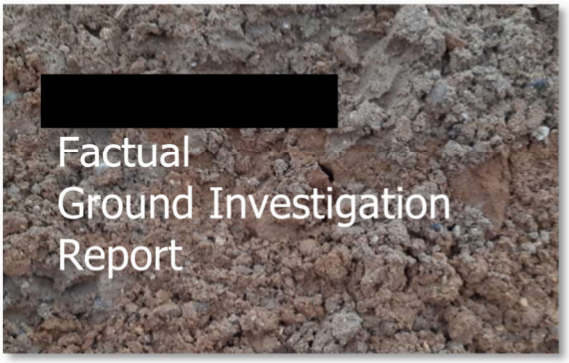
Appendix C

WYG Factual Ground Investigation Report (Phase II GI)



[redacted] Factual Ground Investigation Report

Prepared by WYG Environment Planning Transport Limited

December 2020

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Contents

Appendices

1.0 Introduction

1.1 Instruction

WYG Environment (WYG) were commissioned by Arup to undertake a ground investigation at the site referred to as 'WXT' located in Waltham Cross in July 2020.

1.2 Scope

The proposed scope of investigations is detailed within the specification document (ARUP, 28th July 2020). WYG were also commissioned by ARUP to undertake the following additional surveys during the site investigation programme.

- A Wenner Survey at the proposed location of a substation. Instructions to proceed were provided by an email dated 25th August 2020.
- Monitoring of previous installations undertaken by Endeavour Drilling in 2018. Instructions to proceed were provided by an email dated 29h July 2020

The completed scope of work is summarised in Section 4.1.

1.3 Terms and Conditions

This report has been prepared for the client, ARUP, in accordance with the terms and conditions of the contract. The report is prepared in line with the Invitation to Tender and the WYG tender submission (dated 16th July 2020) and is subject to the report conditions included as Appendix A.

The recommendations and opinions expressed within this report are based on the information provided and other sources of readily available information. Where reference has been made to other reports or information provided by the client, or from other Third-party sources, such data has been reviewed in good faith and it has been assumed that their contents are correct. WYG is unable to guarantee any Third-Party Information. The ground conditions presented herein are representative of the conditions recorded at the time and in the positions of the investigation. Ground conditions may vary over time and in between investigation locations.

2.0 Site Information

2.1 Site Location and Description

'The Site', discussed herein, is centred at approximate National Grid Reference TL 35013 01461 and covers an area of approximately 16 Hectares to the west of the A10 Road and north of the M25 in Waltham Cross (see Exploratory Hole Location Plan, Appendix B). The west boundary is defined by Theobalds Brook and open fields lie to the north and south. An access track crosses the southern portion of the site.

At the time of the investigation, during the period from August to November 2020, the site comprised an open field accessible through Maxwell's West commercial estate situated to the north west of the site. This access point provided vehicle and pedestrian access into the northwest of the site and lead on to an access track which continued to the north following the east side of a Circa 4 metre (m) high stockpile covering an area of approximately 0.15 Hectares.

Most of the site was level with some hummocky areas and undulations resulting from disturbance and settlement occurring from rutting and previous site investigations. The site had been laid to meadow and vegetation had been recently cut short over a generally firm and level surface.

From the levels obtained at exploratory hole positions, the site level ranged from a low of 28.93m above ordnance datum (AOD) at TP209 in the central area, to a high of 32.05m AOD at BH201 in the north extremity of the site

2.2 Geology and Hydrogeology

Information regarding the anticipated underlying geology as summarised from published information and previous ground investigations is summarised in Table 1 extracted from the ARUP specification.

Table 1 Anticipated Ground Conditions

Stratum	Thickness (m)	Level of top of stratum (mAOD)	Aquifer Classification
Topsoil	0.2 to 0.5	28.8 to 31.9	-
Made Ground	0.2 to 0.3	29.4 to 30.7	-
Enfield Silt Member	0.2 to 3.8	28.5 to 31.9	Unproductive Stratum
Kempton Park Gravel Member	2.1 to 8.15	26.1 to 31.9	Secondary A Aquifer
London Clay Formation	11.5 to 19.2	21.9 to 24.7	Unproductive Stratum
Lambeth Group	Not proven	5.1 to 11.1	Secondary A Aquifer

2.3 Services

Service records indicate the presence of a trunk main sewer approximately 116m east of the site. Land drains were also anticipated and were encountered in PLT212 and PLT214 and comprised c.300mm diameter perforated ceramic drains buried at depths ranging between 0.7m and 0.9m below ground level (bgl).

Ground Penetrating Radar (GPR) and electromagnetic scanning using a Cable Avoidance Tool were undertaken at all exploratory hole locations. No indication of buried services was encountered at any of the locations.

3.0 Ground Investigation

3.1 Summary of Scope

The WYG ground investigation was undertaken between the between the 24th of August and the 23rd of November 2020 and comprised the following scope.

- A non-intrusive magnetometer survey covering approximately 6 Hectares of the central and east portion of the site to confirm the UXO hazard level. This survey was undertaken to reduce the risks of encountering UXO during the investigation, and to inform the risk assessment for the design of the permanent works for the proposed development.
- A Wenner Survey was undertaken to establish the insulating properties of the shallow ground over an area of approximately 0.2 Hectares in the south west at the location of a proposed substation.
- 19no. cable percussion borehole to depths between 10m to 35m bgl with Standard Penetration Testing (SPTs) and undisturbed aluminium thick-walled sampling (U100) in fine soils and cohesive bedrock.
- 4no. rotary coring boreholes to a depth of 30m bgl to obtain core samples of bedrock. These locations were initiated using cable percussive methods to install casing for the progression of the boreholes into the London Clay Formation using rotary methods to obtain 100mm diameter core samples.
- 15no. machine excavated trial pits to 4.5m bgl to investigate shallow soils
- 4no. machine excavated trial pits with soakaway tests in general accordance with BRE 365 to maximum depth of 4.5m bgl.
- 15no. plate load tests were undertaken at a depth of 0.50m bgl (between 28.71 and 31.84m AOD).
- Dual purpose gas and groundwater monitoring apparatus were installed in 18No. of the boreholes.

- Recommissioning of existing standpipe installations from the previous ground investigation (Endeavour Drilling, 2018) to allow there incorporation into subsequent gas and groundwater monitoring visits.
- 2No. post-fieldwork groundwater sampling visits
- 4No. post-fieldwork land gas monitoring visits
- 6No. post-fieldwork groundwater monitoring visits
- 5No. digital data-loggers were placed within the installations for continuous water level monitoring. A digital barometric data logger was placed at ground level to allow atmospheric pressure compensation of down-hole logger data.
- Laboratory geotechnical testing of soil samples for geotechnical and geoenvironmental purposes.
- Laboratory environmental testing of soil and groundwater samples for geotechnical and geoenvironmental purposes.
- Factual reporting and digital data to conform to BS 5930 Section 10 and, as applicable, also to BS 10175 and BS 8576 (factual elements only).

Exploratory hole and non-intrusive survey locations were surveyed to Ordnance Datum and are indicated on the Exploratory Hole Location Plan (Appendix B).

Site investigation activities were undertaken in general accordance with BS5930:2015 'Code of Practice for Site Investigations' which incorporates BS-EN 1997-2:2007 and BS10175:2011 A1:2013.

3.2 Summary of Ground Conditions

The encountered ground conditions compared well to the conditions anticipated from published geological maps and data provided from previous investigations, and in summary comprised the following deepening succession.

- Topsoil & Made Ground
- Enfield Silt Member
- Kempton Park Gravel Member
- London Clay Formation
- Harwich Formation
- Lambeth Group

With reference to the British Geological Survey (BGS) Lexicon [1] , the Harwich Formation, which is present throughout the London Basin, has been identified at the base of the London Clay Formation.

Although attempts have been made to assign nomenclature to the Undifferentiated Lambeth Group deposits, the variable composition and consistency of these units, which is confirmed by both published literature and the engineers soil descriptions, has in most cases rendered them indistinguishable.

Therefore, for the purposes of this discussion, as per the requirements set out in the specification, these soils have been discussed in terms of their predominant grading and composition, namely 'Lambeth Group – Cohesive' where soils are predominantly fine, and 'Lambeth Group – Coarse' where soils are predominantly sand and gravel.

A summary of strata depths and thicknesses is provided in Tables 2.1 to 2.4. Detailed soil descriptions are provided on the Engineering Logs included in Appendix C1, C2 and C3.

[1] British Geological Survey (BGS) Lexicon of Named Rock Units (2020) : Harwich Formation https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=HWH

BH209 (located at NGR 535004, 201609) was terminated at a depth of 9.50m bgl due to a 3m string of 50mm diameter SPT rods shearing at the end of an SPT Test. The rods could not be recovered and were left in-situ. The borehole was then backfilled with bentonite, instated with a marked post and relocated to BH209A. It is noted that the SPTs rods are ferrous and will likely generate a magnetic field and could be misinterpreted as UXB during magnetometry probing.

Table 2.1 Summary of Strata Depths and Thicknesses – Rotary Coring Boreholes

'>' Denotes the maximum thickness confirmed (the base depth of the material has not been proven)

Location	Topsoil / Made Ground		Enfield Silt Member		Kempton Park Gravel Member		London Clay Formation		Harwich Formation		Lambeth Group	
	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)
BH205	-	-	-	-	-	-	7.40	9.30	16.70	3.15	19.85	>10.1
BH212	-	-	-	-	-	-	6.50	9.00	15.50	3.30	18.80	>11.2
BH217	-	-	-	-	-	-	6.50	9.22	15.72	2.98	18.70	>11.3
BH218	-	-	-	-	-	-	8.00	8.00	16.00	4.50	20.50	>9.5

Table 2.2 Summary of Strata Depths and Thicknesses – Cable Percussive Boreholes

'>' Denotes the maximum thickness confirmed (the base depth of the material has not been proven)

Location	Topsoil / Made Ground		Enfield Silt Member		Kempton Park Gravel Member		London Clay Formation		Harwich Formation		Lambeth Group	
	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)
BH201	0.00	0.10	0.10	4.30	4.40	4.30	8.70	>1.30	-	-	-	-
BH202	0.00	0.30	0.30	4.50	4.80	3.40	8.20	8.30	16.50	4.90	21.40	>8.60
BH203	0.00	0.50	0.50	5.00	5.50	2.50	8.00	10.00	18.00	3.00	21.00	>14.00
BH204	0.00	0.50	0.50	0.50	1.00	6.00	7.00	9.00	16.00	3.00	19.00	>11.00
BH206	0.00	0.10	0.10	1.90	2.00	4.00	6.00	>4.00	-	-	-	-
BH207	0.00	0.50	0.50	0.90	1.40	6.60	8.00	7.50	15.50	3.50	19.00	>16.00
BH208	0.00	0.10	0.10	2.70	2.80	2.20	5.80	10.85	16.65	2.55	19.20	>10.80
BH209	0.00	1.20	1.20	2.30	3.50	3.00	6.50	>3.00	Borehole terminated due to sheared SPT rods which have been buried and left in situ at approximately 9.50m bgl.			
BH209A	0.00	1.20	1.20	2.30	3.50	3.00	6.50	11.50	18.00	2.20	20.20	>9.80
BH210A	0.00	0.10	0.10	3.50	3.60	2.90	6.50	>3.50	-	-	-	-
BH211	0.00	1.20	1.20	2.20	3.40	2.35	5.75	10.70	16.45	1.75	18.20	>11.80
BH213	0.00	0.10	0.10	2.10	2.20	4.00	6.20	10.80	17.00	3.50	20.50	>9.50
BH214	0.00	0.10	0.10	4.40	4.50	1.50	6.00	>4.00	-	-	-	-
BH215	0.00	0.60	0.60	1.90	2.50	3.50	6.00	10.50	16.50	1.50	18.00	>12.00
BH216	0.00	0.30	0.30	2.00	2.30	3.50	5.80	11.80	17.60	2.40	20.00	>15.00
BH219	0.00	0.30	-	-	0.30	9.10	9.40	>1.55	-	-	-	-
BH220	0.00	0.10	0.10	1.10	1.20	7.30	8.50	8.50	17.00	3.00	20.00	>5.00
BH221	0.00	1.20	-	-	1.20	8.30	9.50	7.90	17.40	2.10	19.50	>0.90
BH222	0.00	1.20	-	-	1.20	8.80	9.00	8.50	17.50	1.50	19.00	>6.00
BH223	0.00	0.20	0.20	1.80	2.00	6.60	8.60	8.40	17.00	2.30	19.30	>5.70

Table 2.3 Summary of Strata Depths and Thicknesses – Plate Load Tests

'>' Denotes the maximum thickness confirmed (the base depth of the material has not been proven)

Location	Topsoil / Made Ground		Enfield Silt Member		Kempton Park Gravel Member		London Clay Formation		Harwich Formation		Lambeth Group	
	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)
PLT201	0.00	>0.75	-	-	-	-	-	-	-	-	-	-
PLT202	0.00	>0.75	-	-	-	-	-	-	-	-	-	-
PLT203	0.00	>1.25	-	-	-	-	-	-	-	-	-	-
PLT204	0.00	0.50	0.50	0.70	1.20	>0.05	-	-	-	-	-	-
PLT205	0.00	>1.25	-	-	-	-	-	-	-	-	-	-
PLT206	0.00	>0.75	-	-	-	-	-	-	-	-	-	-
PLT207	0.00	0.50	0.50	>0.75	-	-	-	-	-	-	-	-
PLT208	0.00	>0.75	-	-	-	-	-	-	-	-	-	-
PLT209	0.00	0.50	0.50	>0.75	-	-	-	-	-	-	-	-
PLT210	0.00	1.20	-	-	1.20	>0.05	-	-	-	-	-	-
PLT211	0.00	1.15	-	-	1.15	>0.10	-	-	-	-	-	-
PLT212	0.00	>0.83	-	-	-	-	-	-	-	-	-	-
PLT213	0.00	0.39	0.39	>0.86	-	-	-	-	-	-	-	-
PLT214	0.00	0.85	-	-	0.85	>0.40	-	-	-	-	-	-
PLT215	0.00	0.39	0.39	0.56	0.95	>0.30	-	-	-	-	-	-

Table 2.4 Summary of Strata Depths and Thicknesses – Trial Pitting

'>' Denotes the maximum thickness confirmed (the base depth of the material has not been proven)

Location	Topsoil / Made Ground		Enfield Silt Member		Kempton Park Gravel Member		London Clay Formation		Harwich Formation		Lambeth Group	
	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)	From (m bgl)	Thickness (m)
TP201	0.00	0.30	0.30	3.70	4.00	>1.10	-	-	-	-	-	-
TP202	0.00	0.20	0.20	1.20	1.40	>2.80	-	-	-	-	-	-
TP203	0.00	0.20	0.20	3.40	3.60	>0.90	-	-	-	-	-	-
TP204	0.00	0.30	0.30	3.00	3.30	>1.20	-	-	-	-	-	-
TP205	0.00	0.20	0.20	1.80	2.00	>2.40	-	-	-	-	-	-
TP206	0.00	0.20	0.20	1.60	1.80	>2.70	-	-	-	-	-	-
TP207	0.00	0.30	0.30	1.80	2.10	>2.40	-	-	-	-	-	-
TP208	0.00	0.30	0.30	1.90	2.20	>2.30	-	-	-	-	-	-
TP209	0.00	0.30	0.30	0.80	1.10	>3.40	-	-	-	-	-	-
TP210	0.00	0.30	0.30	0.80	1.10	>3.30	-	-	-	-	-	-
TP211	0.00	0.30	0.30	0.60	0.90	>3.40	-	-	-	-	-	-
TP212	0.00	0.30	0.30	1.00	1.30	>3.00	-	-	-	-	-	-
TP213	0.00	0.30	0.30	0.80	1.10	>2.10	-	-	-	-	-	-
TP214	0.00	0.20	0.20	0.70	0.90	>3.30	-	-	-	-	-	-
TP215	0.00	0.20	0.20	0.40	0.60	>3.90	-	-	-	-	-	-
TP216	0.00	0.30	0.30	0.70	1.00	>3.50	-	-	-	-	-	-
TP217	0.00	0.30	0.30	0.60	0.90	>3.60	-	-	-	-	-	-
TP218	0.00	0.20	0.20	0.70	0.90	>3.60	-	-	-	-	-	-
TP219	0.00	0.40	-	-	0.40	>4.10	-	-	-	-	-	-

3.3 Topsoil and Made Ground

Topsoil / Made Ground was encountered in all exploratory locations. These soils typically comprised a 0.10 to 0.30m thick layer of Topsoil over a 0.10 to 1.20m thick layer of Made Ground / disturbed Enfield Silt Member.

The Topsoil consisted of soft dark brown slightly sandy gravelly clay / silt with roots / rootlets and occasional brick fragments.

The Made Ground was variable and comprised both predominantly coarse and predominantly fine soils. In terms of composition, the Made Ground was similar to the underlying Enfield Silt Member, however occasional gravel size brick and chalk fragments were noted suggestive of anthropogenic influence, including possible disturbance / importation of materials into the upper levels of the Enfield Silt Member.

Land drains were encountered within the Made Ground (reworked Enfield Silt Member). The drains were set within coarse gravels at depths ranging between 0.65 and 0.85m bgl (in locations PLT212 and PLT214).

3.4 Enfield Silt Member

The Enfield Silt Member was encountered below the Topsoil and Made Ground (where present) at depths ranging between 0.10 and 1.20m bgl. The deposit ranged in thickness between 0.50 and 5.00m although the full thickness was not established in all locations.

The deposit was relatively consistent in composition and typically comprised firm orangish brown slightly gravelly silt with localised lenses of sand and gravel. Occasional rootlets and worm burrow holes were observed. The deposit generally increases in consistency at deeper levels.

No visual or olfactory evidence of contamination was noted within the Enfield Silt Member.

3.5 Kempton Park Gravel Member

The Kempton Park Gravel Member was encountered at depths ranging between 0.20 and 5.50m bgl.

Where confirmed, the deposit ranged in thickness between 1.50 and 8.50m, however most of the Trial Pit and Plate Load Test locations were terminated within this unit.

Although some lenses / layers of predominantly fine soils (silt / clay) were noted (including at BH206, BH213, BH215, BH219, BH221 and BH223), the deposit was predominantly coarse and comprised orangish brown clayey sandy gravel with rare flint cobbles.

No visual or olfactory evidence of contamination was identified noted within the coarse Superficial Deposits.

3.6 London Clay Formation

The London Clay Formation was encountered at depths ranging between 5.00 and 9.50m bgl in all borehole positions, and where confirmed, ranged in thickness between 7.50 and 11.80m. The base of the London Clay Formation was not encountered in BH201, BH206, BH210, BH214 and BH219.

The deposit was relatively uniform in composition and comprised firm grey silty and slightly sandy clay. Occasional thin laminations of disseminated pyrite were identified (including BH202 BH203, BH207, BH208 and BH220). Selenite crystals were also identified in discrete depths / locations and soils at deeper levels, near the interface with the underlying Harwich Formation which was occasionally described as glauconitic. Potential organic matter was also identified at deeper levels.

3.7 Harwich Formation

The Harwich Formation was encountered at depths ranging between 15.50 and 18.00m bgl and ranged in thickness between 1.50 and 5.10m.

The deposit was relatively uniform in composition and generally comprised stiff to very stiff grey and green (glauconitic) silty slightly sandy clay, however occasional

horizons containing shell fragments and layers where silt was more prevalent were also noted.

3.8 Lambeth Group

The Lambeth Group was encountered at depths ranging between 18.00 and 21.40m bgl. The full thickness of the deposit was not established as it continued beyond the base of all exploratory hole locations.

Although distinct units have been tentatively identified, in general the Lambeth Group was variable in composition.

The top of the Lambeth Group generally comprised soft to very stiff mottled brown, grey and red sandy silty clay (possibly the Reading Formation). At deeper levels a distinct unit of greenish grey clay, silt and sand with abundant shell fragments has been identified in many areas, this unit is possibly the Woolwich Formation.

Below the upper predominantly fine soil horizon, coarse horizons were more prevalent, and typically comprised yellowish brown sand. A layer of fine to medium subrounded to rounded, flat and elongate, vitreous / shiny black gravel was identified in BH209A between 21.50 and 22.45m bgl.

3.9 Groundwater Strikes

Groundwater strikes occurred during the formation of BH207, BH209A, BH213, BH216 and BH221) as summarised in Table 3.

Table 3 Summary of Groundwater Strikes During the Investigation

	Depth (m bgl)	Strata	Notes
BH207	19.80	Lambeth Group	Strike encountered within the Lambeth Group which then rose to 17.00m bgl in the Harwich Formation after 20 minutes. Sealed at 19m bgl.
BH209A	12.50 22.00	London Clay Formation Lambeth Group	Water levels remained static.
BH213	19.50	Harwich Formation	Water levels remained static.
BH216	20.00	Harwich Formation	Strike encountered within the Harwich Formation which then rose to 19.00m bgl at the top of the Harwich Formation after 20 minutes.
BH221	13.00	London Clay Formation	Strike encountered within the London Clay Formation which then rose to 12.10m bgl after 20 minutes. Sealed at 14m bgl.

3.10 Soil Infiltration Testing

Soakaway tests were carried out in four selected trial pit locations (TP201, TP204, TP212 and TP213) in general accordance with BRE365.

The testing within TP201, TP212 and TP213 was aborted on instruction from Arup after a single fill in each pit due slow infiltration rates. Infiltration test calculation sheets are presented in Appendix D and summarised in Table 4.

Table 4 Summary of Soil Infiltration Testing

	Test Depth (m bgl)		Strata	Soil Infiltration Rate (f) m/s		
	From	To		Test 1	Test 2	Test 3
TP201	4.00	5.00	Enfield Silt Member (fine soil)	TT	NU	NU
TP204	3.30	4.30	Kempton Park Gravel Member (coarse soil)	$5.42x10^{-5}$	$4.14x10^{-5}$	NU
TP212	1.33	2.66	Kempton Park Gravel Member (coarse soil)	TT	NU	NU
TP213	1.54	3.20	Kempton Park Gravel Member (coarse soil)	TT	NU	NU

TT – Test terminated prior to reaching T25% due to low infiltration rate. NU – Not undertaken

3.11 Monitoring Installations

Dual purpose land gas and groundwater monitoring standpipes were installed within one Rotary Borehole and sixteen Cable Percussion boreholes. Dual installations (targeting both shallow and deep groundwater) were installed in four locations.

Installations were constructed using either slotted 50mm or 33mm diameter HDPE standpipe with a 325µm filter wrap and 10mm dia. pea-shingle surround or a plastic Casagrande piezometer tip with a filter sand surround.

Sharp sand was introduced at the top of the filter zone to prevent mixing of the bentonite seal placed above and below the response zone.

Installation details are provided on the engineering logs and summarised in Table 5 and it is noted that some of the base depths recorded during the ongoing monitoring phase have recorded lower depths than the installation base depths recorded on completion of the installation. These deeper levels are likely to be due to minor settlement occurring below the base of the installation during the installation of the standpipe and during the monitoring period. The degree of settlement occurring is also recorded in Table 5.

Table 5 Summary of Borehole Installations

		Specified Response Zone (m bgl)		Base Depth Variation (m bgl)			
	Diameter (mm)	Top	Base	Initial	Round 2	Settlement (mm)	Response Zone Strata
BH202	50	5.30	7.70	6.89	6.99	100	Kempton Park Gravel Member
BH203S	35	5.70	7.50	7.69	7.69	0	Kempton Park Gravel Member
BH203D	35	25.00	26.00	25.29	25.29	0	Lambeth Group
BH204S	35	4.50	6.50	6.30	6.48	180	Kempton Park Gravel Member
BH204D	35 Piezo	27.50	28.00	20.40	20.53	130	Lambeth Group
BH206	35	4.00	5.50	4.83	4.91	80	Kempton Park Gravel Member
BH207	50	20.80	21.80	22.05	22.05	0	Lambeth Group
BH208S	35	3.60	5.40	5.05	5.05	0	Kempton Park Gravel Member
BH208D	35 Piezo	10.00	10.50	10.25	10.16	-90	London Clay Formation
BH209A	50	4.00	6.00	5.92	5.92	0	Kempton Park Gravel Member
BH210A	50	4.10	5.50	5.66	5.77	110	Kempton Park Gravel Member
BH211	50	3.70	5.20	5.16	5.14	-20	Kempton Park Gravel Member
BH214	50	5.00	6.00	6.08	6.18	100	Kempton Park Gravel Member
BH215	50	3.70	5.50	16.39	16.32	-70	Kempton Park Gravel Member
BH216S	35	4.00	5.30	Not monitored			Kempton Park Gravel Member
BH216D	35	30.30	30.50	Not monitored			Lambeth Group
BH217	50	15.00	16.00	16.39	16.32	-70	London Clay Formation
BH220	50	5.00	8.00	8.09	8.16	70	Kempton Park Gravel Member
BH221	50	16.00	16.80	16.78	16.81	30	London Clay Formation
BH222	50	21.00	22.00	22.5	22.57	70	Lambeth Group
BH223	50	6.00	8.10	8.20	8.25	50	Kempton Park Gravel Member

'S' Denotes Shallow and 'D' Denotes Deep Installation

3.12 Groundwater Monitoring

Groundwater monitoring was undertaken during 6No. return visits, during which water levels within recent WYG borehole installations and previous investigation investigations were checked using a digital dip meter. Water levels during these visits are summarised in Table 6.1 and 6.2. A detailed record of ground water monitoring in included in Appendix F1.

Table 6.1 Summary of Groundwater Depth (m bgl) Recorded During Monitoring Visits (WYG Borehole Installations)

	Round 1 10.09.2020	Round 2 17-25.09.2020	Round 3 09.10.2020	Round 4 22.10.2020	Round 5 05.11.2020	Round 6 23.11.2020
BH202	6.44	6.50	NM	NM	NM	NM
BH203S	6.72	6.79	7.14	7.12	7.12	7.10
BH203S	11.91	NM	12.97	12.51	13.70	14.28
BH204S	5.56	5.60	6.00	6.00	5.99	5.96
BH204D	18.28	16.77	16.25	15.73	15.64	15.46
BH206	Dry	Dry	Dry	Dry	Dry	Dry
BH207	16.26	16.12	NM	NM	NM	NM
BH208S	Dry	5.02	5.27	5.25	5.27	Dry
BH208D	5.41	5.43	5.77	5.71	5.80	5.80
BH209A	5.48	NM	NM	NM	NM	NM
BH210A	5.50	5.51	5.78	5.77	5.78	5.75
BH211	5.015	5.00	5.31	5.33	5.34	5.33
BH214	5.46	NM	NM	NM	NM	NM
BH217	Dry	NM	16.52	16.55	16.60	16.62
BH220	7.41	7.44	7.84	7.83	7.81	7.74
BH221	15.72	15.72	16.09	16.08	16.22	16.11
BH222	17.32	NM	NM	NM	NM	NM
BH223	7.41	7.49	7.86	7.87	7.70	7.70

NM - not measured – See Section 3.13

Table 6.2 Summary of Groundwater Depth (m bgl) Recorded During Monitoring Visits (Previous Investigation Installations)

	Round 1 4.09.2020	Round 2 11.09.2020	Round 3 09.10.2020	Round 4 22.10.2020	Round 5 05.11.2020	Round 6 23.11.2020
BH101 S	Dry	Dry	Dry	NM	Dry	Dry
BH101 D	17.02	16.94	16.34	NM	16.17	15.97
BH102 S	Dry	Dry	Dry	NM	Dry	Dry
BH102 D	17.42	17.59	16.78	NM	16.37	15.86
BH103	7.1	7.145	7.18	NM	7.20	7.19
BH104	16.22	16.47	14.15	NM	15.87	15.56
BH105	14.98	Dry	14.88	NM	14.72	14.44
BH106 S	Dry	Dry	Dry	NM	Dry	3.09
BH106 D	11.09	10.91	10.78	NM	10.70	10.57
BH107 S	Dry	Dry	Dry	NM	Dry	Dry
BH107 D	18.31	18.23	18.75	NM	17.86	17.48
BH108	17.1	17.23	16.69	NM	16.59	16.21
BH111	6.12	6.07	6.16	NM	6.14	6.11
BH112	Wet	5.8	5.89	NM	5.91	5.89
BH113	5.56	5.64	5.67	NM	5.68	5.66
BH114	6.01	6.17	Dry	NM	6.18	6.15
BH115	Dry	Dry	6.11	NM	6.15	6.11
BH116	Dry	Dry	Dry	NM	Dry	Dry
BH117	7.88	8.13	8.28	NM	8.27	8.15

NM - not measured – See Section 3.13

3.13 Data Loggers

On completion of the investigation, absolute water level dataloggers were placed in the installations at BH202, BH207, BH209A, BH214 and BH222 to automatically and continuously record fluctuations in water level at 15minute intervals.

Absolute dataloggers measure both water and atmospheric pressure; and the water level data obtained from the data loggers has been compensated using atmospheric data recorded at ground level. The water levels calculated from the water level obtained during manual dipping of the boreholes using an assumed pressure relationship of 0.98mBar per mm of water column.

Charts displaying the water levels derived from the logger data vs depth are provided in Appendix F2.

3.14 Groundwater Sampling

Two return groundwater sampling visits were carried out to collect samples from BH203s, BH204s, BH208d, BH210A, BH215, BH220, BH221, BH223, BH115 and BH116 on the following dates.

- Round 1: 10th and 11th September 2020
- Round 2: 17th and 18th September 2020

During the initial visit boreholes were purged to 3 x the well volume (where possible) prior to low flow sample recovery at each location during which the pH, temperature, conductivity, dissolved oxygen and redox were monitored until stable (see Appendix F1). Locations BH221 and BH116 had insufficient water for sampling during both sampling rounds.

No obvious visual or olfactory evidence of contamination was noted during the groundwater sampling.

3.15 Landgas Monitoring

Land gases including methane, carbon dioxide, oxygen, carbon monoxide and hydrogen sulphide were measured during four monitoring rounds using a GA5000 infra-red land gas analyser. Land gas monitoring is currently on-going, results from competed visits are presented in Appendix G and summarised in Tables 7 and 8.

Table 7 Summary of Measured Land Gas Concentrations

	Methane (CH_4) (% by Vol.)			Carbon Dioxide (CO_2) (% by Vol.)			Carbon Monoxide (ppm)			Atmospheric Pressure Trend
	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	
10.09.2020	ND	ND	ND	5.2	0.1	2.28	16	1	2.5	Falling
24.09.2020	ND	ND	ND	5.6	0.1	3.72	ND	ND	-	Falling
07.10.2020	0.1	ND	-	5.1	0.1	2.2	3.0	ND	-	Rising
22.10.2020	0.1	ND	1	5.9	0.7	3.5	2.0	ND	-	Rising

ND: Not Detected (readings below instrument detection limit)

Table 8 Summary of Measured Volatile Organic Compound Vapours

	VOC (ppm)			Atmospheric Pressure Trend
	Max.	Min.	Mean	
10.09.2020	ND	ND	-	Falling
24.09.2020	1.8	ND	-	Falling
07.10.2020	0.7	ND	-	Rising
	ND	ND	-	Rising

ND: Not Detected (readings below instrument detection limit)

Appendices

Appendix A Report Conditions

Report Ref: A117846 FGIR V5 FINAL 071220

This report is produced solely for the benefit of **ARUP** and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the site.

This report is based on a visual site inspection, reference to accessible referenced historical records, information supplied by those parties referenced in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented as the best that can be obtained without further extensive research. Where ground contamination is suspected but no physical site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to activities related to the site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, perhaps in higher concentrations, elsewhere on the site cannot be discounted.

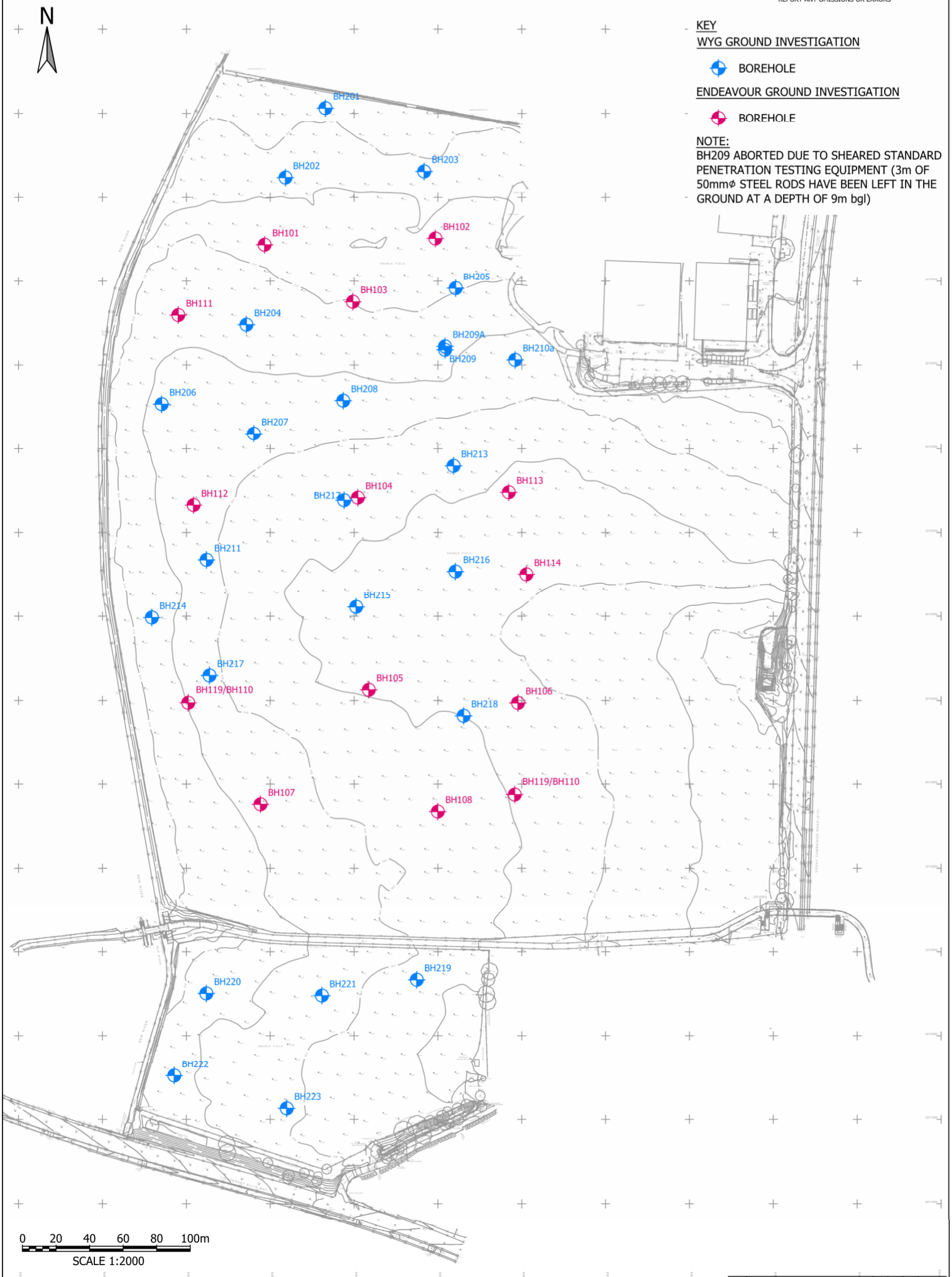
Whilst confident in the findings detailed within this report because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categoric assurances that they will be accepted by Authorities or Funds etc. without question as such bodies often have unpublished, more stringent objectives. This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to WYG. In time improved practices or amended legislation may necessitate a re-assessment.

The assessment of ground conditions within this report is based upon the findings of the study undertaken. We have interpreted the ground conditions in between locations on the assumption that conditions do not vary significantly. However, no investigation can inspect each and every part of the site and therefore changes or variances in the physical and chemical site conditions as described in this report cannot be discounted.

The report is limited to those aspects of land contamination specifically reported on and is necessarily restricted and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents. The opinions expressed cannot be absolute due to the limitations of time and resources imposed by the agreed brief and the possibility of unrecorded previous use and abuse of the site and adjacent sites. The report concentrates on the site as defined in the report and provides an opinion on surrounding sites. If migrating pollution or contamination (past or present) exists further extensive research will be required before the effects can be better determined.

Appendix B Drawings

DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS



REV	DESCRIPTION	BY	CHK	APP	DATE

5th FLOOR
LONGCROSS COURT
47 NEWPORT ROAD
CARDIFF
CF24 0AD

TEL: +44 (0)29 2082 9200
e-mail: cardiff@wyg.com

Client: OVE ARUP & PARTNERS LIMITED

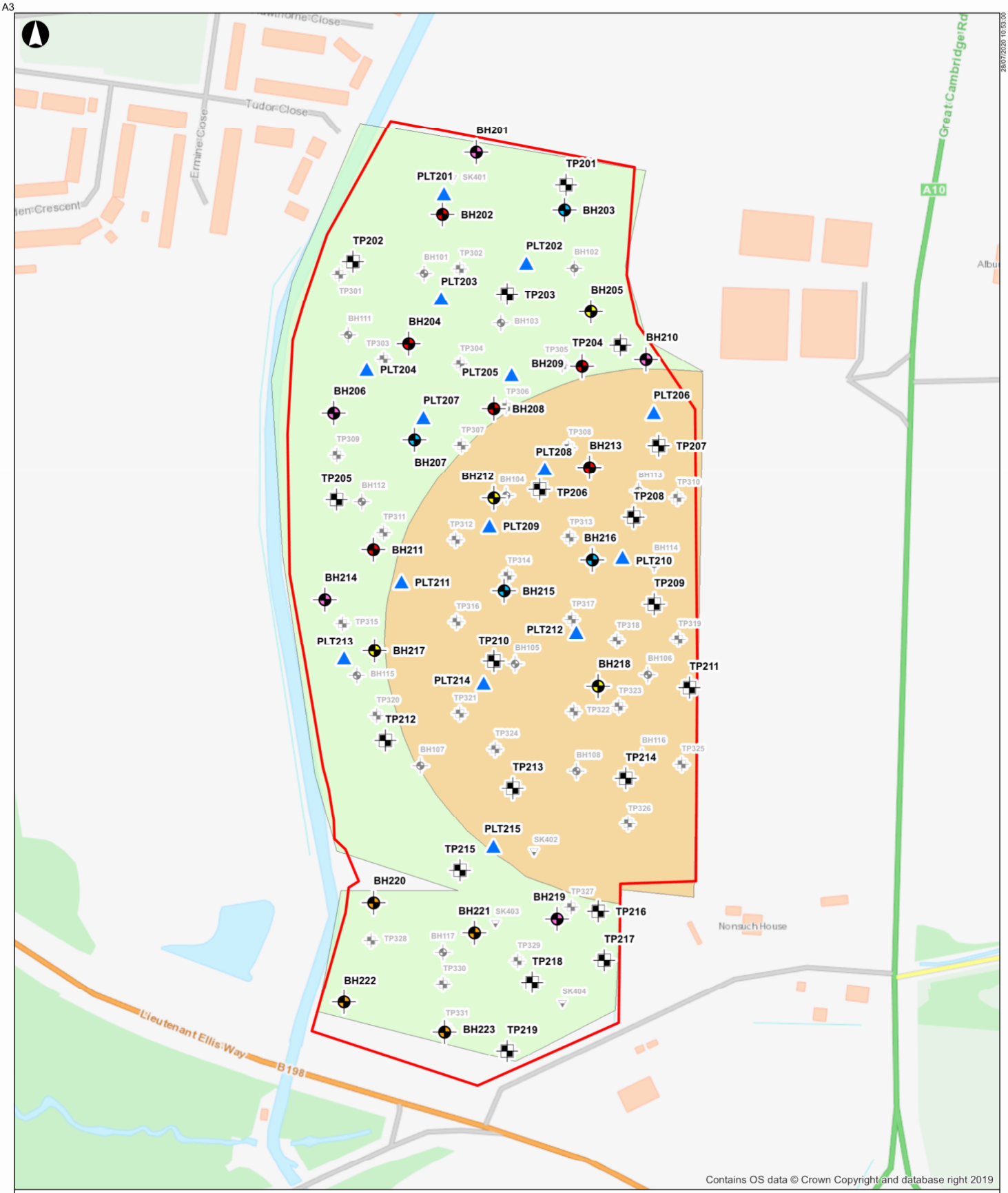
Project: A117846
PROJECT WXT GI

Drawing Title:
EXPLORATORY HOLE LOCATION PLAN

Scale @ A3	Drawn	Date	Checked	Date	Approved	Date
1:1,250	CM	03.09.20				

Project No.	Office	Type	Drawing No.	Revision
A117846	CDF	N	01	

A3



Legend

- Site Boundary

Phase 2 GI

- 30m OH+RC Borehole
- 35m CP Borehole
- 30m CP Borehole
- 25m CP Borehole
- 10m CP Borehole
- Trial Pit
- Plate Load Test

Historic GI

- Borehole
- Trial Pit
- Soakaway Pit

UXO Risk Zones

- Low
- Moderate *(Magnetometer Survey)*

Coordinate System: British National Grid

Rev	Date	By	Chkd	Appd
P01	28/07/2020	JC	CR	AP

Metres

0 25 50 100 150

ARUP

4 Pierhead Street
Cardiff
CF10 4QP

www.arup.com

Client
Buckingham

Project Title
.

Drawing Title
Phase 2 GI Proposed Locations

Scale at A3
1:2,500

Role
Geotechnical

Suitability
For Information

Arup Job No
274310

Rev
P01

Name
Drawing 1

28/07/2020 10:53:00

C:\Users\Jak.Canham\Desktop\WTX\Drawing 2.mxd

Appendix C1 Borehole Logs

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534932.86	Northing:	201753.16
Level:	32.05mAOD	Depth:	10.00m
Logger:	SO	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH201**

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	10.00	Cable Percussion	D4000	SE Drilling	1.20 10.00 10.00	300 248 200	10.00 10.00	200 248	05/08	17:15	10.00	9.00	DRY

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 05/08/2020
Finish Date: 05/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Brown mottled with orangish brown very silty, slightly gravelly fine to coarse SAND. Occasional brick fragments and rootlets. Gravel is fine to coarse angular to sub-rounded of flint. (MADE GROUND) MGR		0.10	31.95			0.00 - 0.50 0.00 - 0.50	B2 ES1	
Firm orangish brown very clayey, sandy slightly gravelly SILT. Gravel is fine and medium angular to sub-rounded of flint. Sand is fine to coarse. (ENFIELD SILT MEMBER) ESI						1.50 - 1.95	D3	SPT(S) 1.50m, N=11 (1,2/2,2,3,4)
						2.50 - 2.95	D4	SPT(S) 2.50m, N=9 (1,2/2,2,3,2)
						3.50 - 3.95	D5	SPT(S) 3.50m, N=10 (1,1/2,3,2,3)
Dense orangish brown sandy silty GRAVEL. Sand is fine to coarse. Gravel is fine to coarse sub-angular to rounded of flint with medium cobble content. (KEMPTON PARK GRAVEL MEMBER) KPGR		4.40	27.65			4.50 - 5.00	B6	SPT(C) 4.50m, N=41 (4,7/8,9,10,14)
						6.00 - 6.50	B7	SPT(C) 6.00m, 50 (9,16/50 for 140mm)
						7.50 - 8.00	B8	SPT(C) 7.50m, 50 (7,14/50 for 155mm)
Firm brownish grey silty CLAY. (LONDON CLAY FORMATION) LC		8.70	23.35			9.00 - 9.45	U1009	Ublows=25 Recovery=100%
						9.45 - 9.90 9.50	D10 B11	SPT(S) 9.45m, N=24 (2,3/5,5,7,7)
EOH at 10.00m - Target depth reached		10.00	22.05					

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH backfilled with bentonite.

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
			4.70	8.50	SED58	60

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534909.05	Northing:	201711.62
Level:	31.74mAOD	Depth:	30.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH202**

Sheet 1 of 3

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	30.00	Cable Percussion	CP	M. P

Diameter	
Depth (m)	Diam (mm)
1.20	300
8.50	250
21.90	200
30.00	150

Casing	
Depth(m)	Diam (mm)
8.50	250
21.90	200
30.00	150

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
03/08	18:00	4.00	4.00	DRY
04/08	18:00	11.90	10.40	11.50
05/08	18:00	22.00	21.90	17.00
06/08	18:00	30.00	30.00	22.50

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 03/08/2020
Finish Date: 07/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Brown mottled with orangish brown very silty slightly gravelly fine to coarse SAND. Occasional brick fragments and rootlets. Gravel is fine to coarse angular to sub-rounded of flint. (MADE GROUND) MGR		0.30	31.44			0.00 - 0.30 0.00 - 0.50	ES2 B1	
Orangish brown clayey very sandy slightly gravelly SILT. Occasional organics. Sand is fine and medium. Gravel is fine sub-angular of flint. (ENFIELD SILT MEMBER) ESI						1.00 - 1.20 1.00 - 1.20 1.20 - 1.65	B3 ES4 D5	SPT(S) 1.20m, N=11 (4,3/3,3,3,2)
From 2.40m to 3.00m bgl occasional thin bands of fine to coarse subangular flint gravel.						2.00 - 2.45 2.00 - 2.50	D6 B7	SPT(S) 2.00m, N=10 (1,2/2,2,3,3)
						3.00 - 3.45 3.00 - 3.50	D8 B9	SPT(S) 3.00m, N=11 (2,1/3,2,3,3)
						4.00 - 4.45 4.00 - 4.50	D10 B11	SPT(S) 4.00m, N=26 (1,0/1,4,9,12)
Dense orangish brown slightly silty very sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse angular to rounded flint with medium cobble content. Cobbles are sub-angular to sub-rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		4.80	26.94			4.80 - 5.00	B12	
						5.00 - 5.50	B13	SPT(C) 5.00m, N=48 (1,3/9,15,14,10)
						6.00 - 6.50	B14	
						6.50	SPT14	SPT(C) 6.50m, N=48 (4,12/9,13,11,15)
						7.00 - 7.50	B15	
						8.00 - 8.20	B16	SPT(C) 8.00m, N=13 (2,2/2,3,4,4)
Firm grey silty slightly sandy CLAY. Occasional thin laminations of disseminated pyrite, occasional selenite crystals, rare pyrite replaced wood fragments. (LONDON CLAY FORMATION) LC		8.20	23.54			8.20 - 8.50	B17	
From 8.20m to 8.40m bgl becoming brown.						8.50 - 8.95	U10018	Ublows=26 Recovery=100%
						8.95 - 9.40	D19	SPT(S) 8.95m, N=15 (3,2/3,3,4,5)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with a 50mm HDPE pipe to 6.90m bgl (response zone 5.3-6.9m).

Chiselling		
From (m)	To (m)	Time (mins)

Water Added	
From (m)	To (m)
4.80	6.50

Hammer Information	
Serial No.	Energy Ratio %
AP2	84

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534909.05	Northing:	201711.62
Level:	31.74mAOD	Depth:	30.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH202**

Sheet 2 of 3

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	30.00	Cable Percussion	CP	M. P

Diameter	
Depth (m)	Diam (mm)
1.20	300
8.50	250
21.90	200
30.00	150

Casing	
Depth(m)	Diam (mm)
8.50	250
21.90	200
30.00	150

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
03/08	18:00	4.00	4.00	DRY
04/08	18:00	11.90	10.40	11.50
05/08	18:00	22.00	21.90	17.00
06/08	18:00	30.00	30.00	22.50

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 03/08/2020
Finish Date: 07/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Firm grey silty slightly sandy CLAY. Occasional thin laminations of disseminated pyrite, occasional selenite crystals, rare pyrite replaced wood fragments. (LONDON CLAY FORMATION) LC						11.00 - 11.45	U10020	Ublows=33 Recovery=100%
						11.45 - 11.90	D21	SPT(S) 11.45m, N=23 (3,3/4,7,6,6)
						13.50 - 13.95	U10022	Ublows=38 Recovery=100%
						13.95 - 14.40	D23	SPT(S) 13.95m, N=24 (3,4/6,6,6,6)
						16.00 - 16.45	U10024	Ublows=48 Recovery=100%
Very stiff grey mottled with green very silty slightly sandy CLAY. Occasionally glauconitic and occasional shell fragments. Sand is fine. (HARWICH FORMATION) LC		16.50	15.24			16.45 - 16.90	D25	SPT(S) 16.45m, N=27 (2,4/4,6,9,8)
Very stiff thinly laminated grey clayey sandy SILT. Occasionally glauconitic and shell fragments. Sand is fine and medium. (HARWICH FORMATION) LC		17.80	13.94			18.50 - 18.95	U10026	Ublows=34 Recovery=100%
						18.95 - 19.40	D27	SPT(S) 18.95m, N=66 (6,10/18,16,15,17)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with a 50mm HDPE pipe to 6.90m bgl (response zone 5.3-6.9m).

Chiselling		
From (m)	To (m)	Time (mins)

Water Added	
From (m)	To (m)

Hammer Information	
Serial No.	Energy Ratio %
AP2	84

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534909.05	Northing:	201711.62
Level:	31.74mAOD	Depth:	30.00m
Logger:	EH	Type:	CP
Inclination:	90°		

Status: FINAL

Borehole Number: **BH202**

Sheet 3 of 3

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	30.00	Cable Percussion	CP	M. P

Diameter	
Depth (m)	Diam (mm)
1.20	300
8.50	250
21.90	200
30.00	150

Casing	
Depth(m)	Diam (mm)
8.50	250
21.90	200
30.00	150

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
03/08	18:00	4.00	4.00	DRY
04/08	18:00	11.90	10.40	11.50
05/08	18:00	22.00	21.90	17.00
06/08	18:00	30.00	30.00	22.50

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 03/08/2020
Finish Date: 07/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Very stiff thinly laminated grey clayey sandy SILT. Occasionally glauconitic and shell fragments. Sand is fine and medium. (HARWICH FORMATION) LC						21.00 - 21.45	U10028	Ublows=40 Recovery=100%
Very dense brownish yellow mottled with red clayey silty slightly gravelly fine to coarse SAND. Occasional pyrite nodules. Gravel is fine to coarse sub-angular to sub-rounded of ferrous sandstone, possibly representative of thin sandstone bands disturbed during drilling. (LAMBETH GROUP - POSSIBLY READING FORMATION) LMBE		21.40	10.34			21.45 - 21.90	D29	SPT(S) 21.45m, N=90 (6,6/10,20,40,20)
						23.00 - 24.00	B30	SPT(C) 23.00m, 72 (4,18/72 for 225mm)
Very stiff yellowish brown mottled with light greenish grey slightly silty sandy gravelly CLAY with medium cobble content. Sand is fine and medium. Gravel is fine to coarse sub-angular of ironstone and sandstone. Cobbles are sub-rounded of ironstone. (LAMBETH GROUP - POSSIBLY READING FORMATION) LMBE		23.50	8.24					
Very stiff greenish grey clayey sandy SILT. Abundant shell fragments. Sand is fine and medium. (LAMBETH GROUP - POSSIBLY WOOLWICH FORMATION) LMBE		25.00	6.74			25.00 - 26.00	B31	SPT(C) 25.00m, N=38 (3,5/5,13,13,7)
Dense to very dense grey clayey very silty fine and medium SAND. Occasional shell fragments. (LAMBETH GROUP - POSSIBLY WOOLWICH FORMATION) LMBE		27.00	4.74			27.00 - 28.00	B32	SPT(S) 27.00m, N=50 (4,8/12,13,13,12)
						29.00 - 29.45 29.00 - 29.50	D33 B34	SPT(S) 29.00m, 50 (10,15/50 for 130mm)
EOH at 30.00m - Target depth reached		30.00	1.74					

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with a 50mm HDPE pipe to 6.90m bgl (response zone 5.3-6.9m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP2	84

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534991.78	Northing:	201715.22
Level:	31.85mAOD	Depth:	35.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH203**

Sheet 1 of 4

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	35.00	Cable Percussion	CP	N. L

Diameter	
Depth (m)	Diam (mm)
1.20	300
10.50	250
35.00	200

Casing	
Depth(m)	Diam (mm)
10.50	250
35.00	200

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
03/08	18:00	2.00	2.00	DRY
04/08	18:00	10.50	10.50	DRY
05/08	18:00	21.40	10.50	DRY
06/08	18:00	24.00	24.00	17.20
07/08	18:00	32.00	32.00	20.50
10/08	18:00	35.00	35.00	18.80

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 03/08/2020
Finish Date: 13/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Orangish brown slightly clayey very sandy slightly gravelly SILT. Occasional ash and organics. Gravel is fine and medium sub-rounded of various lithologies. (TOPSOIL)						0.00 - 0.50	B1	
						0.00 - 0.50	ES2	
MGR(TS)		0.50	31.35					
Orangish brown clayey very sandy SILT. Occasional organics. Sand is fine to coarse. (ENFIELD SILT MEMBER) ESI						0.50 - 1.00	ES3	
						0.50 - 1.20	B4	
						1.20 - 1.65	B6	SPT(S) 1.20m, N=10 (3,2/2,3,3,2)
						1.20 - 1.65	D5	
						2.00 - 2.45	D7	SPT(S) 2.00m, N=8 (2,2/2,2,2,2)
						2.00 - 2.50	B8	
						3.00 - 3.45	D9	SPT(S) 3.00m, N=10 (3,2/2,2,3,3)
						3.00 - 3.50	B10	
From 4.00m bgl occasional thin bands of fine to medium flint gravel.						4.00 - 4.45	D11	SPT(S) 4.00m, N=13 (3,2/3,3,3,4)
						4.00 - 4.50	B12	
Dense orangish brown very silty slightly gravelly fine and medium SAND. Gravel is fine and medium angular to sub-rounded of flint. (ENFIELD SILT MEMBER) ESI		5.00	26.85			5.00 - 5.50	B13	SPT(C) 5.00m, N=33 (4,6/6,7,10,10)
		5.50	26.35			5.50	B14	
Very dense orangish brown slightly silty sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse angular to rounded of flint with medium cobble content. Cobbles are sub-rounded to rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR						6.50 - 6.95	B15	SPT(C) 6.50m, 50 (8,9/50 for 154mm)
						7.03 - 7.80	EW1	
						7.40 - 7.50	EW2	
Firm to very stiff grey silty slightly sandy CLAY. Sand is fine. Occasional thin laminations of disseminated pyrite. (LONDON CLAY FORMATION) LC		8.00	23.85			8.00 - 8.45	U10016	Ublows=31 Recovery=100%
						8.45 - 8.90	D17	SPT(S) 8.45m, N=15 (2,3/3,4,4,4)
From 8.40m bgl clay is brown and slightly sandy.								

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with dual installation of 33mm pipe to 7.50m bgl (response zone 5.7-7.5m) and 26.0m bgl (response zone 25-26m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP3	62

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534991.78	Northing:	201715.22
Level:	31.85mAOD	Depth:	35.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH203**

Sheet 2 of 4

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	35.00	Cable Percussion	CP	N. L

Diameter	
Depth (m)	Diam (mm)
1.20	300
10.50	250
35.00	200

Casing	
Depth(m)	Diam (mm)
10.50	250
35.00	200

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
03/08	18:00	2.00	2.00	DRY
04/08	18:00	10.50	10.50	DRY
05/08	18:00	21.40	10.50	DRY
06/08	18:00	24.00	24.00	17.20
07/08	18:00	32.00	32.00	20.50
10/08	18:00	35.00	35.00	18.80

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 03/08/2020
Finish Date: 13/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Firm to very stiff grey silty slightly sandy CLAY. Sand is fine. Occasional thin laminations of disseminated pyrite. (LONDON CLAY FORMATION) LC						10.50 - 10.95	U10018	Ublows=27 Recovery=100%
						10.95 - 11.40	D19	SPT(S) 10.95m, N=34 (3,6/8,8,9,9)
						13.00 - 13.45	U10020	Ublows=29 Recovery=35%
						13.45 - 13.90	D21	SPT(S) 13.45m, N=41 (5,7/9,10,11,11)
						15.50 - 15.95	U10022	Ublows=48 Recovery=100%
						15.95 - 16.40	D23	SPT(S) 15.95m, N=34 (5,6/8,8,9,9)
Thinly laminated grey clayey sandy SILT. Occasional shell fragments. Sand is fine. (LHARWICH FORMATION) LC		18.00	13.85			18.45 - 18.95	D25	SPT(S) 18.45m, 100 (12,12/100 for 225mm)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with dual installation of 33mm pipe to 7.50m bgl (response zone 5.7-7.5m) and 26.0m bgl (response zone 25-26m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP3	62

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534991.78	Northing:	201715.22
Level:	31.85mAOD	Depth:	35.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH203**

Sheet 3 of 4

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	35.00	Cable Percussion	CP	N. L

Diameter	
Depth (m)	Diam (mm)
1.20	300
10.50	250
35.00	200

Casing	
Depth(m)	Diam (mm)
10.50	250
35.00	200

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
03/08	18:00	2.00	2.00	DRY
04/08	18:00	10.50	10.50	DRY
05/08	18:00	21.40	10.50	DRY
06/08	18:00	24.00	24.00	17.20
07/08	18:00	32.00	32.00	20.50
10/08	18:00	35.00	35.00	18.80

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 03/08/2020
Finish Date: 13/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Thinly laminated grey clayey sandy SILT. Occasional shell fragments. Sand is fine. (LHARWICH FORMATION) LC						20.50 - 20.95	U10026	Ublows=73 Recovery=100%
						20.95 - 21.40	D27	SPT(S) 20.95m, 81 (10,12/81 for 94mm)
Very dense light grey mottled with brownish yellow clayey silty fine to coarse SAND. (LAMBETH GROUP) LMBE		21.00	10.85					
Very stiff light greenish grey mottled with yellowish brown silty slightly sandy slightly gravelly CLAY with medium cobble content. Sand is fine and medium. Gravel is fine to coarse sub-angular to rounded of sandstone, chert, and ironstone. cobbles are sub-rounded of ironstone and chert. (LAMBETH GROUP - POSSIBLY READING FORMATION) LMBE		22.00	9.85			23.00 - 23.45	B28	SPT(C) 23.00m, 50 (11,13/50 for 110mm)
						24.50 - 24.80	B29	
Firm to stiff light grey mottled with yellow very silty slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine. Gravel is fine to coarse sub-rounded to rounded of chert and siltstone. Cobbles are sub-rounded to rounded of chert. (LAMBETH GROUP) LMBE		24.80	7.05			25.00 - 25.45	B30	SPT(C) 25.00m, 50 (25 for 10mm/50 for 19mm)
Firm to stiff grey very clayey sandy slightly gravelly SILT. Abundant shell fragments and occasional bioturbation. Sand is fine. Gravel is fine and medium rounded of chert. LAMBETH GROUP - POSSIBLY WOOLWICH FORMATION) LMBE		25.50	6.35			25.60	B31	
						27.00 - 27.45	B33	SPT(S) 27.00m, 50 (12,13/50 for 202mm)
						27.00 - 27.45	D32	
						29.00 - 29.45	U-NR34	Ublows=28 Recovery=0%
						29.45 - 29.90	B36	SPT(S) 29.45m, 50 (18,7/50 for 151mm)
						29.45 - 29.90	D35	

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with dual installation of 33mm pipe to 7.50m bgl (response zone 5.7-7.5m) and 26.0m bgl (response zone 25-26m).

Chiselling		
From (m)	To (m)	Time (mins)

Water Added	
From (m)	To (m)

Hammer Information	
Serial No.	Energy Ratio %
AP3	62

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534991.78	Northing:	201715.22
Level:	31.85mAOD	Depth:	35.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH203**

Sheet 4 of 4

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	35.00	Cable Percussion	CP	N. L	1.20	300	10.50	250	03/08	18:00	2.00	2.00	DRY
					10.50	250	35.00	200	04/08	18:00	10.50	10.50	DRY
					35.00	200			05/08	18:00	21.40	10.50	DRY
									06/08	18:00	24.00	24.00	17.20
									07/08	18:00	32.00	32.00	20.50
									10/08		35.00	35.00	18.80

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 03/08/2020
Finish Date: 13/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Firm to stiff grey very clayey sandy slightly gravelly SILT. Abundant shell fragments and occasional bioturbation. Sand is fine. Gravel is fine and medium rounded of chert. LAMBETH GROUP - POSSIBLY WOOLWICH FORMATION) LMBE						31.00 - 31.45 31.00 - 31.45	B38 D37	
						31.40 - 31.95 31.45 - 31.90	D39 B40	SPT(S) 31.40m, 50 (25 for 72mm/50 for 150mm)
						33.00 - 33.45 33.00 - 33.45	B42 D41	SPT(S) 33.00m, 50 (9,15/50 for 150mm)
								SPT(S) 34.00m, 50 (25 for 72mm/50 for 75mm)
EOH at 35.00m - Target depth reached		35.00	-3.15			35.00 - 35.45 35.00 - 35.45	B43 D44	SPT(S) 35.00m, 41 (23 for 72mm/41 for 75mm)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with dual installation of 33mm pipe to 7.50m bgl (response zone 5.7-7.5m) and 26.0m bgl (response zone 25-26m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP3	62

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534885.80	Northing:	201624.00
Level:	30.73mAOD	Depth:	30.00m
Logger:	EH	Type:	CP
Inclination: 90°			

Status: FINAL

Borehole Number: **BH204**

Sheet 1 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time					
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)	
0.00	30.00	Cable Percussion	CP	M. P	1.20	300	7.00	250	10/08	18:00	5.45	5.00	4.00	
					7.00	250	21.00	200	11/08	18:00	10.90	10.30		
					21.00	200	30.00	150	12/08	18:00	20.90	20.20	19.00	
					30.00	150			13/08	18:00	30.45	30.00	18.00	

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 10/08/2020
Finish Date: 18/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Brown very clayey sandy slightly gravelly SILT. Occasional brick fragments and rare ash. Gravel is fine and medium angular to sub-rounded of flint and chalk. (TOPSOIL) MGR(TS)						0.00 - 0.50 0.00 - 0.50	B1 ES1	
Orangish brown clayey sandy very slightly gravelly SILT. Occasional organics. Sand is fine and medium. Gravel is fine sub-angular of flint. (ENFIELD SILT MEMBER) ESI		0.50	30.23					
Medium dense to loose orangish brown silty very clayey sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse angular to rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		1.00	29.73			1.00 - 1.20 1.00 - 1.20 1.20 - 1.65 1.20 - 1.65	B2 ES2 B4 D3	SPT(S) 1.20m, N=11 (2,2/2,3,3,3)
						2.00 - 2.45 2.00 - 2.45	B7 D5	SPT(C) 2.00m, N=8 (1,1/2,2,2,2)
Dense orangish brown slightly silty very sandy GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to rounded of flint Cobbles are sub-rounded to rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		3.00	27.73			3.00 - 3.50	B8	SPT(C) 3.00m, N=45 (4,8/8,11,14,12)
						4.00 - 4.50	B9	SPT(C) 4.00m, N=40 (3,4/7,7,11,15)
						5.00 - 5.50	B10	SPT(C) 5.00m, N=46 (6,6/10,11,11,14)
						6.00 - 6.60 6.20 - 6.50	EW1 EW2	
Medium dense orangish brown silty very sandy GRAVEL with medium boulder content. Sand is medium and coarse. Gravel is fine and medium sub-angular to rounded of flint (KEMPTON PARK GRAVEL MEMBER) KPGR		6.50	24.23			6.50 - 7.00	B11	SPT(C) 6.50m, N=17 (2,1/3,4,5,5)
Firm to very stiff grey silty CLAY. Occasional selenite crystals. Occasional partings of fine sand. (LONDON CLAY FORMATION) LC		7.00	23.73			7.50 - 7.95	U10012	Ublows=21 Recovery=100%
						7.95 - 8.50	D13	SPT(S) 7.95m, N=19 (2,3/4,4,5,6)
						10.00 - 10.45	U10014	Ublows=31 Recovery=100%

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with dual installation of 33mm pipe to 6.5m bgl (response zone 4.5-6.5m) and piezo tip at 28.0m bgl.

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP2	84

Groundwater						Project Number
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks	**A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534885.80	Northing:	201624.00
Level:	30.73mAOD	Depth:	30.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH204**

Sheet 2 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	30.00	Cable Percussion	CP	M. P	1.20	300	7.00	250	10/08	18:00	5.45	5.00	4.00
					7.00	250	21.00	200	11/08	18:00	10.90	10.30	
					21.00	200	30.00	150	12/08	18:00	20.90	20.20	19.00
					30.00	150			13/08	18:00	30.45	30.00	18.00

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 10/08/2020
Finish Date: 18/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Firm to very stiff grey silty CLAY. Occasional selenite crystals. Occasional partings of fine sand. (LONDON CLAY FORMATION) LC						10.45 - 10.90	D15	SPT(S) 10.45m, N=24 (3,4/5,6,6,7)
						12.50 - 12.95	U10016	Ublows=32 Recovery=100%
						12.95 - 13.40	D17	SPT(S) 12.95m, N=26 (3,5/5,6,7,8)
						15.00 - 15.45	U10018	Ublows=41 Recovery=100%
						15.45 - 15.90	D19	SPT(S) 15.45m, N=48 (5,8/8,12,18,10)
Very stiff greenish grey clayey very sandy SILT. Occasional shell fragments and glauconite. Sand is fine to medium. (HARWICH FORMATION) LC		16.00	14.73			17.50 - 17.95	U10020	Ublows=48 Recovery=100%
						17.95 - 18.40	D21	SPT(S) 17.95m, N=46 (7,9/10,9,15,12)
Medium dense light grey slightly clayey very silty slightly gravelly fine to coarse SAND. Gravel is fine subangular of chert. (LAMBETH GROUP) LMBE		19.00	11.73			20.00 - 20.45 20.00 - 20.50	U-NR32 B22	Ublows=35 Recovery=0%

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with dual installation of 33mm pipe to 6.5m bgl (response zone 4.5-6.5m) and piezo tip at 28.0m bgl.

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP2	84

Groundwater						
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks	

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534885.80	Northing:	201624.00
Level:	30.73mAOD	Depth:	30.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH204**

Sheet 3 of 3

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	30.00	Cable Percussion	CP	M. P

Diameter	
Depth (m)	Diam (mm)
1.20	300
7.00	250
21.00	200
30.00	150

Casing	
Depth(m)	Diam (mm)
7.00	250
21.00	200
30.00	150

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
10/08	18:00	5.45	5.00	4.00
11/08	18:00	10.90	10.30	
12/08	18:00	20.90	20.20	19.00
13/08	18:00	30.45	30.00	18.00

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 10/08/2020
Finish Date: 18/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Medium dense light grey slightly clayey very silty slightly gravelly fine to coarse SAND. Gravel is fine subangular of chert. (LAMBETH GROUP) LMBE						20.45 - 20.90	D23	SPT(S) 20.45m, N=13 (1,2/3,3,3,4)
Soft to stiff grey silty sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine and medium rounded of black chert. (LAMBETH GROUP) LMBE		21.80	8.93			22.00 - 22.50	B24	SPT(C) 22.00m, N=19 (3,3/4,5,5,5)
Dense grey slightly clayey very silty slightly gravelly fine to coarse SAND. Occasional thin laminations of grey clay. Gravel is fine subangular of chert. (LAMBETH GROUP - POSSIBLY WOOLWICH FORMATION) LMBE		24.00	6.73			24.00 - 24.45 24.00 - 24.50	D25 B26	SPT(S) 24.00m, N=49 (4,5/8,14,17,10)
Dense grey slightly clayey very silty slightly gravelly fine to coarse SAND with abundant shell fragments. Gravel is fine subangular of chert. (LAMBETH GROUP - POSSIBLY WOOLWICH FORMATION) LMBE		27.50	3.23			26.00 - 26.45 26.00 - 26.50	D27 B28	SPT(S) 26.00m, N=46 (6,6/12,12,10,12)
EOH at 30.00m - Target depth reached		30.00	0.73			28.00 - 28.45 28.00 - 28.50	D29 B30	SPT(S) 28.00m, N=16 (2,3/5,3,3,5)
						30.00 - 30.45	D31	SPT(S) 30.00m, N=37 (1,2/3,6,11,17)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with dual installation of 33mm pipe to 6.5m bgl (response zone 4.5-6.5m) and piezo tip at 28.0m bgl.

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP2	84

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	535010.54	Northing:	201645.75
Level:	31.01mAOD	Depth:	30.00m
Logger:	+RN	Type:	CP+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH205**

Sheet 1 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00 7.40	7.40 30.00	Cable Percussion Rotary Core	Dando 4000	SE Drilling Endeavour	1.20 7.25	300 200	7.25	200	03/08	18:00	8.00	7.25	

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 20/08/2020
Finish Date: 25/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Sequence not logged. Drilled for establishment of casing pre-rotary drilling.													
Soft to firm dark grey very silty CLAY. (LONDON CLAY FORMATION) LC		7.40	23.61					7.40 8.50		100			
								8.50 10.00		100			

1 2 3 4 5 6 7 8 9 10

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Cable percussive drilling to 7.40m bgl, rotary coring drilling to 30.0m bgl.
3. No groundwater strikes noted during drilling.
4. On completion BH backfilled with bentonite.

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type

Hammer Information

Serial No.	Energy Ratio %

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	535010.54	Northing:	201645.75
Level:	31.01mAOD	Depth:	30.00m
Logger:	+RN	Type:	CP+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH205**

Sheet 2 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00 7.40	7.40 30.00	Cable Percussion Rotary Core	Dando 4000	SE Drilling Endeavour	1.20 7.25	300 200	7.25	200	03/08	18:00	8.00	7.25	

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 20/08/2020
Finish Date: 25/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Soft to firm dark grey very silty CLAY. (LONDON CLAY FORMATION) LC *From 10.00m bgl with occasional dark grey fine sand lenses.* *From 15.05m to 15.30m bgl very sandy with occasional black carbonaceous material.*								10.00 11.50		100			
								11.50 13.00		100			
								13.00 14.50		100			
								14.50 16.00		100			
Dense dark grey very silty fine SAND with occasional white shell fragments. (HARWICH FORMATION) LC *From 17.95m to 18.00m bgl abundant white shell fragments.* *From 18.25m to 18.30m bgl abundant white shell fragments.* *From 18.85m to 18.90m bgl abundant white shell fragments.*		16.70	14.31					16.00 17.50		100			
								17.50 19.00		100			
								19.00 20.50		100			
Extremely weak green SILTSTONE recovered as non intact clayey gravels.		19.85	11.16										

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Cable percussive drilling to 7.40m bgl, rotary coring drilling to 30.0m bgl.
3. No groundwater strikes noted during drilling.
4. On completion BH backfilled with bentonite.

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type

Hammer Information

Serial No.	Energy Ratio %

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	535010.54	Northing:	201645.75
Level:	31.01mAOD	Depth:	30.00m
Logger:	+RN	Type:	CP+RC
Inclination: 90°			

Status: FINAL

Borehole Number: **BH205**

Sheet 3 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00 7.40	7.40 30.00	Cable Percussion Rotary Core	Dando 4000	SE Drilling Endeavour	1.20 7.25	300 200	7.25	200	03/08	18:00	8.00	7.25	

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 20/08/2020
Finish Date: 25/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Extremely weak green SILTSTONE recovered as non intact clayey gravels. (LAMBETH GROUP) LMBE *From 20.05m to 20.10m bgl hard cream calcite nodules.* *From 20.30m to 20.35m bgl hard cream calcite nodules.*						20.05 20.05 - 20.10	D1 C2						
Extremely weak green mottled orangish brown SILTSTONE recovered as non intact clayey gravels. (LAMBETH GROUP) LMBE *From 21.26m to 21.35m greenish grey silty fine to medium sand.*		20.90	10.11					20.50 22.00		90			
No recovery.		21.85	9.16										
Dense greenish grey mottled orangish brown silty fine to medium SAND. (LAMBETH GROUP) LMBE *From 22.85m to 23.00m bgl extremely weak greenish grey mottled orangish brown siltstone.* *From 23.00m to 23.03m bgl rounded to well rounded fine to medium gravel of flint.*		22.00	9.01					22.00 23.50		76			
Dense greenish grey fine to medium SAND. (LAMBETH GROUP) LMBE		23.03 23.15	7.98 7.86										
No recovery. Dense greenish grey fine to medium SAND. (LAMBETH GROUP) LMBE *From 23.96m to 23.98m bgl extremely weak greenish grey siltstone.*		23.50	7.51					23.50 25.00		93			
Dense dark grey very silty fine to coarse SAND. (LAMBETH GROUP) LMBE *From 25.30m to 25.55m bgl firm to stiff dark grey sandy clay.*		25.00	6.01					25.00 26.50		93			
Firm dark grey very silty slightly sandy CLAY with abundant white shell fragments. (LAMBETH GROUP) LMBE		26.87	4.14					26.50 28.00		86			
No recovery.		27.80	3.21										
Dense dark grey very silty fine to coarse SAND with abundant white shell fragments. (LAMBETH GROUP) LMBE		28.00	3.01					28.00 29.50		66			
No recovery. *From 29.00m to 29.50m bgl assumed zone of core loss.*		29.00	2.01										
Dark grey very silty fine to coarse SAND with abundant white shell fragments. (LAMBETH GROUP) LMBE		29.50	1.51					29.50 30.00		100			
EOH at 30.00m - Target depth reached.		30.00	1.01										

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Cable percussive drilling to 7.40m bgl, rotary coring drilling to 30.0m bgl.
3. No groundwater strikes noted during drilling.
4. On completion BH backfilled with bentonite.

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type

Hammer Information

Serial No.	Energy Ratio %

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534835.24	Northing:	201576.78
Level:	30.39mAOD	Depth:	10.00m
Logger:	RN	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH206**

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	10.00	Cable Percussion	Dando 2000	M. M	1.20 10.00	300 200	10.00	200	03/08 04/08	18:00 18:00	3.50 10.05	3.50 10.00	9.90

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 03/08/2020
Finish Date: 04/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Brown slightly sandy slightly gravelly CLAY with occasional plant remains. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse flint and chalk cobbles with brick fragments. (TOPSOIL) MGR(TS)		0.10	30.29			0.00 - 0.70	B1	
						0.50	ES1	
Orangish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to rounded fine to medium flint and quartzite. (ENFIELD SILT MEMBER) ESI		0.70	29.69			0.70 - 1.20	B2	
						1.20 - 1.65 1.20 - 2.20	D3 B4	SPT(S) 1.20m, N=16 (3,3/6,5,3,2)
Soft to firm orangish brown silty slightly sandy CLAY. Sand is fine to coarse. (ENFIELD SILT MEMBER) ESI								
Loose to medium dense, brown very silty slightly sandy GRAVEL. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		2.00 2.20	28.39 28.19			2.20 - 2.65 2.20 - 3.00	D5 B6	SPT(S) 2.20m, N=10 (2,2/1,1,3,5)
Firm orangish brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		2.70	27.69					
Dense to very dense grey silty sandy GRAVEL. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of flint and quartzite. (KEMPTON PARK GRAVEL MEMBER) KPGR						3.00 - 3.45 3.00 - 3.50	D7 B8	SPT(S) 3.00m, N=42 (4,5/7,7,14,14)
						3.50 - 3.95 3.50 - 4.50	D9 B10	SPT(C) 3.50m, 50 (3,5/8,17,25,)
						4.50 - 4.95 4.50 - 5.50	D11 B12	SPT(C) 4.50m, 50 (6,9/14,19,17,)
From 5.50m bgl: medium dense						5.50 - 5.95 5.50 - 6.10	D13 B14	SPT(C) 5.50m, N=27 (3,6/9,8,6,4)
Firm to very stiff grey silty CLAY. (LONDON CLAY FORMATION)		6.00	24.39			6.20 - 6.40	U10016	Ublows=49 Recovery=100%
						6.40 - 6.60	D17	
LC						6.60 - 7.02	D18	SPT(S) 6.60m, N=18 (3,2/4,4,5,5)
From 6.60m bgl clay is brownish grey.								
						9.00 - 9.40	U10019	Ublows=54 Recovery=100%
						9.40 - 9.60	D20	
						9.60 - 10.05	D21	SPT(S) 9.60m, N=24 (4,3/5,6,6,7)
EOH at 10.00m - Target depth reached.		10.00	20.39					

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with a single installed of 50mm pipe to 5.5m bgl (response zone 4-5.5m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP1	66

Groundwater						Project Number
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks	**A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534890.16	Northing:	201559.14
Level:	30.21mAOD	Depth:	35.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH207**

Sheet 1 of 4

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	35.00	Cable Percussion	CP	M. P	1.20	300	8.00	250	18/08	18:00	6.50	6.50	6.00
					8.00	250	35.00	200	19/08	18:00	15.50	14.20	15.00
					35.00	200			20/08	18:00	27.20	27.20	19.00
									21/08	18:00	33.00	32.80	19.00
									24/08	18:00	35.00	34.80	19.00

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 18/08/2020
Finish Date: 24/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Brown silty slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse angular to subrounded flint with brick and chalk fragments. Occasional rootlets. (TOPSOIL) MGR(TS)						0.00 - 0.50	B1	
						0.00 - 0.50	ES1	
		0.50	29.71			0.50 - 0.70	B2	
Soft to firm orangish brown very clayey sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse angular to rounded of flint. Occasional organics. (ENFIELD SILT MEMBER) ESI						1.20 - 1.65	D3	SPT(S) 1.20m, N=21 (2,2/4,5,6,6)
		1.40	28.81			1.40 - 1.60	B4	
Medium dense orangish brown silty very clayey slightly sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse angular to rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR						2.00 - 2.50	B6	SPT(C) 2.00m, N=23 (3,4/4,6,7,6)
		2.80	27.41					
Medium dense to dense light grey slightly silty sandy GRAVEL with high cobble content. Gravel is fine to coarse subangular to rounded of flint and chert. (KEMPTON PARK GRAVEL MEMBER) KPGR *From 2.80m to 3.00m bgl Gravel is slightly clayey.*						3.00 - 3.50	B8	SPT(C) 3.00m, N=25 (3,3/3,7,6,9)
						4.00 - 4.50	B10	SPT(C) 4.00m, N=43 (5,5/7,10,12,14)
						5.00 - 5.50	B12	SPT(C) 5.00m, N=43 (5,6/6,10,14,13)
						6.50 - 7.00	B14	SPT(C) 6.50m, N=12 (3,2/2,3,4,3)
		7.20	23.01					
Medium dense brown silty sandy GRAVEL with low cobble content. Sand is fine to coarse. Gravel is fine to coarse subangular to rounded of flint and chert. (KEMPTON PARK GRAVEL MEMBER) KPGR								
		8.00	22.21			8.00 - 8.50	B16	SPT(C) 8.00m, N=13 (2,3/3,3,4,3)
Stiff grey silty CLAY. Occasional partings of fine sand. Occasional disseminated pyrite and rare organic matter. (LONDON CLAY FORMATION) LC						8.50 - 8.95	U10017	Ublows=30 Recovery=70%
						8.95 - 9.40	D18	SPT(S) 8.95m, N=18 (2,3/4,4,5,5)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Groundwater strike at 19.8m bgl , rising to 17.00m bgl (20mins).
installed with single installation of 50mm pipe to 21.8m bgl (response zone 20.8-21.8m)
3. On completion BH

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
			2.80	6.50	AP2	84

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534890.16	Northing:	201559.14
Level:	30.21mAOD	Depth:	35.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH207**

Sheet 2 of 4

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time					Scale:	1:50
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)	Checked By:	DP
0.00	35.00	Cable Percussion	CP	M. P	1.20	300	8.00	250	18/08	18:00	6.50	6.50	6.00	Approved By:	RT
					8.00	250	35.00	200	19/08	18:00	15.50	14.20	15.00	Start Date:	18/08/2020
					35.00	200			20/08	18:00	27.20	27.20	19.00	Finish Date:	24/08/2020
									21/08	18:00	33.00	32.80	19.00		
									24/08	18:00	35.00	34.80	19.00		

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Stiff grey silty CLAY. Occasional partings of fine sand. Occasional disseminated pyrite and rare organic matter. (LONDON CLAY FORMATION) LC						11.00 - 11.45	U10019	Ublows=31 Recovery=50%
						11.45 - 11.90	D20	SPT(S) 11.45m, N=21 (3,3/4,4,7,6)
						13.50 - 13.95	U10021	Ublows=41 Recovery=100%
						13.95 - 14.40	D22	SPT(S) 13.95m, N=28 (4,4/7,6,7,8)
Very stiff dark grey brown clayey sandy SILT. Sand is fine and medium. Occasional organics, shell fragments, and bioturbation. (HARWICH FORMATION) LC		15.50	14.71			16.00 - 16.45	D23	SPT(S) 16.00m, N=56 (4,8/10,16,14,16)
						18.00 - 18.45	U10024	Ublows=38 Recovery=90%
From 18.50m to 19.00m bgl occasional fine to coarse rounded black chert pebbles.						18.45 - 18.90	D25	SPT(S) 18.45m, N=49 (5,7/11,11,12,15)
Dense lightly greenish grey mottled yellow brown clayey silty slightly gravelly fine to coarse SAND. Gravel is fine to coarse rounded of black chert pebbles. (LAMBETH GROUP) LMBE		19.00	11.21			20.00 - 20.45	B27	SPT(C) 20.00m, N=32 (4,3/4,6,11,11)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Groundwater strike at 19.8m bgl , rising to 17.00m bgl (20mins).
installed with single installation of 50mm pipe to 21.8m bgl (response zone 20.8-21.8m)

3. On completion BH

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP2	84

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks
19.80	19	19	20	17.00	

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534890.16	Northing:	201559.14
Level:	30.21mAOD	Depth:	35.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH207**

Sheet 3 of 4

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time					Scale:	1:50
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)	Checked By:	DP
0.00	35.00	Cable Percussion	CP	M. P	1.20	300	8.00	250	18/08	18:00	6.50	6.50	6.00	Approved By:	RT
					8.00	250	35.00	200	19/08	18:00	15.50	14.20	15.00	Start Date:	18/08/2020
					35.00	200			20/08	18:00	27.20	27.20	19.00	Finish Date:	24/08/2020
									21/08	18:00	33.00	32.80	19.00		
									24/08	18:00	35.00	34.80	19.00		

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Dense lightly greenish grey mottled yellow brown clayey silty slightly gravelly fine to coarse SAND. Gravel is fine to coarse rounded of black chert pebbles. (LAMBETH GROUP) LMBE								
Very dense silty very clayey slightly gravelly fine to coarse SAND with frequent laminations of very thinly laminated greyish brown mudstone. Gravel is fine to coarse elongate subangular of mudstone. (LAMBETH GROUP) LMBE		21.00	9.21			22.00 - 22.50	B29	SPT(C) 22.00m, 50 (6,15/50 for 22mm)
From 23.00m to 23.80m bgl frequent organics and occasional lignite within the laminated mudstone.								
Dense to very dense light grey mottled grey slightly clayey silty fine to coarse SAND. Occasional glauconite. (LAMBETH GROUP) LMBE		23.80	6.41			24.00 - 24.45	D30	SPT(S) 24.00m, 50 (2,3/50 for 265mm)
						26.00 - 26.45	D31	SPT(S) 26.00m, N=38 (3,6/7,7,10,14)
						28.00 - 28.45	D32	
Very dense grey clayey sandy SILT with frequent shell fragments. Sand is fine and medium. (LAMBETH GROUP) LMBE		29.00	1.21			30.00 - 30.45	D33	SPT(S) 30.00m, 50 (7,11/50 for 180mm)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Groundwater strike at 19.8m bgl , rising to 17.00m bgl (20mins).
3. On completion BH installed with single installation of 50mm pipe to 21.8m bgl (response zone 20.8-21.8m)

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP2	84

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534890.16	Northing:	201559.14
Level:	30.21mAOD	Depth:	35.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH207**

Sheet 4 of 4

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	35.00	Cable Percussion	CP	M. P

Diameter	
Depth (m)	Diam (mm)
1.20	300
8.00	250
35.00	200

Casing	
Depth(m)	Diam (mm)
8.00	250
35.00	200

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
18/08	18:00	6.50	6.50	6.00
19/08	18:00	15.50	14.20	15.00
20/08	18:00	27.20	27.20	19.00
21/08	18:00	33.00	32.80	19.00
24/08	18:00	35.00	34.80	19.00

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 18/08/2020
Finish Date: 24/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Very dense grey clayey sandy SILT with frequent shell fragments. Sand is fine and medium. (LAMBETH GROUP) LMBE								
		30.50	-0.29					
Very dense grey silty sandy GRAVEL with moderate cobble content. Sand is fine to coarse. Gravel and cobbles are fine to coarse rounded to well rounded of black flint and chert. (LAMBETH GROUP) LMBE						32.00 - 32.50	B35	SPT(C) 32.00m, 50 (5,10/50 for 181mm)
						34.00 - 35.00	B37	SPT(C) 34.00m, N=46 (7,7/10,13,11,12)
EOH at 35.00m - Target depth reached		35.00	-4.79					

31 32 33 34 35 36 37 38 39 40

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Groundwater strike at 19.8m bgl , rising to 17.00m bgl (20mins).
3. On completion BH installed with single installation of 50mm pipe to 21.8m bgl (response zone 20.8-21.8m)

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP2	84

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534943.54	Northing:	201578.87
Level:	30.28mAOD	Depth:	30.00m
Logger:	EH	Type:	CP
Inclination: 90°			

Status: FINAL

Borehole Number: **BH208**

Sheet 1 of 3

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	30.00	Cable Percussion	CP	N. L

Diameter	
Depth (m)	Diam (mm)
1.20	300
16.00	250
30.00	200

Casing	
Depth(m)	Diam (mm)
7.00	250
30.00	200

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
14/08	18:00	1.20	0.00	DRY
17/08	18:00	7.00	7.00	5.20
19/08	08:00	16.50	16.50	16.47
19/08	18:00	30.00	30.00	23.00
20/08	08:00	30.00	30.00	19.30
18/09	18:00	16.50	16.50	DRY

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 17/08/2020
Finish Date: 20/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Brown very clayey sandy slightly gravelly SILT. Occasional brick fragments. Gravel is fine and medium angular to subrounded of flint and chalk. (TOPSOIL) MGR(TS)		0.10	30.18			0.00 - 0.50	ES1	
						0.10 - 1.00	B2	
Soft to firm orangish brown very clayey slightly sandy SILT. (ENFIELD SILT MEMBER) ESI								
						1.20 - 1.65	B4	SPT(S) 1.20m, N=15 (2,3/4,4,3,4)
						1.20 - 1.65	D3	
						2.00 - 2.45	U1005	Ublows=36 Recovery=100%
Medium dense light grey brown slightly clayey silty sandy GRAVEL with moderate flint cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		2.80	27.48			2.80	B6	
		3.00	27.28			3.00 - 3.45	B7	SPT(C) 3.00m, N=35 (6,6/9,9,8,9)
Dense light grey brown slightly silty sandy GRAVEL with high flint cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to rounded of flint and chert. (KEMPTON PARK GRAVEL MEMBER) KPGR						4.00 - 4.45	B8	SPT(C) 4.00m, N=34 (5,6/8,8,9,9)
						5.00 - 5.45	B9	SPT(C) 5.00m, N=30 (6,8/7,7,8,8)
Firm to stiff grey silty CLAY with occasional partings of fine sand. Occasional disseminated pyrite. (LONDON CLAY FORMATION) LC		5.80	24.48			5.90	B10	
From 5.90m to 6.20m bgl clay is brown.						6.50 - 6.95	U10011	Ublows=33 Recovery=100%
						6.95 - 7.40	D12	SPT(S) 6.95m, N=35 (5,7/9,8,9,9)
						8.50 - 9.50	EW2	
						9.00 - 9.45	U10013	Ublows=41 Recovery=100%
						9.45 - 9.90	D14	SPT(S) 9.45m, N=37 (6,8/9,9,10,9)
						10.00 - 10.50	EW1	

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with dual installation of 33mm pipe to 5.4m bgl (response zone 3.6-5.4m) and piezo tip at 10.5m bgl.

Chiselling		
From (m)	To (m)	Time (mins)

Water Added	
From (m)	To (m)
2.80	7.00

Hammer Information	
Serial No.	Energy Ratio %
AP3	62

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:
Location: **Waltham Cross**
Client: **ARUP**

Location Details			
Easting:	534943.54	Northing:	201578.87
Level:	30.28mAOD	Depth:	30.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH208**

Sheet 2 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time					Scale:	1:50
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)	Checked By:	DP
0.00	30.00	Cable Percussion	CP	N. L	1.20	300	7.00	250	14/08	18:00	1.20	0.00	DRY	Approved By:	RT
					16.00	250	30.00	200	17/08	18:00	7.00	7.00	5.20	Start Date:	17/08/2020
					30.00	200			19/08	08:00	16.50	16.50	16.47		
									19/08	18:00	30.00	30.00	23.00	Finish Date:	20/08/2020
									20/08	08:00	30.00	30.00	19.30		
									18/09	18:00	16.50	16.50	DRY		

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Firm to stiff grey silty CLAY with occasional partings of fine sand. Occasional disseminated pyrite. (LONDON CLAY FORMATION) LC						11.50 - 11.95	U10015	Ublows=38 Recovery=30%
						11.95 - 12.40	D16	SPT(S) 11.95m, N=31 (5,6/7,8,8,8)
						14.00 - 14.45	U10017	Ublows=50 Recovery=100%
						14.45 - 14.90	D18	SPT(S) 14.45m, N=27 (5,5/6,7,7,7)
Grey very thinly laminated very weak mudstone and siltstone recovered as silty gravelly CLAY. Gravel is fine to coarse elongate subangular of mudstone and siltstone.		16.20	14.08			16.50 - 16.95	B19	SPT(C) 16.50m, 50 (25 for 0mm/50 for 0mm)
(LONDON CLAY FORMATION) LC		16.65	13.63					
Stiff brownish grey mottled green slightly gravelly clayey very sandy SILT. Frequent glauconite. Occasional shell fragments and bioturbation. Sand is fine. Gravel is fine to coarse elongate subangular of siltstone. (HARWICH FORMATION) LC						19.00 - 19.45 19.00 - 19.50	D20 B21	SPT(S) 19.00m, 50 (5,10/50 for 135mm)
Firm to stiff light grey mottled grey silty very sandy slightly gravelly CLAY. Sand is fine and medium. Gravel is fine to coarse rounded of black chert. (LAMBETH GROUP) LMBE		19.20	11.08					

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with dual installation of 33mm pipe to 5.4m bgl (response zone 3.6-5.4m) and piezo tip at 10.5m bgl.

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
16.20	16.30	60			AP3	62
16.30	16.60	60				
16.60	16.65	30				

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:
Location: **Waltham Cross**
Client: **ARUP**

Location Details			
Easting:	534943.54	Northing:	201578.87
Level:	30.28mAOD	Depth:	30.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH208**

Sheet 3 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time					Scale:	1:50
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)	Checked By:	DP
0.00	30.00	Cable Percussion	CP	N. L	1.20	300	7.00	250	14/08	18:00	1.20	0.00	DRY	Approved By:	RT
					16.00	250	30.00	200	17/08	18:00	7.00	7.00	5.20	Start Date:	17/08/2020
					30.00	200			19/08	08:00	16.50	16.50	16.47		
									19/08	18:00	30.00	30.00	23.00	Finish Date:	20/08/2020
									20/08	08:00	30.00	30.00	19.30		
									18/09	18:00	16.50	16.50	DRY		

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Firm to stiff light grey mottled grey silty very sandy slightly gravelly CLAY. Sand is fine and medium. Gravel is fine to coarse rounded of black chert. (LAMBETH GROUP) LMBE						21.00 - 21.45 21.00 - 21.50	D22 B23	SPT(S) 21.00m, 50 (7,12/50 for 150mm)
Medium dense to dense Black mottled light grey silty sandy GRAVEL with high cobble content. Sand is fine and medium. Gravels and cobbles are fine to coarse rounded to well rounded of black chert. (LAMBETH GROUP) LMBE		22.00	8.28			22.00	B24	
Firm light grey mottled grey slightly gravelly silty very sandy CLAY. Sand is fine and medium. Gravel is fine to coarse rounded of black chert. (LAMBETH GROUP) LMBE		22.50	7.78			23.00 - 23.45 23.00 - 23.50	D25 B26	SPT(S) 23.00m, 50 (8,11/50 for 156mm)
From 25.00m to 30.00m bgl occasional organics.						25.00 - 25.45 25.00 - 25.50	D27 B28	SPT(S) 25.00m, 50 (7,12/50 for 208mm)
						27.00 - 27.45 27.00 - 27.50	D29 B30	SPT(S) 27.00m, 50 (10,14/50 for 151mm)
						29.00 - 29.45 29.00 - 29.50	D31 B32	SPT(S) 29.00m, 50 (25 for 30mm/50 for 90mm)
EOH at 30.00m - Target depth reached.		30.00	0.28					

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with dual installation of 33mm pipe to 5.4m bgl (response zone 3.6-5.4m) and piezo tip at 10.5m bgl.

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP3	62

Groundwater						Project Number
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks	**A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	535004.19	Northing:	201609.12
Level:	30.56mAOD	Depth:	9.50m
Logger:	DP	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH209**

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	9.50	Cable Percussion	CP	M. M	1.20 6.50	300 200	6.50	200	26/08 27/08	18:00 18:00	3.50 9.50	3.50 6.50	DRY DRY

Scale:	1:50
Checked By:	DP
Approved By:	RT
Start Date:	26/09/2020
Finish Date:	26/09/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Soft dark brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine sub-angular to sub-rounded flint. Abundant roots. (TOPSOIL) MGR(TS)		0.20	30.36			0.30 - 1.20 0.40	B1 ES1	
MADE GROUND: Soft light orangish brown slightly gravelly SILT. Gravel is fine to medium sub-angular to sub-rounded flint. Occasional rootlets and rare brick fragments. (MADE GROUND) MGR(C)		1.20	29.36			1.20 - 2.20	B3	SPT(S) 1.20m, N=6 (1,1/1,1,2,2)
Soft to firm light orangish brown silty slightly gravelly CLAY. Gravel is fine angular flint. (ENFIELD SILT MEMBER) ESI						2.20 - 3.20	B5	SPT(S) 2.20m, N=6 (1,1/1,2,2,1)
						3.20 - 4.20 3.20 - 4.20	7 B7	SPT(S) 3.20m, N=22 (1,2/2,3,7,10)
Dense light yellowish brown clayey/silty sandy GRAVEL. Sand is fine to coarse. Gravel is fine to medium angular to sub-rounded flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		3.50	27.06			4.20 - 5.20	B8	SPT(C) 4.20m, N=40 (3,7/10,10,8,12)
						5.20 - 6.50	B9	SPT(C) 5.20m, N=36 (4,9/10,9,9,8)
Firm grey sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine sub-angular to sub-rounded flint. (LONDON CLAY FORMATION) LC		6.50	24.06			6.50 - 6.90	U10	
						6.90 - 7.10	D11	
								SPT(S) 7.10m, N=18 (3,3/4,4,5,5)
						9.00 - 9.45	U10013	Ublows=15 Recovery=100%
....at 9.50m bgl: a 3m string of 50mm diameter SPT rods sheared during SPT testing. The rods could not be recovered from the base of the borehole and the BH209 was consequently terminated and relocated to BH209A		9.50	21.06					SPT(S) 9.60m, N=24 (4,4/5,6,6,7)
EOH at 9.50m - SPT rod sheared down hole.								

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. SPT rod sheared during SPT test at 9.5m bgl in BH209. Location had to be moved 2m N and continued under name BH209A.
3. BH209 backfilled upon termination.

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP1	66

Groundwater						Project Number
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks	**A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	535004.19	Northing:	201609.12
Level:	30.56mAOD	Depth:	30.00m
Logger:	DP	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH209A**

Sheet 1 of 3

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	30.00	Cable Percussion	CP	M. M

Diameter	
Depth (m)	Diam (mm)
1.20	300
7.30	200
30.00	150

Casing	
Depth(m)	Diam (mm)
7.30	200
30.00	150

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
28/08	18:00	11.50	7.00	DRY
01/09	18:00	18.85	18.00	17.3
02/09	08:00	18.00	18.00	12.30
02/09	18:00	30.00	30.00	17.62

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 26/08/2020
Finish Date: 03/09/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Description transferred from BH209: MADE GROUND: Soft dark brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine sub-angular to sub-rounded flint. Abundant roots. (TOPSOIL) MGR(TS)		0.20	30.36			0.40	ES1	
Description transferred from BH209: MADE GROUND: Soft light orangish brown slightly gravelly SILT. Gravel is fine to medium sub-angular to sub-rounded flint. Occasional rootlets and rare brick fragments. (MADE GROUND) MGR		1.20	29.36					
Description transferred from BH209: Soft to firm light orangish brown silty slightly gravelly CLAY. Gravel is fine angular flint. (ENFIELD SILT MEMBER) ESI *From 2.20m bgl becoming slightly gravelly clayey SILT.*								
Description transferred from BH209: Dense light yellowish brown clayey/silty sandy GRAVEL. Sand is fine to coarse. Gravel is fine to medium angular to sub-rounded flint. (KEMPTON PARK GRAVEL MEMBER) KPGR *From 4.20m bgl becoming dark orangish brown sandy GRAVEL. Sand is fine to coarse. Gravel is fine to medium very angular to sub-rounded flint.*		3.50	27.06					
Description transferred from BH209: Firm grey sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine sub-angular to sub-rounded flint. (LONDON CLAY FORMATION) LC		6.50	24.06					
Firm grey sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine sub-angular to sub-rounded flint. (LONDON CLAY FORMATION)		9.50	21.06			9.60 - 10.05	D15	

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Borehole relocated from BH209.(which was aborted due to unrecoverable SPT equipment sheared in the borehole). The borehole was therefore drilled from GL to 9.50 without undertaking SPTs, samples and detailed soil logging.
3. Water strikes noted at 12.5 and 22.0m bgl.
4. On completion BH installed with 50mm pipe to 6.0m bgl (response zone 4.0-6.0m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
6.20	6.50	45			AP1	66

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	535004.19	Northing:	201609.12
Level:	30.56mAOD	Depth:	30.00m
Logger:	DP	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH209A**

Sheet 2 of 3

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	30.00	Cable Percussion	CP	M. M

Diameter	
Depth (m)	Diam (mm)
1.20	300
7.30	200
30.00	150

Casing	
Depth(m)	Diam (mm)
7.30	200
30.00	150

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
28/08	18:00	11.50	7.00	DRY
01/09	18:00	18.85	18.00	17.3
02/09	08:00	18.00	18.00	12.30
02/09	18:00	30.00	30.00	17.62

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 26/08/2020
Finish Date: 03/09/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Firm grey sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine sub-angular to sub-rounded flint. (LONDON CLAY FORMATION) LC								
From 9.50m bgl becoming very dark grey sandy CLAY. Sand is fine to coarse.						11.50 - 11.90	U10016	Ublows=17 Recovery=100%
From 11.90m bgl becoming dark grey mottled brown very sandy CLAY. Sand is fine to coarse. Possible shells observed.						11.90 - 12.10	D17	
From 12.10m bgl becoming sandy CLAY. Possible shells observed.				▼		12.10 - 12.55	D18	SPT(S) 12.10m, N=22 (3,4/5,5,6,6)
						14.00 - 14.40	U10019	Ublows=24 Recovery=100%
						14.40 - 14.60	D20	
						14.60 - 15.05	D21	SPT(S) 14.60m, N=25 (4,5/6,6,6,7)
						16.50 - 16.90	U10022	Ublows=18 Recovery=100%
						16.90 - 17.10	D23	
						17.10 - 17.55	D24	SPT(S) 17.10m, N=29 (3,4/6,6,7,10)
Firm to stiff dark greenish grey very sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine angular to sub-rounded flint. (HARWICH FORMATION) LC		18.00	12.56			18.00 - 18.40	B25	Ublows=35 Recovery=0%
						18.00 - 18.40	U-NR26	
						18.40 - 18.85	D27	SPT(S) 18.40m, N=23 (3,5/5,5,6,7)
From 19.50m bgl becoming dark greenish grey slightly gravelly slightly clayey SAND. Sand is fine to coarse. Gravel is fine to medium flint.						19.50 - 19.95	D28	SPT(S) 19.50m, 50 (9,12/50 for 225mm)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Borehole relocated from BH209.(which was aborted due to unrecoverable SPT equipment sheared in the borehole). The borehole was therefore drilled from GL to 9.50 without undertaking SPTs, samples and detailed soil logging.
3. Water strikes noted at 12.5 and 22.0m bgl.
4. On completion BH installed with 50mm pipe to 6.0m bgl (response zone 4.0-6.0m).

Chiselling		
From (m)	To (m)	Time (mins)

Water Added	
From (m)	To (m)

Hammer Information	
Serial No.	Energy Ratio %
AP1	66

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks
12.50	-	-	0	0.00	Seep

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	535004.19	Northing:	201609.12
Level:	30.56mAOD	Depth:	30.00m
Logger:	DP	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH209A**

Sheet 3 of 3

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	30.00	Cable Percussion	CP	M. M

Diameter	
Depth (m)	Diam (mm)
1.20	300
7.30	200
30.00	150

Casing	
Depth(m)	Diam (mm)
7.30	200
30.00	150

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
28/08	18:00	11.50	7.00	DRY
01/09	18:00	18.85	18.00	17.3
02/09	08:00	18.00	18.00	12.30
02/09	18:00	30.00	30.00	17.62

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 26/08/2020
Finish Date: 03/09/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Firm to stiff dark greenish grey very sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine angular to sub-rounded flint. (HARWICH FORMATION) LC		20.20	10.36			20.20 - 20.60 20.20 - 21.50	U10030 B29	Ublows=19 Recovery=100%
Soft mottled dark grey light brown and red very sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium sub-angular to rounded flint. Some bands of compacted sand. (LAMBETH GROUP - POSSIBLY READING FORMATION) LMBE *From 20.60m bgl becoming red mottled grey and brown slightly gravelly clayey SAND. Sand is fine to coarse. Gravel is fine sub-angular to sub-rounded flint.*						20.60 - 20.80	D31	
Very dense brownish yellow clayey gravelly SAND. Sand is fine to coarse. Gravel is fine to medium sub-angular to rounded possible flint. Pockets of greyish clay present. (LAMBETH GROUP) LMBE *From 21.50m to 22.45m bgl gravel appeared as flattish black very glossy component. May be due to being eroded and polished by Cable Percussive drilling processes.*		21.50	9.06	▼		21.50 - 22.00 22.00 - 22.45 22.00 - 30.00	B32 D33 B34	SPT(C) 21.50m, 50 (8,10/50 for 225mm) SPT(S) 22.00m, 50 (9,14/50 for 225mm)
Very dense yellowish grey slightly clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is fine sub-angular flint. (LAMBETH GROUP) LMBE		22.45	8.11					
Very dense grey mottled brown SAND. Sand is fine to coarse. Pockets of sandy clay present. (LAMBETH GROUP - POSSIBLY WOOLWICH FORMATION) LMBE		24.00	6.56			24.00 - 24.45	D35	SPT(S) 24.00m, 50 (10,15/50 for 150mm)
From 28.00m bgl becoming dark grey mottled brown slightly clayey SAND Sand is fine to coarse. Abundant shell fragments.						26.00 - 26.45 28.00 - 28.45	D36 D37	SPT(S) 26.00m, N=50 (8,11/11,12,14,13) SPT(S) 28.00m, 50 (15,10/50 for 150mm)
EOH at 30.00m - Target depth reached.		30.00	0.56			30.00 - 30.45	D38	SPT(S) 30.00m, 50 (16,9/50 for 150mm)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Borehole relocated from BH209.(which was aborted due to unrecoverable SPT equipment sheared in the borehole). The borehole was therefore drilled from GL to 9.50 without undertaking SPTs, samples and detailed soil logging.
3. Water strikes noted at 12.5 and 22.0m bgl.
4. On completion BH installed with 50mm pipe to 6.0m bgl (response zone 4.0-6.0m).

Chiselling		
From (m)	To (m)	Time (mins)
21.50	22.00	60

Water Added	
From (m)	To (m)

Hammer Information	
Serial No.	Energy Ratio %
AP1	66

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks
22.00	-	-	0	0.00	Medium

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	535046.84	Northing:	201613.17
Level:	30.36mAOD	Depth:	
Logger:		Type:	RC
		Inclination:	°

Status: FINAL

Borehole Number: **BH210**

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date:
Finish Date:

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring							
						Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Location moved to BH210A.													

1 2 3 4 5 6 7 8 9 10

Observations / Remarks

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type

Hammer Information

Serial No.	Energy Ratio %

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	535046.00	Northing:	201603.09
Level:	30.30mAOD	Depth:	10.00m
Logger:	SO	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH210A**

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	10.00	Cable Percussion	CP	SE Drilling	1.20 10.00	300 150	6.50	150	06/08	18:00	10.00	6.50	

Scale:	1:50
Checked By:	DP
Approved By:	RT
Start Date:	06/08/2020
Finish Date:	06/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Soft brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium subangular to subrounded flint. (TOPSOIL) MGR(TS)		0.10	30.20			0.50	B1	
Soft to firm dark brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse of flint. (ENFIELD SILT MEMBER) ESI		1.00	29.30			1.50	D2	SPT(S) 1.50m, N=8 (1,2/1,2,2,3)
Soft to firm orange brown very sandy SILT. Sand is fine. (ENFIELD SILT MEMBER) ESI		2.00	28.30			2.50	D3	SPT(S) 2.50m, N=19 (1,1/3,5,6,5)
Firm light orange and brown mottled slightly sandy slightly gravelly CLAY/SILT. Sand is fine and medium. Gravel is fine to coarse angular to sub-angular of flint. (ENFIELD SILT MEMBER) ESI		3.60	26.70			3.50 - 4.50	B4	SPT(C) 3.50m, 50 (9,16/50 for 170mm)
Dense multi coloured (light grey, blue, orange and brown) sandy fine to coarse GRAVEL of flint. Sand is fine to coarse. (KEMPTON PARK GRAVEL MEMBER) KPGR						4.50 - 5.00	B5	SPT(C) 4.50m, 50 (8,15/50 for 170mm)
						5.75 - 6.00 5.80 - 5.90	EW1 EW2	
Dense light orange brown clayey sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse sub-angular ro sub-rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		6.00	24.30			6.00 - 6.50	B6	
Firm dark grey CLAY with occasional grey burrows <2mm long infilled with silt. (LONDON CLAY FORMATION) LC		6.50	23.80			6.50 - 6.95	U1007	Ublows=23 Recovery=100%
						7.00 7.00	D8 D9	SPT(S) 7.00m, N=23 (2,3/5,7,5,6)
From 8.50m bgl becoming Stiff						9.00 - 9.45	U10010	Ublows=50 Recovery=100%
						9.50 9.50	D11 D12	SPT(S) 9.50m, N=25 (3,3/6,6,6,7)
EOH at 10.00m - Target depth reached.		10.00	20.30					

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 5.5m bgl (response zone 4.1-5.0m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
			3.50	6.00	SED58	60

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534862.00	Northing:	201483.79
Level:	30.18mAOD	Depth:	30.00m
Logger:	DP	Type:	CP
Inclination: 90°			

Status: FINAL

Borehole Number: **BH211**

Sheet 1 of 3

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	30.00	Cable Percussion	CP	N. L

Diameter	
Depth (m)	Diam (mm)
1.20	300
10.00	250
30.00	200

Casing	
Depth(m)	Diam (mm)
10.00	250
30.00	200

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
27/08	18:00	3.00	3.00	DRY
28/08	18:00	9.00	9.00	DRY
01/09	18:00	19.00	10.00	DRY
02/09	08:00	19.00	10.00	17.80
02/09	18:00	30.00	30.00	20.00

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 27/08/2020
Finish Date: 03/09/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Soft dark brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium sub-angular to sub-rounded flint. Abundant roots. (TOPSOIL) MGR(TS)		0.15	30.03			0.00 - 1.20	B1	
						0.40	ES1	
MADE GROUND: Soft light yellowish brown slightly gravelly SILT. Gravel is fine sub-angular to sub-rounded flint. Occasional rootlets and rare brick fragments. (MADE GROUND) MGR								
Firm orangish brown clayey slightly gravelly SILT. Gravel is fine angular to sub-rounded flint. Occasional rootlets. (ENFIELD SILT MEMBER) ESI		1.20	28.98			1.20 - 1.65	B3	SPT(S) 1.20m, N=22 (4,5/5,6,5,6)
						1.20 - 1.65	D2	
						1.60	B4	
From 2.20m bgl becoming light yellowish brown.						2.00 - 2.45	U1005	Ublows=20 Recovery=100%
Firm to stiff dark orangish brown mottled grey slightly clayey slightly sandy gravelly SILT. Sand is fine to coarse. Gravel is fine to medium sub-angular to rounded flint. (ENFIELD SILT MEMBER) ESI		3.00	27.18			3.00 - 3.45	B7	SPT(C) 3.00m, N=34 (4,6/8,8,9,9)
						3.00 - 3.45	SPT6	
		3.40	26.78			3.50	B8	
Medium dense to dense orangish brown very sandy GRAVEL. Sand is fine to coarse. Gravel is fine to medium angular to rounded flint. (KEMPTON PARK GRAVEL MEMBER) KPGR						4.00 - 4.45	B6	SPT(C) 4.00m, N=38 (6,7/9,9,10,10)
						4.00 - 4.45	SPT9	
						4.50	B10	
						5.00 - 5.45	B11	SPT(C) 5.00m, N=29 (5,8/8,7,7,7)
						5.00 - 5.45	SPT11	
						5.50	B12	
Firm to stiff grey mottled light brown slightly sandy slightly gravelly CLAY. Sand is fine. Gravel is fine angular to rounded flint. (LONDON CLAY FORMATION) LC		5.75	24.43					
						6.50 - 6.95	U10013	Ublows=39 Recovery=100%
						6.95 - 7.40	D14	SPT(S) 6.95m, N=33 (6,7/8,8,8,9)
From 9.00m bgl gravel no longer present.						9.00 - 9.45	U10015	Ublows=41 Recovery=100%
						9.45 - 9.90	D16	SPT(S) 9.45m, N=34 (6,6/8,8,9,9)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 5.2m bgl (response zone 3.7-5.2m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP3	62

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:
Location: **Waltham Cross**
Client: **ARUP**

Location Details			
Easting:	534862.00	Northing:	201483.79
Level:	30.18mAOD	Depth:	30.00m
Logger:	DP	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH211**

Sheet 2 of 3

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	30.00	Cable Percussion	CP	N. L

Diameter	
Depth (m)	Diam (mm)
1.20	300
10.00	250
30.00	200

Casing	
Depth(m)	Diam (mm)
10.00	250
30.00	200

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
27/08	18:00	3.00	3.00	DRY
28/08	18:00	9.00	9.00	DRY
01/09	18:00	19.00	10.00	DRY
02/09	08:00	19.00	10.00	17.80
02/09	18:00	30.00	30.00	20.00

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 27/08/2020
Finish Date: 03/09/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Firm to stiff grey mottled light brown slightly sandy slightly gravelly CLAY. Sand is fine. Gravel is fine angular to rounded flint. (LONDON CLAY FORMATION) LC								
						11.50 - 11.95	U10017	Ublows=31 Recovery=100%
From 11.95m bgl becoming mottled reddish brown.						11.95 - 12.40	D18	SPT(S) 11.95m, N=39 (7,8/8,10,10,11)
						14.00 - 14.45	U10019	Ublows=21 Recovery=100%
From 14.45m bgl potential shells observed.						14.45 - 14.90	D20	SPT(S) 14.45m, N=38 (7,7/9,9,10,10)
						15.00	B21	
						16.00 - 16.45	U10022	Ublows=27 Recovery=100%
Soft to firm dark grey sandy CLAY. Sand is fine. (LONDON CLAY FORMATION / POSSIBLE HARWICH FORMATION) LC		16.45	13.73			16.45 - 16.90	D23	SPT(S) 16.45m, N=34 (8,9/8,8,9,9)
Firm to hard mottled grey brown and red sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine angular to sub-rounded flint. Possible shells observed. (LAMBETH GROUP - POSSIBLY READING FORMATION) LMBE		18.20	11.98			18.20	B24	
						19.00 - 19.45	U10025	Ublows=50 Recovery=100%
From 19.45m bgl gravel no longer present.						19.45 - 19.90	D26	SPT(S) 19.45m, 50 (25,28/50 for 20mm)
						20.00	B27	

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 5.2m bgl (response zone 3.7-5.2m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP3	62

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534862.00	Northing:	201483.79
Level:	30.18mAOD	Depth:	30.00m
Logger:	DP	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH211**

Sheet 3 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	30.00	Cable Percussion	CP	N. L	1.20	300	10.00	250	27/08	18:00	3.00	3.00	DRY
					10.00	250	30.00	200	28/08	18:00	9.00	9.00	DRY
					30.00	200			01/09	18:00	19.00	10.00	DRY
									02/09	08:00	19.00	10.00	17.80
									02/09	18:00	30.00	30.00	20.00

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 27/08/2020
Finish Date: 03/09/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Firm to hard mottled grey brown and red sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine angular to sub-rounded flint. Possible shells observed. (LAMBETH GROUP - POSSIBLY READING FORMATION)								
LMBE								
						21.50 - 21.95	U10028	Ublows=39 Recovery=100%
From 21.95m bgl becoming very sandy CLAY. Sand is fine to coarse.						21.95 - 22.40	D29	SPT(S) 21.95m, 50 (10,14/50 for 170mm)
		22.00	8.18					
Very dense dark grey speckled black slightly clayey SAND. Sand is fine to coarse. (LAMBETH GROUP)								
LMBE						22.50	B30	
						24.00 - 24.45	D31	SPT(S) 24.00m, 50 (9,13/50 for 170mm)
						26.00 - 26.45	D32	SPT(S) 26.00m, 50 (10,10/50 for 170mm)
From 28.00m bgl becoming dark grey sandy CLAY in patches.						28.00 - 28.45	D12	SPT(S) 28.00m, 50 (11,14/50 for 170mm)
						28.00 - 28.45	D33	
EOH at 30.00m - Target depth reached.		30.00	0.18			30.00 - 30.45	D34	SPT(S) 30.00m, 50 (12,12/50 for 145mm)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 5.2m bgl (response zone 3.7-5.2m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP3	62

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:
Location: **Waltham Cross**
Client: **ARUP**

Location Details			
Easting:	534944.03	Northing:	201519.28
Level:	29.68mAOD	Depth:	30.00m
Logger:	RN	Type:	CP+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH212**

Sheet 1 of 4

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	7.00	Cable Percussion	Dando 2000	SE Drilling	1.20	300	5.70	200	03/08	18:00	2.40	-	
7.00	30.00	Rotary Core		Endeavour	5.70	200			04/08	18:00	6.50	5.70	

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 03/08/2020
Finish Date: 14/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Sequence not logged. Drilled for establishment of casing pre-rotary drilling.													
Firm to stiff grey silty CLAY. (LONDON CLAY FORMATION) LC		6.50	23.18					6.50 7.00		100			
								7.00 8.50		100			
								8.50 10.00		100			

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Cable percussive drilling to 6.50m bgl, rotary coring drilling to 30.0m bgl.
3. No groundwater strikes noted during drilling.
4. On completion BH backfilled with bentonite.

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type

Hammer Information

Serial No.	Energy Ratio %

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:
Location: **Waltham Cross**
Client: **ARUP**

Location Details			
Easting:	534944.03	Northing:	201519.28
Level:	29.68mAOD	Depth:	30.00m
Logger:	RN	Type:	CP+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH212**

Sheet 2 of 4

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	7.00	Cable Percussion	Dando 2000	SE Drilling	1.20	300	5.70	200	03/08	18:00	2.40	-	
7.00	30.00	Rotary Core		Endeavour	5.70	200			04/08	18:00	6.50	5.70	

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 03/08/2020
Finish Date: 14/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Firm to stiff grey silty CLAY. (LONDON CLAY FORMATION) LC								10.00 11.50		100			
								11.50 13.00		100			
At 12.30m bgl 1No phosphate nodule with pyrite replacement (35mm x 10mm). *At 12.50m bgl 1No phosphate nodule with pyrite replacement (65mm x 40mm).* *At 12.80m bgl 1No phosphate nodule with pyrite replacement (45mm x 20mm).*								13.00 14.50		100			
At 13.95m bgl dark brown pockets.								14.50 16.00		100			
Firm dark grey silty sandy CLAY with rare shell fragments. Sand is fine. (HARWICH FORMATION) LC		15.50	14.18										
At 15.50m bgl layer of white shell fragments.								16.00 17.50		100			
At 17.13m bgl layer of white shell fragments. *At 17.20m bgl layer of white shell fragments.* *From 17.50m to 17.60m bgl soft black silty sandy CLAY with abundant white shell fragments.*								17.50 19.00		100			
Stiff light greenish grey mottled orangish brown very silty CLAY. (LAMBETH GROUP) LMBE		18.80	10.88					19.00 20.50		100			

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Cable percussive drilling to 6.50m bgl, rotary coring drilling to 30.0m bgl.
3. No groundwater strikes noted during drilling.
4. On completion BH backfilled with bentonite.

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type

Hammer Information

Serial No.	Energy Ratio %

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534944.03	Northing:	201519.28
Level:	29.68mAOD	Depth:	30.00m
Logger:	RN	Type:	CP+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH212**

Sheet 3 of 4

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	7.00	Cable Percussion	Dando 2000	SE Drilling	1.20	300	5.70	200	03/08	18:00	2.40	-	
7.00	30.00	Rotary Core		Endeavour	5.70	200			04/08	18:00	6.50	5.70	

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 03/08/2020
Finish Date: 14/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Stiff light greenish grey mottled orangish brown very silty CLAY. (LAMBETH GROUP) LMBE													
		20.50	9.18										
33% recovery of: Soft to firm greenish grey silty CLAY. (LAMBETH GROUP) LMBE *From 20.50m to 20.60m bgl soft dark grey silty CLAY with black carbonaceous material with pyrite.* *From 20.95m to 21.00m bgl black carbonaceous material with pyrite.*								20.50 22.00		33			
		22.00	7.68										
Firm greenish grey silty sandy CLAY with occasional black carbonaceous material. (LAMBETH GROUP) LMBE *From 22.60m to 22.85m bgl very sandy. Sand is fine.* *From 23.35m to 23.50m bgl fine sand lenses.* *From 23.86m to 23.88m 1 No very thin bed of strong grey coarse pyritic sandstone.*								22.00 23.50		100			
		23.88	5.80										
Stiff light greenish grey silty CLAY with occasional sand lenses. (LAMBETH GROUP) LMBE								23.50 25.00		100			
		25.20	4.48										
Dense grey silty fine to medium SAND. (LAMBETH GROUP) LMBE								25.00 26.50		93			
		26.50	3.18										
Dense dark grey slightly silty fine to coarse SAND. (LAMBETH GROUP) LMBE								26.50 28.00		100			
		28.70	0.98					28.00 29.50		100			
Dense dark grey very silty fine to medium SAND with abundant white shell fragments. (LAMBETH GROUP) LMBE													
		29.75	-0.07					29.50 30.00		100			
Dense dark grey silty sandy GRAVEL. Gravel is subangular to rounded fine to coarse of flint		30.00	-0.32										

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Cable percussive drilling to 6.50m bgl, rotary coring drilling to 30.0m bgl.
3. No groundwater strikes noted during drilling.
4. On completion BH backfilled with bentonite.

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type

Hammer Information

Serial No.	Energy Ratio %

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534944.03	Northing:	201519.28
Level:	29.68mAOD	Depth:	30.00m
Logger:	RN	Type:	CP+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH212**

Sheet 4 of 4

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00 7.00	7.00 30.00	Cable Percussion Rotary Core	Dando 2000	SE Drilling Endeavour	1.20 5.70	300 200	5.70	200	03/08 04/08	18:00 18:00	2.40 6.50	- 5.70	

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 03/08/2020
Finish Date: 14/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring							
						Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Dense dark grey silty sandy GRAVEL. Gravel is subangular to rounded fine to coarse of flint with abundant white shell fragments. (LAMBETH GROUP) LMBE													
EOH at 30.00m - Target depth reached.													

31
32
33
34
35
36
37
38
39
40

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Cable percussive drilling to 6.50m bgl, rotary coring drilling to 30.0m bgl.
3. No groundwater strikes noted during drilling.
4. On completion BH backfilled with bentonite.

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type

Hammer Information

Serial No.	Energy Ratio %

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	535009.26	Northing:	201539.73
Level:	29.72mAOD	Depth:	30.00m
Logger:	DP	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH213**

Sheet 1 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	30.00	Cable Percussion	CP	M. M	1.20 6.50 27.00	300 200 150	6.50 27.00	200 150	21/08 24/08 25/08 26/08 26/08	18:00 18:00 18:00 08:00 18:00	6.50 17.50 27.00 27.00 30.00	6.50 17.50 27.00 27.00 30.00	DRY DRY 19.50 17.27 19.45

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 20/08/2020
Finish Date: 26/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Soft dark brown slightly sandy gravelly SILT / CLAY. Sand is fine to coarse. Gravel is fine sub-angular to sub-rounded flint. Abundant rootlets. (TOPSOIL) MGR(TS)		0.10	29.62			0.10 - 1.20	B1	
Soft light brown slightly gravelly SILT. Gravel is fine sub-angular to sub-rounded flint. Abundant rootlets. (ENFIELD SILT MEMBER) ESI						0.50	ES1	
From 1.20m bgl becoming firm with rare rootlets.						1.20 - 1.65 1.20 - 2.20	D3 B4	SPT(S) 1.20m, N=11 (2,2/3,2,4,2)
Soft light grey mottled orangish brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine sub-angular to sub-rounded flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		2.20	27.52			2.20 - 2.65 2.20 - 3.20	D5 B6	SPT(S) 2.20m, N=10 (1,2/2,1,3,4)
Very dense light yellowish brown very clayey very sandy GRAVEL. Sand is fine to coarse. Gravel is fine to medium very angular to sub-rounded flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		3.20	26.52			3.20 - 3.65 3.20 - 4.20	D7 B8	SPT(S) 3.20m, N=44 (7,7/9,11,12,12)
						4.20 - 5.20	D9	SPT(C) 4.20m, 50 (8,8/50 for 250mm)
						5.20 - 6.20	B10	SPT(C) 5.20m, 50 (10,11/50 for 256mm)
Firm dark brownish grey very sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine sub-angular to sub-rounded flint. Some pockets of clayey SAND throughout. (LONDON CLAY FORMATION) LC		6.20	23.52			6.20 - 6.50 6.20 - 6.65	B12 D11	SPT(C) 6.20m, N=17 (4,4/3,6,4,4)
						6.50 - 6.95	U10013	Ublows=10 Recovery=100%
From 7.00m bgl laminations observed within the clay.						6.90 - 7.10 7.10 - 7.55	D14 SPT14	SPT(S) 7.10m, N=21 (2,2/4,4,5,8)
						9.00 - 9.40	U10015	Ublows=12 Recovery=100%
						9.40 - 9.60	D16	
						9.60 - 10.05	D17	SPT(S) 9.60m, N=23 (4,5/4,6,6,7)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Water strike at 19.50m bgl.
3. On completion BH backfilled with bentonite to to GL.

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
			3.50	6.50	AP1	66

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	535009.26	Northing:	201539.73
Level:	29.72mAOD	Depth:	30.00m
Logger:	DP	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH213**

Sheet 2 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	30.00	Cable Percussion	CP	M. M	1.20	300	6.50	200	21/08	18:00	6.50	6.50	DRY
					6.50	200	27.00	150	24/08	18:00	17.50	17.50	DRY
					27.00	150			25/08	18:00	27.00	27.00	19.50
									26/08	08:00	27.00	27.00	17.27
									26/08	18:00	30.00	30.00	19.45

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 20/08/2020
Finish Date: 26/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Firm dark brownish grey very sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine sub-angular to sub-rounded flint. Some pockets of clayey SAND throughout. (LONDON CLAY FORMATION) LC						11.50 - 11.90	U10018	Ublows=22 Recovery=100%
						11.90 - 12.10	D19	
						12.10 - 12.55	D20	SPT(S) 12.10m, N=26 (5,4/4,6,7,9)
From 14.60m bgl possible shells observed.						14.00 - 14.40	U10021	Ublows=16 Recovery=100%
						14.40 - 14.60	D22	
						14.60 - 15.05	D23	SPT(S) 14.60m, N=23 (2,3/4,5,7,7)
						16.50 - 16.90	U10024	Ublows=21 Recovery=100%
						16.90 - 17.10	D25	
Firm dark brownish grey very sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine sub-angular to sub-rounded flint. Some pockets of clayey SAND throughout. With shell fragments. (HARWICH FORMATION) LC		17.00	12.72			17.10 - 17.55	D26	SPT(S) 17.10m, N=42 (8,10/11,10,10,11)
						19.00 - 19.40	B28	Ublows=33 Recovery=100%
						19.00 - 19.40	U10027	
				▼		19.40 - 19.85	D29	SPT(S) 19.40m, N=50 (8,7/12,17,16,5)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Water strike at 19.50m bgl.
3. On completion BH backfilled with bentonite to to GL.

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
17.50	18.00	60			AP1	66

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks
19.50	-	-	0	0.00	

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	535009.26	Northing:	201539.73
Level:	29.72mAOD	Depth:	30.00m
Logger:	DP	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH213**

Sheet 3 of 3

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	30.00	Cable Percussion	CP	M. M

Diameter	
Depth (m)	Diam (mm)
1.20	300
6.50	200
27.00	150

Casing	
Depth(m)	Diam (mm)
6.50	200
27.00	150

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
21/08	18:00	6.50	6.50	DRY
24/08	18:00	17.50	17.50	DRY
25/08	18:00	27.00	27.00	19.50
26/08	08:00	27.00	27.00	17.27
26/08	18:00	30.00	30.00	19.45

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 20/08/2020
Finish Date: 26/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Firm dark brownish grey very sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine sub-angular to sub-rounded flint. Some pockets of clayey SAND throughout. With shell fragments. (HARWICH FORMATION) LC								
		20.50	9.22			20.50 - 23.00	B30	
Very dense mottled red brown and grey clayey/silty slightly gravelly SAND. Sand is fine to coarse. Gravel is fine sub-angular flint. Some areas very sandy CLAY/SILT throughout. (LAMBETH GROUP - POSSIBLY READING FORMATION) LMBE						21.00 - 21.45	D31	SPT(S) 21.00m, 50 (8,9/50 for 220mm)
From 21.50m bgl becoming soft to firm reddish brown sandy gravelly SILT. Sand is fine to coarse. Gravel is fine to medium angular to rounded flint.								
		23.00	6.72			23.00 - 23.45	D32	SPT(S) 23.00m, 50 (25,/50 for 150mm)
Dense to very dense grey slightly clayey/silty slightly gravelly SAND. Sand is fine to coarse. Gravel is fine sub-angular with a black 'glassy shard' appearance. (LAMBETH GROUP) LMBE								
From 25.00m bgl becoming dark grey mottled light brown slightly clayey/silty SAND. Sand is fine to coarse.						25.00 - 25.45	D33	SPT(S) 25.00m, N=44 (6,7/10,10,11,13)
						26.00 - 26.45 26.00 - 30.00	D34 B35	SPT(S) 26.00m, N=50 (9,9/13,15,13,9)
						28.00 - 28.45	D36	SPT(S) 28.00m, 50 (8,9/50 for 225mm)
		30.00	-0.28			30.00 - 30.45	D37	SPT(S) 30.00m, 50 (10,10/50 for 225mm)
EOH at 30.00m - Target depth reached.								

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Water strike at 19.50m bgl.
3. On completion BH backfilled with bentonite to to GL.

Chiselling		
From (m)	To (m)	Time (mins)
23.00	23.50	60

Water Added	
From (m)	To (m)

Hammer Information	
Serial No.	Energy Ratio %
AP1	66

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534829.36	Northing:	201449.15
Level:	30.71mAOD	Depth:	10.00m
Logger:	SO	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH214**

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	10.00	Cable Percussion	CP	SE Drilling	1.20 4.50	300 150	4.50	150	06/08	18:00	4.50	4.50	

Scale:	1:50
Checked By:	DP
Approved By:	RT
Start Date:	06/08/2020
Finish Date:	07/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Soft dark brown sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine sub-angular to sub-rounded flint. (TOPSOIL) MGR(TS)		0.10	30.61			0.50	B1	
Soft to firm light orange brown slightly sandy slightly gravelly SILT. Sand is fine to medium. Gravel is fine to medium sub-angular to sub-rounded of flint. (ENFIELD SILT MEMBER) ESI						1.50	D2	SPT(S) 1.50m, N=12 (3,3/4,3,2,3)
						2.50 - 3.00	B4	SPT(C) 2.50m, N=30 (4,5/9,7,8,6)
						3.50	D5	SPT(S) 3.50m, N=12 (1,2/2,3,4,3)
Dense light brown sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		4.50	26.21			4.50 - 5.00	B6	SPT(C) 4.50m, 50 (5,11/50 for 230mm)
Firm brownish grey CLAY with occasional burrows <2mm infilled with light grey silt. (LONDON CLAY FORMATION) LC		6.00	24.71			6.00 - 6.45	U1007	Ublows=25 Recovery=100%
						6.50 6.50	D8 D9	SPT(S) 6.50m, N=23 (3,4/4,5,6,8)
At 8.50m bgl becoming stiff.						8.50 - 8.95	U10010	Ublows=55 Recovery=100%
						8.90	D11	SPT(S) 9.00m, N=24 (2,4/5,5,7,7)
						9.50	D12	
EOH at 10.00m - Target depth reached.		10.00	20.71					

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 6m bgl (response zone 5-6m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
			2.30 4.30	2.90 4.50	SED58	60

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534951.18	Northing:	201455.52
Level:	29.33mAOD	Depth:	35.00m
Logger:	EH/DP	Type:	CP
		Inclination:	0°

Status: FINAL

Borehole Number: **BH215**

Sheet 1 of 4

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	35.00	Cable Percussion	CP	N. L

Diameter	
Depth (m)	Diam (mm)
1.20	300
10.00	250
35.00	200

Casing	
Depth(m)	Diam (mm)
10.00	250
35.00	200

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
21/08	14:00	6.50	6.50	DRY
24/08	08:00	6.50	6.50	4.60
24/08	18:00	16.50	16.50	DRY
25/08	18:00	23.50	23.50	17.60
26/08	08:00	23.50	23.50	14.20
26/08	18:00	35.00	35.00	17.00

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 20/08/2020
Finish Date: 27/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Brown clayey sandy gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse angular to subrounded of flint, chert, rare chalk. Occasional rootlets. (TOPSOIL) MGR(TS)						0.00 - 0.60 0.00 - 0.60	B1 ES1	
Medium dense orangish brown silty sandy very gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to rounded of flint and chert. Occasional organics. (ENFIELD SILT MEMBER) ESI *From 2.00m to 2.50m bgl slightly gravelly.*		0.60	28.73			0.60 - 1.20 0.60 - 1.20 1.20 - 1.65 2.00 - 2.45	B2 ES2 B3 B4	 SPT(C) 1.20m, N=23 (3,4/5,6,6,6) SPT(C) 2.00m, N=29 (3,5/7,7,8,7)
Dense orangish brown slightly silty sandy GRAVEL with high cobble content. Sand is fine to coarse. Gravel is fine to coarse subangular to rounded of flint and chert. (KEMPTON PARK GRAVEL MEMBER) KPGR		2.50	26.83			3.00 - 3.45 4.00 - 4.45 4.95 - 5.88 5.00 - 5.45 5.20 - 5.50	B5 B6 EW1 B7 EW2	SPT(C) 3.00m, N=38 (5,7/9,10,9,10) SPT(C) 4.00m, N=42 (6,8/8,10,12,12) SPT(C) 5.00m, N=40 (6,6/9,10,10,11)
Stiff grey silty CLAY. Occasional pockets of very sandy CLAY. (LONDON CLAY FORMATION) LC *From 6.00m to 6.50m bgl brown in colour.*		6.00	23.33			6.00 6.50 - 6.95 6.95 - 7.50 9.00 - 9.45 9.45 - 9.90	B8 U1009 D10 U10011 D12	 Ublows=58 Recovery=100% SPT(S) 6.95m, N=36 (7,8/9,9,9,9) Ublows=42 Recovery=100% SPT(S) 9.45m, N=36 (6,9/10,8,9,9)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 5.5m bgl (response zone 3.7-5.5m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP3	62

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:
Location: **Waltham Cross**
Client: **ARUP**

Location Details			
Easting:	534951.18	Northing:	201455.52
Level:	29.33mAOD	Depth:	35.00m
Logger:	EH/DP	Type:	CP
		Inclination:	0°

Status: FINAL

Borehole Number: **BH215**

Sheet 2 of 4

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	35.00	Cable Percussion	CP	N. L

Diameter	
Depth (m)	Diam (mm)
1.20	300
10.00	250
35.00	200

Casing	
Depth(m)	Diam (mm)
10.00	250
35.00	200

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
21/08	14:00	6.50	6.50	DRY
24/08	08:00	6.50	6.50	4.60
24/08	18:00	16.50	16.50	DRY
25/08	18:00	23.50	23.50	17.60
26/08	08:00	23.50	23.50	14.20
26/08	18:00	35.00	35.00	17.00

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 20/08/2020
Finish Date: 27/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Stiff grey silty CLAY. Occasional pockets of very sandy CLAY. (LONDON CLAY FORMATION) LC						11.50 - 11.95	U10013	Ublows=37 Recovery=100%
						11.90 - 12.40	D14	SPT(S) 11.95m, N=35 (6,7/8,8,9,10)
						14.00 - 14.45	U10015	Ublows=40 Recovery=100%
						14.45 - 14.80	D16	SPT(S) 14.45m, N=39 (7,9/9,10,10,10)
Stiff grey slightly sandy gravelly SILT with occasional sandy lenses. Sand is fine to coarse. Gravel is fine to coarse angular of claystone. (HARWICH FORMATION) LC		16.50	12.83			16.50	U-NR17	Ublows=24 Recovery=0%
						16.95 - 17.40 16.95 - 17.40	B19 D18	SPT(S) 16.95m, 56 (7,9/56 for 161mm)
Stiff greenish grey and brown mottled silty CLAY. (LAMBETH GROUP) LMBE		18.00	11.33			19.00 - 19.45	U10020	Ublows=50 Recovery=66%
						19.45 - 19.60 19.45 - 19.60	B22 D21	SPT(S) 19.45m, 50 (25 for 10mm/50 for 140mm)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 5.5m bgl (response zone 3.7-5.5m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP3	62

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534951.18	Northing:	201455.52
Level:	29.33mAOD	Depth:	35.00m
Logger:	EH/DP	Type:	CP
		Inclination:	0°

Status: FINAL

Borehole Number: **BH215**

Sheet 3 of 4

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	35.00	Cable Percussion	CP	N. L

Diameter	
Depth (m)	Diam (mm)
1.20	300
10.00	250
35.00	200

Casing	
Depth(m)	Diam (mm)
10.00	250
35.00	200

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
21/08	14:00	6.50	6.50	DRY
24/08	08:00	6.50	6.50	4.60
24/08	18:00	16.50	16.50	DRY
25/08	18:00	23.50	23.50	17.60
26/08	08:00	23.50	23.50	14.20
26/08	18:00	35.00	35.00	17.00

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 20/08/2020
Finish Date: 27/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Stiff greenish grey and brown mottled silty CLAY. (LAMBETH GROUP) LMBE		20.50	8.83					
Very stiff light grey sandy SILT. Sand is fine to coarse. (LAMBETH GROUP) LMBE						21.00 - 21.45 21.00 - 21.45	B24 D23	SPT(S) 21.00m, 50 (10,12/50 for 151mm)
Very dense black fine to coarse rounded to well rounded GRAVEL of chert. (LAMBETH GROUP) LMBE		22.50	6.83			22.50 23.00 - 23.45	B25 B26	 SPT(S) 23.00m, 50 (25 for 10mm/50 for 17mm)
Very dense dark grey very silty slightly gravelly fine to coarse SAND. Gravel is fine to coarse rounded chert. (LAMBETH GROUP) LMBE		25.00	4.33			25.00 - 25.45 27.00 - 27.45 27.00 - 27.45	B27 B29 D28	SPT(S) 25.00m, 50 (25 for 30mm/50 for 83mm) SPT(S) 27.00m, N=55 (3,3/11,14,14,16)
Very stiff dark grey very sandy SILT with occasional shell fragments. Sand is fine to medium. (LAMBETH GROUP) LMBE		29.00	0.33			29.00 - 29.45 29.00 - 29.45	B31 D30	SPT(S) 29.00m, N=55 (2,4/13,12,15,15)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 5.5m bgl (response zone 3.7-5.5m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP3	62

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534951.18	Northing:	201455.52
Level:	29.33mAOD	Depth:	35.00m
Logger:	EH/DP	Type:	CP
		Inclination:	0°

Status: FINAL

Borehole Number: **BH215**

Sheet 4 of 4

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	35.00	Cable Percussion	CP	N. L	1.20	300	10.00	250	21/08	14:00	6.50	6.50	DRY
					10.00	250	35.00	200	24/08	08:00	6.50	6.50	4.60
					35.00	200			24/08	18:00	16.50	16.50	DRY
									25/08	18:00	23.50	23.50	17.60
									26/08	08:00	23.50	23.50	14.20
									26/08	18:00	35.00	35.00	17.00

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 20/08/2020
Finish Date: 27/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Very stiff dark grey very sandy SILT with occasional shell fragments. Sand is fine to medium. (LAMBETH GROUP) LMBE *From 31.00m to 35.00m bgl frequent shell fragments.*						31.00 - 31.45 31.00 - 31.45	B33 D32	SPT(S) 31.00m, N=55 (3,3/12,14,14,15)
						33.00 - 33.45 33.00 - 33.45	B35 D34	SPT(S) 33.00m, N=56 (4,5/13,14,15,14)
EOH at 35.00m - Target depth reached.		35.00	-5.67			35.00 - 35.45 35.00 - 35.45	B37 D36	SPT(S) 35.00m, N=51 (4,3/12,13,13,13)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 5.5m bgl (response zone 3.7-5.5m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP3	62

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	535010.42	Northing:	201476.83
Level:	29.29mAOD	Depth:	35.00m
Logger:	RN	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH216**

Sheet 1 of 4

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	35.00	Cable Percussion	Dando 2000	M. P

Diameter	
Depth (m)	Diam (mm)
1.20	300
6.50	250
35.00	200

Casing	
Depth(m)	Diam (mm)
6.00	250
35.00	200

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
25/08	18:00	10.00	6.00	DRY
26/08	18:00	21.00	20.30	19.00
27/08	18:00	31.50	31.30	17.00
28/08	18:00	35.00	35.00	17.00

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 25/08/2020
Finish Date: 28/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Brown slightly sandy slightly gravelly CLAY with occasional plant remains. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse flint and quartzite.. (TOPSOIL)		0.30	28.99			0.00 - 0.30	B1	
MGR(TS)						0.50	ES1	
Firm orangish brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse flint. (ENFIELD SILT MEMBER) ESI						0.50 - 0.80	B2	
						1.00 - 1.20	B3	
						1.20 - 1.65	D4	SPT(S) 1.20m, N=19 (3,5/5,5,5,4)
						2.00 - 2.45	D5	SPT(S) 2.00m, N=25 (2,2/4,5,7,9)
Medium dense to dense orangish brown slightly silty slightly sandy GRAVEL with low cobble content. Gravel is subangular to well rounded fine to coarse of flint and quartzite Cobbles are rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		2.30	26.99			3.00 - 3.50	B7	SPT(C) 3.00m, N=14 (2,1/2,2,5,5)
						4.00 - 4.50	B9	SPT(C) 4.00m, N=35 (7,6/7,8,10,10)
						5.00 - 5.50	B11	SPT(C) 5.00m, N=39 (8,7/7,10,11,11)
Firm to stiff dark grey very silty CLAY. (LONDON CLAY FORMATION) LC		5.80	23.49			6.50 - 6.95	U10012	Ublows=24 Recovery=100%
						6.95 - 7.40	D13	SPT(S) 6.95m, N=16 (2,2/4,3,4,5)
						9.00 - 9.45	U10014	Ublows=38 Recovery=100%
						9.45 - 9.90	D15	SPT(S) 9.45m, N=21 (3,3/5,5,5,6)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Groundwater strike noted at 20.00m bgl.
3. On completion BH installed with dual installation of 33mm pipe to 5.30m bgl (response zone 4.00-5.30m) and 30.50m bgl.

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP2	84

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	535010.42	Northing:	201476.83
Level:	29.29mAOD	Depth:	35.00m
Logger:	RN	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH216**

Sheet 2 of 4

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	35.00	Cable Percussion	Dando 2000	M. P

Diameter	
Depth (m)	Diam (mm)
1.20	300
6.50	250
35.00	200

Casing	
Depth(m)	Diam (mm)
6.00	250
35.00	200

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
25/08	18:00	10.00	6.00	DRY
26/08	18:00	21.00	20.30	19.00
27/08	18:00	31.50	31.30	17.00
28/08	18:00	35.00	35.00	17.00

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 25/08/2020
Finish Date: 28/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Firm to stiff dark grey very silty CLAY. (LONDON CLAY FORMATION) LC						11.50 - 11.95	U10016	Ublows=42 Recovery=100%
						11.95 - 12.40	D17	SPT(S) 11.95m, N=23 (3,4/4,6,7,6)
						14.00 - 14.45	U10018	Ublows=40 Recovery=90%
						14.45 - 14.90	D19	SPT(S) 14.45m, N=30 (4,6/7,7,7,9)
						16.50 - 16.95	U10020	Ublows=41 Recovery=90%
						16.95 - 17.40	D21	SPT(S) 16.95m, N=31 (6,6/7,7,7,10)
Firm dark grey silty slightly sandy CLAY with occasional white shell fragments. (HARWICH FORMATION) LC		17.60	11.69					
Firm grey silty sandy CLAY. Sand is fine to medium. (HARWICH FORMATION) LC		19.00	10.29			19.00 - 19.45	U10022	Ublows=40 Recovery=10%
						19.45 - 19.90	D23	SPT(S) 19.45m, N=34 (6,6/5,7,10,12)
		20.00	9.29					

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Groundwater strike noted at 20.00m bgl.
3. On completion BH installed with dual installation of 33mm pipe to 5.30m bgl (response zone 4.00-5.30m) and 30.50m bgl.

Chiselling		
From (m)	To (m)	Time (mins)

Water Added	
From (m)	To (m)

Hammer Information	
Serial No.	Energy Ratio %
AP2	84

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks
20.00	-	-	20	19.00	

Project Number: **A117846**

Project:
Location: **Waltham Cross**
Client: **ARUP**

Location Details			
Easting:	535010.42	Northing:	201476.83
Level:	29.29mAOD	Depth:	35.00m
Logger:	RN	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH216**

Sheet 3 of 4

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	35.00	Cable Percussion	Dando 2000	M. P	1.20	300	6.00	250	25/08	18:00	10.00	6.00	DRY
					6.50	250	35.00	200	26/08	18:00	21.00	20.30	19.00
					35.00	200			27/08	18:00	31.50	31.30	17.00
									28/08	18:00	35.00	35.00	17.00

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 25/08/2020
Finish Date: 28/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Dense grey very silty fine to medium SAND. (LAMBETH GROUP) LMBE						21.00 - 21.45	D24	SPT(S) 21.00m, N=47 (3,3/6,9,12,20)
						23.00 - 23.45	D25	SPT(S) 23.00m, N=42 (4,4/7,10,11,14)
Very dense grey slightly silty slightly sandy GRAVEL. Sand is fine to medium. Gravel is subangular to well rounded fine to coarse of flint. (LAMBETH GROUP) LMBE		23.60	5.69					
Firm to stiff grey mottled dark orangish brown sandy CLAY with occasional hard ironstone nodules. (LAMBETH GROUP) LMBE		24.00	5.29			24.00 - 24.50	B26	
Very dense dark grey very silty fine to medium SAND. (LAMBETH GROUP) LMBE		24.50	4.79			25.00 - 25.40	D27	SPT(S) 25.00m, 49 (3,5/49 for 265mm)
						27.00 - 27.45	D28	SPT(S) 27.00m, N=30 (2,2/4,8,9,9)
Very dense dark grey very silty fine to medium SAND with abundant white shell fragments. (LAMBETH GROUP) LMBE		28.00	1.29			29.00 - 29.28	D29	SPT(S) 29.00m, 50 (8,12/50 for 103mm)
Very dense grey slightly silty slightly sandy GRAVEL. Gravel is subangular to well rounded fine to coarse of flint. (LAMBETH GROUP)		29.50	-0.21					

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Groundwater strike noted at 20.00m bgl.
3. On completion BH installed with dual installation of 33mm pipe to 5.30m bgl (response zone 4.00-5.30m) and 30.50m bgl.

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP2	84

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	535010.42	Northing:	201476.83
Level:	29.29mAOD	Depth:	35.00m
Logger:	RN	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH216**

Sheet 4 of 4

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	35.00	Cable Percussion	Dando 2000	M. P

Diameter	
Depth (m)	Diam (mm)
1.20	300
6.50	250
35.00	200

Casing	
Depth(m)	Diam (mm)
6.00	250
35.00	200

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
25/08	18:00	10.00	6.00	DRY
26/08	18:00	21.00	20.30	19.00
27/08	18:00	31.50	31.30	17.00
28/08	18:00	35.00	35.00	17.00

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 25/08/2020
Finish Date: 28/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Very dense grey slightly silty slightly sandy GRAVEL. Gravel is subangular to well rounded fine to coarse of flint. (LAMBETH GROUP) LMBE						31.00 - 31.45	D30	SPT(S) 31.00m, N=48 (8,7/11,11,11,15)
								SPT(C) 33.00m, N=50 (10,11/11,15,15,9)
EOH at 35.00m - Target depth reached.		35.00	-5.71					SPT(C) 35.00m, 50 (10,15/50 for 150mm)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. Groundwater strike noted at 20.00m bgl.
3. On completion BH installed with dual installation of 33mm pipe to 5.30m bgl (response zone 4.00-5.30m) and 30.50m bgl.

Chiselling		
From (m)	To (m)	Time (mins)

Water Added	
From (m)	To (m)

Hammer Information	
Serial No.	Energy Ratio %
AP2	84

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534863.74	Northing:	201414.83
Level:	30.09mAOD	Depth:	30.00m
Logger:	RN	Type:	CP+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH217**

Sheet 1 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00 6.50	6.50 30.00	Cable Percussion Rotary Core	Dando 2000	SE Drilling Endeavour	1.20 6.45	300 200	6.45	200	05/08	18:00	7.00	6.45	DRY

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 18/08/2020
Finish Date: 20/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Sequence not logged. Drilled for establishment of casing pre-rotary drilling.													
Firm dark grey very silty CLAY. (LONDON CLAY FORMATION) LC		6.50	23.59					6.50 8.00		93			
								8.00 8.50		100			
At 8.77m bgl 1No phosphate nodule (20mm x 15mm). *At 9.10m bgl black carbonaceous material.*								8.50 10.00		100			

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 16.0m bgl (response zone 15-16m).

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type

Hammer Information

Serial No.	Energy Ratio %

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project: **WXT GI**

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534863.74	Northing:	201414.83
Level:	30.09mAOD	Depth:	30.00m
Logger:	RN	Type:	CP+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH217**

Sheet 2 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	6.50	Cable Percussion	Dando 2000	SE Drilling	1.20	300	6.45	200	05/08	18:00	7.00	6.45	DRY
6.50	30.00	Rotary Core		Endeavour	6.45	200							

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 18/08/2020
Finish Date: 20/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Firm dark grey very silty CLAY. (LONDON CLAY FORMATION) LC								10.00 11.50		100			
Stiff dark grey CLAY. (LONDON CLAY FORMATION) LC		11.20	18.89					11.50 13.00		100			
Stiff dark grey very silty CLAY. (LONDON CLAY FORMATION) LC		12.55	17.54					13.00 14.50		100			
Firm to stiff dark grey very silty slightly sandy CLAY. Sand is fine. (LONDON CLAY FORMATION) LC		14.07	16.02										
Stiff dark grey very silty CLAY. (LONDON CLAY FORMATION) LC		14.50	15.59					14.50 16.00		100			
Firm dark grey silty sandy CLAY. Sand is fine. (HARWICH FORMATION) LC		15.72	14.37										
Dense dark grey very silty fine SAND. (HARWICH FORMATION) LC		16.00	14.09										
Stiff dark grey very silty slightly sandy CLAY. Sand is fine. (HARWICH FORMATION) LC *From 17.80m to 17.90m bgl dark grey silty fine sand.* *At 18.00m bgl occasional white shell fragments.*		16.40	13.69					16.00 17.50		100			
								17.50 19.00		93			
Stiff light greenish grey locally mottled orangish brown silty CLAY. (LAMBETH GROUP) LMBE		18.70 18.90 19.00	11.39 11.19 11.09										
No recovery. *From 18.90m to 19.00m bgl assumed zone of core loss.*													
Stiff light greenish grey locally mottled orangish brown silty CLAY. (LAMBETH GROUP) LMBE		19.90	10.19					19.00 20.50		100			

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 16.0m bgl (response zone 15-16m).

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type

Hammer Information

Serial No.	Energy Ratio %

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534863.74	Northing:	201414.83
Level:	30.09mAOD	Depth:	30.00m
Logger:	RN	Type:	CP+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH217**

Sheet 3 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00 6.50	6.50 30.00	Cable Percussion Rotary Core	Dando 2000	SE Drilling Endeavour	1.20 6.45	300 200	6.45	200	05/08	18:00	7.00	6.45	DRY

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 18/08/2020
Finish Date: 20/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Very stiff orangish brown mottled greenish grey silty CLAY. (LAMBETH GROUP) LMBE													
Very stiff greenish grey silty locally slightly sandy CLAY with occasional light brown sand lenses. Sand is fine. (LAMBETH GROUP) LMBE *At 23.15m bgl rare black carbonaceous material.*		21.00	9.09			20.50 22.00				100			
Dense light greenish grey very silty fine SAND. (LAMBETH GROUP) LMBE *At 23.90m bgl rare black carbonaceous material.* *From 25.41m to 25.49m bgl greenish grey silty fine sand.*		23.75	6.34			22.00 23.50				100			
Light grey very silty fine SAND. (LAMBETH GROUP) LMBE *From 27.95m to 28.05m bgl dark grey silty fine to medium sand.*		26.20	3.89			23.50 25.00				100			
26% Recovery of Grey silty fine to coarse SAND. (LAMBETH GROUP) LMBE		28.05	2.04			25.00 26.50				100			
10% Recovery of Grey rounded to well rounded fine to coarse GRAVEL of flint. (LAMBETH GROUP) LMBE		29.50	0.59			26.50 28.00				100			
EOH at 30.00m -		30.00	0.09			28.00 29.50				26			
						29.50 30.00				10			

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 16.0m bgl (response zone 15-16m).

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type

Hammer Information

Serial No.	Energy Ratio %

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	535015.29	Northing:	201390.92
Level:	29.51mAOD	Depth:	30.00m
Logger:	RN	Type:	CP+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH218**

Sheet 1 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	8.00	Cable Percussion	Dando 2000	SE Drilling	1.20	300	7.60	200	04/08	18:00	8.50	7.60	
8.00	30.00	Rotary Core		Endeavour	7.60	200							

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 14/08/2020
Finish Date: 18/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Sequence not logged. Drilled for establishment of casing pre-rotary drilling.													
Soft dark grey slightly sandy slightly gravelly CLAY. Sand is fine. Gravel is rounded to well rounded fine to coarse flint. (LONDON CLAY FORMATION) LC		8.00	21.51					8.00 9.00		90			
Firm dark grey silty CLAY. (LONDON CLAY FORMATION) LC		8.45	21.06					9.00 10.00		100			

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH backfilled with bentonite.

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type

Hammer Information

Serial No.	Energy Ratio %

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	535015.29	Northing:	201390.92
Level:	29.51mAOD	Depth:	30.00m
Logger:	RN	Type:	CP+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH218**

Sheet 2 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00 8.00	8.00 30.00	Cable Percussion Rotary Core	Dando 2000	SE Drilling Endeavour	1.20 7.60	300 200	7.60	200	04/08	18:00	8.50	7.60	

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 14/08/2020
Finish Date: 18/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Firm dark grey silty CLAY. (LONDON CLAY FORMATION) LC								10.00 11.50		100			
Stiff dark grey CLAY. (LONDON CLAY FORMATION) LC		11.30	18.21					11.50 13.00		100			
From 14.40m to 14.50m bgl dark grey very silty fine to medium sand.. *At 14.50m bgl 1No rounded cobble of cementstone (100x80mm).*						14.50 14.50 14.50 - 14.60	D1 D2 C1	13.00 14.50		100			
								14.50 16.00		100			
Soft to firm dark grey very silty sandy CLAY with occasional white shell fragments. Sand is fine to medium. (HARWICH FORMATION) LC		16.00	13.51					16.00 17.50		100			
From 17.97m to 18.20m bgl dark grey very silty fine to medium sand with abundant white shell fragments.								17.50 19.00		100			
Firm to stiff grey mottled greenish grey silty CLAY with occasional sand lenses. (HARWICH FORMATION) LC		19.30 19.50	10.21 10.01					19.00 20.50		33			
Assumed zone of core loss. CLAY (Drillers description).													

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH backfilled with bentonite.

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type

Hammer Information

Serial No.	Energy Ratio %

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	535015.29	Northing:	201390.92
Level:	29.51mAOD	Depth:	30.00m
Logger:	RN	Type:	CP+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH218**

Sheet 3 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	8.00	Cable Percussion	Dando 2000	SE Drilling	1.20	300	7.60	200	04/08	18:00	8.50	7.60	
8.00	30.00	Rotary Core		Endeavour	7.60	200							

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 14/08/2020
Finish Date: 18/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Assumed zone of core loss. CLAY (Drillers description).													
Dense light greenish grey silty fine to coarse SAND with abundant black carbonaceous material. (LAMBETH GROUP) LMBE		20.50	9.01										
Dense light greenish grey mottled orange very silty slightly gravelly fine to coarse SAND with rare black carbonaceous material. Gravel is rounded fine to coarse of flint. (LAMBETH GROUP) LMBE		20.85	8.66										
Assumed zone of core loss. SAND (Drillers description).		21.15	8.36					20.50 22.00		43			
Dense light grey mottled orange very silty fine to coarse SAND. (LAMBETH GROUP) LMBE		22.00	7.51										
Firm to stiff light greenish grey silty CLAY with occasional sand lenses. (LAMBETH GROUP) LMBE *From 22.30m to 22.42m bgl light grey silty fine to medium sand.* *From 23.20m to 23.30m bgl abundant black carbonaceous material.* *From 23.30m to 23.50m blg assumed zone of core loss.* *From 23.50m to 23.60m bgl abundant black carbonaceous material.* *From 24.05m to 24.20m bgl grey fine to medium sand.*		22.30	7.21					22.00 23.50		86			
Assumed zone of core loss. SAND (Drillers descriptions).		24.20	5.31					23.50 25.00		46			
Dense grey silty gravelly fine to coarse SAND. Gravel is rounded to well rounded fine to coarse flint. (LAMBETH GROUP) LMBE		25.00	4.51										
Assumed zone of core loss. SAND (Drillers description).		25.50	4.01					25.00 26.50		33			
Soft dark grey silty sandy CLAY. Sand is fine. (LAMBETH GROUP) LMBE		26.50	3.01										
Assumed zone of core loss. GRAVEL (Drillers description).		27.00	2.51					26.50 28.00		33			
Dense dark grey rounded to well rounded fine to coarse GRAVEL of flint. (LAMBETH GROUP) LMBE		28.00	1.51										
Assumed zone of core loss. GRAVEL (Drillers description).		28.40	1.11					28.00 29.50		26			
								29.50 30.00		0			
EOH at 30.00m - Target depth reached.		30.00	-0.49										

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH backfilled with bentonite.

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type

Hammer Information

Serial No.	Energy Ratio %

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534987.35	Northing:	201233.27
Level:	29.75mAOD	Depth:	10.95m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH219**

Sheet 1 of 2

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time					
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)	
0.00	10.95	Cable Percussion	CP		1.20	300								

Scale:	1:50
Checked By:	DP
Approved By:	RT
Start Date:	10/08/2020
Finish Date:	10/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Soft dark brown sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine subangular to subrounded flint. (TOPSOIL) MGR(TS)		0.30	29.45					
Medium dense light brown very silty sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR						0.50	B1	
Firm light orangish brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		1.50	28.25			1.50 - 2.00	B2	SPT(C) 1.50m, N=28 (4,5/5,7,7,9)
Medium dense dark orangish brown clayey sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		2.40	27.35			2.50 - 3.00	B3	SPT(C) 2.50m, 38 (7,10/38 for 225mm)
						3.50 - 4.00	B4	SPT(C) 3.50m, 50 (9,15/50 for 165mm)
Dense light brown sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		4.00	25.75			4.50 - 5.00	B5	SPT(C) 4.50m, 50 (6,9/50 for 220mm)
						6.00 - 6.50	B6	SPT(C) 6.00m, 50 (7,13/50 for 155mm)
						7.50 - 8.00	B7	SPT(C) 7.50m, 50 (8,16/50 for 151mm)
						9.00 - 9.50	B8	SPT(C) 9.00m, N=24 (3,2/3,5,7,9)
Firm dark brownish grey sandy CLAY. Sand is fine. (LONDON CLAY FORMATION) LC *From 9.60m bgl becoming dark grey.*		9.40	20.35			10.00 - 10.45	U1009	Ublows=36 Recovery=100%

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH backfilled with bentonite.

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP1	66

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534987.35	Northing:	201233.27
Level:	29.75mAOD	Depth:	10.95m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH219**

Sheet 2 of 2

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time					Scale:	1:50
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)	Checked By:	DP
0.00	10.95	Cable Percussion	CP		1.20	300								Approved By:	RT
														Start Date:	10/08/2020
														Finish Date:	10/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Firm dark brownish grey sandy CLAY. Sand is fine. (LONDON CLAY FORMATION) LC						10.50	D10	SPT(S) 10.50m, N=21 (2,3/4,5,5,7)
EOH at 10.95m - Target depth reached.		10.95	18.80					

11 12 13 14 15 16 17 18 19 20

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH backfilled with bentonite.

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP1	66

Groundwater						Project Number
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks	**A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534861.91	Northing:	201225.17
Level:	30.73mAOD	Depth:	25.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH220**

Sheet 1 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	25.00	Cable Percussion	CP	M. M	1.20	300	21.00	200	04/08	18:00	1.20	-	DRY
					21.00	200	25.00	150	05/08	18:00	11.00	9.00	7.60
					25.00	150			06/08	08:00	11.00	9.00	9.30
									06/08	18:00	21.00	20.00	DRY
									07/08	18:00	24.00	24.00	22.30
									10/08	18:00	25.00	25.00	

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 05/08/2020
Finish Date: 10/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Brown very clayey sandy slightly gravelly SILT. Occasional brick fragments and rootlets. Gravel is fine to coarse angular to sub-rounded of flint and chalk. (TOPSOIL) MGR(TS)		0.10	30.63			0.00 - 0.50 0.00 - 1.20 0.10 - 1.20	ES1 B1 D2	
Soft to firm brown very clayey sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse angular to sub-angular of flint. (ENFIELD SILT MEMBER) ESI								
Firm orangish brown slightly clayey sandy very gravelly SILT with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse sub-angular to rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		1.20	29.53			1.20 - 1.65 1.20 - 2.20	D3 B4	SPT(C) 1.20m, N=25 (2,4/4,6,7,8)
						2.20 - 2.65 2.20 - 3.20	D4 B5	SPT(S) 2.20m, N=16 (1,2/2,4,6,4)
						3.20 - 3.65 3.20 - 4.00	D6 B7	SPT(S) 3.20m, N=27 (3,3/6,6,7,8)
Medium dense to dense orangish brown slightly silty sandy GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse sub-angular to rounded of flint Cobbles are sub-angular to sub-rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		3.80	26.93			4.00 - 5.00	B8	SPT(C) 4.00m, N=19 (3,4/5,5,8,1)
						5.00 - 6.50	B9	SPT(C) 5.00m, N=42 (4,6/6,8,13,15)
						6.50 - 8.00	B10	SPT(C) 6.50m, N=21 (8,3/3,5,6,7)
						7.80 - 8.50	EW1	
						8.00 - 8.40 8.00 - 8.50	EW2 B11	SPT(C) 8.00m, N=23 (4,5/6,6,5,6)
Firm to very stiff grey silty CLAY. Occasional disseminated pyrite and occasional selenite crystals. Occasional thin partings of fine sand. (LONDON CLAY FORMATION) LC		8.50	22.23			8.50 - 8.95	U10012	Ublows=11 Recovery=80%
						8.90 - 9.10	D13	
						9.10 - 9.55	D14	SPT(S) 9.10m, N=21 (3,3/5,5,6,5)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 8.0m bgl (response zone 5-8m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
			3.80	8.50	AP1	66

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:
Location: **Waltham Cross**
Client: **ARUP**

Location Details			
Easting:	534861.91	Northing:	201225.17
Level:	30.73mAOD	Depth:	25.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH220**

Sheet 2 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	25.00	Cable Percussion	CP	M. M	1.20 21.00 25.00	300 200 150	21.00 25.00	200 150	04/08 05/08 06/08 06/08 07/08 10/08	18:00 18:00 08:00 18:00 18:00 18:00	1.20 11.00 11.00 21.00 24.00 25.00	- 9.00 9.00 20.00 24.00 25.00	DRY 7.60 9.30 DRY 22.30

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 05/08/2020
Finish Date: 10/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Firm to very stiff grey silty CLAY. Occasional disseminated pyrite and occasional selenite crystals. Occasional thin partings of fine sand. (LONDON CLAY FORMATION) LC						11.00 - 11.45	U10015	Ublows=16 Recovery=90%
						11.40 - 11.60	D16	
						11.60 - 12.05	D17	SPT(S) 11.60m, N=27 (4,4/6,6,7,8)
						13.50 - 13.95	U10018	Ublows=22 Recovery=100%
						13.90 - 14.10	D19	
						14.10 - 14.55	D20	SPT(S) 14.10m, N=21 (3,3/5,5,5,6)
From 16.50m to 17.00m bgl increase in partings of fine sand. Occasional bioturbation.						16.00 - 16.45	U10021	Ublows=11 Recovery=100%
						16.45 - 16.90	D22	SPT(S) 16.45m, 50 (5,7/50 for 246mm)
Stiff grey and light grey clayey very sandy SILT. Occasional shell fragments and bioturbation. Sand is fine and medium. (HARWICH FORMATION) LC		17.00	13.73			18.50 - 18.95	U10023	Ublows=14 Recovery=80%
From 19.00m to 20.00m bgl hard band (grey fine grained sandstone)						18.95 - 19.40	D24	SPT(S) 18.95m, N=50 (9,7/14,14,18,4)
		20.00	10.73			20.00 - 20.45	U10025	Ublows=30 Recovery=70%

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 8.0m bgl (response zone 5-8m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP1	66

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534861.91	Northing:	201225.17
Level:	30.73mAOD	Depth:	25.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH220**

Sheet 3 of 3

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	25.00	Cable Percussion	CP	M. M

Diameter	
Depth (m)	Diam (mm)
1.20	300
21.00	200
25.00	150

Casing	
Depth(m)	Diam (mm)
21.00	200
25.00	150

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
04/08	18:00	1.20	-	DRY
05/08	18:00	11.00	9.00	7.60
06/08	08:00	11.00	9.00	9.30
06/08	18:00	21.00	20.00	DRY
07/08	18:00	24.00	24.00	22.30
10/08	18:00	25.00	25.00	

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 05/08/2020
Finish Date: 10/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Very stiff light greyish green mottled with reddish brown slightly silty CLAY. (LAMBETH GROUP - POSSIBLY READING FORMATION) LMBE						20.60 - 21.05	D26	SPT(S) 20.60m, 50 (6,9/50 for 225mm)
						22.00 - 23.00	B30	
Very dense light greenish grey silty very clayey fine and medium SAND. (LAMBETH GROUP) LMBE		22.30	8.43			22.50 - 22.90	U10027	Ublows=11 Recovery=70%
						22.90 - 23.10	D28	
						23.10 - 23.55	D29	SPT(S) 23.10m, N=50 (6,7/14,13,18,5)
						24.00 - 25.00	B31	SPT(C) 24.00m, N=50 (9,8/10,14,16,10)
EOH at 25.00m - Target depth reached.		25.00	5.73			25.00 - 25.45	D32	SPT(S) 25.00m, 50 (10,15/50 for 256mm)

21 22 23 24 25 26 27 28 29 30

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 8.0m bgl (response zone 5-8m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP1	66

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534930.79	Northing:	201223.91
Level:	30.15mAOD	Depth:	20.40m
Logger:	DP	Type:	CP
		Inclination:	0°

Status: FINAL

Borehole Number: **BH221**

Sheet 1 of 3

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	20.40	Cable Percussion	CP	M. M

Diameter	
Depth (m)	Diam (mm)
1.20	300
9.60	200
18.00	150

Casing	
Depth(m)	Diam (mm)
9.60	200
18.00	150

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
10/08	18:00	1.20	-	DRY
11/08	18:00	8.00	8.00	5.30
12/08	18:00	18.00	9.50	DRY
13/08	08:00	14.50	9.50	10.30
13/08	18:00	19.50	18.70	
14/08	18:00	20.50	18.00	

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 10/08/2020
Finish Date: 14/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Soft light brown clayey sandy gravelly SILT. Sand is fine. Gravel is fine and medium elongated sub-angular to sub-rounded of flint and chalk. (TOPSOIL) MGR(TS)		0.20	29.95			0.00 - 0.20 0.10 - 1.20 0.20 - 1.20	ES1 B2 ES3	
MADE GROUND: Firm light brown silty sandy very gravelly CLAY. Sand is fine to coarse. Gravel is fine and medium sub-angular to rounded of flint. (MADE GROUND) MGR								
Medium Dense light brown slightly silty sandy GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to rounded Cobbles are sub-rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		1.20	28.95			1.20 - 2.00	B4	SPT(C) 1.20m, N=36 (5,9/8,8,10,10)
Stiff orangish brown sandy very gravelly CLAY. Sand is fine to coarse. Gravel is fine and medium sub-angular to rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR *From 2.00m to 2.70m bgl becoming very clayey GRAVEL.*		2.00	28.15			2.00 - 2.45 2.00 - 3.00	D5 B6	SPT(S) 2.00m, N=29 (4,5/6,7,7,9)
Medium dense orangish brown slightly clayey very sandy GRAVEL. Sand is fine to coarse. Gravel is fine and medium angular to rounded of flint (KEMPTON PARK GRAVEL MEMBER) KPGR		3.00	27.15			3.00 - 4.00	B7	SPT(C) 3.00m, N=45 (7,8/11,12,11,11)
						4.00 - 5.00	B9	SPT(C) 4.00m, N=26 (5,6/7,6,6,7)
						5.00 - 6.50	B11	SPT(C) 5.00m, N=14 (1,3/3,4,3,4)
						6.50 - 8.00	B13	SPT(C) 6.50m, N=37 (4,6/6,8,11,12)
From 8.00m to 9.50m bgl occasional flint cobbles.						8.00 - 9.50	B15	SPT(C) 8.00m, N=31 (2,3/6,8,8,9)
Firm dark grey occasionally brown slightly sandy slightly gravelly CLAY. Sand is fine and medium. Gravel is fine and medium sub-angular to sub-rounded of flint. (LONDON CLAY FORMATION)		9.50	20.65			9.50 - 9.90	U10016	Ublows=17 Recovery=100%
						9.90 - 10.10	D17	

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe with piezo tip to 16.5m bgl.

Chiselling		
From (m)	To (m)	Time (mins)

Water Added	
From (m)	To (m)
3.00	8.00

Hammer Information	
Serial No.	Energy Ratio %
AP1	66

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534930.79	Northing:	201223.91
Level:	30.15mAOD	Depth:	20.40m
Logger:	DP	Type:	CP
		Inclination:	0°

Status: FINAL

Borehole Number: **BH221**

Sheet 2 of 3

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	20.40	Cable Percussion	CP	M. M

Diameter	
Depth (m)	Diam (mm)
1.20	300
9.60	200
18.00	150

Casing	
Depth(m)	Diam (mm)
9.60	200
18.00	150

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
10/08	18:00	1.20	-	DRY
11/08	18:00	8.00	8.00	5.30
12/08	18:00	18.00	9.50	DRY
13/08	08:00	14.50	9.50	10.30
13/08	18:00	19.50	18.70	
14/08	18:00	20.50	18.00	

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 10/08/2020
Finish Date: 14/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Firm dark grey occasionally brown slightly sandy slightly gravelly CLAY. Sand is fine and medium. Gravel is fine and medium sub-angular to sub-rounded of flint. (LONDON CLAY FORMATION) LC						10.10 - 10.55	D18	SPT(S) 10.10m, N=19 (2,4/3,5,5,6)
						12.00 - 12.40	U10019	Ublows=16 Recovery=100%
						12.40 - 12.60	D20	
						12.60 - 13.05	D21	SPT(S) 12.60m, N=25 (2,5/5,6,7,7)
						14.50 - 14.90	U10023	Ublows=18 Recovery=100%
						14.90 - 15.10	D24	
						15.10 - 15.55	D25	SPT(S) 15.10m, N=31 (8,7/7,8,7,9)
						17.00 - 17.40	U10026	Ublows=25 Recovery=100%
Very stiff dark brownish green silty slightly sandy gravelly CLAY. Gravel is fine sub-angular of flint. (HARWICH FORMATION) LC		17.40	12.75			17.40 - 17.60	D27	
								SPT(C) 17.60m, N=50 (10,15/25,18,7,0)
						18.00 - 18.40	B30	Ublows=80 Recovery=0%
						18.00 - 18.40	U-NR29	
From 18.40m to 18.75m bgl shell fragments.						18.40 - 18.75	D31	SPT(S) 18.40m, N=50 (10,12/12,16,16,6)
Medium dense light grey mottled with brown slightly clayey silty fine to coarse SAND. (LAMBETH GROUP) LMBE		19.50	10.65			19.50	B33	Ublows=50 Recovery=0%
						19.50 - 19.90	U-NR32	
						20.00 - 20.45	D34	SPT(S) 20.00m, N=50 (7,7/9,10,19,12)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe with piezo tip to 16.5m bgl.

Chiselling		
From (m)	To (m)	Time (mins)
18.00	18.00	60

Water Added	
From (m)	To (m)

Hammer Information	
Serial No.	Energy Ratio %
AP1	66

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks
13.00	10	14	20	12.10	Seep

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534930.79	Northing:	201223.91
Level:	30.15mAOD	Depth:	20.40m
Logger:	DP	Type:	CP
		Inclination:	0°

Status: FINAL

Borehole Number: **BH221**

Sheet 3 of 3

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	20.40	Cable Percussion	CP	M. M

Diameter	
Depth (m)	Diam (mm)
1.20	300
9.60	200
18.00	150

Casing	
Depth(m)	Diam (mm)
9.60	200
18.00	150

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
10/08	18:00	1.20	-	DRY
11/08	18:00	8.00	8.00	5.30
12/08	18:00	18.00	9.50	DRY
13/08	08:00	14.50	9.50	10.30
13/08	18:00	19.50	18.70	
14/08	18:00	20.50	18.00	

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 10/08/2020
Finish Date: 14/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Medium dense light grey mottled with brown slightly clayey silty fine to coarse SAND. (LAMBETH GROUP) LMBE								
From 19.50m to 20.40m bgl organic material observed.		20.40	9.75					
EOH at 20.40m - Terminated on hard ground.								

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe with piezo tip to 16.5m bgl.

Chiselling		
From (m)	To (m)	Time (mins)

Water Added	
From (m)	To (m)

Hammer Information	
Serial No.	Energy Ratio %
AP1	66

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534842.76	Northing:	201176.00
Level:	30.58mAOD	Depth:	25.00m
Logger:	EH	Type:	CP
Inclination: 90°			

Status: FINAL

Borehole Number: **BH222**

Sheet 1 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time					Scale:	1:50
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)	Checked By:	DP
0.00	25.00	Cable Percussion	CP	M. M	1.20 17.00 25.00	300 200 150	7.00 25.00	200 150	17/08 18/08 19/08	18:00 18:00 18:00	6.00 16.00 20.50	6.00 9.00 20.50	4.80 DRY DRY	Approved By:	RT
														Start Date:	17/08/2020
														Finish Date:	20/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Grass over soft orangish brown silty sandy very gravelly CLAY. Gravel is fine to coarse angular to rounded of flint. Sand is fine to coarse. Occasional flint cobbles. Frequent rootlets. (TOPSOIL) MGR(TS)						0.00 - 0.50 0.00 - 1.20	ES1 B2	
Medium dense to dense orangish brown very clayey silty sandy GRAVEL with moderate flint cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		1.20	29.38			1.20 - 2.20	B3	SPT(C) 1.20m, N=33 (8,8/9,8,7,9)
						2.20 - 3.20	B4	SPT(C) 2.20m, N=26 (4,6/6,6,8,6)
From 3.20m to 3.50m bgl silty sandy clay lense.						3.20 - 3.65 3.20 - 4.00	D5 B6	SPT(S) 3.20m, N=16 (1,1/2,3,3,8)
Medium dense orangish brown slightly silty sandy GRAVEL with high flint cobble content. Sand is fine to coarse. Gravel is fine to coarse subangular to rounded of flint and chert. (KEMPTON PARK GRAVEL FORMATION) KPGR		3.60	26.98			4.00 - 5.00	B7	SPT(C) 4.00m, N=27 (4,5/6,6,7,8)
						5.00 - 6.50	B8	SPT(C) 5.00m, N=27 (5,6/8,7,6,6)
Medium dense orangish brown sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse subangular to rounded of flint and chert. (KEMPTON PARK GRAVEL MEMBER) KPGR		6.50	24.08			6.50 - 8.00	B9	SPT(C) 6.50m, N=23 (4,3/4,6,5,8)
						8.00 - 9.00	B10	SPT(C) 8.00m, N=13 (3,3/2,3,4,4)
Firm to stiff grey silty CLAY. (LONDON CLAY FORMATION) LC		9.00	21.58			9.00 - 9.45	U10011	Ublows=16 Recovery=100%
						9.60 - 10.05	D12	SPT(S) 9.60m, N=15 (2,2/3,3,4,5)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 22.0m bgl (response zone 21-22m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
			4.00 6.00	6.00 9.00	AP1	66

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534842.76	Northing:	201176.00
Level:	30.58mAOD	Depth:	25.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH222**

Sheet 2 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	25.00	Cable Percussion	CP	M. M	1.20 17.00 25.00	300 200 150	7.00 25.00	200 150	17/08 18/08 19/08	18:00 18:00 18:00	6.00 16.00 20.50	6.00 9.00 20.50	4.80 DRY DRY

Scale:	1:50
Checked By:	DP
Approved By:	RT
Start Date:	17/08/2020
Finish Date:	20/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Firm to stiff grey silty CLAY. (LONDON CLAY FORMATION) LC						11.50 - 11.90	U10013	Ublows=17 Recovery=90%
						11.90 - 12.10	D14	
						12.20 - 12.55	D15	SPT(S) 12.10m, N=23 (2,4/6,6,5,6)
						14.00 - 14.40	U10016	Ublows=15 Recovery=100%
						14.40 - 14.60	D17	
						14.60 - 15.05	D18	SPT(S) 14.60m, N=37 (5,6/8,8,10,11)
						16.00 - 16.40	U10018	Ublows=27 Recovery=100%
						16.60 - 17.05	D20	SPT(S) 16.60m, N=34 (4,6/6,8,10,10)
Very dense grey mottled green clayey very silty fine and medium SAND. Occasional glauconite, shell fragments, organics, and bioturbation. (HARWICH FORMATION) LC		17.50	13.08			17.50 - 17.95 17.50 - 19.00	D21 B22	SPT(S) 17.50m, 50 (5,8/50 for 266mm)
Firm to stiff red mottled greenish grey and yellow silty very sandy CLAY. Sand is fine and medium. (LAMBETH GROUP - POSSIBLY READING FORMATION) LMBE		19.00	11.58			19.00 - 19.40 19.00 - 20.05	U10023 B25	Ublows=30 Recovery=70%
						19.60 - 20.05	D24	SPT(S) 19.60m, N=40 (4,7/8,11,11,10)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 22.0m bgl (response zone 21-22m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					AP1	66

Groundwater						
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks	

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534842.76	Northing:	201176.00
Level:	30.58mAOD	Depth:	25.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH222**

Sheet 3 of 3

Method, Plant and Crew				
From (m)	To (m)	Type	Plant Used	Crew
0.00	25.00	Cable Percussion	CP	M. M

Diameter	
Depth (m)	Diam (mm)
1.20	300
17.00	200
25.00	150

Casing	
Depth(m)	Diam (mm)
7.00	200
25.00	150

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
17/08	18:00	6.00	6.00	4.80
18/08	18:00	16.00	9.00	DRY
19/08	18:00	20.50	20.50	DRY

Scale:	1:50
Checked By:	DP
Approved By:	RT
Start Date:	17/08/2020
Finish Date:	20/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Firm to stiff red mottled greenish grey and yellow silty very sandy CLAY. Sand is fine and medium. (LAMBETH GROUP - POSSIBLY READING FORMATION) LMBE								
Dense light greyish green mottled yellow brown silty very clayey fine to coarse SAND. (LAMBETH GROUP - POSSIBLY READING FORMATION) LMBE		20.90	9.68			21.00 - 21.45 21.00 - 23.00	D26 B27	SPT(S) 21.00m, 37 (6,7/37 for 262mm)
Very dense grey silty very clayey fine to coarse SAND. (LAMBETH GROUP) LMBE		23.00	7.58			23.00 - 23.45 23.00 - 25.00	D28 B29	SPT(S) 23.00m, 50 (8,10/50 for 225mm)
EOH at 25.00m - Target depth reached.		25.00	5.58			25.00 - 25.45	D30	SPT(S) 25.00m, 50 (25 for 75mm/50 for 192mm)

21 22 23 24 25 26 27 28 29 30

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 22.0m bgl (response zone 21-22m).

Chiselling		
From (m)	To (m)	Time (mins)

Water Added	
From (m)	To (m)

Hammer Information	
Serial No.	Energy Ratio %
AP1	66

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534909.80	Northing:	201156.49
Level:	30.07mAOD	Depth:	25.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH223**

Sheet 1 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time					
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)	
0.00	25.00	Cable Percussion	CP	SE Drilling	1.20 25.00	300 200	25.00	200						

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 11/08/2020
Finish Date: 13/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Brown sandy very gravelly clayey SILT. Occasional brick fragments. Sand is fine to coarse. Gravel is fine to coarse angular to sub-rounded of flint and chalk. (TOPSOIL) MGR(TS)		0.20	29.87			0.00 - 0.50 0.00 - 0.50	B2 ES1	
Firm yellowish brown clayey sandy very gravelly SILT with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse sub-angular to rounded of flint. Cobbles are sub-rounded to rounded of flint. (ENFIELD SILT MEMBER) ESI						1.00 - 2.00	B3	SPT(C) 1.50m, 32 (7,9/32 for 55mm)
						2.50 - 3.00	B4	SPT(C) 2.50m, N=29 (4,5/5,7,9,8)
Medium dense orangish brown very clayey sandy GRAVEL with low cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to sub-rounded of flint Cobbles are sub-rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		3.00	27.07			3.50 - 4.00	B5	SPT(C) 3.50m, N=19 (4,5/4,4,5,6)
Soft to firm orangish brown silty sandy CLAY. Occasional dark pockets of ash and organics. Sand is fine to coarse. (KEMPTON PARK GRAVEL MEMBER) KPGR		4.20	25.87			4.50 - 4.95 4.50 - 5.00	D6 B7	SPT(S) 4.50m, N=25 (1,3/3,6,8,8)
Medium dense orangish brown slightly silty sandy GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to rounded of flint Cobbles are sub-rounded of flint. (KEMPTON PARK GRAVEL MEMBER) KPGR		5.20	24.87			6.00 - 6.45	D8	SPT(S) 6.00m, N=27 (3,3/6,7,6,8)
						7.50 - 8.00 7.50 - 8.00	B9 D9	SPT(C) 7.50m, N=26 (3,4/5,5,8,8)
						7.80 - 8.00 7.80 - 8.50	EW2 EW1	
Firm to very stiff grey silty CLAY. Occasional selenite crystal and occasional partings of fine sand. (LONDON CLAY FORMATION) LC		8.60	21.47			9.00 - 9.45	U10010	Ublows=30 Recovery=100%
						9.50 9.50 - 9.95	D11 D12	SPT(S) 9.50m, N=21 (3,3/5,4,5,7)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 8.1m bgl (response zone 6-8.1m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					SED58	60

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534909.80	Northing:	201156.49
Level:	30.07mAOD	Depth:	25.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH223**

Sheet 2 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	25.00	Cable Percussion	CP	SE Drilling	1.20 25.00	300 200	25.00	200					

Scale:	1:50
Checked By:	DP
Approved By:	RT
Start Date:	11/08/2020
Finish Date:	13/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Firm to very stiff grey silty CLAY. Occasional selenite crystal and occasional partings of fine sand. (LONDON CLAY FORMATION) LC						11.50 - 12.00	U10013	Ublows=35 Recovery=100%
						12.00 12.00 - 12.45	D14 D15	SPT(S) 12.00m, N=25 (2,2/5,6,6,8)
						14.00 - 14.50	U10016	Ublows=50 Recovery=100%
						14.50 14.50 - 14.95	D17 D18	SPT(S) 14.50m, N=29 (5,4/7,7,6,9)
						16.50 - 16.95	U10019	Ublows=85 Recovery=100%
Very dense grey very sandy clayey SILT. Sand is fine to coarse. (HARWICH FORMATION) LC *From 18.00m to 19.30m bgl occasional shell fragments.*		17.00	13.07			17.00 - 17.45	D20	SPT(S) 17.00m, 50 (6,10/50 for 220mm)
						19.00 - 19.45	U10021	Ublows=100 Recovery=100%
Stiff to very stiff light grey mottled with light green and red slightly sandy silty CLAY. Sand is fine. (LAMBETH GROUP - POSSIBLY READING FORMATION) LMBE		19.30	10.77			19.50 - 19.95	D22	SPT(S) 19.50m, 50 (6,15/50 for 215mm)

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 8.1m bgl (response zone 6-8.1m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					SED58	60

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Project:

Location: **Waltham Cross**

Client: **ARUP**

Location Details			
Easting:	534909.80	Northing:	201156.49
Level:	30.07mAOD	Depth:	25.00m
Logger:	EH	Type:	CP
		Inclination:	90°

Status: FINAL

Borehole Number: **BH223**

Sheet 3 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time					
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)	
0.00	25.00	Cable Percussion	CP	SE Drilling	1.20 25.00	300 200	25.00	200						

Scale: 1:50
Checked By: DP
Approved By: RT
Start Date: 11/08/2020
Finish Date: 13/08/2020

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Stiff to very stiff light grey mottled with light green and red slightly sandy silty CLAY. Sand is fine. (LAMBETH GROUP - POSSIBLY READING FORMATION) LMBE						21.50 - 22.00	U10023	Ublows=80 Recovery=100%
						22.00 - 22.45	D24	SPT(S) 22.00m, 50 (6,13/50 for 160mm)
Grey clayey sandy SILT. Occasional shell fragments. Sand is fine and medium. (LAMBETH GROUP - POSSIBLY WOOLWICH FORMATION) LMBE		22.50	7.57			23.50 - 24.00	U10025	Ublows=95 Recovery=100%
						24.00 - 24.45	D26	SPT(S) 24.00m, 50 (3,8/50 for 233mm)
EOH at 25.00m - Target depth reached		25.00	5.07					

21 22 23 24 25 26 27 28 29 30

Observations / Remarks

1. Inspection pit hand dug to to 1.2m bgl.
2. No groundwater strikes noted during drilling.
3. On completion BH installed with single installation of 50mm pipe to 8.1m bgl (response zone 6-8.1m).

Chiselling			Water Added		Hammer Information	
From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
					SED58	60

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **A117846**

Appendix C2 Trial Pit Logs