APPENDIX A

Engineer's Borehole Logs

BH01

BH01	**Excavation type and method:** Borehole/Window Sampler	**Client: Charles Edward Limited**
Job Number:	**Project: 1 Ellerdale Road, Hampstead**	**Co-ordinates: NA**
Driller: R Davies	**Engineer: J Melville**	**Date: 02/09/2015**

Surface (m OD): NA

Depth (m BGL)	Description	Samples	Water
0.0 – 0.2	Dark brown slightly sandy SILT. Sand is fine (MADE GROUND).	0.0 - 0.2	
0.2 – 1.2	Brown silty fine SAND with occassional fine to medium, sub angular to sub rounded flint gravels, red brick fragments and stones of mixed lithology (MADE GROUND).	0.2 - 1.2	DRY
1.2 – 2.2	Very loose brown slightly silty fine SAND with occassional medium sand and fine rounded flint gravel pockets (up to 0.2 x 0.2m) (CLAYGATE MEMBER)	1.2 - 2.2	
2.2 – 2.4	Firm brown sandy SILT with occassional pockets of black organic material (up to 0.5 x 0.5m) (CLAYGATE MEMBER)	2.2 - 2.4	
2.4 – 3.8	Firm brown / grey slightly gravelly sandy SILT. Sand is fine. Gravel is fine to medium, angular to rounded, predominantly flint (CLAYGATE MEMBER).	2.4 - 3.8	
3.8 – 4.8	Firm becoming stiff orange brown mottled grey CLAY with fine to medium angular to rounded flint gravels (CLAYGATE MEMBER)	3.8 - 4.8	

End of Borehole: 4.80 m bgl - Refusal

BH02	**Excavation type and method:** Borehole/Window Sampler	Client: Charles Edward Limited
Job Number:	**Project: 1 Ellerdale Road, Hampstead**	**Co-ordinates: NA**
Driller: R Davies	**Engineer: J Melville**	**Date: 02/09/2015**

Surface (m OD): NA

Depth (m BGL)	Description	Samples	Water
0.0 – 0.3	Dark brown slightly sandy SILT. Sand is fine (MADE GROUND).	0.0 - 0.3	
0.3 – 1.6	Loose brown slightly silty fine SAND with occassional medium sand and fine rounded flint gravel pockets (up to 0.2 x 0.2m) (CLAYGATE MEMBER)	0.3 - 1.6	DRY
1.6 – 2.1	Firm to stiff brown fine sandy SILT with occassional pockets of black organic material (up to 0.5 x 0.5m) and occassional rootlets (up to 0.05 x 0.1m) (CLAYGATE MEMBER)	1.6 - 2.1	
2.1 – 2.7	Hard becoming v stiff brown / grey slightly gravelly sandy SILT. Sand is fine. Gravel is fine to medium, angular to rounded, predominantly flint (CLAYGATE MEMBER)	2.1 - 2.7	
2.7 – 3.7	Firm to stiff orange brown mottled grey CLAY with fine to medium angular to rounded flint gravels (CLAYGATE MEMBER)	2.7 - 3.7	
3.7 – 5.0	Medium dense orange brown silty fine SAND (CLAYGATE MEMBER)	3.7 - 5.0	

End of Borehole: 5.00 m bgl - Complete

APPENDIX B

Laboratory Results

Summary of Chemical Analysis
Soil Samples

Our Ref 15-44446
Client Ref
Contract Title 1 ELLERDALE RD

			Lab No	863287	863288	863289	863290	863291	863292	863293	863294	863295	863296	863297	863298
			Sample ID	BH01	BH01	BH01	BH01	BH01	BH01	BH02	BH02	BH02	BH02	BH02	BH02
			Depth	0.20	0.20-1.20	1.20-2.20	2.20-2.40	2.40-3.80	3.80-4.80	0.30	0.30-1.60	1.60-2.10	2.10-2.70	2.70	3.70-5.00
			Other ID												
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	02/09/15	02/09/15	02/09/15	02/09/15	02/09/15	02/09/15	02/09/15	02/09/15	02/09/15	02/09/15	02/09/15	02/09/15
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**												
Inorganics															
pH	DETSC 2008#			7.7	7.8	7.8	7.2	7.3	6.9	7.5	7.8	7.2	7.5	7.2	7.2
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	290	1500	2100	1000	580	320	52	25	22	36	< 10	14

IAN FARMER ASSOCIATES

Laboratory Test Report - 16699

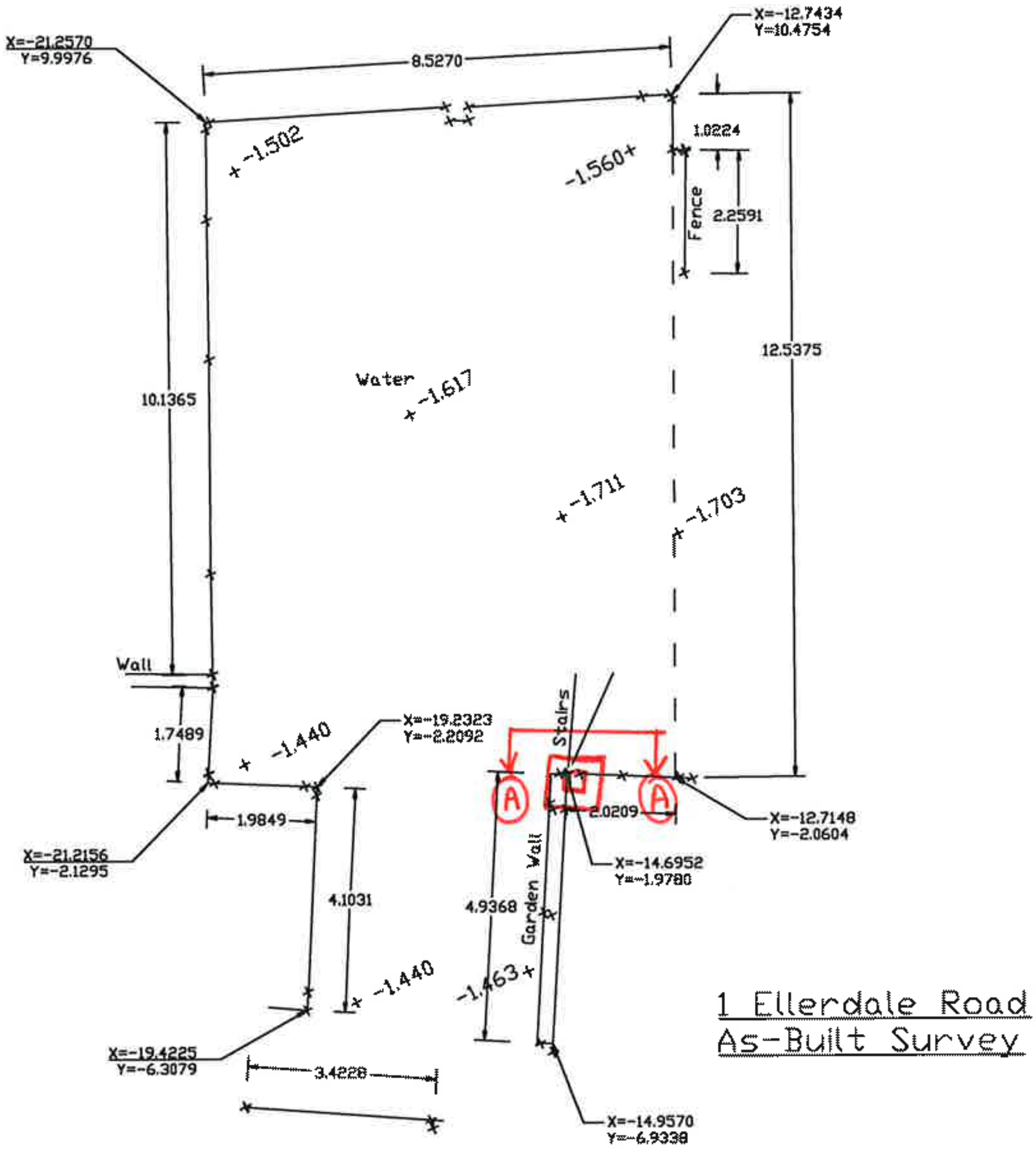
Site	: Ellerdale Road	Job Number	16699
Client	: Soil Environmental Services Limited	Page	2 / 3

DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY AND LIQUIDITY INDEX

Borehole/ Trial Pit	Depth (m)	Sample	Natural / Sieved	Natural Moisture Content %	Sample Passing 425μm Sieve		Liquid Limit %	Plastic Limit %	Plasticity Index %	Liquidity Index	Class	Description / Remarks
					Percentage %	Moisture Content %						
M9054/1	1.20	BH1	Sieved	18	81	22		NP				Brown silty SAND
M9054/2	2.40	BH1	Sieved	22	74	28	45	22	23	0.26	CI	Brown gravelly sandy CLAY
M9054/3	3.80	BH1	Natural	17	61	25	43	18	25	0.28	CI	Brown gravelly sandy CLAY
M9054/4	0.30	BH2	Sieved	18	69	24		NP				Brown silty SAND
M9054/5	1.60	BH2	Natural	22	80	27	31	20	11	0.64	CL	Brown gravelly sandy CLAY
M9054/6	2.10	BH2	Natural	16	67	22	28	18	10	0.40	CL	Brown gravelly sandy CLAY
M9054/7	2.70	BH2	Natural	18	98	18	32	18	14	0.00	CL	Brown slightly silty CLAY
M9054/8	3.70	BH2	Natural	21	99	21	33	22	11	-0.09	CL	Brown slightly silty CLAY

Method of Preparation : BS 1377:PART 1:1990:7.4 Preparation of samples for classification tests BS 1377:PART 2:1990:4.2 & 5.2 Sample preparations

Method of Test : BS 1377:PART 2:1990:3.2 Determination of moisture content 4.3 Determination of the liquid limit 5.3 Determination of the plastic limit and plasticity index

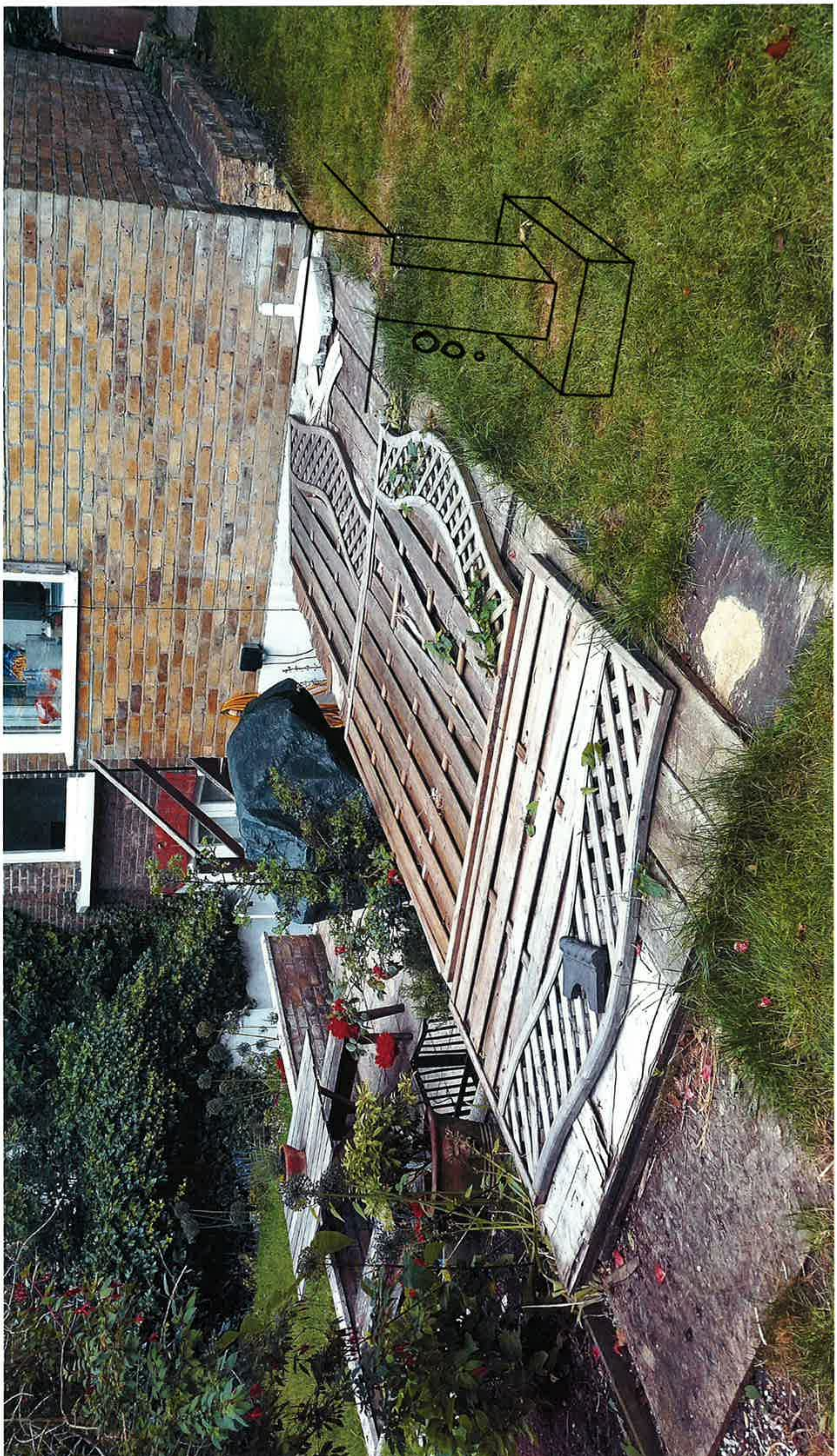


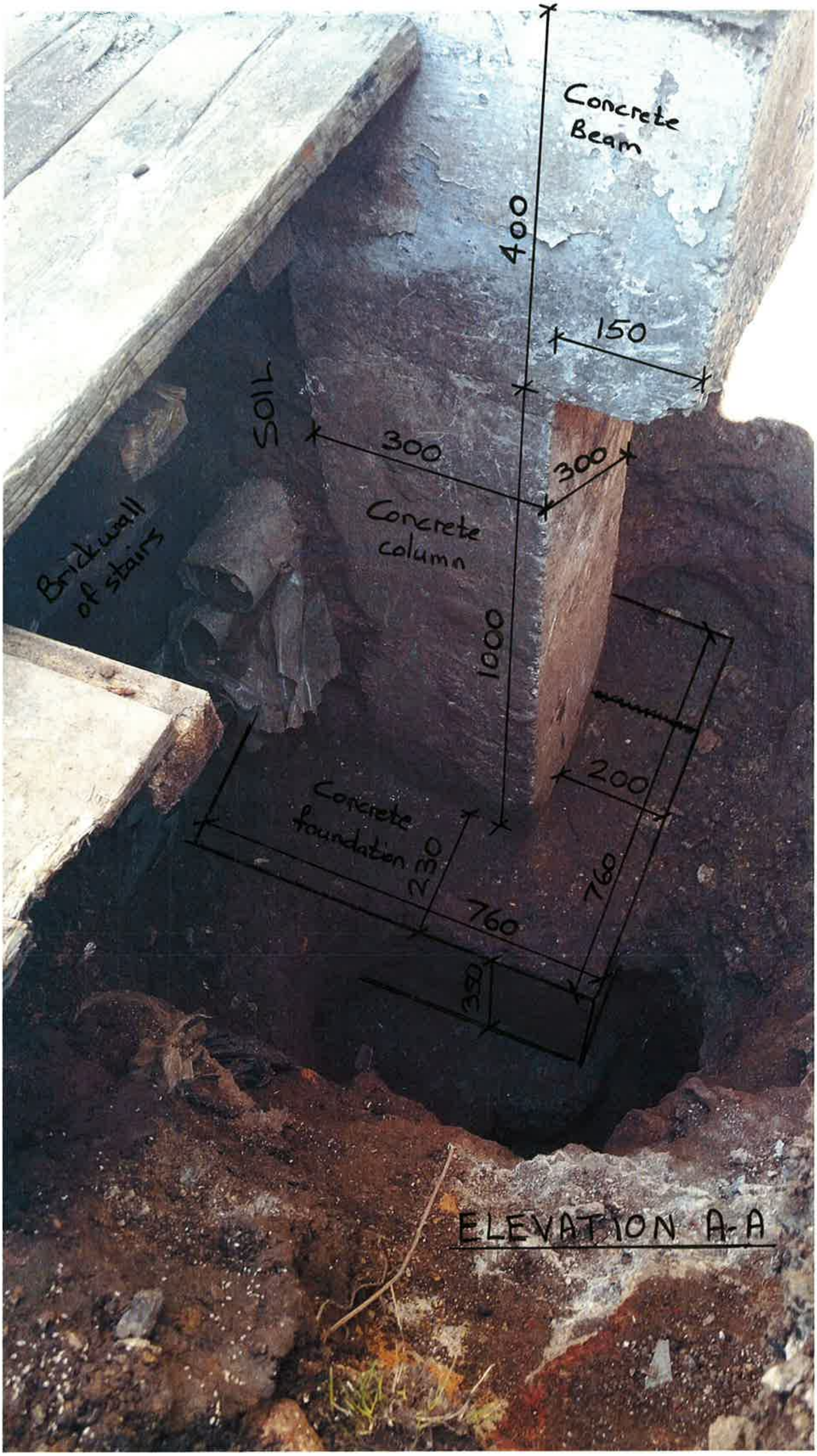
Trial Pit Investigation

of corner of exisisting

house extension.

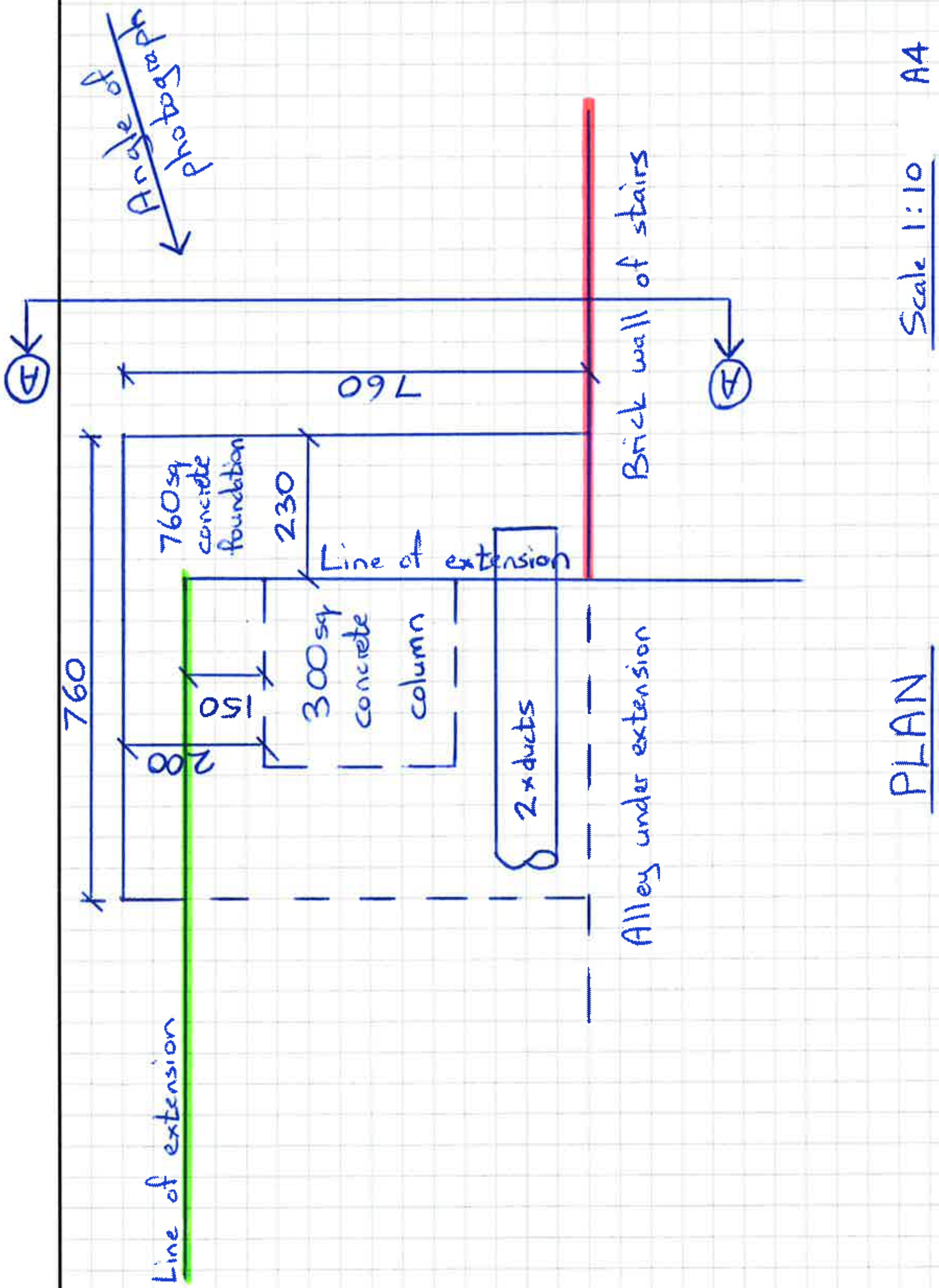
17 | 08 | 15




Concrete Beam
400
150
SOIL
300
300
Concrete column
Brickwall of stairs
1000
200
Concrete foundation
230
760
760
350
ELEVATION A-A

BYRNE BROS	Project: 1 Ellerdale Rd			Sheet No: 1 of 2
	Job No.	Prep by: S. H	Check by	Date: 17/08/15

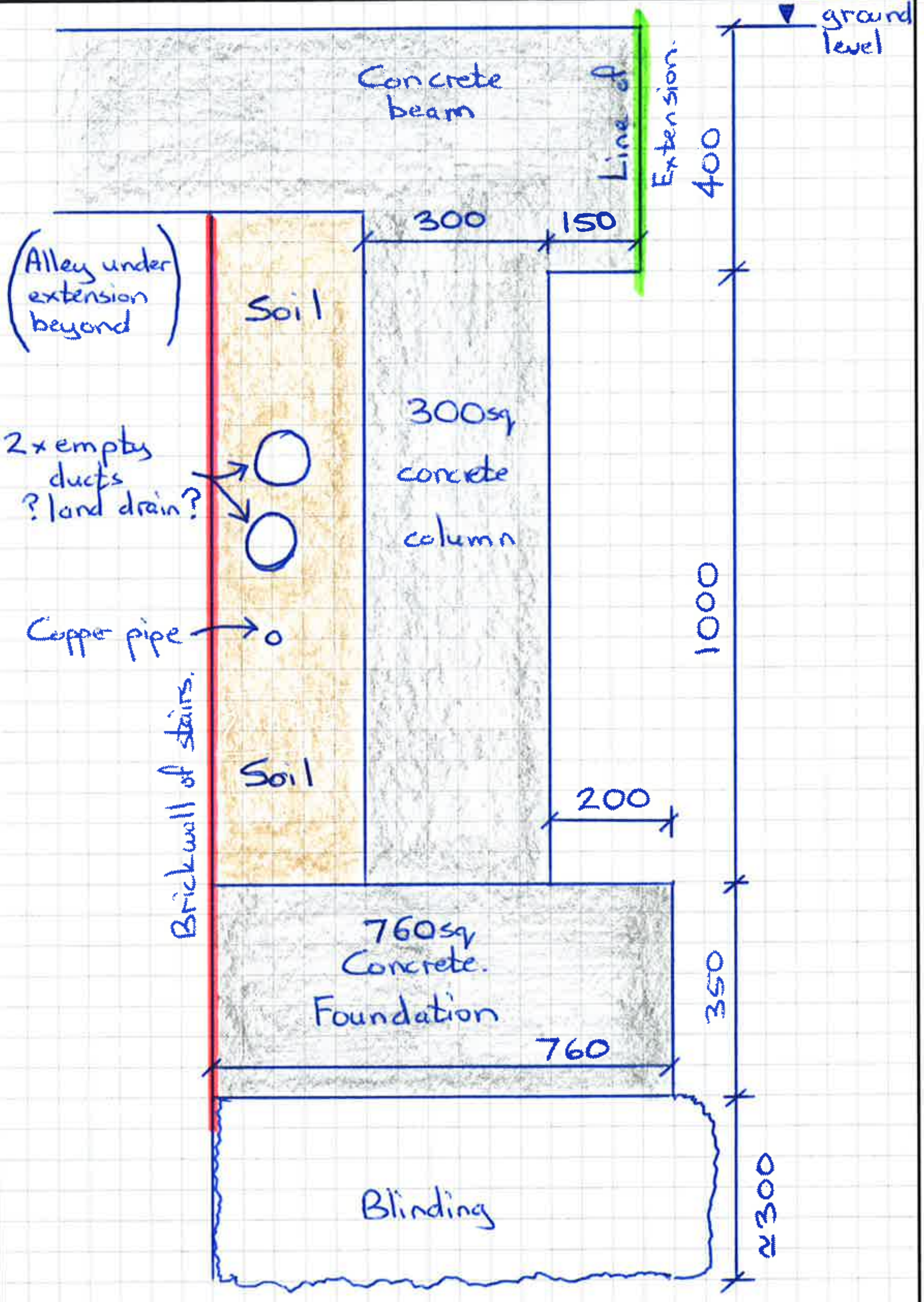
Element / Description: As-Built of Existing Extension - Plan.

REF.	CALCULATIONS	OUTPUT
		

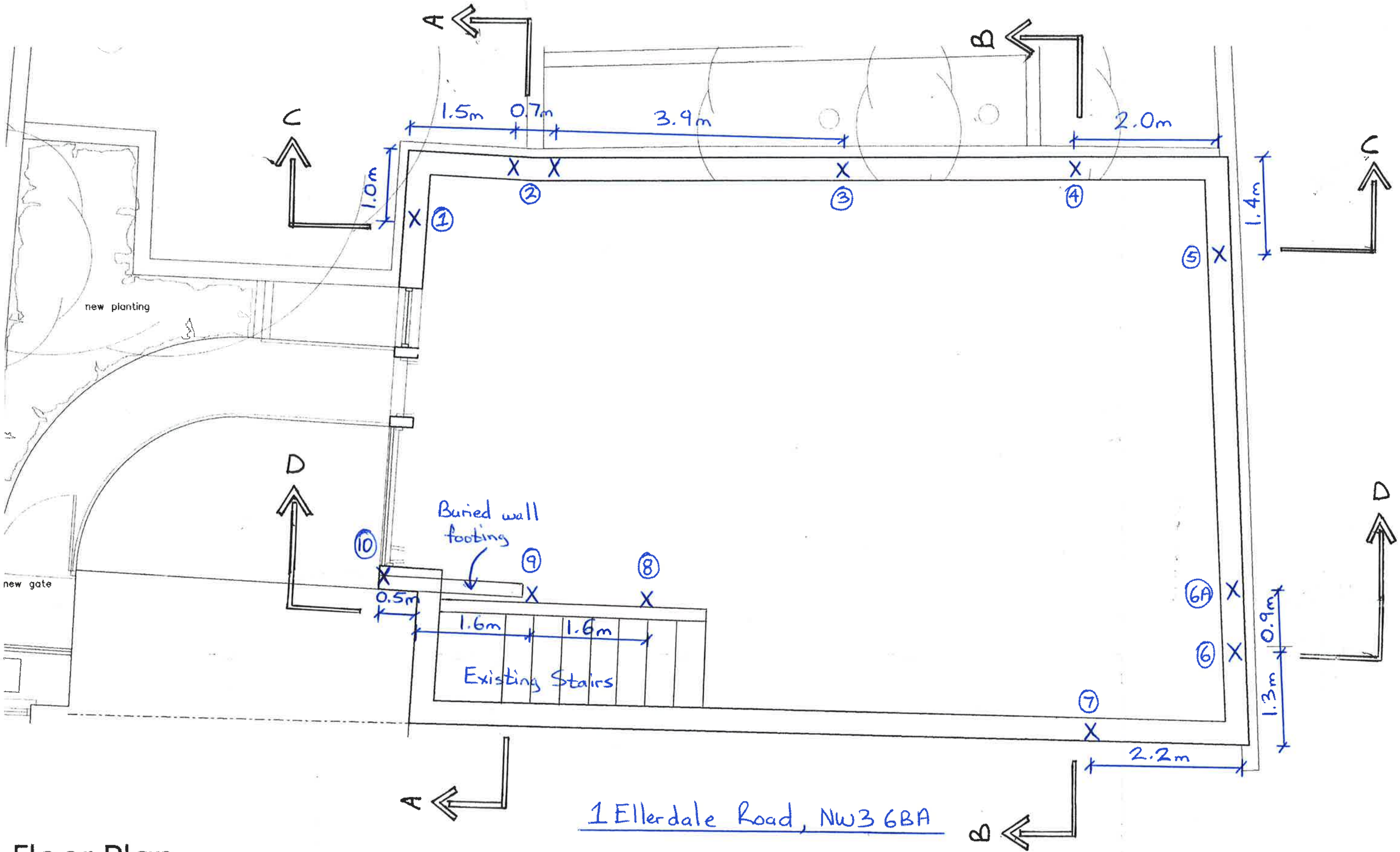
BYRNE BROS	Project: 1 Ellerdale Rd			Sheet No: 2 of 2
	Job No.	Prep by: S.H	Check by	Date: 17/08/15

Element / Description: As-Built of Existing Extension - Elevation

REF.	CALCULATIONS	OUTPUT



ELEVATION A-A



Floor Plan

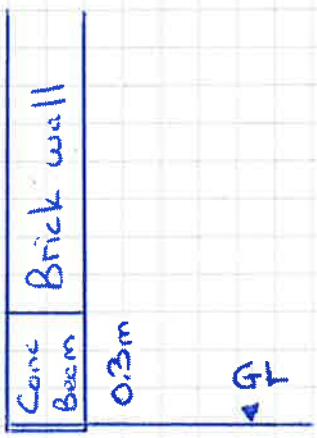
1 Ellerdale Road, NW3 6BA

Trial Pit Locations

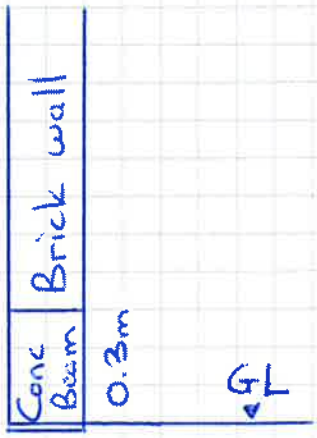
Scale ≈1:50

BYRNE BROS	Project: 1 Ellerdale Rd			Sheet No: 1 of 2
	Job No.	Prep by: SH	Check by	Date: 30/06/15
Element / Description: Trial Pit Foundation Survey				

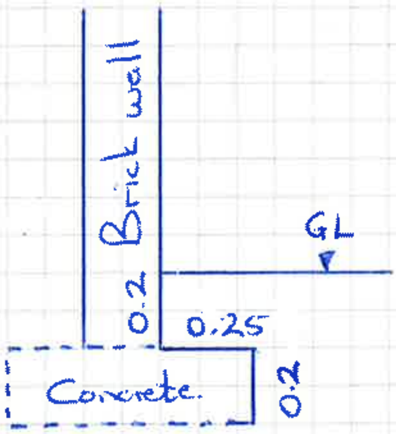
REF.	CALCULATIONS	OUTPUT



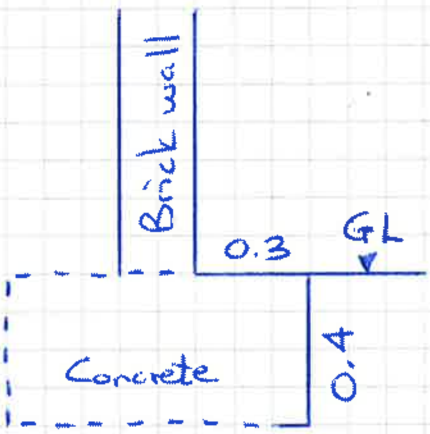
Pit 1



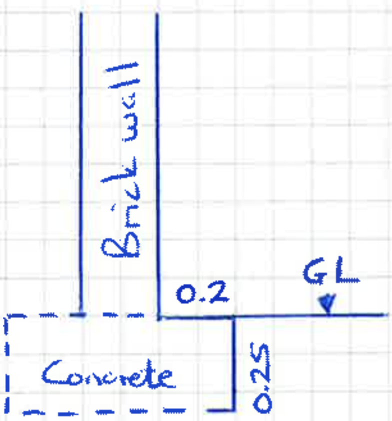
Pit 2A



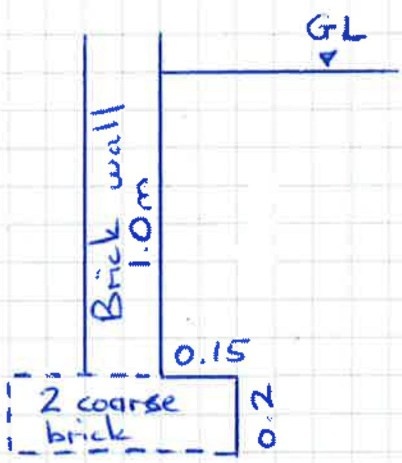
Pit 2B



Pit 3



Pit 4



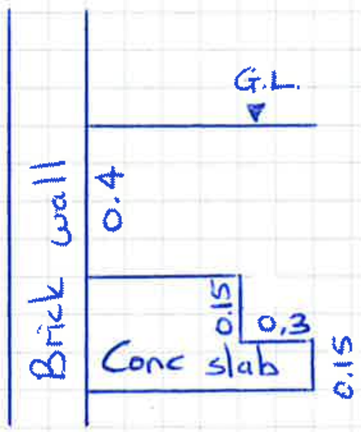
Pit 5

BYRNE BROS	Project: 1 Ellerdale Rd			Sheet No: 2 of 2
	Job No.	Prep by: S.H	Check by	Date: 30/06/15

Element / Description: Trial Pit Foundation Survey

REF.	CALCULATIONS	OUTPUT

Pit 6A



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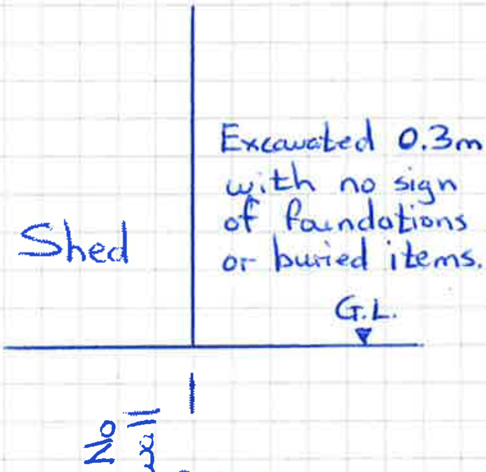

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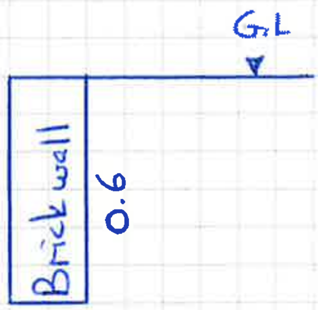

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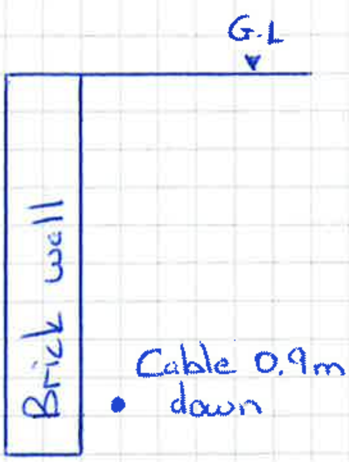

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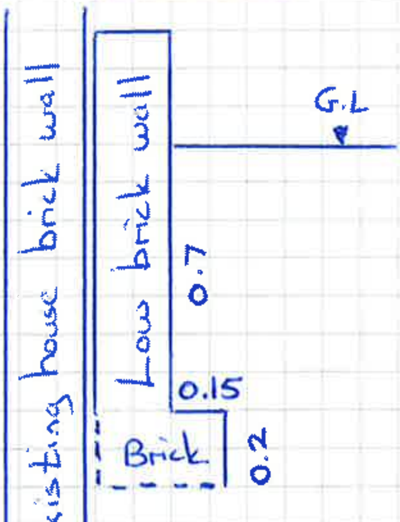
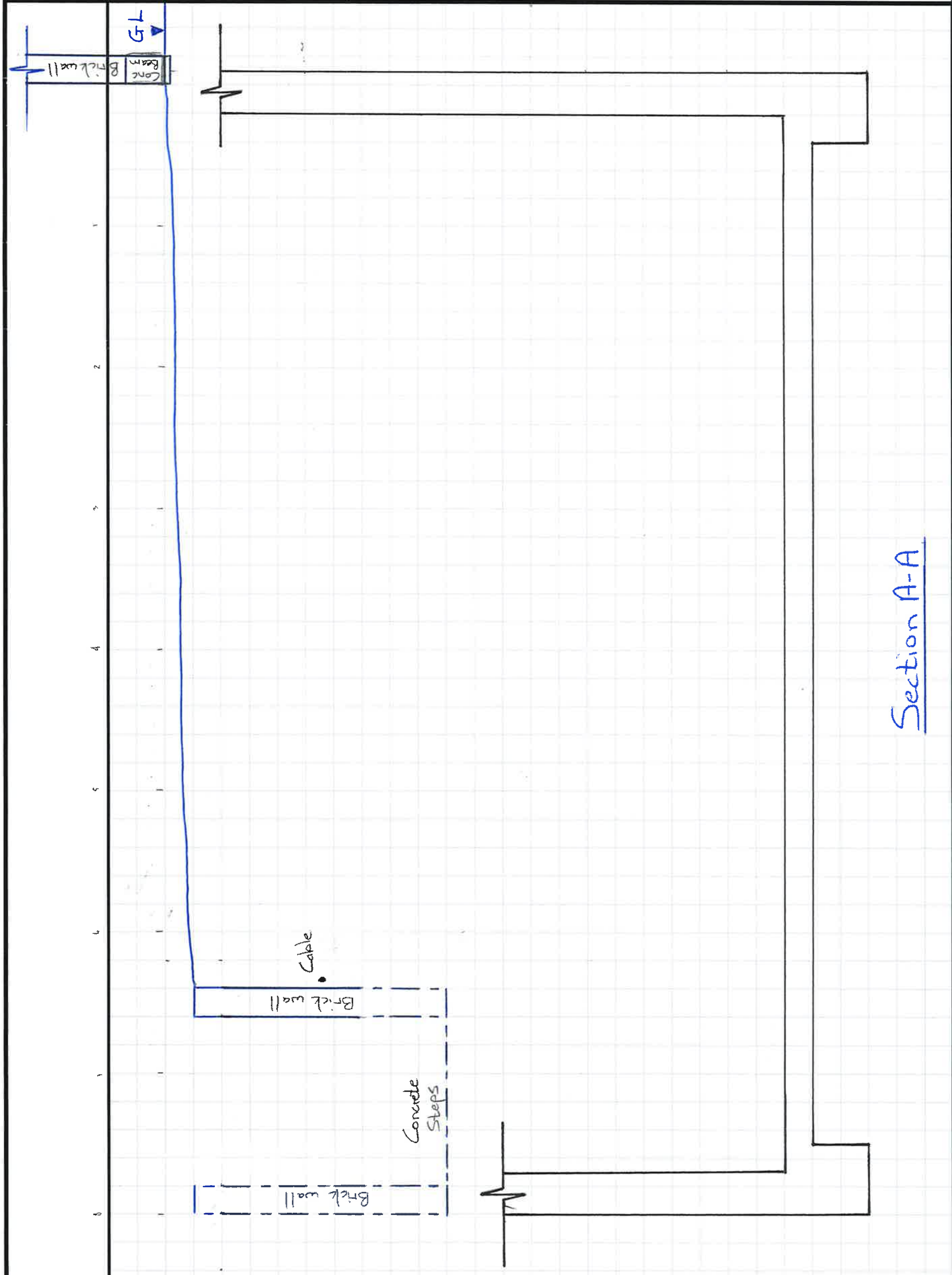


Pit 10

BYRNE BROS

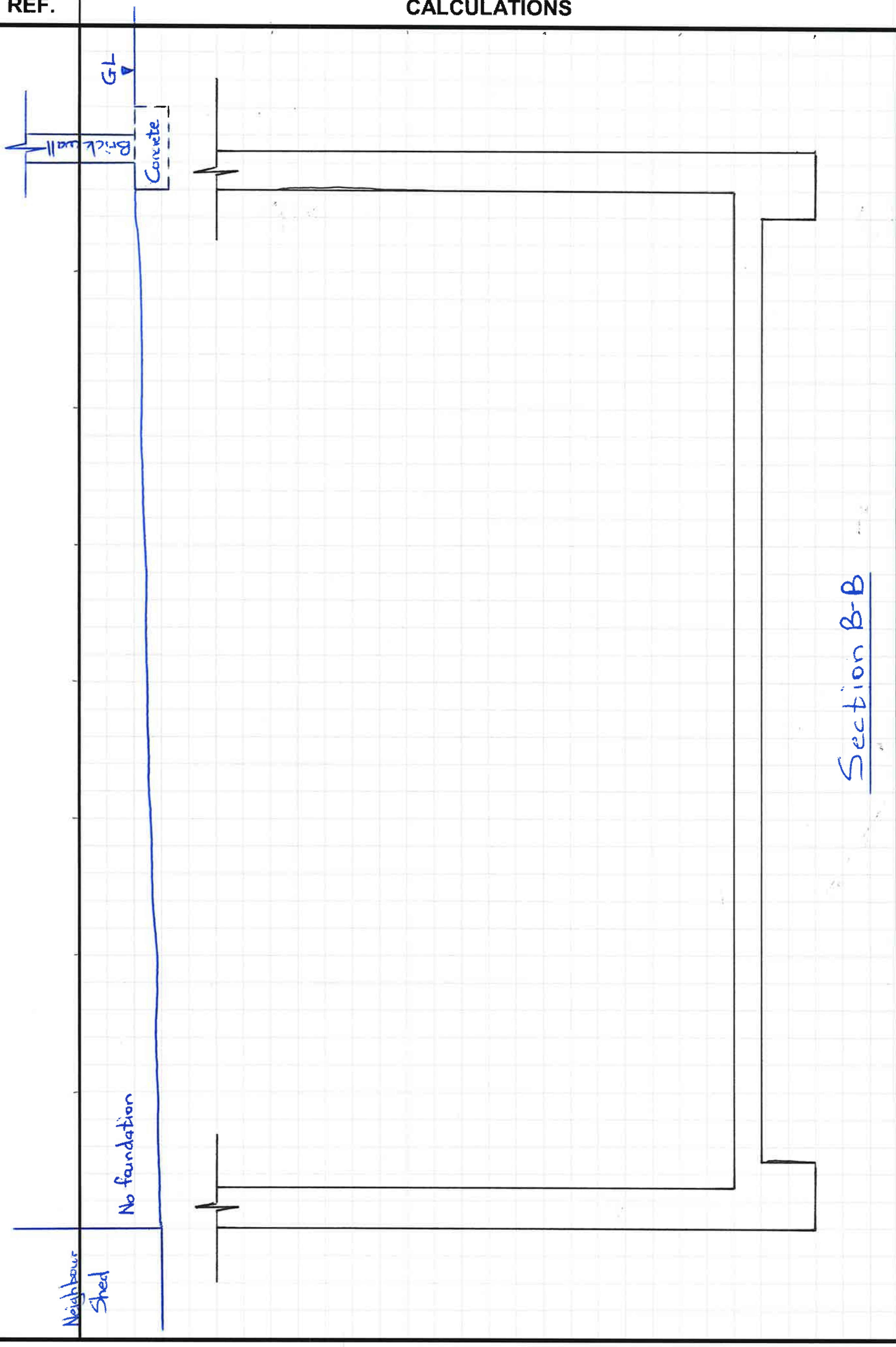
Project			Sheet No
1 Ellerdale Rd			1 of 4
Job No.	Prep by	Check by	Date
	S.H		02/07/15

Element / Description: Section A-A

REF.	CALCULATIONS	OUTPUT
		

BYRNE BROS	Project: 1 Ellerdale Rd			Sheet No: 2 of 4
	Job No.	Prep by: S.H	Check by	Date: 02/07/15

Element / Description: Section B-B

REF.	CALCULATIONS	OUTPUT
		

BYRNE BROS

Project			Sheet No
1 Ellerdale Rd			3 of 4
Job No.	Prep by	Check by	Date
	S.H		02/07/15

Element / Description

Section C-C

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	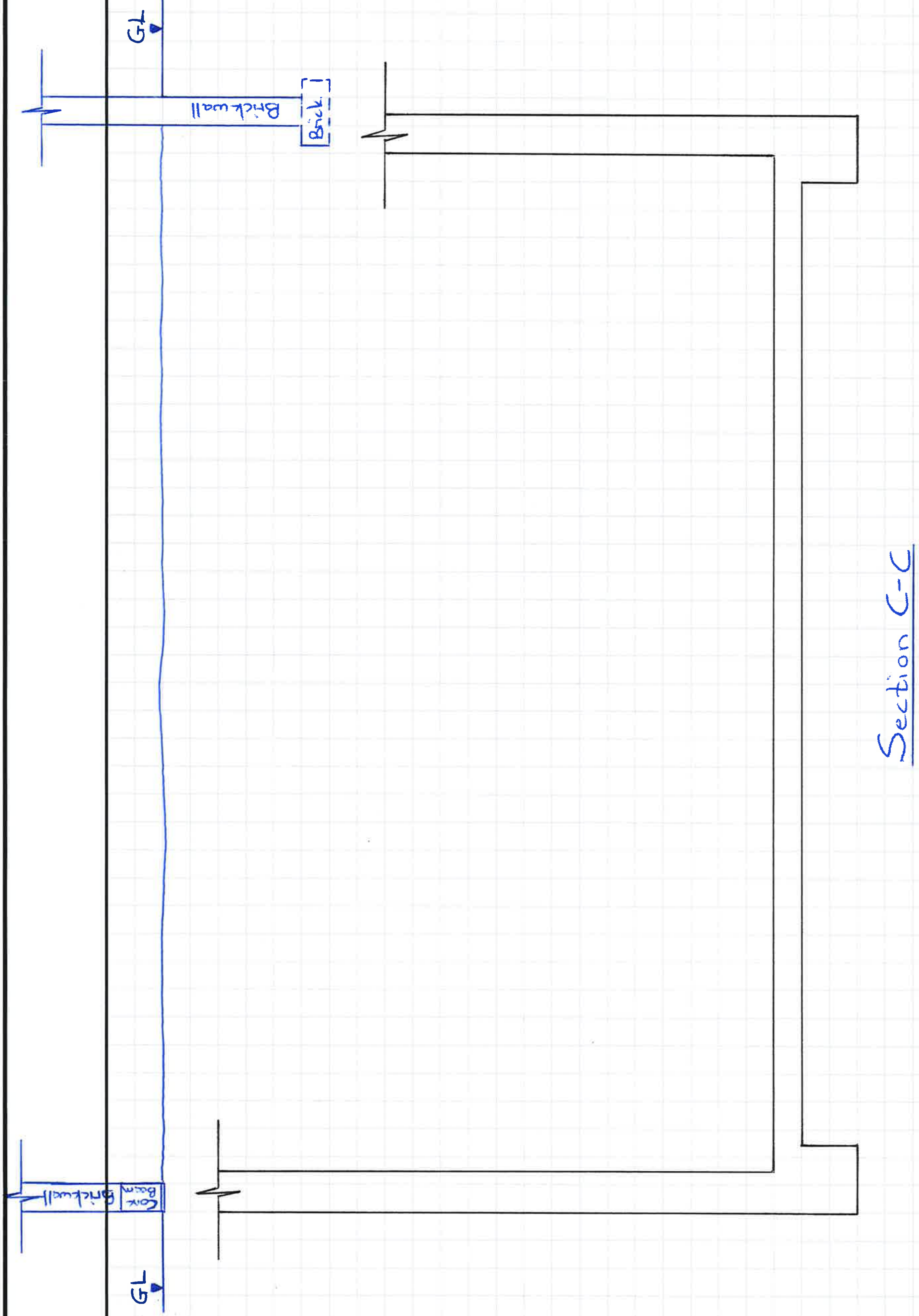	

BYRNE BROS	Project: 1 Ellerdale Rd			Sheet No: 4 of 4.
	Job No.	Prep by: S.H	Check by	Date: 02/07/15

Element / Description: Section D-D

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	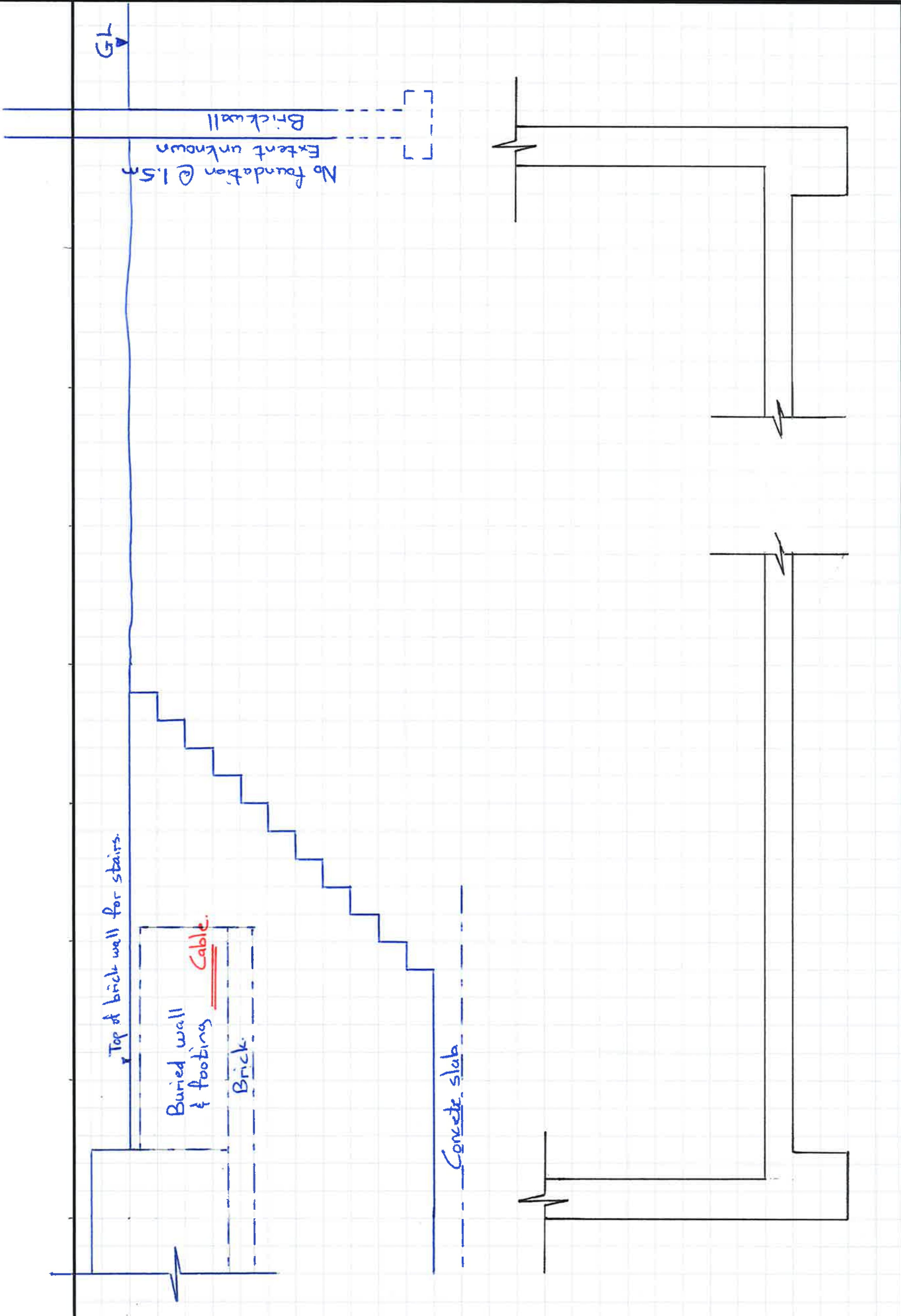	


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Appendix F – site investigation repot 2014

GROUND ENGINEERING LIMITED
Newark Road
Peterborough PE1 5UA
Tel: 01733 566566 Fax: 01733 315280

SITE INVESTIGATION REPORT

LAND BY 1 ELLERDALE ROAD

LONDON NW3

Report Reference No. C13183

On behalf of:-

Mr Georg Galberg
Flat C, 15 Cleveland Square
London
W2 6DG

March 2014

MR GEORG GALBERG

ALAN BAXTER & ASSOCIATES LLP

CONSULTING ENGINEERS

REPORT ON A SITE INVESTIGATION

AT

LAND BY 1 ELLERDALE ROAD

LONDON NW3

Report Reference No. C13183 **March 2014**

INTRODUCTION

Mr Georg Galberg, the client, intends to construct a dwelling within a garden plot adjacent No.1 Ellerdale Road, London NW3. The proposed house will have a single storey above ground level and a single level basement. The upper storey will be cut into the ground and the total depth of excavation will be between 4.50m and 5.00m below the existing site level.

It is anticipated that the basement will be formed in part by underpinning and in part within a perimeter contiguous piled wall.

Ground Engineering Limited was instructed by the client to carry out a site investigation comprising a desk study and ground investigation under the direction of Consulting Engineers, Alan Baxter & Associates. The ground investigation was to determine the nature and geotechnical properties of the underlying soils in relation to foundation/basement design and construction. In addition, a contamination assessment was to be included within the scope of this investigation.

LOCATION, TOPOGRAPHY AND GEOLOGY OF THE SITE

The land by No.1 Ellerdale Road is situated immediately to the east of the dwelling, at the north-eastern end of Ellerdale Road, some 35m south-west of its junction with Fitzjohn's Avenue, and some 200m south of the centre of Hampstead, within the London Borough of Camden, London NW3. The site is centred at National Grid Reference TQ 264 855.

The 18m long and 8m wide rectangular plot is accessed via an 18m long narrow path from Ellerdale Road. The site is bounded to the north-west by the rear garden to No.85 Fitzjohn's Avenue and a pair of residents' garages; to the north-east by the rear gardens of houses facing onto Fitzjohn's Avenue; to the south-east by No.1 Ellerdale Road, its rearward kitchen extension and rear garden; and to the south-east by the rear elevation and gardens of Arthur West House, a student residential block.

At the time of the investigation the site was a vacant garden plot covered with grass and the site boundaries were formed by brick walls, wooden fences and buildings. Part of a wall, to the rear of No.85 Fitzjohn's Avenue adjacent the site's access path had reportedly collapsed and had been removed, whilst the rear garden fence separating the site from the rear garden of No.1 Ellerdale Road had fallen over.

The adjacent gardens to the north-east contained several trees including a mature Ash and a Bay Laurel. A 200mm diameter tree stump was present adjacent the centre of the south-eastern boundary wall, where it met the rear of Arthur West House. A London Plane tree was located within the Ellerdale Road footpath to the north-west of the plot.

The site stands at an approximate elevation of 103mOD on south-westward falling ground, on the southern slopes of the Hampstead high ground. The route of Ellerdale Road, adjacent the site, runs down the centre of a minor valley feature on the hillside, which trends north-east to south-west.

The 1934 geological map for the area at 1:10,560 scale is based on the 1920 Ordnance Survey London Sheet I SE and shows the site to be underlain by the solid geology of the Bagshot Sand, which also caps the high ground to the north, and then in turn by the underlying Claygate Beds and London Clay, which form the lower slopes to the west and south. This map also shows that the site lies some 235m north-east of a southward draining headwater stream (now culverted) to the Westbourne River.

The 2006 geological map for the area at 1:50,000 scale, Sheet 256, shows the site at the edge of ground directly underlain by the solid geology Bagshot Formation, which caps the Hampstead high ground to the north, and then the underlying Claygate Member of the London Clay Formation. The undifferentiated London Clay below the Claygate Member is depicted at the surface beneath the lower slopes, some 200m south-west of the site.

Previous work within this part of London has found an often significant cover thickness of superficial 'hillwash' or Head Deposit mantling the solid geology strata.

It is understood that a previous investigation at this site, undertaken by others, found 2.90m of made ground (clayey sand and sandy clay fill), underlain by medium dense, clayey sand and sandy clay with occasional gravel to 5.50m, then clayey sand to 6.00m, and stiff very sandy clay with sand partings to at least 9.00m below ground level.

Well records on the 1934 geological map indicate that the Unproductive Stratum of the London Clay is about 90m thick beneath this part of London and that the underlying Principal Aquifer of the Chalk lies 168m below ground level (-39mOD). Based on the topography of the site area the direction of near surface groundwater and surface water flow would locally be from north-east to south-west.

HISTORY OF THE SITE

Historical maps dating between 1745 and the present day have been reviewed as part of this desk study together with internet research. Selected map sheets are reproduced in Appendix 1 with relevant descriptions given below.

John Roque's Plan of the Cities of London and Westminster and Borough of Southwark, and the Country Ten Miles Around, was published in 1745 (not reproduced) and shows the site within an open field on sloping ground to the south of Hampstead. Similar maps of 1786 (Cary) and 1807 (Ordnance Survey) show the site unchanged, as does John Tallis' map of 1851.

Stanfordøs óLibrary Map of London and its Suburbsô was published in 1862 (Figure A) and shows the site as before to the south-west of Field Place and immediately west of an unnamed building.

The 1866, First Edition O.S. map for the area at 1:2500 scale (Figure B), London Sheet VII, and O.S. Town Plan of 1871 (Figure C) at 1:1056 scale, show the site within an open field immediately to the west of Mount Farm. A pump was present within the field, 30m to the north-west, and several ponds were located within the surrounding area, notably 95m to the north and 110m to the south-west.

The O.S. Town Plan of 1893 (Figure D) at 1:1056 scale and 1896, Second Edition O.S. map (Figure E) for the area at 1:2500 scale, London Sheet XXVII, show the site within the rear gardens of a pair of semi-detached houses that face north-eastwards onto Fitzjohn's Avenue (formerly Field Place). The site was bounded by similar rear gardens to the north-west, and to the south-west by rear gardens to similar dwellings (Nos.1 & 3) that face north-westwards onto Ellerdale Road. The land to the south-east was a large garden to the rear of a detached house at the junction of Fitzjohn's Avenue and Prince Arthur Road. The residential development of the area around the site had removed Mount Farm, which had been replaced with a grid of partially completed streets. Former ponds to the north and south-west had been infilled by this date.

The 1915, 3rd Edition O.S. map (London Sheet I.16) at 1:2500 scale (Figure F) has the site and adjacent housing unchanged. A formerly vacant plot 150m to the south-west had been developed as University College School and part of its grounds are shown to be terraced into the sloping ground.

The 1920, O.S. map (London I.SE) at 1:10,560 scale shows the site and surrounding area (not reproduced) unchanged from 1915.

The 1938 Provisional Edition O.S. map (London I.SE) at 1:10,560 scale (Figure G) also has the site and surrounding area apparently as before.

The London Bomb Damage Map (1939-1945) for the area (not reproduced) shows the site, and the surrounding housing, to have survived unscathed. The closest bomb damage was 130m to the south and 260m to the east of the site.

The 1948-49 O.S. maps at 1:10,560 scale (TQ 28 SW & NW) have the site (Figure H) and surrounding area as it was before WWII.

The 1953, O.S. map at 1:2500 scale (TQ 2685) has the site and adjacent properties as before apart from the addition of a pair of residents' garages at the southern end of the rear garden to No.87 Fitzjohn's Avenue, adjacent the site; the addition of a large outbuilding or annexe within a rear garden 15m to the south-west; and the removal of a small outbuilding within the garden to the south-east (Figure I). A rear garden on the opposite, north-eastern side of Ellerdale Road, had also been redeveloped with a row of four residents' garages behind a new dwelling. The University College School site to the south-west now contained an outdoor swimming pool and a terrace of tennis courts, whilst elsewhere within the district some infilling of formerly vacant plots with further dwellings and residents' garages had taken place, and some large detached houses and their gardens had been replaced with residential blocks. A small commercial garage was marked 70m to the north-north-west of the site, on Perrin's Walk, and another larger garage and a small printing works were denoted 120m and 100m north-north-east of the plot.

The 1965, O.S. map at 1:2500 scale (TQ 2685) shows the site (Figure J) as before. A small rearward extension was depicted to No.81 Fitzjohn's Avenue, to the north-east of the site.

Further infilling and redevelopment with residential blocks had taken place by the time of this survey, notably 70m east of the site.

The 1973-78, 1:1250 scale maps TQ 2685 SW, NW, SE & NE (Figure K) have the site and immediate surrounding area unchanged from the 1960s apart from the development of the adjacent rear garden to the south-east with a large residential block (Arthur West House) with a rearward extension that abutted the site. The two commercial garages to the north of the site had been redeveloped for housing by the time of this survey, and an electricity sub-station was depicted 95m north-east of the plot.

The 1991 revisions of the 1:1250 scale maps TQ 2685 SW, NW, SE & NE (Figure L), have the site and surrounding area as before.

The 2002 Raster Map at 1:10,000 scale (Figure M), shows the site and surrounding area unchanged from the 1990s. Similarly, the 2012 Master Map at 1:1250 scale (Figure N), has the site as before and not defined as a single plot, as it was at the time of this investigation in January 2014. The 2013 aerial photograph presented on page 1 of Appendix 2 shows the site as gardens with several trees within neighbouring gardens.

Summary

In summary, the site was within open fields associated with Mount Farm until the 1870s when the farmland was covered by residential development. The small plot spanned several rear gardens to adjoining dwellings, and remained as such until recently amalgamated as a single plot by the current owner. The surrounding area was developed during the latter part of the Nineteenth Century, and parts were progressively redeveloped from the 1950s as vacant plots were infilled and existing large houses and their gardens were redeveloped with residential blocks.

ENVIRONMENTAL DATABASE INFORMATION

Appendix 2 contains information from Environmental Databases for a radius of up to 2km from the site. The information covers various datasets and contributors include the Environment Agency, Local Authorities, British Geological Survey, Ordnance Survey and the Coal Authority. The results obtained are presented together with a detailed search on selected areas of enquiry, and have been described below for a radius of 250m from the site.

Environmental Permits, Incidents & Registers

The following is a summary of the main points for environmental authorisations:

Statutory Authorisations

IPC & IPPC Regulations: There are no (0) recorded sites authorised by the Environment Agency under Part I of the Environmental Protection Act 1990, to carry out processes subject to Integrated Pollution Control (IPC) or Integrated Pollution Prevention and Control (IPPC) on, or within 250m of the site. There are no (0) recorded IPC Registered Waste Sites on, or within 250m of the site.

Water Industry Act Referrals: There are no (0) recorded referrals under the Water Industry Act on or within 250m of the site.

Local Authority Pollution Prevention and Control Enforcements: There are no (0) recorded enforcements under Part I of the Environmental Protection Act 1990 on, or within 250m of the site.

Keeping of Dangerous Substances: There are no (0) Environment Agency List 1 or 2 Dangerous Substance Inventory Sites listed on or within 250m of the site.

Enforcement Notices and Authorised Processes: There are no (0) Part A(2) and Part B activities and enforcements recorded by the Environment Agency under Part I of the Environmental Protection Act 1990 on site and two (2) Part B activities listed within 250m of the site. The latter both refer to a dry cleaners, 197m north of the site.

Keeping of Radioactive Substances: There are no (0) recorded sites registered by the Environment Agency under the Radioactive Substances Act 1993, on or within 250m of the site.

Discharge Consents

Discharges to Water: There no (0) consents issued, by the Environment Agency, to discharge to watercourses in accordance with the Water Resources Act 1991 positioned within 250m of the site.

Storage of Hazardous Substances

Storage of Hazardous Substances: There are no (0) recorded sites subject to hazardous substances consents granted by the relevant local authority under the Planning (Hazardous Substances) Act 1990 on, or within 250m of the site.

Control of Major Accidents: There are no (0) recorded sites regulated by the Health and Safety Executive under the Control of Major Accident Hazards (COMAH) regulations 1999, on, or within 250m of the site.

Notification of Installations Handling Hazardous Substances: There are no (0) sites within 250m of the site regulated by the HSE under the Notification of Installations Handling Hazardous Substances (NIHHS) regulations.

Pollution Incidents

Pollution Incidents and Prosecutions: There is one (1) pollution incident recorded within 250m of the site, of fire-fighting run-off some 239m north-east of the site in 2002. This incident was listed as having no impact to water, land or air.

Contaminated Land Register Entries & Notices: There are no (0) recorded entries or notices on the Contaminated Land Register listed on, or within 250m of the site.

Landfill & Waste Sites

The following is a summary of the main points for the Waste section:

Landfill Sites: There are no (0) recorded landfill sites licensed by the Environment Agency under Part II of the Environmental Protection Act 1990, within 250m of the site.

Registered Landfill or Local Authority Recorded Landfill Sites: There are no (0) recorded operational or non-operational landfills located on or within 250m of the site.

Registered Waste Transfer Site: There are no recorded waste transfer sites on or within 250m of the site.

Waste Treatment, Transfer and Disposal: There are no (0) records of waste treatment licences issued by the Environment Agency under Part II of the Environmental Protection Act 1990 recorded on or within 250m of the site.

Potentially Contaminative Uses

Current Industrial Sites: There are no (0) recorded potentially contaminative uses recorded for the site, and ten (10) within 250m of the site. The closest of these, at No.4 Heath Street, refers to a photographic and optical equipment supplier, whilst the remainder are for six electricity sub-stations, vehicle repairers and a construction materials supplier.

Fuel Station Entries: There are no (0) recorded fuel stations within 250m of the site.

High Pressure Oil & Gas Pipelines: There are no (0) recorded underground high pressure oil and gas pipelines within 250m of the site.

Geology & Hydrogeology – Pathways & Receptors

The following is a summary of the main points for the sensitivity section:

Artificial & Made Ground: The site, including a 50m buffer, is recorded as not being covered by artificial or made ground.

Drift Deposits & Solid Geology: The site, including a 50m buffer, is recorded as being directly underlain by the solid geology of the Bagshot Formation (sand) and Claygate Member (clay, silt and sand).

Groundwater Vulnerability: The site is designated by the EA as being underlain by the Secondary (A) Aquifer of the Bagshot Formation and Claygate Member. The London Clay Formation, directly underlying the lower slopes 200m to the south-west of the site, is listed as an Unproductive stratum.

Water Abstractions: There are no (0) recorded water abstraction licences listed on, or within 2000m of the site.

Source Protection Zones: The site does not lie within a Source Protection Zone.

River Quality: There is no (0) Environment Agency information relating to river quality within 250m of the site.

River Network & Surface Water Features: There are no (0) detailed river network or surface water feature entries within 250m of the site.

Flood Risk: The site is not within 250m of a Zone 2 or Zone 3 flood plain. The site is not within a zone benefiting from flood defences and is not used for flood storage.

The site is designated as within an area with a óLimited Potentialô to groundwater flooding.

<u>Environmentally Sensitive Receptors</u>

Environmentally Sensitive Areas: There are no (0) environmentally sensitive areas within 250m of the site.

Protected Countryside Areas: There are no (0) National Parks or other protected areas or parks recorded as being either on or within 250m of the site.

Nitrate Vulnerable Zones: The site and surroundings are not indicated to be within a nitrate vulnerable zone.

<u>Natural & Mining Hazards</u>

Natural Subsidence Risk: According to the British Geological Survey there is a óModerateô hazard potential for Shrinking or Swelling Clay; a 'Low' hazard potential for Running Sand; a óVery Lowô hazard potential for Landslides and Collapsible Rocks; and a óNull-Negligibleô hazard potential for Soluble Rocks, Compressible Ground and Shallow Mining.

Coal Mining: The site is not within 75m of any areas affected by coal mining.

Brine Affected Areas: The site is not within 75m of any areas affected by brine extraction.

Radon Affected Area: The site lies within an area where less than 1% of properties are above the action level for radon.

Radon Protection Measures: The site lies within an area where no radon protection measures are necessary for new dwellings or extensions in accordance with Building Research Establishment report BR211 (1999).

PRELIMINARY RISK ASSESSMENT

In order to assess the risks associated with the presence of ground contamination the linkages between the sources and potential receptors to contamination need to be established and evaluated. This is in accordance with the Environmental Protection Act 1990, which provides a statutory definition of Contaminated Land. To fall within this definition it is necessary that, as a result of the condition of the land, substances may be present on or under the land such that

- *Significant harm is being caused or there is a significant possibility of such harm being caused; or*
- *Pollution of controlled waters is being, or is likely to be, caused*

There are three principal factors that are assessed whilst undertaking a qualitative risk assessment for any site. These are the presence of a contamination source, the existence of migration pathways and the presence of a sensitive target(s). It should be noted that it is necessary for each element of source, pathway and target to be present in order for exposure of a human or environmental receptor to occur.

UK Government guidance on the assessment of contaminated land, requires risk to human health and the environment to be reviewed using source ï pathway ï target relationships. If each of these elements is present, the linkage provides a potential risk to the identified targets. ***Contaminants or potential pollutants*** identified as ***sources*** in relation to the identified previous uses are listed below in Table 1.

Table 1: Identified Potential Contaminant Sources

Contaminant Source	*Comments*
Drainage	Effluent from leaking drains would provide a contaminant source.
Soil Beneath Site	Contamination may be present within any made ground materials beneath the site.
Soil Gas	Potential soil gas generated from made ground or natural organic soils.
Ground Contamination Outside Site Boundary	Ground contamination migrating from adjoining sites.

A ***Pathway*** is defined as one or more routes through which a receptor is being, or could be, exposed to, or affected by, a given contaminant.

Potential ***Target or Receptors*** fall within the categories of Human Health, Water Environment, Flora and Fauna, and Building Materials.

There are a number of possible pathways for the contaminants identified on the site to impact human and/or environmental receptors and these are summarised in Tables 2 and 3.

Table 2: Human Receptors and Pathways

Human Receptor-Mechanism	***Typical Exposure Pathway***
Human Inhalation	Breathing Dust and Fumes Breathing Gas emissions
Human Ingestion	Eating -contaminated soil, for example by small children -plants grown on contaminated soil Ingesting dust or soil on fruit or vegetables Drinking contaminated water
Human Contact	Direct skin contact with contamination Direct skin contact with contaminated liquids

Table 3: Water Receptors and Pathways

Receptor-Water Environment	***Typical Exposure Pathway***
Groundwater The site is reportedly underlain by a Secondary (A) Aquifer, the solid geology Bagshot Formation and Claygate Member, and at depth by the Unproductive stratum of the London Clay.	Surface infiltration of atmospheric waters into the soils beneath the site could wash or dissolve potential contaminants and migrate to underlying groundwater. Contamination leads to restriction/prevention of use as a resource, for example, drinking water, and can have secondary impacts on other resources, which depend on it.
Surface Water There are no water courses or surface water features recorded within 250m of the site, although an historical headwater stream to the Westbourne River was depicted on the 1934 geology map some 235m to the south-west of the site.	Surface infiltration of atmospheric waters into the soils beneath the site could wash or dissolve potential contaminants and laterally migrate. Contamination leads to a restriction/prevention of use: -as drinking water resource -for amenity use Effects on aquatic life

Preliminary Conceptual Model

Assessment of the potential linkage between ground contamination sources, human and environmental receptors have been assessed based on the desk study research documented in the preceding sections of this report.

A generalised preliminary conceptual model relative to the construction phase and completed development is presented below in Table 4.

Table 4: Preliminary Conceptual Model Relative to Construction/Future Use of Site

Receptors	Pathway	Estimated Potential for Linkage with Contaminant Sources			
		Drainage	Soil Beneath Site	Soil Gas	Ground Contamination Outside Site Boundary
Human Health ï ground workers	Ingestion and Inhalation of contaminated Soil, Dust and Vapour	Likely	Low likelihood	Low likelihood	Low likelihood
Human Health ï users of completed development	Ingestion and Inhalation of contaminated Soil, Dust and Vapour	Unlikely	Low likelihood	Low likelihood	Low likelihood
Water Environment	Migration through ground into surface water or groundwater	Low likelihood	Low likelihood	Unlikely	Low likelihood
Flora	Vegetation on site growing on contaminated soil.	Low likelihood	Low likelihood	Unlikely	Low likelihood
Building Materials	Contact with contaminated soil	Low likelihood	Low likelihood	Unlikely	Low likelihood

Key to Table 4

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

SITE WORK

A single borehole and four foundation inspection pits were undertaken at the positions depicted on the site plan at the rear of this report, as requested by the Engineer. Services information was obtained and referenced in relation to the exploratory hole positions prior to boring.

The investigation was undertaken following the protocols detailed in British Standards (BS) óCode of Practice for Site Investigationsô (BS5930:1999) and óMethods of test for soils for engineering purposesô (BS1377:1990). The elevation, relative to a site datum (SD), of the hole positions have been interpolated using the spot heights detailed on a site survey drawing provided by the Engineer.

Cable Percussive Borehole

A single borehole (BH 1) was undertaken by a restricted access cable percussive boring rig on 27th and 28th January 2014. The borehole position was scanned using a cable avoidance tool (CAT) and a starter pit was dug to 1.20m depth using hand tools, in order to ensure the absence of buried services. The borehole was then advanced using weighted shell and claycutter tools, initially working within 150mm diameter casing that could not be advanced by the 'lightweight' rig below 13.00m, and so the borehole was abandoned at 15.50m below ground level as groundwater could not be sealed out of the hole.

Standard penetration tests were undertaken in order to give an indication of the in-situ relative density/shear strength of the soils encountered. The test was made by driving a 50mm diameter solid cone point (C) or open shoe and split spoon sampler (S) into the soil at the base of the borehole by means of an automatic trip hammer weighing 63.50kg falling freely through 760mm. The penetration resistance is determined as the number of blows (N) required to drive the tool the final 300mm of a total penetration of 450mm into the soil ahead of the borehole. The results have been tabulated, and also plotted against depth in Figure 1.

Undisturbed samples (U) of 100mm in diameter were taken at regular intervals in clay soils. The ends of each sample were capped to maintain it in as representative condition as possible during transit to the laboratory.

Representative small (D) and bulk (B) disturbed samples of soil were taken from the boring tools at regular intervals throughout the depth of the borehole. A sample of water (W) was recovered from the borehole once sufficient water had accumulated for collection.

On completion of boring, a 50mm diameter standpipe was installed to 10.00m depth. The annulus around the standpipe was backfilled with pea gravel with a bentonite seal placed around the top of the installation within 1.00m of ground level. A gas tap was installed in the top of the standpipe. A protective steel stopcock cover was concreted into the ground flush with the surface over the installation. Below the installation the borehole was infilled with clean arisings.

The borehole records give the descriptions and depths of the various strata encountered, results of the in-situ tests, details of all samples taken and the groundwater conditions observed during boring, on completion and within the standpipe.

Trial Pits

Four trial pits (TPs 1 to 4) were undertaken using hand tools and a small hydraulic breaker on 27th and 28th January 2014. Trial pits TP 1 and TP 3 were extended laterally and their extensions have been recorded as TP 1A and TP 3A, respectively.

The exposed strata and foundations were logged and the soils sampled by a supervising Geoenvironmental Engineer. The trial pits were generally completed at depths between 1.15m and 1.70m below ground level, with the exception of TP 4, which was completed at 3.00m depth.

An immediate assessment of the apparent soil cohesion was made using a Pilcon hand shear vane (V) in clay soils. The average of three readings was recorded at each position.

Disturbed samples of soil were taken at regular intervals throughout these pits and placed in polycarbonate pots (D samples).

The trial pit records give descriptions and depths of the various strata encountered, the details of all samples, the results of the in-situ tests and the groundwater conditions observed during excavation. Sketch sections and plans, and photographs, of the exposed footings in the foundation inspection pits are presented on the pages following the record for the relevant excavation. On completion of each excavation, the spoil was returned to the pit and placed in layers, which were recompacted.

Gas and Groundwater Monitoring

Four return visits were made between 6th February and 4th March 2014 in order to monitor methane, carbon dioxide and oxygen gas levels in the BH 1 standpipe. Ambient pressures and flow rates were recorded together with the depth to groundwater. The water levels have been added to the borehole record and the gas/groundwater results are presented following the exploratory hole records.

LABORATORY TESTING

The samples were inspected in the laboratory and assessments of the soil characteristics have been taken into account during preparation of the exploratory hole records. The soil sample descriptions are in accordance with BS5930:1999.

The chemical testing schedule was devised by Ground Engineering Limited for a broad suite of potential contaminants, outlined by the Environment Agency (EA) and National House Building Council (NHBC) document R&D 66; 2008 'Guidance for the Safe Development of Housing on Land Affected by Contamination'.

The geotechnical tests were conducted to BS1377:1990 and other industry standards, and the results are presented following the exploratory hole records, whilst the results of the chemical tests are presented in Appendix 3.

Geotechnical Testing

The moisture content and index properties of selected soil samples were determined as a guide to soil classification and behaviour. The liquid limit was determined by the cone penetrometer method.

The particle size distributions of selected samples were obtained by sieve analysis. The particle size distribution passing the 63µm sieve was obtained for selected samples using a hydrometer. Results of these tests are given as combined particle size distribution curves at the end of this report.

Test specimens were prepared at full diameter from the undisturbed samples recovered from the borehole. Immediate undrained triaxial compression tests were made on the samples at full diameter either at a cell pressure approximately equivalent to the overburden pressure for that sample's depth or using the multi-stage technique. The moisture content and bulk densities of this specimen were also determined.

An indication of the settlement characteristics of selected samples was obtained from tests in the consolidation apparatus or oedometer. The test was performed on a 75mm diameter sample, about 19mm thick, contained in a steel ring. The sample was saturated and the swelling pressure balanced prior to applying a constant load with drainage at both ends. When primary compression was complete, the load was increased and this repeated for three increments of load. The sample was then unloaded in equal stages. The rate and total amount of consolidation were continually monitored using a computer controlled E.L.E. Datasystem 7 Unit. The results were plotted and analysed by the computer for each increment of load to obtain the coefficients of compressibility (m_v), and of consolidation (c_v), which govern the amount and rate of settlement, respectively.

Selected samples of soil and water were analysed to determine the concentration of soluble sulphates. The pH values were also determined using an electrometric method.

Chemical Testing

Six soil samples recovered from the exploratory holes were tested for total concentrations of arsenic, cadmium, chromium, lead, mercury, selenium, nickel and benzo[a]pyrene, together with speciated polyaromatic hydrocarbons (PAH), boron, copper and zinc, phenols, total and free cyanide, hexavalent chromium, sulphate, sulphide and pH. The soil samples were also tested for organic content.

A sample of made ground from BH 1 at 0.60m to 1.20m depth was scheduled for a full Waste Acceptance Criteria (WAC) CEN Leachate Suite at 2l/kg and 10l/kg.

GROUND CONDITIONS

The ground conditions encountered were not initially as expected from the geological records but confirmed an approximately 3.00m thick cover of made ground mantling a layer of 'hillwash' or Head Deposit, which was underlain at 4.70m depth by the solid geology of the Claygate Member. The latter was found to at least 15.50m depth where the borehole was abandoned. The expected Bagshot Formation sand was not encountered, near surface, and the London Clay was not reached by the abandoned borehole.

Made Ground

The made ground beneath this site was predominantly a soft, becoming firm, initially friable, dark grey, brown and dark brown mottled, sandy, gravelly clay or clay/silt with occasional cobble size pieces of brick and concrete and a gravel fraction of flint, brick, concrete, ash and coal, and occasional pieces of metalwork, polystyrene, slate, slag (TP 2), plastic, tile, wood and ceramic pipe. Trial pits TP 1/1A, 2 and 3/3A were completed within this clay fill at 1.15m to 1.70m below ground level, whilst the deeper TP 4 found clay fill to 2.20m below ground level.

The made ground below 2.20m depth in TP4 comprised a brown and grey, slightly gravelly, very silty becoming silty sand, with a gravel fraction of coal, flint, brick and ash. This coarse grained fill was found to at least 3.00m depth (46.4mSD) at this location, where the pit was completed. In the central borehole, made ground was proved to 2.80m below ground level (46.8mSD) and comprised soft, brown and grey mottled, sandy and gravelly, clay/silt.

Head Deposit

In the borehole at 2.80m depth, the made ground was underlain by a 1.90m thick layer of firm, locally stiff, orange brown, brown and light grey mottled, slightly gravelly, sandy clay/silt with bands of silty fine sand and a gravel fraction of angular to sub-rounded flint. This 'hillwash' or Head Deposit was proved to 4.70m depth (44.9mSD) in BH 1.

Claygate Member

The solid geology of the Claygate Member was met beneath the Head Deposit at 4.70m depth and was initially weathered to firm, becoming stiff, laminated, brown and orange brown banded clay/silt with laminae of clayey, silty fine sand. This weathered horizon was 2.60m thick and was proved to 7.30m below ground level (42.3mSD).

Below this level, the Claygate Member was a stiff, grey brown, slightly sandy, clay/silt with occasional grey silt partings that, below 10.00m, became a stiff, dark grey and grey brown mottled, slightly sandy, becoming sandy, silty clay with occasional light grey silty fine sand partings, pockets and bands.

The borehole was abandoned within the Claygate Member strata at 15.50m below ground level (34.1mSD).

Groundwater

The four trial pits were dry during excavation and on completion.

Water was met at 10.00m (39.6mSD) depth within the Claygate Member, and was recorded overnight in the 13.50m deep hole at 7.40m below ground level (43.9mSD). The casing could not be advanced below 13.00m depth and the water level recorded when the borehole was abandoned was at 13.00m.

The standpipe water levels recorded between 6th February and 4th March 2014 ranged from 6.15m to 6.33m below ground level, approximately 43.3mSD to 43.5mSD.

Roots

Live roots were recorded in TPs 1/1A, 2 and 3/3A to at least their full depths and to 1.70m below ground level in TP 4.

Evidence of Contamination

Based on inspection the made ground contained pieces of flint, brick, concrete, ash and coal, and occasional pieces of metalwork, polystyrene, slate, slag (TP 2), plastic, tile, wood and ceramic pipe. There was no olfactory or visual evidence of hydrocarbon contamination. No visual evidence of asbestos containing material was detected within the exploratory holes.

Existing Foundations

Trial pit TP 1, located adjacent the north-eastern boundary wall, found that it was supported on 0.11m diameter concrete piles, and also that a former rear garden wall that once extended south-westwards into the site had only been removed to 0.08m below ground level. The remnant wall below this depth was 0.36m wide and was based on a 0.25m deep concrete strip footing based at 0.75m below ground level. The extant brick wall uncovered in TP 1A similarly had a 0.25m thick concrete strip footing, which was based at 0.50m depth and projected 0.25m into the site.

Trial pit TP 2, at the eastern corner of the site and excavated against the north-eastern boundary wall and the single-storey rearward part of Arthur West House, found that the boundary wall had a nominal and locally absent concrete strip footing based at 0.35m below ground level. The building had a 1.30m deep, corbelled brick on 0.20m thick, concrete strip footing based at 1.30m depth, with a projection of 0.12m.

Trial pit TP 3/3A, dug on the south-eastern boundary wall and at the corner of the single-storey building, found that its footing here comprised corbelled brickwork, without a concrete strip footing, based at 1.60m below ground level, that projected 0.13m. The adjacent brick boundary wall had the same foundation and it would appear that the building locally reused the wall's foundation, possibly augmented by a brick buttress that had a small concrete 'pad' foundation based at 0.45m below ground level. This buttress had suffered sub-horizontal cracking, possibly associated with the adjacent tree stump.

The deepened TP 4 was excavated alongside a basement stairwell and the single-storey kitchen extension to No.1 Ellerdale Road, and found that the kitchen extension was supported by a concrete beam and column that had a 1.90m deep concrete pad foundation, which projected 0.37m into the site. This concrete pad was 1.14m wide and abutted a buried brick wall, which was based at 2.00m depth. The excavation of the ground between this wall and the stairwell brickwork uncovered a bowed (towards its base), rendered brickwork and concrete blockwork wall, which was based on a 0.09m thick concrete layer at the same level as the floor of the adjacent stairwell.

COMMENTS ON THE GROUND CONDITIONS IN RELATION TO FOUNDATION DESIGN AND CONSTRUCTION

The investigation found a 3.00m cover of made ground presumably associated with the terracing of the hillside when the Ellerdale Road and Fitzjohn's Avenue area was first developed in the 1870s. Foundations for the new 4.50m to 5.00m deep basement will penetrate this made ground and be based within the basal Head Deposit and underlying Claygate Member, which should have adequate bearing properties indeed there may be a net reduction in pressure at basement floor level and possible resultant base heave, which will need to be taken into account in the design of the structure. The groundwater level was recorded at least 6.00m below ground level, and should not impact construction.

Foundation Depths

The deep borehole encountered natural ground at 2.80m below ground level within the centre of this site and it could locally be expected to lie at slightly greater depths, particularly along the south-western site boundary with No.1 Ellerdale Road, as in TP 4 where at least 3.00m was present.

The underlying Head Deposit and weathered Claygate Member had modified plasticity indices of 21% and 31%, respectively, and so are of medium volume change potential. In open natural ground, well away from trees, a minimum foundation depth of 0.90m below finished or existing ground level would be required.

The presence of a moderate water demand Ash tree within the neighbouring garden, upslope to the north-east, means that the depth affected by seasonal changes in moisture content of clay soils will have locally been increased. Reference to the National House Building Council (NHBC) Standards Chapter 4.2 ñBuilding near treesò (2010) indicates a minimum footing depth of 1.95m where a single, mature, moderate water demand Ash is present 1.00m from foundations, in these medium volume change potential soils.

Foundations for the new basement, which will be based at 4.50m to 5.00m below existing ground level, will be deeper than any root-induced desiccation effects due to trees, although a check should be made that trees within neighbouring gardens downslope of the site are not within influencing distance and depth, when their relative elevation is taken into account. Foundations within the range of influence of retained and removed trees will have to be separated from the soil by a suitable void former. The required gap dimensions for footings in medium volume change potential clay soils are detailed in the previously cited NHBC document.

Bearing Capacity

The construction of a 4.50m to 5.00m deep basement on this site will remove the surface layers and the foundations will be within the basal Head Deposit and underlying solid geology weathered Claygate Member.

The results of the laboratory triaxial compression strength tests indicate that a net safe bearing capacity of 170kN/m^2 could be applied on a 1.00m wide strip foundation cast at or just below basement level on the firm Head Deposit and Claygate Member at 4.50m to 5.00m depth. This value incorporates a factor of safety of 3.0 against general shear failure and should be sufficient to support the likely foundation pressures applied by the 'two-storey' structure.

Basement

The construction of a 4.50m to 5.00m deep basement will remove the surface layers of made ground, most if not all of the Head Deposit and locally the top of the underlying weathered Claygate Member. Foundations for the basement walls at or just below the basement floor level would be within the firm Head Deposit and Claygate Member and could be designed using the previously detailed bearing capacity of 170kN/m^2 for 1.00m wide strip foundations.

Alternatively a basement raft foundation could be considered for this structure. A net safe bearing capacity of 130kN/m^2, which incorporates a factor of safety of 3.0, could be used for the design of a raft foundation on the Claygate Member at 4.50m to 5.00m below existing ground level.

It is estimated that theoretical base heave at the centre of a 12m long and 8m wide, 5m deep unconfined basement excavation would be in the order of 35mm following the removal of $100kN/m^2$ of overburden pressure. Heave within the basement would begin to take place soon after excavation but would be confined by the basement floor loading once it had been constructed.

A likely basement raft loading is unknown but if it were equal to a pressure of $40kN/m^2$, and hence a net pressure of $-60kN/m^2$ once the overburden is removed, it could result in net theoretical heave in the order of 20mm. This net heave would need to be taken into account in the design of the basement floor slab, which will either need to be suspended and underlain by void forming material, or reinforced to withstand such heave and potential swell pressures.

Excavations/Groundwater

The excavation of the basement to 4.50m to 5.00m below ground level will require the construction of close support to its sides, the control of groundwater, and the need to avoid undermining adjacent structures.

The use of mass concrete walls, constructed in alternate panels around the perimeter of the basement could provide support to the excavation, although such a method of construction to the full depth required might prove difficult on this site.

An alternative would be to use sheet, contiguous or secant piled walls around the perimeter of the basement or combine mass concrete walls at shallow depth with piling to the required depth. Piling to a sufficient depth to mobilise adequate passive pressure below the basement level should be feasible on this site.

The excavation of a 4.50m to 5.00m deep basement could then be undertaken within the piled walls, although it should be noted that contiguous and sheet pile lined excavations may not be water tight.

In order to construct the basement beneath this site it will be necessary to provide permanent support to the adjacent structures, which were often found to be based on relatively shallow strip and pad foundations, although the north-eastern boundary wall was locally supported on piled foundations. This support can either be provided by underpinning these structures to the same depth as the proposed basement prior to basement construction or by constructing piled walls to the excavation that are adequately propped during construction by temporary support and permanently by the basement and ground floors, to prevent movement at the top of the retaining walls. Or a combination of the two.

Such lateral movement would otherwise be accompanied by settlement of the ground behind the basement walls. As an example, Tables 2.2 and 2.4 of CIRIA C580 (2003) indicate very small scale (<10mm) horizontal and vertical movements resulting from the construction of a secant piled wall, as does the use of high support stiffness (high propped walls and top down construction) to the basement excavation. Provided that such a very stiff bracing system is used to prevent deflection of the proposed basement walls, resultant changes to the state of soil stress and structural movement of neighbouring structures should be negligible.

The advice of specialist groundworks contractors with experience of constructing such basements should be sought, particularly in respect of other potential methods of providing support to the sides of the basement excavation.

The basement excavation should be inspected on completion to ensure that the condition of the soil complies with that assumed in design. Should pockets of inferior material be present, they should be removed and replaced with well graded hardcore or lean mix concrete. The excavated surface should be protected from deterioration and a blinding layer of concrete used where foundations are not completed without delay.

Water was recorded within the standpipe within the weathered Claygate Member at about 6.20m, which will be 1.20m to 1.70m below the base of the proposed basement excavation. These measurements were made during the wettest winter on record and should be confirmed by further monitoring closer to the time of construction, which if undertaken during relatively drier summer months is likely to find the depth to groundwater at a lower elevation. Potential flotation due to groundwater on this site will not be a problem.

Even though groundwater levels were recorded below the floor of the proposed basement, it will be considered necessary to waterproof the basement in order to prevent the ingress of water, including downward percolating surface water, into the completed structure.

Piled Foundations

In the event that piled foundations are preferred due to practical or economic considerations related to the construction of the basement and underpinning foundations on this site, the ground conditions are considered suitable for bored or CFA, but not driven piles as the vibrations during installation of driven piles could damage the adjacent dwellings and structures. The advice of specialist piling contractors should be sought as to their preferred method of pile installation in these conditions on this restricted access site and their attention drawn to the presence of former wall foundations beneath the site.

Preliminary working loads for a single bored pile may be estimated for design and cost purposes using pile bearing coefficients, which are based on the following assumptions.

1) The ultimate load on a pile would be the sum of the side friction/adhesion acting on the pile shaft together with the end bearing load.

2) The pile bearing properties within the depth of the proposed basement have been ignored.

3) In the Claygate Member the shaft adhesion and end bearing would be a function of apparent cohesion values determined by the triaxial compression strength tests in the laboratory, and a function of the in-situ SPT results (Figure 1).

4) A factor of safety of at least 2.0 would be used to assess pile working loads. If test loading of selected piles were not practical the factor of safety would be increased to at least 2.5.

Item	Ultimate Pile Bearing Value kN/m^2
Shaft adhesion/friction in ground to 5m depth	Ignored
Average shaft adhesion in Claygate Member, 5m to 7m	35
Average shaft adhesion in Claygate Member, 7m to 15m	45
Average shaft adhesion in Claygate Member, below 15m	60
End bearing in Claygate Member, 8m to 15m	810
End bearing in Claygate Member below 14m	1080

Using these coefficients it is estimated that a single, 300mm diameter bored pile installed to 14m below existing ground level would have an anticipated working load of 170kN, with a factor of safety of 2.5. Different pile lengths, or diameters, from those detailed above would give different available working loads, which could be tailored to suit the working loads required. A piling specialist should undertake final design of piles.

Compressible material will need to be placed around pile caps and beneath ground beams where they are placed in clay soils within the range of influence of nearby trees. These measures are particularly relevant if trees are removed or die.

The design of piled foundations on this site will also need to take into account potential tensile stresses in the piles during basement construction, resulting from potential heave, where the net change in load is to be reduced.

Retaining Walls

The walls of the proposed basement will act as retaining walls and will need to be designed accordingly. For a permanent retaining wall analysis effective stress parameters would be appropriate, however, in the absence of effective stress testing on samples from this site, published parameters, previous experience and in-situ test results could be used as a conservative approach.

The design of retaining walls around the basement area may be based on the following stress parameters:

Soil Type	**Bulk Density (Mg/m^3) γ_B**	**Effective Shear Strength (kPa) c'**	**Angle of Shearing Resistance (degrees) ϕ'**
Made Ground	1.80	0	28
Head Deposit	2.00	0	25-27
Claygate Member	2.00	0-2	25-27

Slope Stability

The ground within which the plot is located slopes down to the south-west and falls from 105.4mOD at the junction of Ellerdale Road and Fitzjohn's Avenue, to 92.2mOD some 105m to the south-west where Ellerdale Road turn southwards. This is an approximate slope angle of 8 degrees, although this slope is not marked as such on Figure 16 of the London Borough of Camden 'Guidance for subterranean development', which indicates slopes of greater than 7 degrees.

Slopes of 8 degrees or greater within the Claygate Member in Hampstead are reported in this document to be potentially unstable if the land topography is adversely disturbed. On this small site, on a terraced hillside bounded upslope and downslope by existing dwellings (often with basements) and their gardens, with a relatively deep recorded groundwater level, it is considered unlikely that the proposed basement development will induce slope instability.

Buried Concrete

Sulphate analysis of the soil and water samples tested gave results in Design Sulphate Classes DS-1 and DS-2 of the BRE Special Digest 1, Table C2 (2005) presented in Appendix 4. The pH results were between 5.5 and 8.2 and so acidic to alkaline.

The Claygate Member is part of the London Clay Formation, which is listed in this publication as being a stratum that may contain sulphides, such as pyrite, hence oxidation due to disturbance during the excavation of foundations and basements may increase the total potential sulphate content. Visual evidence of pyrite beneath this site was not recorded. It should be noted that the use of piled foundations would minimise disturbance of the ground and consequently reduce the potential for the oxidation of any pyritic clay, however, the basement excavation will be within London Clay Formation clay, which should not be left exposed to the elements for any length of time, otherwise there would be a potential for oxidation of any pyrite within the London Clay and, in the long term, possible thaumasite formation.

Using the characteristic sulphate (900mg/kg) and characteristic pH (6.4) results an Aggressive Chemical Environment for Concrete (ACEC) Class of AC-3z would be considered appropriate for buried concrete beneath this site as detailed in the above cited BRE document.

Other Issues

The basement development beneath this site would only be considered likely to affect the drainage system of the site itself. However, drainage and sewerage records for the surrounding buildings will need to be referenced, if available, or perhaps surveyed to confirm that the site does not share a communal drainage system that runs beneath the site.

The flow of surface water within the surrounding area, to the south-west, should not be significantly changed by the proposed redevelopment of this small site.

As previously described, groundwater beneath this site stands within the Claygate Member at about 6.20m depth. The proposed basement depth does not extend below this water level so there should be no displacement of groundwater by its exclusion from beneath the area of the basement after it has been constructed. Consequently there should be no rise in the level at which groundwater currently stands beneath the area around the site.

The orientation of the proposed basement, north-west to south-east, would be across the likely direction of near surface groundwater flow on this south-west facing slope, but as the proposed 4.5m to 5.0m deep structure does not extend below the recorded groundwater level (circa 6.2m depth), the drainage path will not be increased and would not be expected to impact the adjoining properties downslope to the south-west and south.

COMMENTS ON THE CHEMICAL TEST RESULTS

The results of the laboratory chemical testing on near surface soil samples have been compared to CLEA Soil Screening Values (SSVs), which have been used as a screening tool for use in the assessment of land affected by contamination.

Atkins Limited has derived ATRISKsoil SSVs based on the default assumptions provided in SR3, which have been used in the development of the Soil Guideline Values (SGVs) published by the Environment Agency in 2009. Atkins SSVs have been derived in line with the Environment Agency 2009 guidance (SR2, SR3, SR4, SR7) using the CLEA v1.04 and CLEA v1.06 software. These are provided under licence to Ground Engineering Limited, and respective toxicology reports and technical details on the derivation of the SSVs can be provided on request.

The following standard land uses form the basis of the assessment in relation to soils:

- Residential use with home grown produce
- Residential use without home grown produce
- Commercial and industrial usage

The intended purpose of the SSVs are as ñintervention valuesò in the regulatory framework for assessment of human health risks in relation to land use. These values are not binding standards, but are intended to inform judgements about the need for action to ensure that a new use of land does not pose any unacceptable risks to the health of the intended users.

In summary, Table 5 compares the test results with the SSVs in relation to the specified usage. The numbers of test results, which exceed these values, are also provided.

Table 5: Comparison of Chemical Test Results with SSVs

Determinand	Number of Samples	Min Value (mg/kg)	Max Value (mg/kg)	Number of Samples Exceeding SSV for:			Measured 95th Percentile (mg/kg)	Soil Screening Criteria SSV (1% SOM)			
				Residential with home grown produce	Residential without home grown produce	Commercial / Industrial		Assessment Method	Residential with home grown produce (mg/kg)	Residential without home grown produce (mg/kg)	Commercial/ Industrial (mg/kg)
Organic matter	6	2.1%	4.8%	-	-	-	-	-	-	-	-
Arsenic	6	14	32	0	0	0	24.99	SSV	32	35	640
Cadmium	6	<0.10	0.67	0	0	0	0.48	SSV	10	83	230
Trivalent* Chromium	6	30	40	0	0	0	35.61	SSV	12,800	15,500	21,300
Hexavalent Chromium	6	<0.5	<0.5	0	0	0	<0.5	SSV	14	38	330
Lead	6	310	3300	6	3	0	1284.23	SSV	276	383	6490
Mercury	6	0.64	1.5	0	0	0	1.27	SSV	6	7	66
Selenium	6	<0.20	<0.20	0	0	0	<0.20	SSV	350	595	13,000
Nickel	6	6.1	31	0	0	0	20.12	SSV	130	130	1800
Phenols	6	<0.3	<0.3	0	0	0	<0.3	SSV	162	262	686
Benzo[a]pyrene	6	<0.1	2.4	1	1	0	1.43	SSV	0.8	0.9	14
Copper	6	32	96	0	0	0	70.88	SSV	3970	8370	109,000
Zinc	6	60	1100	0	0	0	622.78	SSV	16,900	46,800	917,000
Free Cyanide	6	<0.50	<0.50	0	0	0	<0.50	SSV	34	34	34

Notes

*The concentration of Trivalent Chromium assumed to be equivalent to the Total Chromium concentration. This is because most naturally occurring chromium is in the trivalent (chromic) state.

Discussion of Results and Statistics

The results of the laboratory analysis indicate the made ground contains elevated concentrations of lead and locally benzo[a]pyrene, which exceeded the residential soil screening criteria. The recorded lead and benzo[a]pyrene concentrations did not exceed the screening values for a commercial/industrial end use. None of the other contaminants tested for exceeded their respective screening values for a residential or commercial/industrial land uses.

Statistical analysis, based on the mean value test, indicates that the US95 value for lead exceeded its screening values for residential end uses, and that the benzo[a]pyrene US95 value exceeded its screening value for a residential with home grown produce end use, but not that for a residential without home grown produce. Maximum value tests on the lead and benzo[a]pyrene data indicate that the highest results are not statistical outliers and should be regarded as part of the same statistical populations.

The results indicate that the made ground beneath the site would be unsuitable for retention at the surface in a residential setting due to the presence of lead and benzo[a]pyrene within the made ground. The soils tested would be considered suitable within a commercial/industrial setting.

Asbestos/Hydrocarbon Pollution in Soil

No asbestos containing material (ACM) was found during sample preparation prior to chemical analysis and visual evidence of ACM was not recorded during this investigation.

Visual and olfactory evidence of hydrocarbon impacted soils was not detected within the soils beneath this site during the investigation. The single soil TPH result determined during the WAC testing was <10mg/kg, which confirms the absence of hydrocarbon contamination in the soils beneath this site.

<u>SOIL GAS MONITORING RESULTS</u>

Four return visits to monitor gas levels at this site were made in February and March 2014 to record the concentrations of landfill type gases (methane, carbon dioxide and oxygen) in the standpipe. The results are presented to the rear of the exploratory hole records. The recorded concentrations of methane were all less than 0.1%, whilst the carbon dioxide levels recorded ranged between 1.2% and 2.4%. The recorded oxygen concentrations within the standpipes were generally depleted when compared to atmospheric conditions. The in-situ measurement confirmed a negligible gas emission rate with a recorded flow rate of <0.1l/hr in all instances.

Assuming a positive flow rate of 0.1l/hr, the results give a Gas Screening Value (GSV) of 0.0024l/hr. This GSV falls within the modified Wilson and Card Characteristic Situation 1 or óGreenô classification of the NHBC traffic light system (for low rise housing), as defined by the Construction Industry Research and Information Association, CIRIA Report C665, óAssessing risks posed by hazardous ground gasses to buildingsö.

UPDATED CONCEPTUAL MODEL

Assessment of the potential linkage between ground contamination sources, human and environmental receptors have been assessed based on the desk study research and the intrusive ground investigation documented in the preceding sections of this report.

A generalised conceptual model, updated following the intrusive works, monitoring and testing, and targeted to provide coverage across the site, relative to the construction phase and completed development, is presented below in Table 6.

Table 6: Updated Conceptual Model Relative to Construction and Future Development

Receptors	Pathway	Estimated Potential for Linkage with Contaminant Sources			
		Drainage	Soil Beneath Site	Soil Gas	Ground Contamination Outside Site Boundary
Human Health ï ground workers	Ingestion and Inhalation of contaminated Soil, Dust and Vapour	Moderate	Moderate	Low	Very Low
Human Health ï users of completed development	Ingestion and Inhalation of contaminated Soil, Dust and Vapour	N/A	Low (landscaping) to Moderate (private gardens)	Low	Very Low
Water Environment	Migration through ground into surface water or groundwater	N/A	Very Low	Very Low	Low
Flora	Vegetation on site growing on contaminated soil.	N/A	Very Low	Very Low	Very Low
Building Materials	Contact with contaminated soil	N/A	Very Low	Very Low	Very Low

Key to Table 6

RISK	Definition
Very High	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, or, there is evidence that severe harm to a designated receptor is currently happening. The risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) and remedial works may be necessary in the short term and likely over the long term.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild.
Low	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very Low	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.
N/A	Not Applicable because the proposed development will remove the source.

COMMENTS ON GROUND CONTAMINATION IN RELATION TO PROPOSED DEVELOPMENT

The proposed residential development will have a single storey above ground level, a single level basement and a small front garden. Anticipated exposure scenarios relating to the site and future redevelopment works including remedial options as applicable are discussed as follows.

This investigation may not have revealed the full extent of contamination on the site and appropriate professional advice should be sought if subsequent site works reveal materials that may appear to be contaminated.

Contaminated Soil

The exploratory holes found about 3.00m of made ground beneath the site. The made ground beneath the site contained elevated concentrations of lead and locally benzo[a]pyrene, which exceeded residential soil screening criteria, but not the screening values for a commercial/industrial end use. None of the other contaminants tested for exceeded their respective screening values for a residential or commercial/industrial land uses.

Existing Drainage

Redundant foul or surface water drain runs, should be removed from beneath the site and precautions should ensure that any remaining effluent is directly disposed off-site. The integrity of existing drainage should be checked, and where they are to be retained, any damaged sections should be replaced prior to development. The latter measures should remove any future risk to human health and to the water environment.

Human Health - Construction Workers

The presence of lead and benzo[a]pyrene contamination within the made ground soils beneath the site indicates that there is locally a moderate risk that a pathway could develop affecting groundworkers during the construction phase of development.

However, no special precautions would be required during the development of the site by workers who may come into contact with the soil during groundworks, providing standard precautions are adopted which should generally include the procedures given by the Health and Safety Executive (The Blue Book) HS(G)66.

For the protection of workers during groundworks the following is recommended:

a) Limit repeated or prolonged skin contact with soils by wearing gloves with sleeves rolled down.

b) Washing facilities should be made available to groundworkers, so as to minimise the potential for inadvertent ingestion of soil.

c) If any soils are revealed which are different to those encountered by this ground investigation, the advice of a specialist should be sought in view of classifying the material and ascertaining its risk to groundworkers.

d) Dust suppression measures such as ódamping downö, could also be adopted to prevent the spread of soil contaminants.

e) There is a potential for reduced oxygen levels within deep excavations. This means that safe working procedures will need to be adopted on this site and follow the principles given by the Health and Safety Executive guidance notes with regards to exposure limits and entry into deep excavations/confined spaces, such as the proposed basement. Gas detection equipment and an alarm system for personnel working in excavations may be required, together with other safety facilities.

Human Health - Users of Completed Development

The risk of the encountered ground contamination affecting the site users when present beneath buildings and permanent areas of hardstanding would be considered to be very low. This is because it would be highly unlikely that the general site users would normally be able to penetrate the basement walls and floors, and hardstanding, which would be necessary for them to uncover any contaminated soils beneath the site. However, it is considered that there would be a low to moderate risk of the ground contamination affecting site end users if the near surface fill were retained within private gardens or exposed at the surface within soft landscaped garden areas.

The presence of statistically elevated lead and benzo[a]pyrene within the made ground means that such soils should not be retained at the surface within gardens or soft landscaping in the proposed redevelopment. These soils will need to be removed from such areas and either disposed of off-site, covered with an adequate capping layer, or placed beneath areas of hardstanding, if geotechnically suitable.

Effects on Services

Consideration should be given to upgrading service materials, particularly for water supply pipes, where they will be in contact with made ground containing elevated concentrations of lead and benzo[a]pyrene, or ensure that the made ground is not used as a backfill around such water supply pipes. Further guidance on the selection of materials for use as water supply pipes should be sought from the local water supplier.

Soil Gas

According to database information, there are no active landfills within influencing distance of the site and although 3.00m of made ground was encountered it was not found to include organic and putrescible material.

The gas monitoring has determined that a Wilson and Card Characteristic Situation 1 would apply and that no special precautions are required to protect the proposed development from ingress of soil gases.

The site lies within an area where radon protection measures are not required for new dwellings in accordance with BR211.

Water Environment

Significant soil contamination was not identified by the investigative works; the groundwater table was found to lie at least 6m below ground level within the Secondary (A) Aquifer of the Claygate Member; the site is underlain at depth by the practically impermeable Unproductive stratum of the London Clay; and the site and surrounding area are devoid of water courses, surface water features and source protection zones. It is consequently considered unlikely that the proposed redevelopment would impact the quality of the water environment, indeed the removal of a significant volume of made ground during basement excavation would be considered to improve the situation on this site.

Off-Site Disposal of Soil Arisings

The results of chemical analysis are provided in Appendix 3 and can be used for the basic characterisation of the soil destined for landfill. The Environment Agency publication Hazardous Waste, Technical Guidance WM2 outlines the methodology for classifying wastes and should be referenced for guidance. The test results (total metals, hydrocarbons and cyanide) should be compared to the relevant thresholds to determine whether they fall into the primary categories of non-hazardous waste or hazardous waste and will help indicate the likely European Waste Catalogue (EWC) code, which is determined by the waste type. The results of Waste Acceptance Criteria (WAC) leachate testing should be used to check whether if categorised as non-hazardous waste it could be disposed of at an inert waste landfill; or if categorised as hazardous waste whether it could qualify as stable non-reactive hazardous waste for disposal in non-hazardous landfill.

Excavated material and excess spoil should always be classified prior to removal from site as required by óDuty of Careô (Environmental Protection Act, 1990) legislation. This means that material has to be given a proper description and waste classification prior to removal. Basic characterisation is the responsibility of the waste producer and compliance checking and on-site verification are generally the responsibility of the landfill operator. The landfill operator will need to liaise with the waste producer as the approach relies on the information from basic characterisation.

The clean arisings from the underlying natural soils across this site would fall under the EWC code 17 05 04 under the inert category.

CONCLUSIONS

The proposed residential development will have a single storey above ground level, a single level basement and a small front garden. The existing site is detailed on the site plan at the rear of this report. The proposed site layout will need to be provided by the Engineer in due course. This plan will need to clearly identify areas of gardens and soft landscaping.

Remediation

Remediation of the soils beneath the site, in respect of the redevelopment, is only considered necessary in relation to the creation of new areas of gardens and soft landscaping, as any new hardstanding, and building floors, will prevent contact between any contaminated ground and the site end users.

In order to create new gardens on this site, as a minimum, it will be necessary to either remove a sufficient thickness of the surface layers and replace them with imported topsoil material or isolate the contaminated made ground with a sufficient thickness of cover. The removal of 0.60m of made ground and a cover thickness of the same magnitude would be considered prudent for soft landscaping.

The removal of the surface layers and their replacement will provide a cover layer that will prevent contact between any site end users and any underlying contaminant source. It would be considered prudent to place a geotextile membrane between the cover layer and the underlying ground in order to prevent mixing of these layers.

In the highly unlikely event that the garden is used to produce vegetables and fruit, an increased depth of removal and thickness of imported subsoil and topsoil of up to 1.00m, or if the made ground is less than 1.00m thick, the full thickness of made ground would need to be adopted.

Remediation Plan

This remediation scheme should be used with the proposed development plan to derive a remediation plan, clearly labelled to show the different land uses (for example - hardstanding, buildings, soft landscaping and private rear gardens), which should be submitted to satisfy planning conditions.

Topsoil

Imported topsoil should have appropriate certificates confirming its suitability prior to placement.

Validation

The implementation of this remediation scheme should be checked during construction and on completion, and appropriate records kept so that a Validation Report can be compiled and subsequently submitted to the local authority. In the event that no new gardens are included within the redevelopment and the site is entirely occupied by the building and hardstanding, then remediation and subsequent validation will not be necessary.

GROUND ENGINEERING LIMITED

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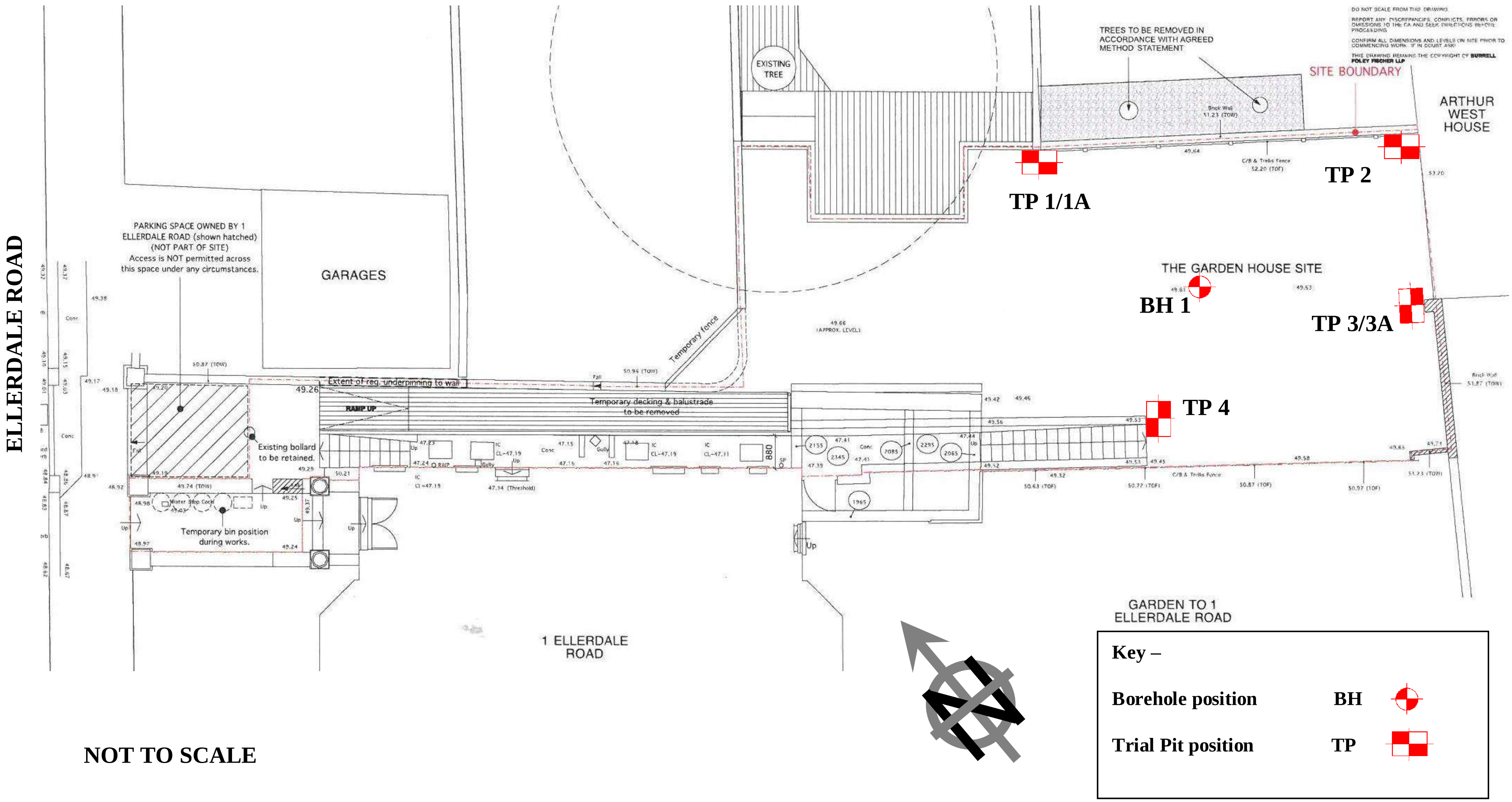
Site Plan

Not to Scale



Project	**Land by 1 Ellerdale Road, London NW3**	**GROUND ENGINEERING LIMITED**	**Project No.**
Client	**Mr Georg Galberg**	Peterborough Tel : 01733 566566	**C13183**

GROUND ENGINEERING LIMITED

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Site: LAND BY 1 ELLERDALE ROAD, LONDON NW3

BOREHOLE BH1

Date: 27/01/14 to 28/01/14

Hole Size: 150mm dia to 15.50m

Ground Level: 49.61m. S.D.

Depth m	Type	Blows	(Date) Casing	Description of Strata	Depth m	S.D. Level m
0.00-0.60	B1			MADE GROUND - Soft, friable, dark grey, slightly sandy, gravelly CLAY with occasional brick cobbles. Gravel of brick, flint and ash.	0.60	49.01
0.60-1.20	B2			MADE GROUND - Soft, brown and grey mottled, sandy, gravelly CLAY. Gravel of flint, brick, concrete and ash.		
1.20-1.70	B3					
1.35-1.65	C	N4				
1.70-2.00	B4				1.70	47.91
2.00-2.50	B5			MADE GROUND - Soft, brown and grey mottled, slightly sandy, slightly gravelly CLAY/SILT. Gravel of flint, ash and coal.		
2.15-2.45	C	N5	1.50			
2.80-3.30	B6				2.80	46.81
2.95-3.25	C	N9	2.25	Firm, locally stiff, orange brown, brown and light grey mottled, slightly gravelly, sandy CLAY/SILT with bands of silty fine sand. Gravel of angular to sub-rounded flint.		
4.00-4.45	U1	60	3.50	(HEAD DEPOSIT)		
4.45	D1				4.70	44.91
5.00-5.50	B7			Firm, becoming stiff, laminated, brown and orange brown banded, CLAY/SILT with laminae of clayey, silty fine sand.		
5.15-5.45	S	N15	4.50			
5.45	D2					
6.00-6.20	U2	35	5.45	(WEATHERED CLAYGATE MEMBER)		
6.20	D3					
7.00	D4					
7.30	D5				7.30	42.31
7.50-8.00	B8			Stiff, grey brown, slightly sandy CLAY/SILT with occasional grey silt partings.		
7.65-7.95	S	N18	5.45			
7.95	D6					
8.50	D7			(CLAYGATE MEMBER)		
9.00-9.45	U3	55	5.45			
9.45	D8					
10.00	D9				10.00	39.61

REMARKS
1. Excavating a pit from 0.00m to 1.20m for 1 hour
2. Borehole cased to 13.00m depth
3. Unable to advance casing below 13.00m depth, and therefore unable to advance hole below 15.50m depth, hole abandoned
4. Gas monitoring standpipe installed to 10.00m depth

Project No 13183

Scale 1:50

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KEY
D - Disturbed Sample
B - Bulk Sample
U - Undisturbed Sample
W - Water Sample
S/C - SPT Spoon/Cone
∇ Water Strike
▼ Water Rise
N - SPT Blows for 0.3m
* - Blows for quoted penetration
V - Vane Shear Test Cohesion ( ) kPa
▼c Level on completion
c▼w Level casing withdrawn
▼s Standpipe Level

Groundwater Strikes

No	Struck	Rose to	Rate	Cased	Sealed
1	10.00		slow	5.45	not

Groundwater Observations

Date	Hole	Casing	Water
27/01/14	13.50	12.70	11.00
28/01/14	13.50	13.00	7.40
28/01/14	15.50	13.00	13.00
06/02/14	10.00		6.29
13/02/14	10.00		6.22

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Site: **LAND BY 1 ELLERDALE ROAD, LONDON NW3**

BOREHOLE **BH1**

Date: 27/01/14 to 28/01/14

Hole Size: 150mm dia to 15.50m

Ground Level: 49.61m. S.D.

Samples and in-situ Tests: Depth m	Type	Blows	(Date) Casing	Inst.	Description of Strata	Legend	Depth m	S.D. Level m
				BENEATH INSTALLATION	Stiff, dark grey and grey brown mottled, slightly sandy, silty CLAY with occasional light grey silty fine sand partings and bands.		**10.00**	**39.61**
10.50-11.00	B9							
10.65-10.95	S	N18	5.45					
10.95	D10							
11.50	D11							
12.00-12.30	U4	40	11.20		(CLAYGATE MEMBER)			
12.70	D12							
13.00-13.50	B10		▼c				**13.00**	**36.61**
13.15-13.45	S	N17	12.70		Stiff, dark grey and grey brown mottled, sandy CLAY/ SILT with occasional light grey silty, fine sand and silt partings and pockets.			
13.50 13.50	D13 W1							
14.50	D14				(CLAYGATE MEMBER)			
15.15-15.45	S	N24	13.00					
15.50	D15						**15.50**	**34.11**
					Borehole abandoned at 15.50m depth			

REMARKS

Project No 13183

Scale 1:50

Page 2/2

KEY
D - Disturbed Sample
B - Bulk Sample
U - Undisturbed Sample
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S/C - SPT Spoon/Cone
∇ Water Strike
▼ Water Rise
N - SPT Blows for 0.3m
* - Blows for quoted penetration
V - Vane Shear Test Cohesion ( ) kPa
▼c Level on completion
c▼w Level casing withdrawn
▼s Standpipe Level

Groundwater Strikes

No	Struck	Rose to	Rate	Cased	Sealed

Groundwater Observations

Date	Hole	Casing	Water
25/02/14	10.00		6.15
04/03/14	10.00		6.33

Borehole Number	Depth (m)	Casing Depth (m)	Depth to Water (m)	Type of Test *	Seating Drive: Blows/Penetration (mm)	Test Drive: 300mm Blows for each successive 75 mm Penetration				N Value	Extrapolated Value
BH1	1.20 - 1.65			C	1/150	1	1	1	1	4	
	2.00 - 2.45	1.50		C	2/150	1	1	1	2	5	
	2.80 - 3.25	2.25		C	2/150	1	2	3	3	9	
	5.00 - 5.45	4.50		S	3/150	2	4	4	5	15	
	7.50 - 7.95	5.45		S	5/150	4	4	5	5	18	
	10.50 - 10.95	5.45		S	4/150	4	4	5	5	18	
	13.00 - 13.45	12.70	11.00	S	4/150	3	4	5	5	17	
	15.00 - 15.45	13.00	13.00	S	8/150	5	6	6	7	24	

* C denotes test using a solid cone
S denotes test using a split barrel sampler

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Results of Standard/Cone Penetration Tests

13183

Table No .

LAND BY 1 ELLERDALE ROAD, LONDON NW3

GROUND ENGiNEERiNG LIMITED
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Site: LAND BY 1 ELLERDALE ROAD, LONDON NW3

TRIAL PIT TP1

Date: 27/01/14

Pit Size: 0.60m L x 0.35m W x 1.15m D.

Ground Level: 49.65m. S.D.

Samples and in-situ Tests: Depth m	Type	Result	(Date) Water	Description of Strata	Legend	Depth m	S.D. Level m
0.20	D1			MADE GROUND - Soft, friable, dark grey and dark brown mottled, sandy, gravelly SILT/CLAY. Gravel of flint, brick, smoker's pipe, polystyrene, brick, coal and ash.		0.55	49.10
0.50	D2						
0.80	D3			MADE GROUND - Firm, locally soft, friable, brown and dark brown mottled, sandy, gravelly CLAY. Gravel of brick, concrete and flint.		1.15	48.50
1.10	D4						
				Pit completed at 1.15m depth			

KEY
- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed Sample
- R - Root Sample
- W - Water Sample
- J - Jar Sample
- ▽ Water Strike
- ▼ Water Rise
- ▼c Level on completion
- MP - Mackintosh Probe
- P( ) - Hand Penetrometer Cohesion ( ) kPa
- V - Vane Shear Test Cohesion ( ) kPa

REMARKS

1. Live roots observed to at least 1.15m depth
2. Pit sides stable
3. Pit dry

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Site: **LAND BY 1 ELLERDALE ROAD, LONDON NW3**

TRIAL PIT TP1A

Date: 27/01/14 to 28/01/14

Pit Size: 0.60m L x 0.35m W x 1.50m D.

Ground Level: 49.65m. S.D.

Samples and in-situ Tests: Depth m	Type	Result	(Date) Water	Description of Strata	Legend	Depth m	S.D. Level m
0.20	D1			MADE GROUND - Soft, friable, dark brown, sandy, gravelly CLAY. Gravel of flint, brick, slate and concrete.			
0.50	D2					**0.60**	**49.05**
0.80	D3			MADE GROUND - Dark brown, clayey, sandy GRAVEL AND COBBLES. Gravel of brick, concrete, polystyrene, slate and metal. Cobbles of brick and concrete.			
1.10	D4						
1.40	D5					**1.50**	**48.15**
				Pit completed at 1.50m depth			

KEY
D - Disturbed Sample
B - Bulk Sample
U - Undisturbed Sample
R - Root Sample
W - Water Sample
J - Jar Sample
∇ Water Strike
▼ Water Rise
▼c Level on completion
MP - Mackintosh Probe
P( ) - Hand Penetrometer Cohesion ( ) kPa
V - Vane Shear Test Cohesion ( ) kPa

REMARKS
1. Live roots observed to at least 1.50m depth
2. Pit sides stable
3. Pit dry

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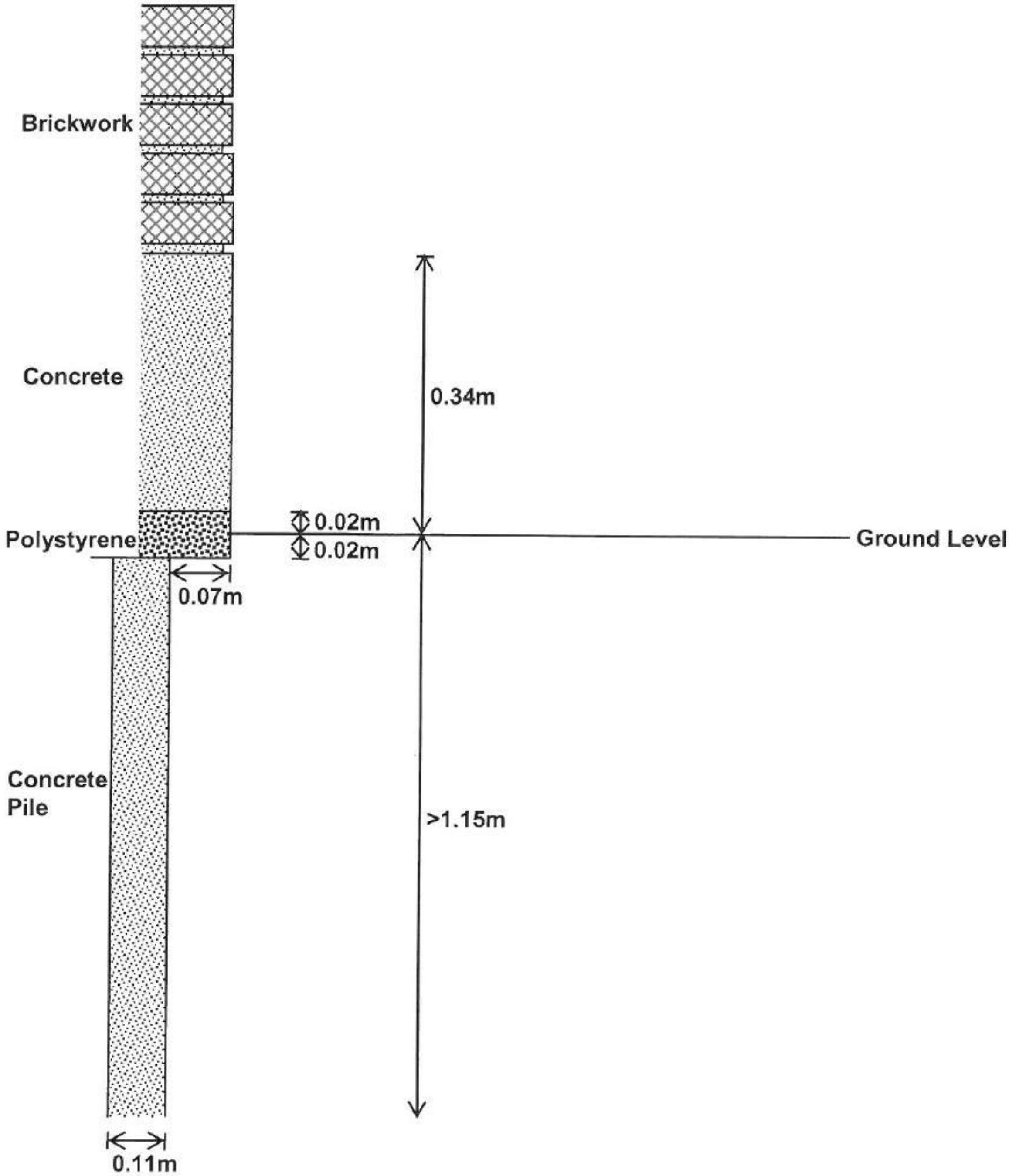
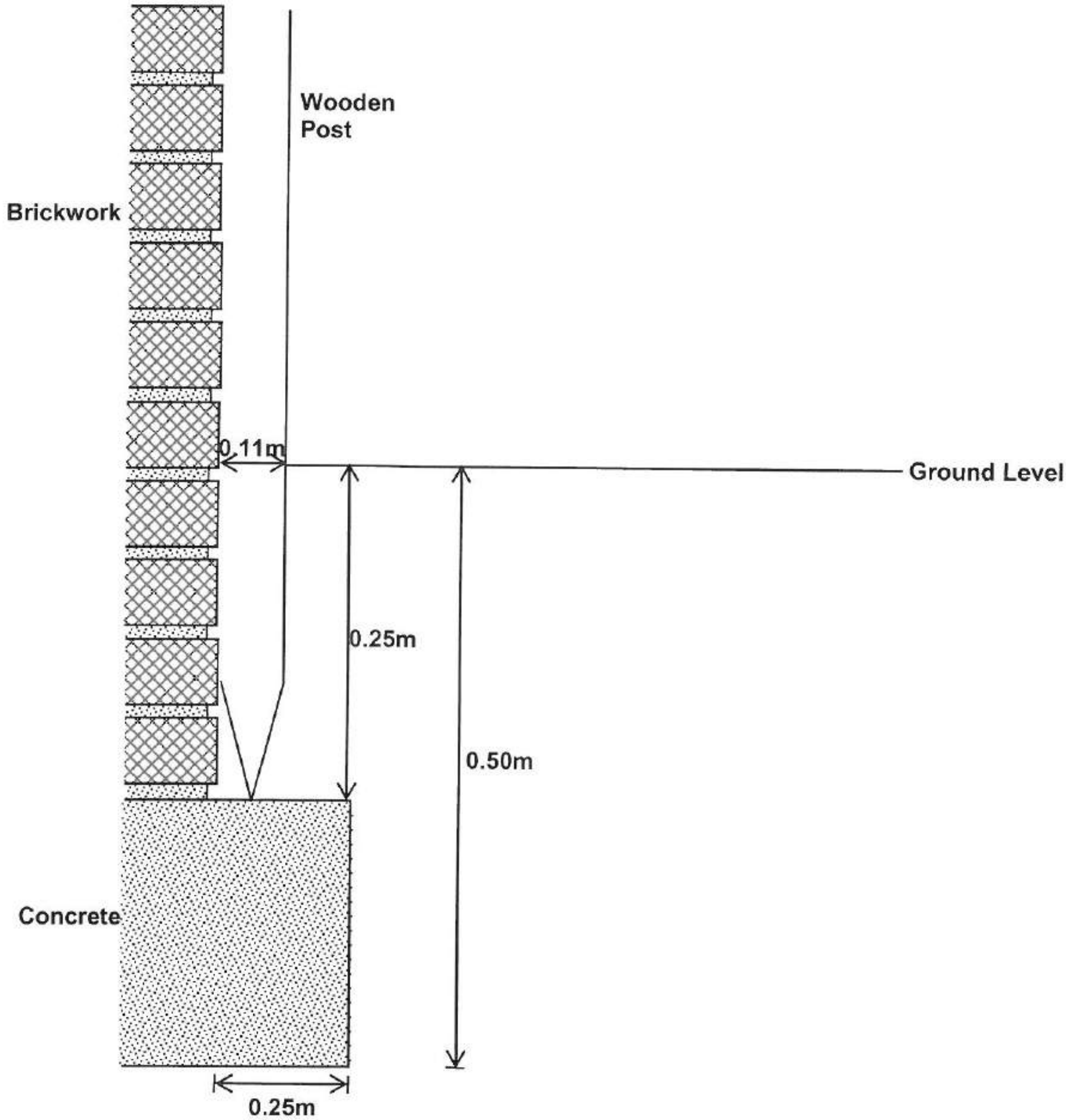
Trial Pit TP 1
Cross Section A-A



Not To Scale

Project : Land by 1 Ellerdale Road, London NW3 **Client : Mr Georg Galberg**	**GROUND ENGINEERING LIMITED** Peterborough Tel : 01733 566566	**Project No. C13183**

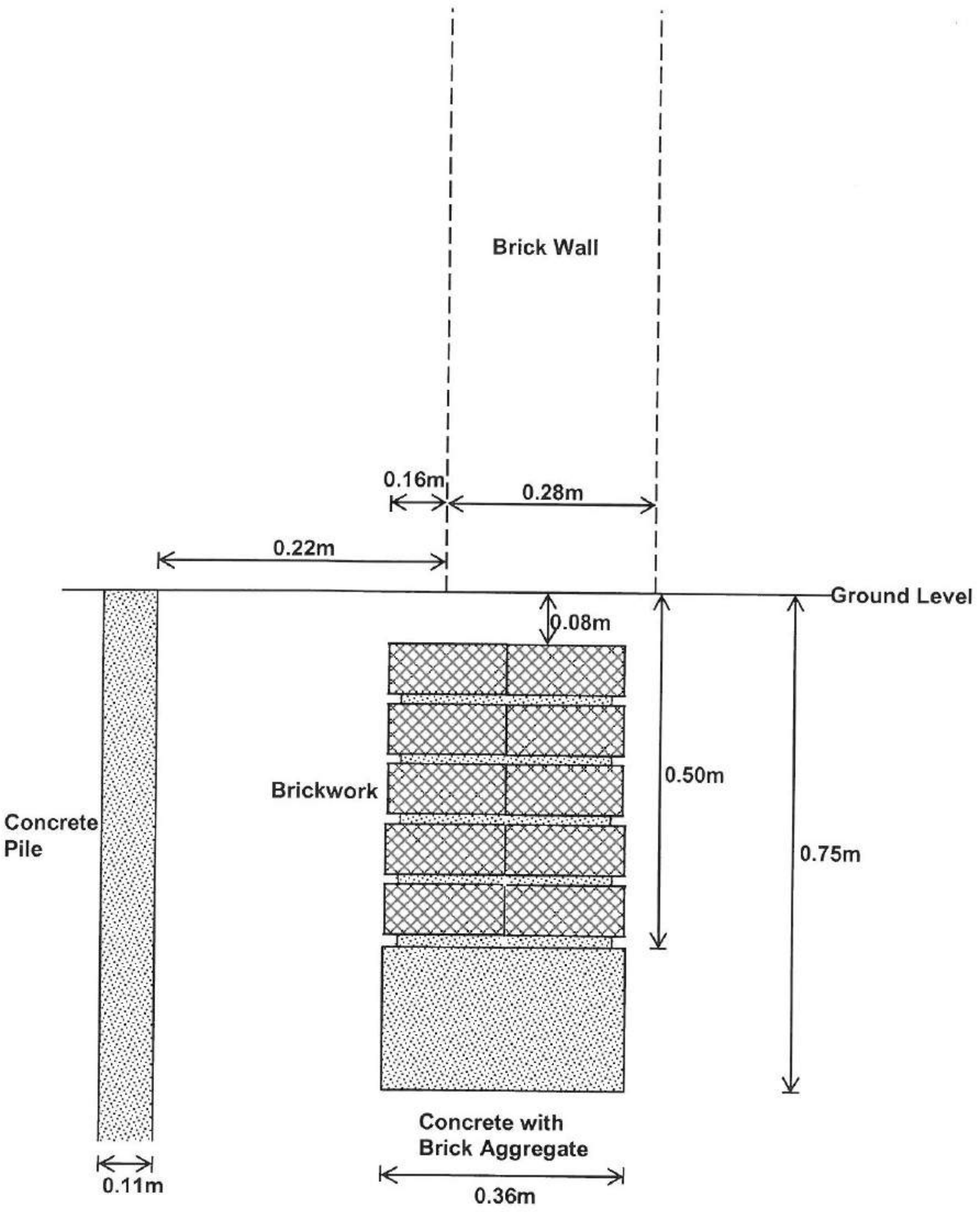
Trial Pit TP 1
Cross Section B-B



Not To Scale

Project : Land by 1 Ellerdale Road, London NW3 Client : Mr Georg Galberg	GROUND ENGINEERING LIMITED Peterborough Tel : 01733 566566	Project No. C13183

Trial Pit TP 1
Cross Section C-C



Not To Scale

Project : Land by 1 Ellerdale Road, London NW3 Client : Mr Georg Galberg	GROUND ENGINEERING LIMITED Peterborough Tel : 01733 566566	Project No. C13183

Trial Pit TP 1
Photographs

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Project : Land by 1 Ellerdale Road, London NW3 **Client : Mr Georg Galberg**	**GROUND ENGINEERING LIMITED** Peterborough Tel : 01733 566566	**Project No. C13183**

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Site: **LAND BY 1 ELLERDALE ROAD, LONDON NW3**

TRIAL PIT **TP2**

Date: 28/01/14

Pit Size: 0.50m L x 0.50m W x 1.50m D.

Ground Level: 49.83m. S.D.

Samples and in-situ Tests: Depth m	Type	Result	(Date) Water	Description of Strata	Legend	Depth m	S.D. Level m
0.30	D1			MADE GROUND - Soft, friable, dark brown, sandy, gravelly CLAY with occasional cobbles of concrete. Gravel of brick, concrete, slag, flint and ash.		0.35	49.48
0.60	D2			MADE GROUND - Firm, friable, brown and dark brown mottled, sandy, gravelly CLAY. Gravel of flint, brick, ash and concrete.		0.90	48.93
0.80	D3						
1.10	D4			MADE GROUND - Firm, brown, slightly sandy, gravelly CLAY. Gravel of flint, brick and coal.		1.30	48.53
1.20	V1	(69)					
1.40	D5			MADE GROUND - Brown, slightly gravelly, silty SAND. Gravel of coal and flint.		1.50	48.33
				Pit completed at 1.50m depth			

KEY
D - Disturbed Sample
B - Bulk Sample
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R - Root Sample
W - Water Sample
J - Jar Sample
∇ Water Strike
▼ Water Rise
▼c Level on completion
MP - Mackintosh Probe
P( ) - Hand Penetrometer Cohesion ( ) kPa
V - Vane Shear Test Cohesion ( ) kPa

REMARKS
1. Live roots observed to at least 1.50m depth
2. Pit sides stable
3. Pit dry

Project No 13183

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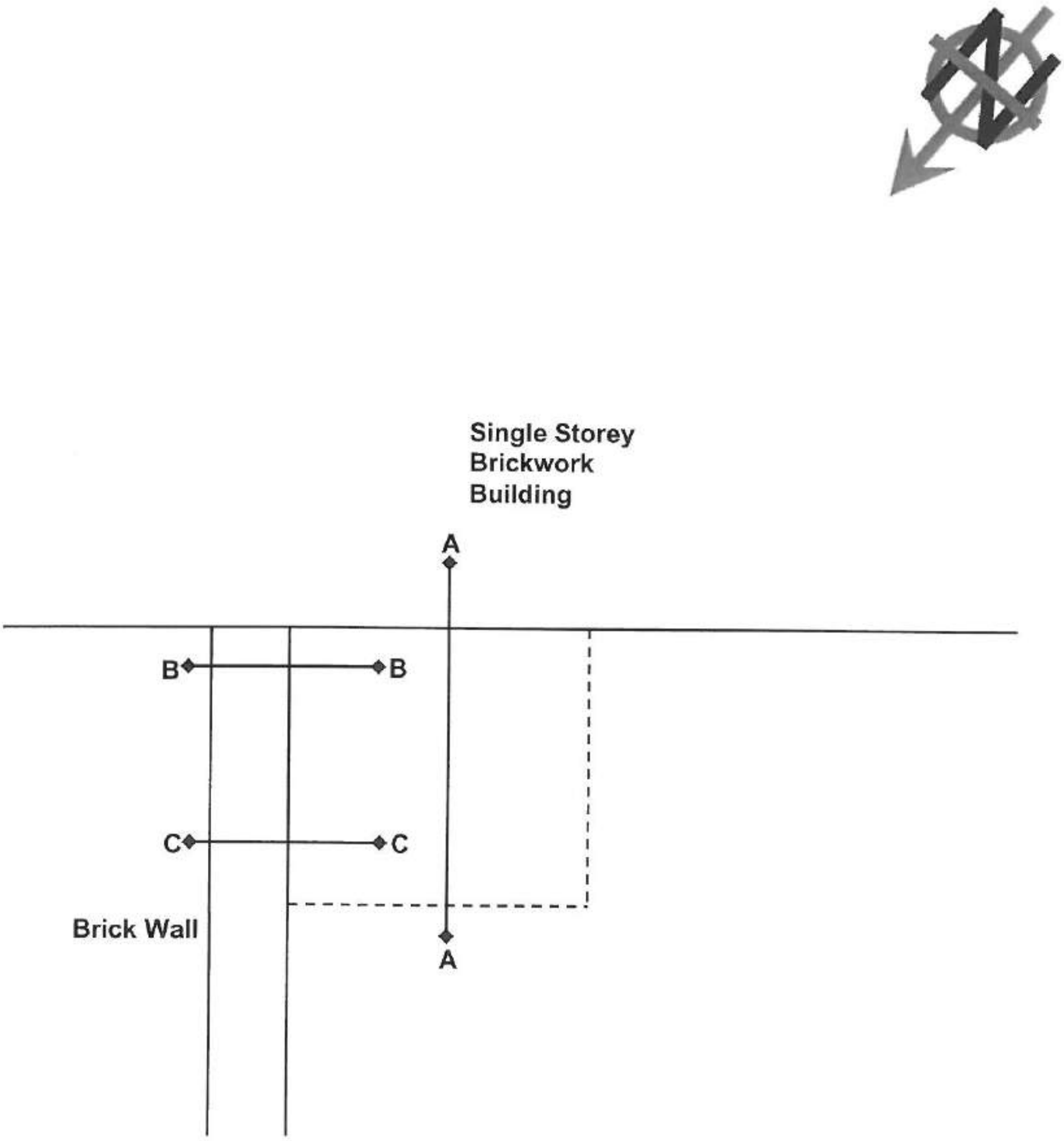
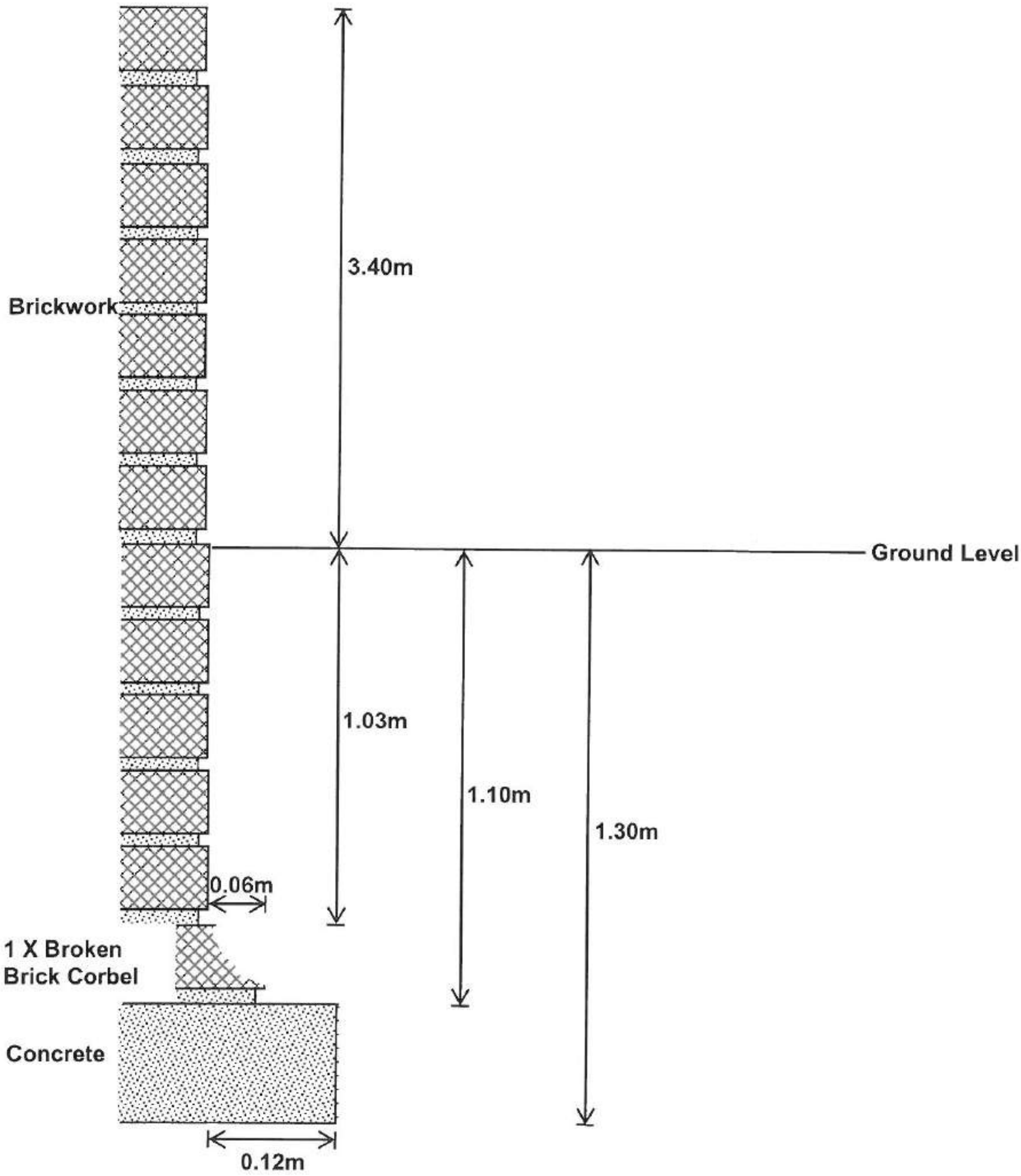
Trial Pit TP 2
Plan



Not To Scale

Project : Land by 1 Ellerdale Road, London NW3 Client : Mr Georg Galberg	GROUND ENGINEERING LIMITED Peterborough Tel : 01733 566566	Project No. C13183

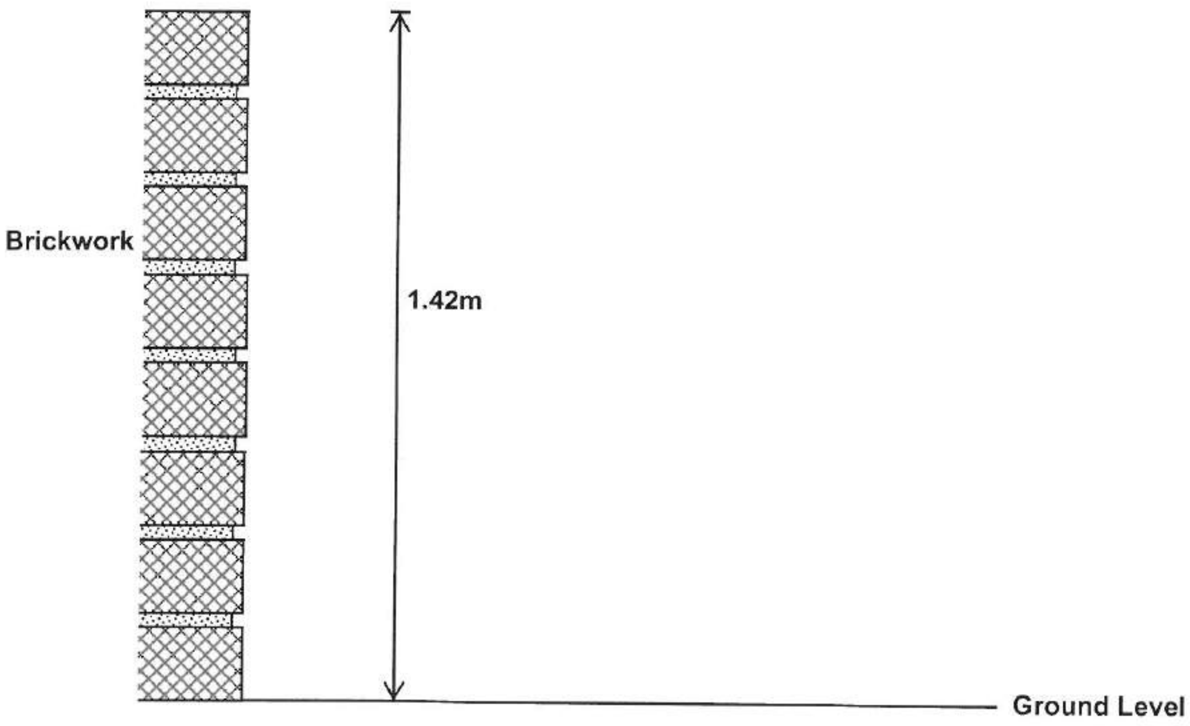
Trial Pit TP 2
Cross Section A-A



Not To Scale

Project : Land by 1 Ellerdale Road, London NW3 **Client : Mr Georg Galberg**	**GROUND ENGINEERING LIMITED** Peterborough Tel : 01733 566566	**Project No. C13183**

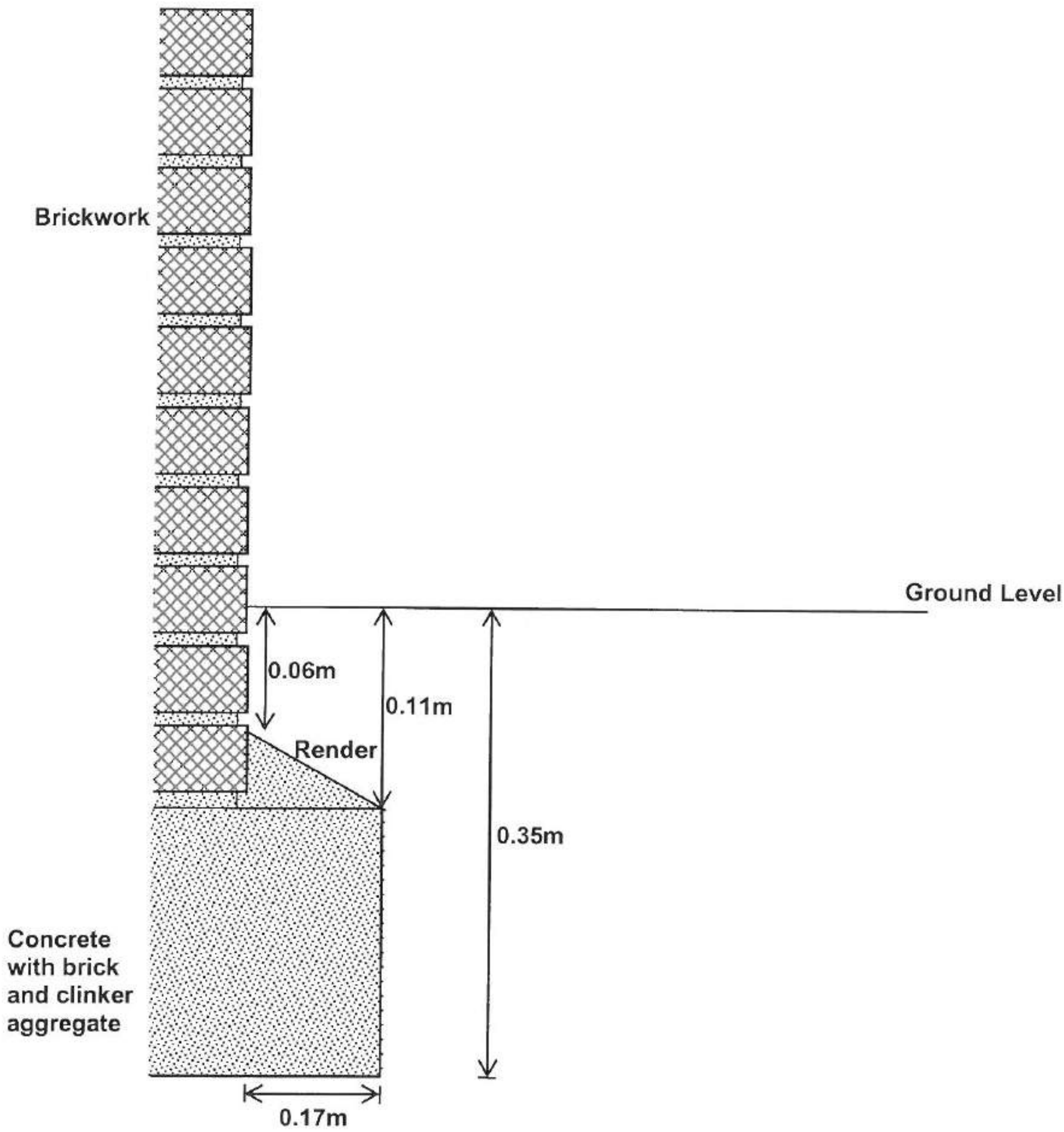
Trial Pit TP 2
Cross Section B-B



Not To Scale

Project : Land by 1 Ellerdale Road, London NW3 **Client** : Mr Georg Galberg	**GROUND ENGINEERING LIMITED** Peterborough Tel : 01733 566566	**Project No.** **C13183**

Trial Pit TP 2
Cross Section C-C



Not To Scale

Project : Land by 1 Ellerdale Road, London NW3 **Client : Mr Georg Galberg**	**GROUND ENGINEERING LIMITED** Peterborough Tel : 01733 566566	**Project No. C13183**

Trial Pit TP 2
Photographs

Not To Scale

Project : Land by 1 Ellerdale Road, London NW3 **Client : Mr Georg Galberg**	**GROUND ENGINEERING LIMITED** Peterborough Tel : 01733 566566	**Project No. C13183**

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Site:	LAND BY 1 ELLERDALE ROAD, LONDON NW3
Date:	28/01/14
Pit Size:	1.00m L x 0.45m W x 1.70m D.
Ground Level:	49.71m. S.D.

TRIAL PIT TP3

Samples and in-situ Tests: Depth m	Type	Result	(Date) Water	Description of Strata	Legend	Depth m	S.D. Level m
0.20	D1			MADE GROUND - Soft, friable, dark brown, sandy, gravelly CLAY. Gravel of flint, brick, concrete and polystyrene.		0.25	49.46
0.50	D2			MADE GROUND - Firm, friable, brown and dark brown mottled, sandy, gravelly CLAY. Gravel of flint, brick, coal and ash.		0.90	48.81
0.80	D3						
1.10	D4			MADE GROUND - Firm, locally soft, brown and light brown mottled, gravelly, very sandy CLAY. Gravel of flint, brick, slate and concrete.		1.55	48.16
1.40	D5						
1.70	D6			MADE GROUND - Brown, slightly clayey, slightly gravelly SAND. Gravel of coal.		1.70	48.01
				Pit completed at 1.70m depth			

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed Sample
- R - Root Sample
- W - Water Sample
- J - Jar Sample
- ∇ Water Strike
- ▼ Water Rise
- ▼c Level on completion
- MP - Mackintosh Probe
- P( ) - Hand Penetrometer Cohesion ( ) kPa
- V - Vane Shear Test Cohesion ( ) kPa

REMARKS

1. Live roots observed to at least 1.70m depth
2. Pit sides stable
3. Pit dry

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Site: **LAND BY 1 ELLERDALE ROAD, LONDON NW3**

TRIAL PIT **TP3A**

Date: 28/01/14

Pit Size: 0.45m L x 0.45m W x 1.60m D.

Ground Level: 49.71m. S.D.

Samples and in-situ Tests: Depth m	Type	Result	(Date) Water	Description of Strata	Legend	Depth m	S.D. Level m
0.20	D1			MADE GROUND - Soft, friable, dark brown, slightly sandy, gravelly CLAY. Gravel of brick, flint, tile, plastic and polystyrene.		**0.30**	**49.41**
0.50	D2			MADE GROUND - Firm, brown and dark brown mottled, sandy, gravelly CLAY. Gravel of flint, brick, concrete and ash.		**0.80**	**48.91**
0.90 1.00 1.20	D3 V1 D4	 (13) 		MADE GROUND - Firm, locally very soft, friable, brown and light brown mottled, slightly gravelly, very sandy CLAY. Gravel of brick, slate and ash.		**1.30**	**48.41**
1.50 1.50	D5 V2			MADE GROUND - Soft, dark brown, slightly gravelly, sandy CLAY. Gravel of coal, brick and flint.		**1.60**	**48.11**
				Pit completed at 1.60m depth			

KEY
- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed Sample
- R - Root Sample
- W - Water Sample
- J - Jar Sample
- ∇ Water Strike
- ▼ Water Rise
- ▼c Level on completion
- MP - Mackintosh Probe
- P( ) - Hand Penetrometer Cohesion ( ) kPa
- V - Vane Shear Test Cohesion ( ) kPa

REMARKS
1. Live roots observed to at least 1.60m depth
2. Pit sides stable
3. Pit dry

Project No 13183

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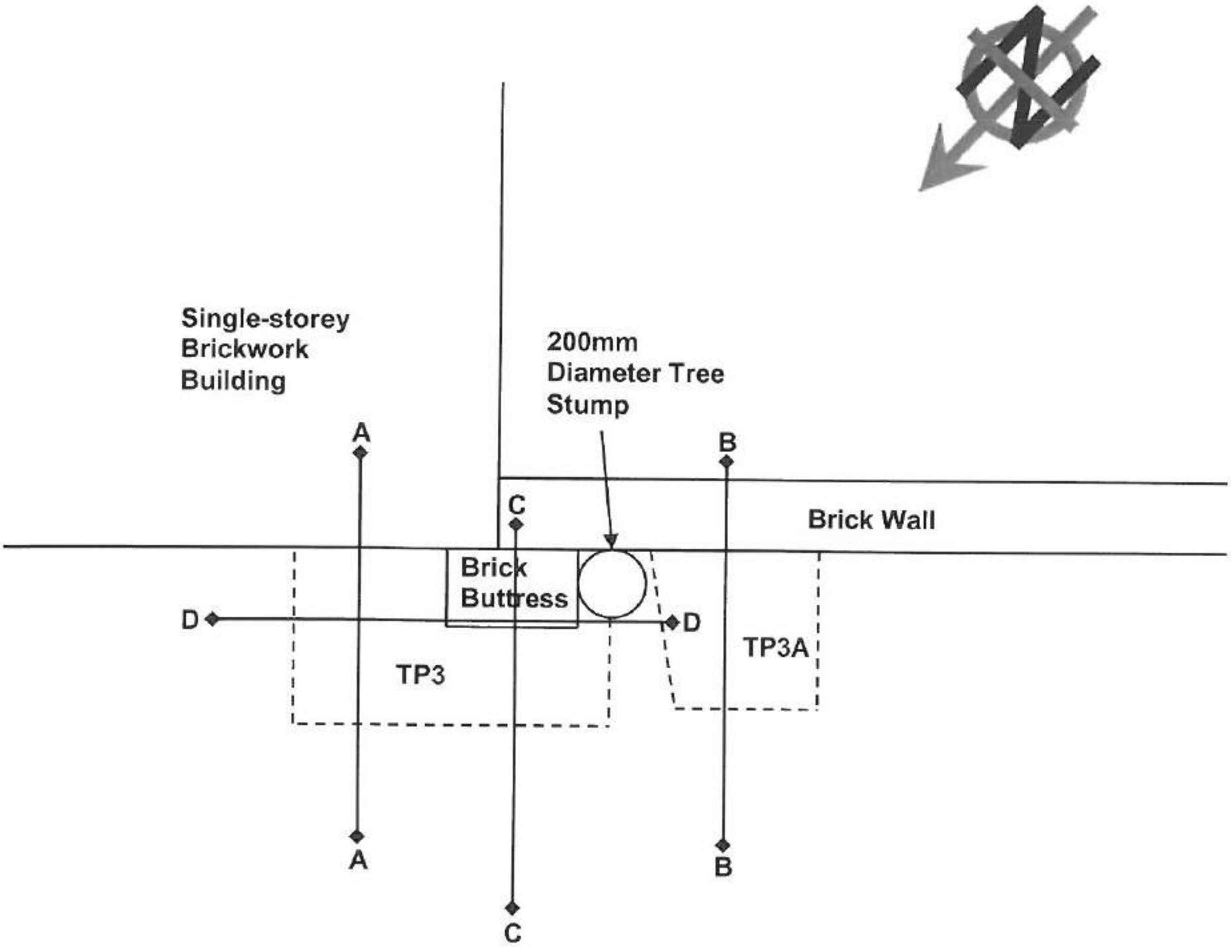
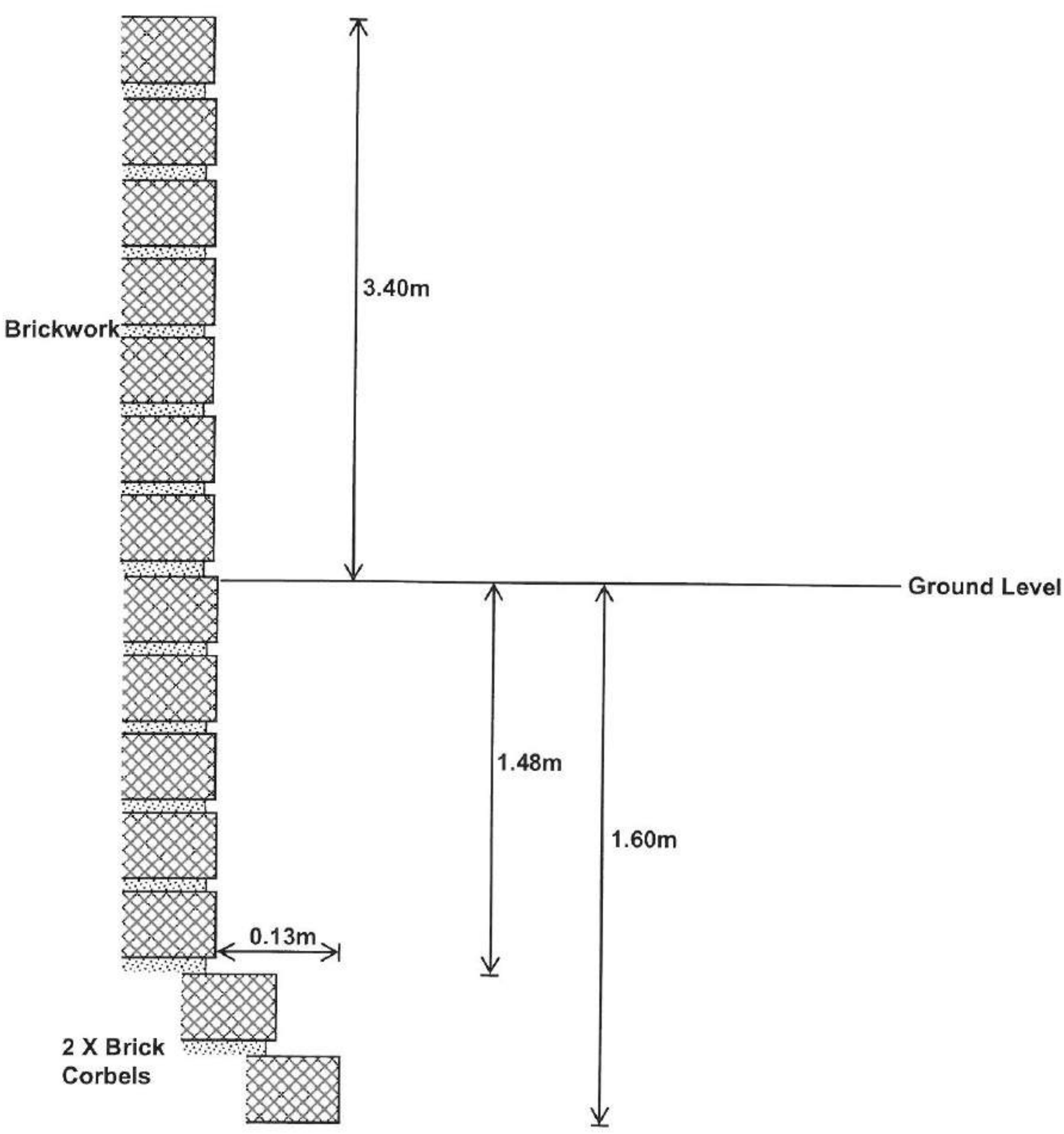
Trial Pit TP 3
Plan



Not To Scale

Project : Land by 1 Ellerdale Road, London NW3 **Client : Mr Georg Galberg**	**GROUND ENGINEERING LIMITED** Peterborough Tel : 01733 566566	**Project No. C13183**

Trial Pit TP 3
Cross Section A-A



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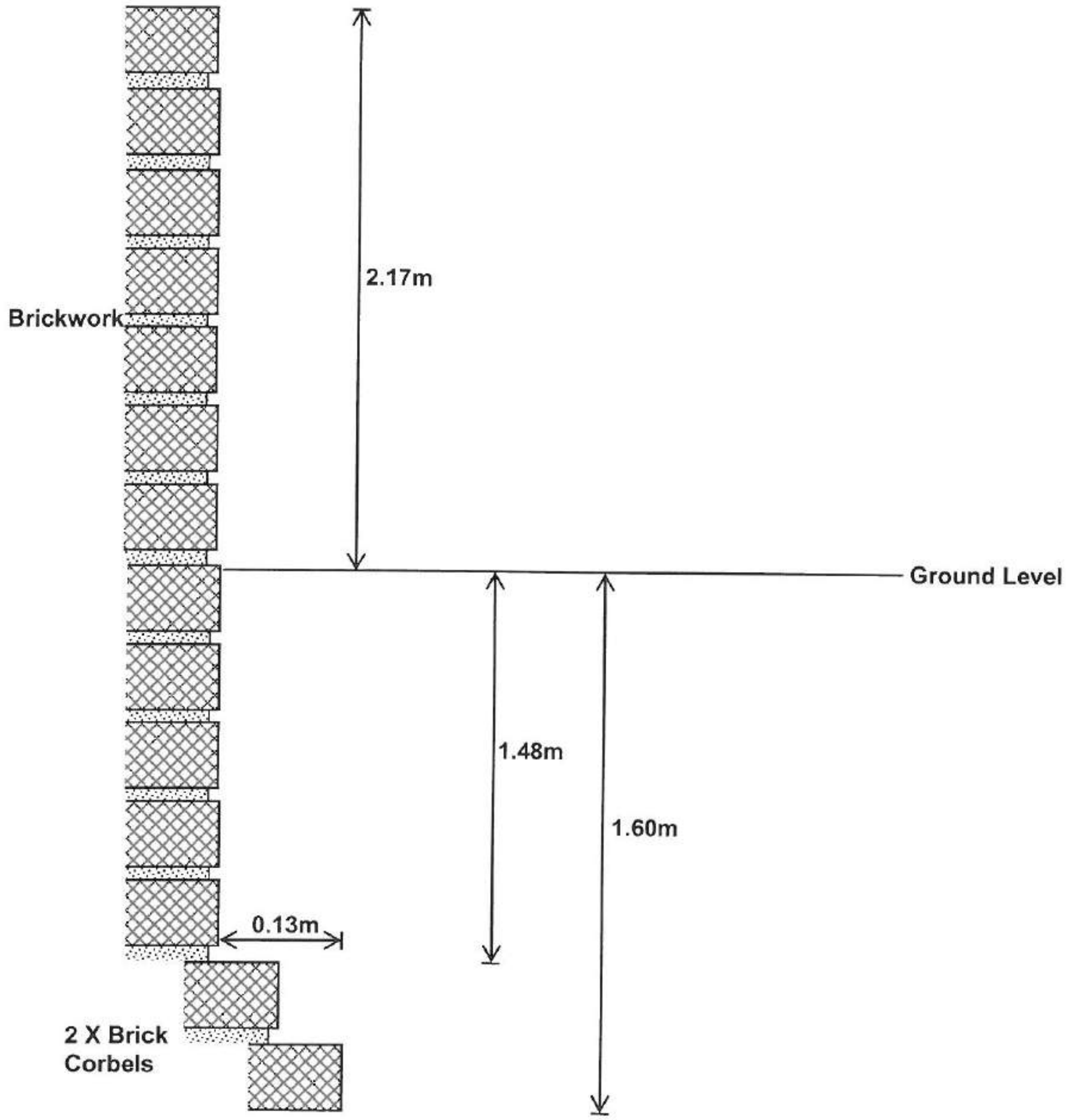
Project : Land by 1 Ellerdale Road, London NW3 **Client : Mr Georg Galberg**	**GROUND ENGINEERING LIMITED** Peterborough Tel : 01733 566566	**Project No. C13183**

Trial Pit TP 3
Cross Section B-B



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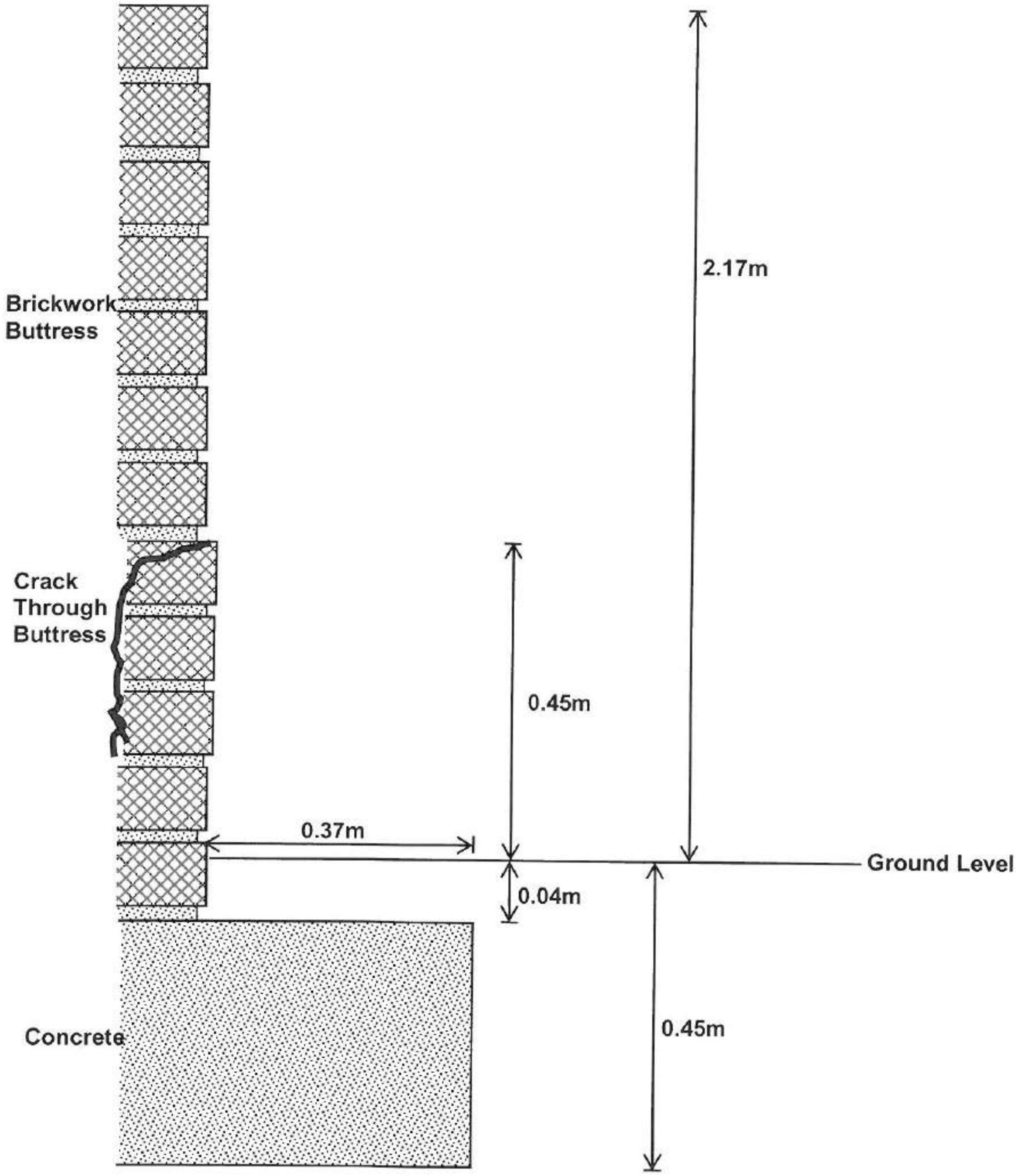
Trial Pit TP 3
Cross Section C-C



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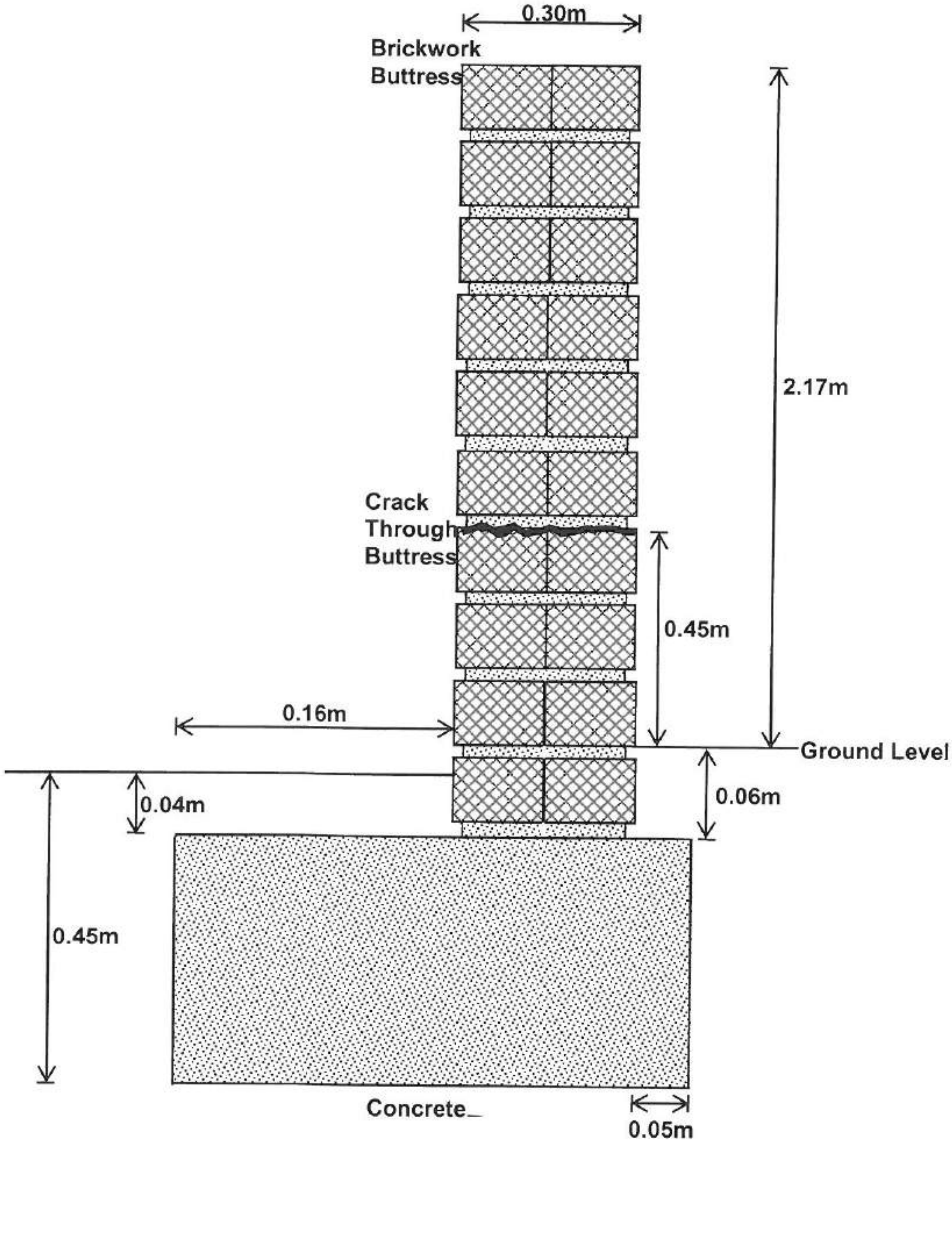
Project : Land by 1 Ellerdale Road, London NW3 Client : Mr Georg Galberg	GROUND ENGINEERING LIMITED Peterborough Tel : 01733 566566	Project No. C13183

Trial Pit TP 3
Cross Section D-D



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Project : Land by 1 Ellerdale Road, London NW3 **Client** : Mr Georg Galberg	**GROUND ENGINEERING LIMITED** Peterborough Tel : 01733 566566	**Project No.** **C13183**