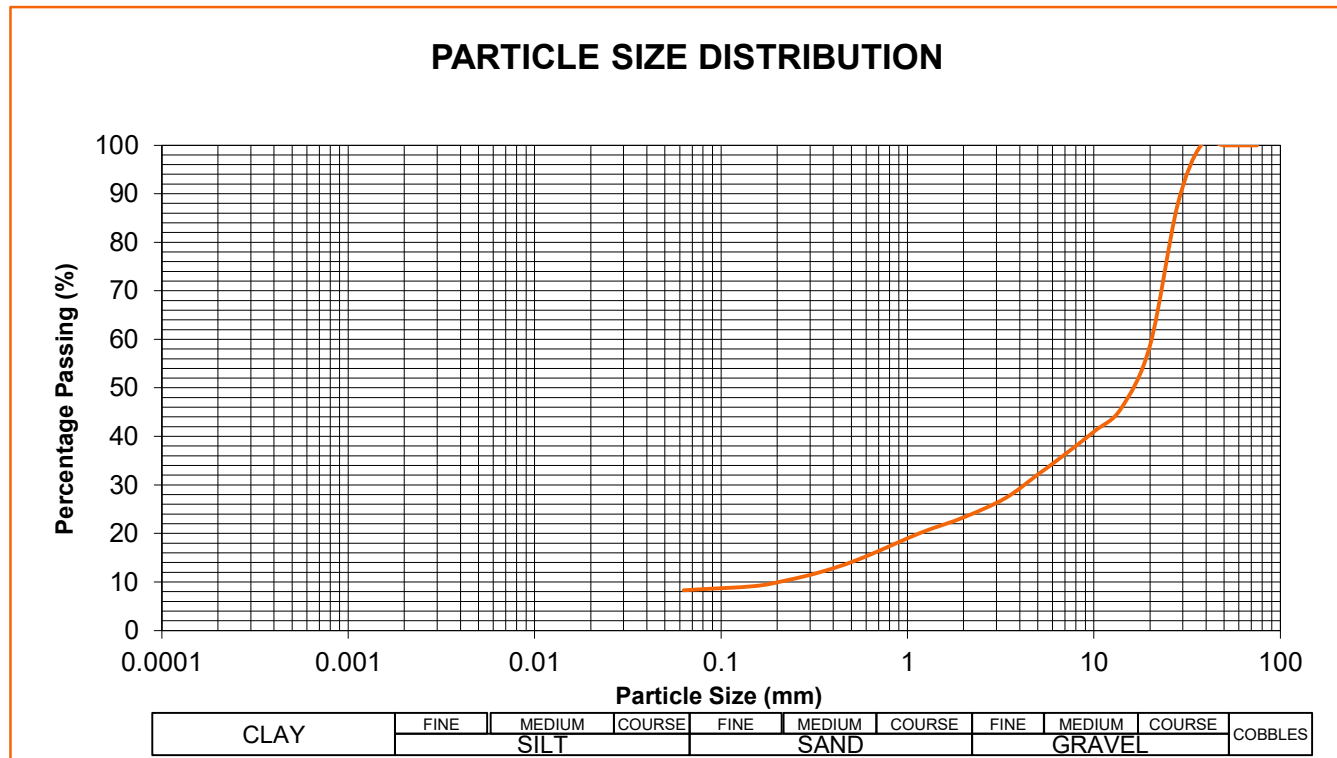
Fines (%) = **10** Sands (%) = **43** Gravels (%) = **47** Cobbles (%) = **0**

British Standard Sieve Test 5930:2015 as Per Test 7a

LOCATION Monks Green Farm Mangrove Lane Brickendon Hertford, Herts SG13 8QL

 Location : **WS2** Depth : **2.00 m** Sample No: **U** Initial Mass: **600 g**

Sieve Size (mm)	Weight Retained (g)	Percent Retained (%)	Total Passing (%)
75	0	0	100
63	0	0	100
50	0	0	100
37.50	0	0	100
28.00	75	13	88
20.00	172	29	59
14.00	78	13	46
10.00	29	5	41
6.30	36	6	35
5.00	17	3	32
3.35	29	5	27
2.00	24	4	23
1.180	19	3	20
0.600	29	5	15
0.425	13	2	13
0.300	10	2	12
0.212	8	1	10
0.150	6	1	9
0.063	5	1	8


 Fines (%) = **8** Sands (%) = **15** Gravels (%) = **77** Cobbles (%) = **0**
British Standard Sieve Test 5930:2015 as Per Test 7a