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32027A/L/003/RJM
26th June 2015

Nanayaa Ampoma
Planning Officer
Regeneration and Planning
London Borough of Camden
Town Hall
Argyle Street
London WC1H 8ND

Dear Nanayaa,

BASEMENT IMPACT ASSESSMENT – ADDENDUM
6 ANTRIM GROVE, NW3 4XR

Introduction

Further to the Audit undertaken by GEA of our Basement Impact Assessment (BIA), Letter Reference J14312/MC/1, dated 7th November 2014, and subsequent correspondence and telephone conversations, we are pleased to submit this Addendum to the BIA which, along with the attached appendices, addresses the points raised by the audit.

To assist with your review, we have adopted the same numbering system as the GEA letter.

Item 1.2 - Proposed Development: Based on the findings of further trial pit and window sampler investigations in the front and rear gardens of the property, we confirm that the preferred method of construction will consist of reinforced concrete underpinning of existing walls, and cast insitu reinforced concrete cantilevered retaining walls where the basement extends beyond the existing building, constructed in hit and miss panels of limited width. Temporary support will be provided.

Details of the proposed construction methodology and sequence are provided in the following additional documents which are attached with this Addendum:

- Supplementary Site Investigation Records, Knapp Hicks & Partners Ltd
- Preliminary Structural Drawings (32842/01-06), Knapp Hicks & Partners
- Groundwater Flow Screening and Scoping BIA Assessment, dated 19th May 2015, by Stephen Buss Environmental Consulting Ltd
- Ground Movement Assessment, dated 22nd May 2015, by Gabriel GeoConsulting Ltd
- Basement Construction Plan, 510/BCP rev B, dated 29th May 2015, by PWY Consultancy
- Construction Management Plan, 510/CMP rev B, dated 29th May, 2015, by PWY Consultancy

Item 2.3 – Author Qualification: The BIA and this subsequent addendum has been prepared by Richard Moore, a Technical Director at Knapp Hicks and Partners Limited (KHPL), a Fellow of the Geological Society (FGS), and a Chartered Geologist (CGeol) with more than 25 years experience of geotechnical projects including hydrogeological assessment, slope stability, foundations and site investigation.

Richard also specified and supervised the additional site investigation works which are reported in a separate attachment to this addendum.

Richard Moore has been assisted in the preparation of the BIA by KHPL colleague Jennifer Sturman, Chartered Civil Engineer (CEng) and Member of the Institution of Civil Engineers (MICE), who has over 25 years experience of civils and drainage design, and flood risk assessment. Her career to date has included experience with Local Authority, contractors and consultants. Jennifer has contributed to both the Land Stability and the Surface Water & Flooding stages of our assessment.

The structural drawings and loading calculations, upon which the Ground Movement Assessment, the Basement Construction Plan and Construction Management Plan are based, have been prepared by Knapp Hicks Structural Engineer Steve Hazell who has more than 25 years experience of preparation of structural designs for basement extensions in London.

We also confirm that the attached Ground Movement Assessment has been prepared by Keith Gabriel (MSc, DIC, CGeol, FGS, RoGEP) to calculate predicted ground movements and structural impact based on the Burland Movement Classification system, and the attached Groundwater Flow Assessment BIA bas been prepared by hydrogeologist Stephen Buss, MSc FGS CGeol who has modelled the groundwater to determine the impact of the basement.

This Addendum report has also been reviewed by our Managing Director Geoff Davies.

Item 2.4.1 – Site Investigation:

Original Site Investigation (2013-2014)

The original site investigations included 1No windowless sampler borehole to a depth 7.4mbgl at the front of the property. Standard Penetration tests (SPT's) were carried out at 1m depth intervals in this borehole to help justify the results of hand penetrometer readings taken at regular (nominal 250mm) depth intervals.

The original investigation also included 3No hand dug pits which attempted to prove existing foundation details to No 6 Antrim Grove, and ground conditions to the rear of the property.

The above investigations were supervised by BSc graduate geotechnical engineer Morwenna Richardson who also logged the borehole/trial pits which were provided in the original BIA submission.

Supplementary Site Investigations (2015)

As recommended in the original BIA, we returned to site to undertake further hand dug pits and boreholes in the rear garden and front gardens to help confirm ground conditions at depth and how they vary across the site, and to measure the existing groundwater levels and permeability in order that the potential impacts of the new basement could be assessed in greater detail, in particular in terms of ground movement and groundwater.

In addition, a trial pit was excavated adjacent to the front door to confirm the foundation detail.

Groundwater monitoring wells were installed in 1 trial pit and in 3 windowless sampler boreholes. Three subsequent monitoring visits were undertaken at 2-3 week intervals and some rising head tests were attempted.

Our assessments have also taken account the ground investigation information obtained for No8 Antrim Grove.

The results of the supplementary site investigation are provided in Appendix A.

Item 2.6 - Basement Impact Assessment:

We have reviewed and assessed the following in relation to the most current version of CPG4 (September 2013) and the related Arup Report, and the screening stage flowcharts have been updated as required to take account of the findings.

Item 2.6.1 – Surface Water Flow & Flooding: The audit confirmed that the responses in the questionnaire are generally acceptable. The paved terrace area remains the same for both but skylights are indicated in the basement scheme which extend through the sedum roof area. The two skylights equate to an area of 11.3m^2. It is calculated that this area could generate some 0.16 litres/sec in accordance with Building Regs Document H3 Para 2.4. However, this will drain entirely onto the garden area and it is reasonable to assume that it will be disposed of by evaporation and plant uptake. No additional flows will pass to the positive drainage system on the site. There is no change in the permeable area in the front garden.

Item 2.6.2 – Groundwater Flow: A separate assessment has been prepared by Stephen Buss Environmental Consulting Ltd to address the points raised by your audit. The full report, including updated responses to the screening questionnaire, is provided in Appendix C.

Item 2.6.3 – Ground Stability: We have reviewed the data in relation to possible desiccation associated with existing vegetation and this is discussed in Appendix A. The principal observation to be aware of is that the lower moisture contents at shallow depth are strongly associated with the gravelly clay/clayey gravel Head Deposits which are, at worst, medium shrinkage potential. The underlying London Clay deposits generally show a trend which does not indicate significant desiccation.

It should also be noted that the tree which was the subject of a TPO in a neighbouring garden to the rear has been assessed by an arboriculturalist as being in poor condition and, following recent consultation with the Local Authority Tree Officer, will be felled.

An analysis of ground movement associated with the excavation and construction process, including heave, has been prepared by Gabriel GeoConsulting and the full report is provided in Appendix D. Data has been presented as contoured plots of vertical displacements and is also tabulated with accompanying text.

Requirements to minimise ground movements are reviewed.

A Damage category is provided for representative locations using typical displacements alongside underpins and reinforced concrete retaining walls.

The attached structural drawings (Appendix B), Basement Construction Plan (Appendix E) and the Construction Management Plan (Appendix F) describe the proposed construction methods and sequence and we would conclude that the assessment of ground stability is now more robust and we trust this will be acceptable.

3.0 - SUMMARY:

We have noted the comments made by GEA in their BIA Audit document, and we confirm that we have undertaken the necessary additional site investigations to complete the data set required to fully assess the impacts of this proposed basement.

Following completion of the investigations, further structural, hydrogeological and geotechnical analysis have been undertaken to complete our assessment of the basement impacts.

In addition, a Construction Management Plan and Basement Construction Plan are provided which describe the proposed construction sequence and method, and address requirements in respect of access and consideration of vehicle movement, safety issues etc.

We are confident that these supplementary measures satisfactorily conclude the Basement Impact Assessment process in accordance with LB Camden Planning Guidance and that the various assessments have demonstrated that the proposed scheme may be constructed with minimal impact to neighbouring property and the environment.

We trust that this addendum will provide the necessary information to conclude the BIA and we look forward to receiving your response in due course..

Yours Sincerely,
For and on behalf of Knapp Hicks & Partners Ltd

Richard Moore

APPENDICES

A. **Supplementary Site Investigation Records, Knapp Hicks & Partners Ltd**

B. **Preliminary Structural Drawings (32842/01-06), Knapp Hicks & Partners**

C. **Groundwater Flow Screening and Scopinjg BIA Assessment, dated 19th may 2015, by Stephen Buss Environmental Consulting Ltd**

D. **Ground Movement Assessment, dated 22nd May 2015, by Gabriel GeoConsulting Ltd**

E. **Basement Construction Plan, 510/BCP rev B, dated 29th May 2015, by PWY Consultancy**

F. **Construction Management Plan, 510/CMP rev B, dated 29th May, 2015, by PWY Consultancy**

A. Supplementary Site Investigation Records, Knapp Hicks & Partners Ltd

Supplementary Site investigation Records
6 Antrim Grove

Introduction

A preliminary investigation by Knapp Hicks & Partners included a driven tube windowless sampler borehole in the front garden of the property and a number of hand dug trial pits were attempted to confirm the geology and foundations.

The BIA Audit identified that whilst further investigations would be unlikely to provide significantly greater information on groundwater flow, a requirement for monitoring standpipes was identified to provide greater confidence. Knapp Hicks agree with this conclusion and therefore further works were specified and carried out. The detail of these further investigations is discussed in greater detail below.

The original trial pits did not confirm the nature and depth of the existing foundations and photographs were not provided. Further details are provided with this document.

The audit also queried whether desiccation is present and the shear strengths of the soils reported in the logs. Further review of the moisture content data reveals that the lower moisture contents correspond to the gravelly head strata. Moisture contents within the London Clay generally follow a similar trend. Nevertheless it is noted that the final structural designs should take this into account when designing the basement walls where they retain Head deposits which may be affected by tree roots.

Desk Study

As part of the original BIA, a desk study was undertaken which included a review of a Groundsure Report which provides a source of environmental and geological information from a range of sources and a set of histporic maps at 1:1,250 and 1:10,000 scales.

The results of our review are summarised in the following table:

Review of GroundSure Report Reference EMS-235188 312763-4, dated 27 Jan 2014

- No records of artificial / made ground on or in the vicinity of the site.
- No records of landslips on or near the site.
- No Radon Protection Measures are required.
- Northern Line tunnels pass underground on the other side of Haverstock Hill. We understand these are deep lines and are located well below the depth of influence of the proposed basement.
- Moderate risk of shrink-swell clays and natural ground subsidence.
- Geology is confirmed as London Clay strata (Refer also to site investigation records for details of Head Deposits).
- London Clay is an Unproductive Strata for groundwater.
- There are no records of Environmental Permits, Incidents or Registers within 200m
- There are no records of landfills, waste sites or other landuse within 200m
- There are no records of abstraction licences or Source Protection Zones which will affect the site
- There is no Groundwater Vulnerability and Soil Leaching Potential on site.
- There are no EA recorded river entries or surface water features within 250m of site
- There are no EA Zone 2 or Zone 3 floodplains within 250m of site
- BGS have assessed there is negligible potential for groundwater flooding risk, and the assessed confidence rating for this is low.
- There are no Environmentally Sensitive Sites within 250m of site

Review of Historic Maps (1:2,500 to 1:10,000)

1866-96	The site is within a Nursery with greenhouses

1915-16	The house is first shown along with the neighbouring properties to either side and the surrounding area, with Antrim Grove also now shown. The area now occupied by allotments is now shown as an open space.
1953 to present	There is little change except for the allotments being labelled as Allotment Gardens.

Site Investigations

The following intrusive investigations have now been undertaken. The locations of the holes are indicated on the attached site plan (reproduced below), and borehole and trial pit logs are appended along with a table of groundwater monitoring results and geotechnical laboratory test results:

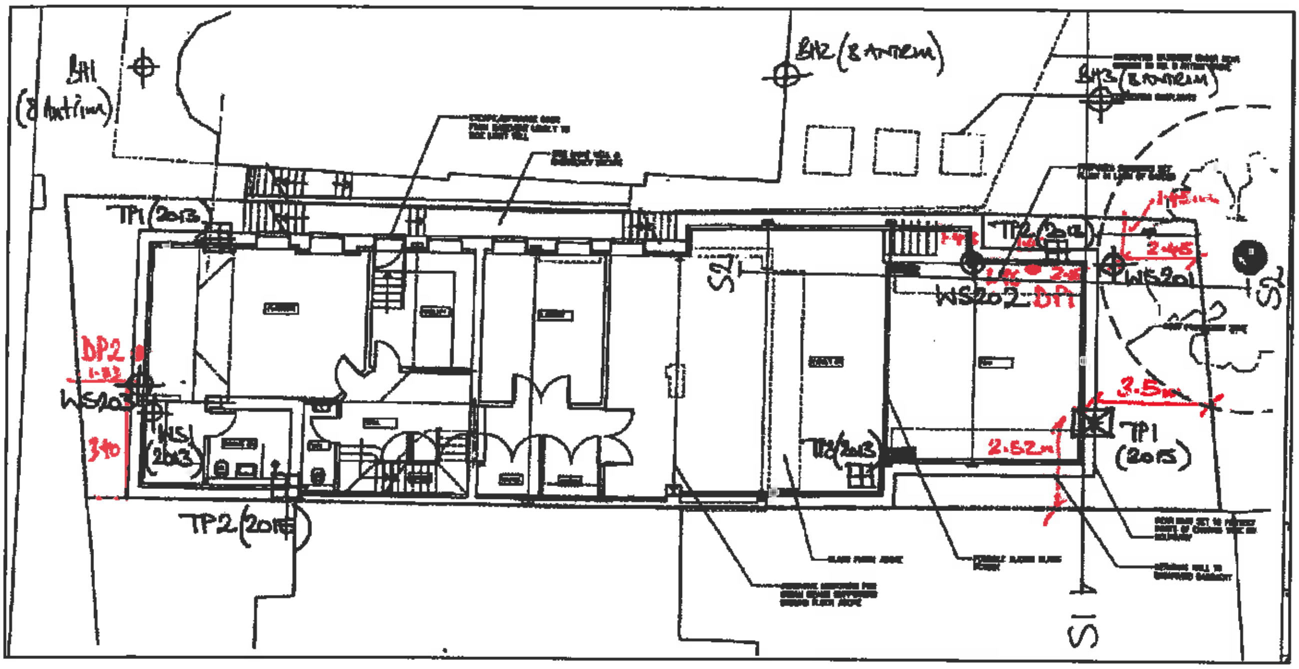


Figure 1 - Borehole location plan (Refer to later figures for Sections S1 and S2)

2013/2014		
BH/TP	**Depth (mbgl)**	**Summary of findings**
WS1	GL-0.50m 0.50m-1.50m 1.50m-7.40m 7.40m	Mixed made ground (refer to logs for details) Medium dense orangish brown clayey sandy GRAVEL Firm brown fissured CLAY, grading to firm to stiff and becoming stiff below 4.50m. End of Hole No groundwater encountered during boring Live rootlets noted to 1.70mbgl Note: lower moisture contents correspond with the clayey gravels. Below 1.5m the moisture contents follow a similar trend to other holes on the site.
TP1	GL-0.38m	Mixed made ground (refer to logs for details). Terminated due to services (But foundation detail expected to be similar to the foundation proved in 8 Antrim Grove TP1 and later (2015) trial pit TP2 (see further below), i.e. brick corbel founded on think concrete strip footing placed on compacted rubble of brick, concrete and cinder at less than 1mbgl.

TP2		Note: Located in rear garden (i.e. 0.80m above other holes)
	GL-0.60m	Mixed made ground (refer to logs for details)
	0.60m-1.80m	Firm brown slightly sandy CLAY (HEAD)
	1.80m	Hand auger refusal on gravels
		Rootlets noted. No groundwater during excavation/augering
TP3	GL-0.35m	Patio slab on 340mm concrete
	0.35m-0.60m	Mixed made ground. Described as very soft.
	0.60m	Refusal on gravels
		No roots noted. No groundwater recorded.
Notes on Previous Investigations at 8 Antrim Grove for reference **(Note this has now been redeveloped with a basement)**		
BH/TP	**Depth (mbgl)**	**Summary of findings, including notes on groundwater and roots**
BH1		Located in front garden
	GL-0.50m	Topsoil and made ground (refer to logs for details)
	0.50m-2.40m	Firm to stiff brown clay, gravelly from 1.00m. Proportion of gravel varies Rootlets to 1.20m
	2.40m-5.00m	Stiff brown grey fissured clay (London Clay)
	5.00m	End of hole
		No groundwater encountered and remained dry for 2 hours. Rootlets to 2.90mbgl
BH2		Located in rear passageway (at similar level to BH1)
	GL-0.28m	50mm Concrete over mixed made ground
	0.28m-1.10m	Compact clayey sandy gravel (HEAD)
	1.10m-4.00m	Stiff silty clay. Very stiff below 2.40m.
		Occasional old rotted roots. No groundwater encountered during excavation or for 2 hours after. After 5 hours, slow seepage encountered with water level rising to 3.72mbgl.
BH3		Located in rear garden (elevated approximately 0.80m above BH1 and BH2)
	GL-2.10m	Stiff slightly gravelly silty clay.
	2.10m-6.00m	Very stiff brown and grey fissured laminated clay. Claystone at 2.80m with associated water strike. Groundwater rose 4.35m to 2.9mbgl in 3.5hrs.
		No rootlets noted
TP1		Brick Corble to 0.285mbgl
		Concrete strip footing to 0.35mbgl
		Compact rubble footing 0.35m to 0.70m
		0.70m-0.80m: Soft becoming firm orange brown gravelly clay with rootlets
	0.80m	End of trial pit
2015 (Post BIA Audit)		
BH/TP	**Depth (mbgl)**	**Summary of findings**
Windowless Sampler Boreholes		
WS201		Note: Located in rear garden (i.e. 0.80m above other holes)
	GL-0.75m	Topsoil on made ground (refer to logs for details)
	0.75m-3.25m	Interlayered silty clay, gravelly clay and slightly clayey sandy gravel (HEAD)
	3.25m-4.00m	Stiff brown silty fine sandy fissured and thinly laminated clay (LONDON CLAY)
	4.00m	End of hole
		No obvious live rootlets present below 1.70m Some old rotted rootlets to 3.00m. Groundwater struck between 3 and 4mbgl rising to 1.67mbgl.
		Standpipe installed to 3.11mbgl within HEAD deposits. Rising head test

		carried out giving permeability results in region of 1.79x10-6m/s to 4.8x10-7m/s. Note: lower moisture contents correspond with the clayey gravels/gravelly clays. Below 1.5m the moisture contents follow a similar trend to other holes on the site.
WS202		Note: Located in rear garden (i.e. 0.80m above other holes)
	GL-0.65m	Topsoil over reworked clay
	0.65-2.30m	Firm becoming stiff grey and orange clay. Gravelly from 1.50m to 1.70m
	2.30m-5.00m	Stiff brown fissured and laminated clay (LONDON CLAY)
	5.00m	End of hole
		Trace rootlets noted to 2.70m. No groundwater encountered during or after boring. Standpipe installed to 3.66mbgl and sealed into the underlying clay. Monitoring undertaken. Recorded slow accumulation of water in base of hole only.
WS203		Located in front garden close to 2013/2014 BH1
	GL-0.40m	Mixed made ground
	0.40-1.30m	Stiff gravelly clay (HEAD)
	1.30-3.10m	Stiff greyish borwn fissured clay. No obvious roots. No water strikes.
	3.10m	End of hole
		Standpipe installed to 3.07mbgl. Recorded slow accumulation of water in base of hole only.
Dynamic Probes		
DP1	GL-6.0m	Located between WS201 and WS202 to check relative densities of Head and underlying clay (Remained dry for remainder of day then water level rose slowly to similar level to WS201)
DP2	GL-6.0m	Adjacent WS203 (Remained dry after completion)
Trial Pits		
TP1(2015)	GL-0.65m	Topsoil over mixed made ground. Many roots.
	0.65m-1.13m/1.30m	Firm orangish brown fissured clay with rare gravel of flint. Rootlets noted, reducing in size with depth.(HEAD)
	1.13m/1.30m-1.57m/1.85m	Stiff gravelly clay. Damp with slow seepage noted from fissures. (HEAD)
	1.57m/1.85m-3.70m	Stiff reddish brown and grey fissured clay (LONDON CLAY). Irregular Ironstone noted at 2.55mwith associated slow seepage. Correlates with 'claystone' noted in 8 Antrim Grove BH3. Detailed monitoring was undertaken at start and finish of each day wduring excavation of this pit (11th-17th/2/2015) and a standpipe was installed to the base of the pit on completion. Monitoring gave similar groundwater levels to WS201.
TP2(2015)		Located at front door Brick Corble 0.38m-0.60m Compacted clinker rubble footing, possibly cemented locally 0.60m-0.87m 0.87m-1.05m Stiff orangish brown clay with rare flint gravel (HEAD) 1.05m-1.40m Compact gravelly clay/clayey gravel 1.40m – possible clay

Conclusions

Ground conditions

Based on the site investigations, the site geology consist of a thin mantle (up to 0.60m) of made ground overlying Head Deposits with London Clay present from depths of 1.3m to 1.5m at the front of the property to between 1.57m and 3.25m below the rear garden.

The Head Deposits are variable but generally consist of firm or stiff silty clay with occasional gravel interlayered with clayey sandy gravel layers. The base of the head deposits appears to dip towards the northwestern corner of the site as indicated on the sections S! and S2 reproduced below.
Where trial pits were excavated, the sides were supported with temporary plywood shuttering below 1.2mbgl. However, where this was removed to expose the geology, the pit sides remained stable.

Groundwater

At the rear of the site, groundwater was encountered within the Head Deposits as a perched water table and as a seepage from an ironstone or claystone layer within the London Clay at 2.55m. Refer to Sections S1 and S2 for details.

3No monitoring visits were carried out on 13th March, 31st March and 17th April and the results of these have informed the attached Groundwater Flow BIA document (Refer Appendix C attached). Rising Head tests were attempted in WS201 and also in TP1(2015). The test in TP1 was not successful because the backfill had retained water and meant it was difficult to judge the permeability from the results. However, from the 2No tests in WS201, a permeability of between 1.79×10^{-6}m/s to 4.8×10^{-7}m/s has been assessed for the Head Deposits.

However, in terms of the rate of inflow to excavations, it is perhaps more useful to review the results of monitoring of the groundwater level in the base of the hand dug pit TP1(2015). This was excavated over a period of 6 days during which the groundwater level was recorded in a 200mm deep sump in the base of the pit at the finish of each shift and on returning the following morning. The results are provided on the attached logs which indicate that the sump tended to fill overnight but no dewatering was required during excavation of the pit which was approximately 1.2m x 1.2m in plan dimension.

Based on these observations, it is considered that groundwater inflows during construction excavation may reasonably be managed by sump pumping on condition that the rates of inflow, and the quantity of silt in the groundwater, are continuously monitored.

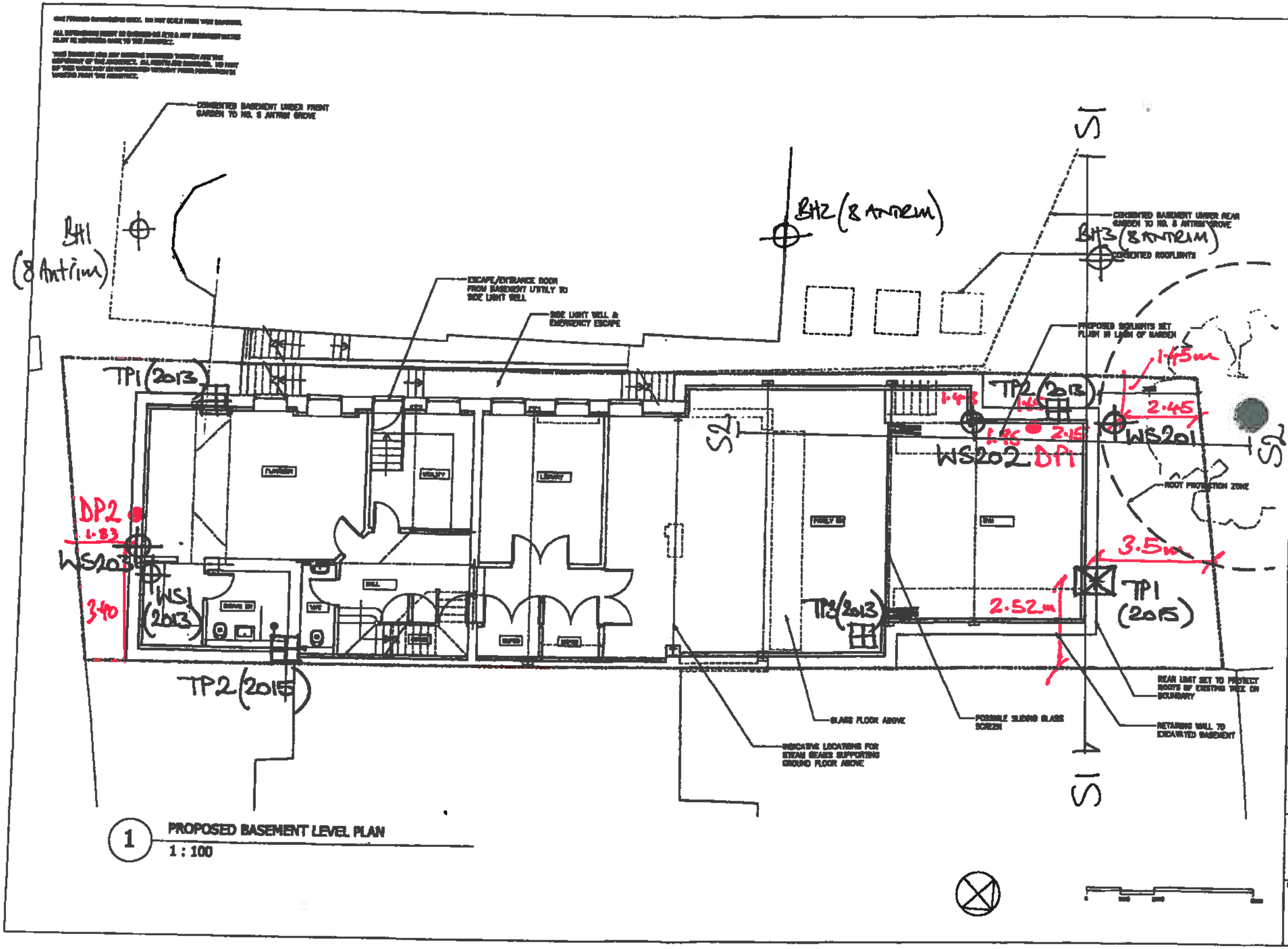
Effects of trees

The attached results include graphs of the moisture contents and pocket penetrometer measurements plotted against depth which is a commonly used method of assessing potential desiccation.

The graphs include, for reference only, a dashed line indicating a typical equilibrium line for London Clay reported by Pugh et al..

The results show a fairly uniform trend line for results on samples in the London Clay. Lower moisture contents were obtained in the Head deposits and the trend lines for each borehole and trial pit quite accurately reflect the depth of the Head deposits. The reduced moisture content also reflects the high gravel content of those samples. However, it is recommended that the final structural design take into account the depths to which live roots were encountered and ensures that the concrete retaining walls are designed to accommodate any residual heave potential associated with the mature tree at the rear of the site.

It should also be noted that kit has been agreed that the ash tree which was the subject of a TPO may be removed. Given the relatively high perched water table in the Head Deposits, it is anticipated that the recovery of moisture contents will be relatively rapid and is likely to occur during the course of the works.



1 PROPOSED BASEMENT LEVEL PLAN
1 : 100

B chitecture
11A [illegible] Road London N2 9AT

6 Antrim Grove, Belsize Park
London NW3 4XR

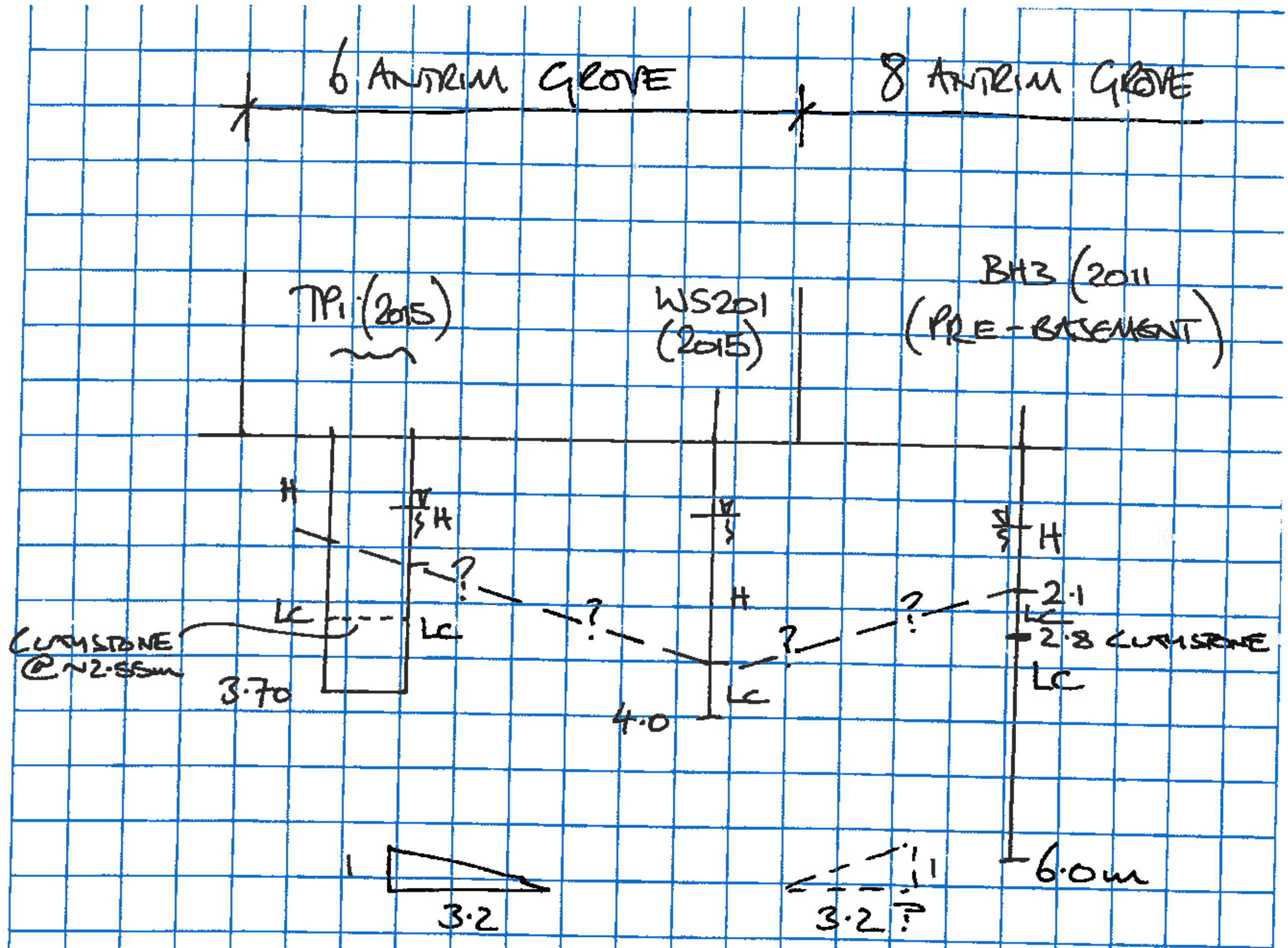
PROPOSED PLANS

DEC 2013

1:100@A3

1310

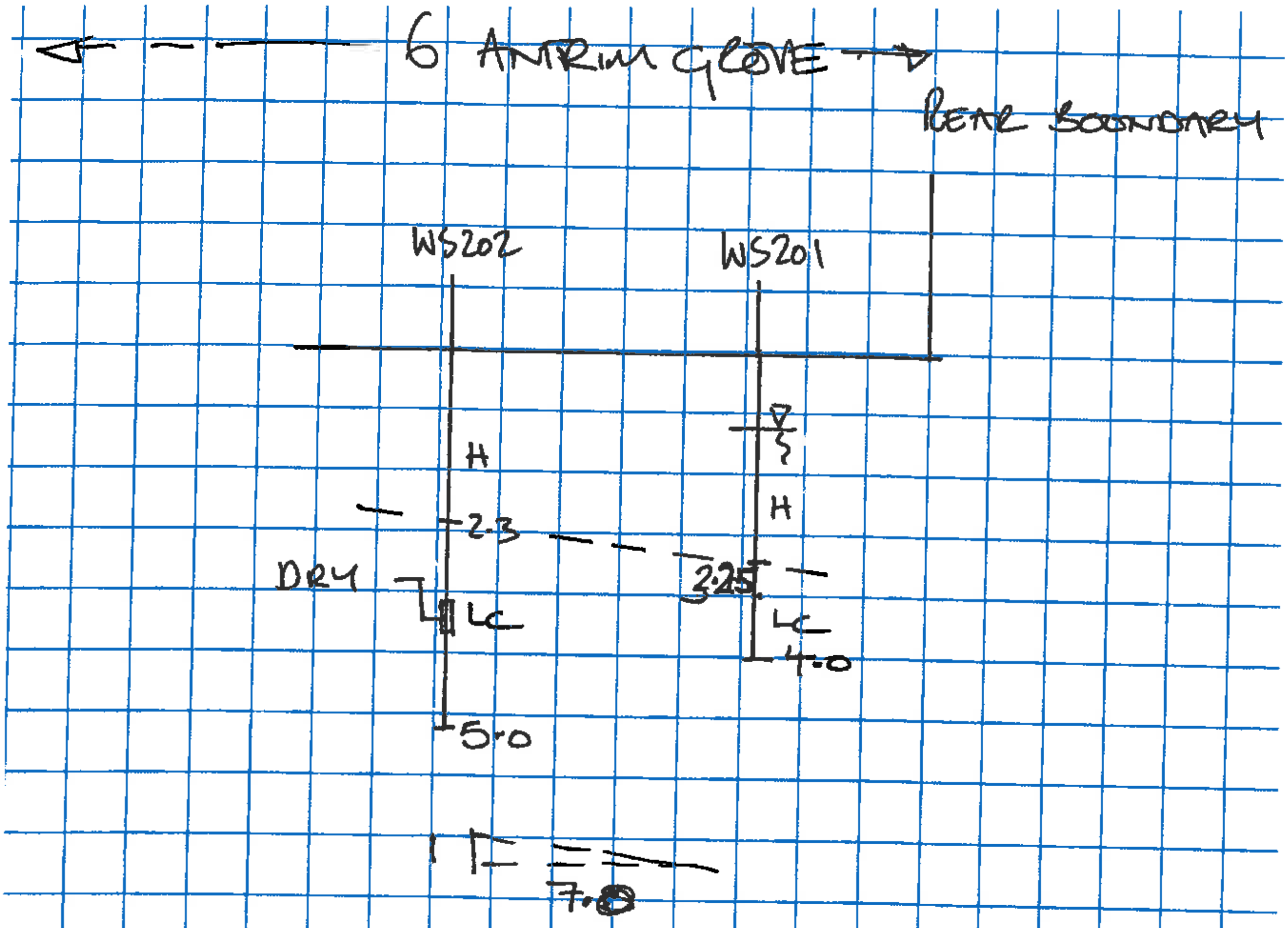
110/C



H HEAD DEPOSITS (GRAVELLY CLAY, CLAY)
LC LONDON CLAY

SECTION S1–S1 ACROSS REAR GARDEN

SCALE 1:100
(APPROX)
(V + H)



SECTION S2 – S2 (REAR GARDEN)

SCALE 1:100
(APPROX.)
(V + H)

Existing foundations

TP2 (2015) has confirmed the existing foundations as being a brick corbel constructed on a compacted clinker rubble footing. This is typical of the properties on Antrim Grove and compares closely with the foundations encountered at 8 Antrim Grove. The proposed method of construction described in the attached Basement Construction Plan (Appendix E) will ensure that any variation in the foundation details will be confirmed well in advance of any bulk excavation.

Buried Concrete

Chemical testing for to confirm pH and water soluble sulphate as SO4 have confirmed that a classification for buried concrete of DS-1 will be appropriate.

Photographs

A selection of representative photographs are attached with the site investigation results.

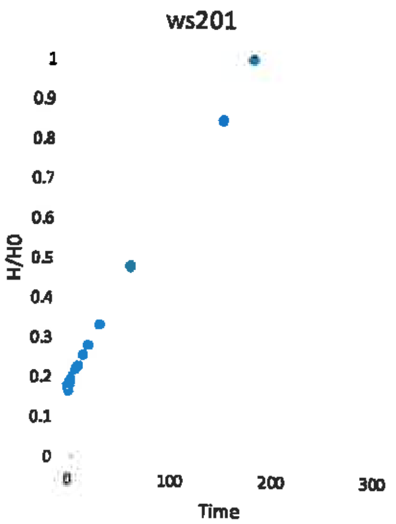
6 Antrim Grove, Belsize Park

WINDOW SAMPLE AND TRIAL PIT LOGS (November 2013)

WINDOW SAMPLE WS201	
GL – 0.20m	Recovered as turf on brown organicsilty clayey TOPSOIL. Damp.
0.20 – 0.75m	MADE GROUND: Brown reworked CLAY mixed with occasional gravel of flint, brick and rare ash. With roots and rootlets.
0.75m – 1.68m	Firm orangish brown silty CLAY. Grey on fissures. Damp. With large roots at 0.75m to 0.80m. Becoming sandy with depth. Very sandy 1.50m to 1.52m. Sand is fine grained.
1.68m – 2.45m	Recover as stiff brown gravelly CLAY. Gravel is sub-rounded to rounded medium to coarse. Sample tube recovered damp but samples appear dry. 2.00m to 2.45m: becomes less gravelly.
2.45m – 2.75m	Recover as compact (unbound) slightly clayey sandy gravel. Wet. Sand is medium to coarse and gravel is fine to coarse.
2.75m – 3.25m	Greyish brown gravelly CLAY. No obvious roots.
3.25m – 4.00m	Stiff brown silty fine sandy CLAY with localised gypsum mineralisation in fissures.
4.00m	*End of Window Sample*

- Upon completion at 4.00m a standpipe was installed because it was not possible to continue window sampling due to groundwater and unstable sides in gravelly strata.
- Groundwater encountered during boring. Upon removal of sampler tube from 3m to 4m, the groundwater level rose quickly to 1.67mbgl.
- No live roots and rootlets recorded below 1.70mbgl, rotted rootlets noted to 3.00mbgl.
- A Rising Head Test was undertaken in the standpipe piezometer on 31st March 2015. The results are presented below and, based on the methods of calculation provided in BS5930, we estimate the permeability of the granular head deposits overlying the London Clay to be up to between 1.79 x 10^{-6}m/sec and 4.8 x 10^{-7}m/sec.

ws201	mins	t				
				H0	h	h/h0
	0	-0.5	2.9	1.985	0.085	0.161905
	0.25	-0.25	2.9		0.085	0.161905
	0.5	0	2.9		0.085	0.161905
	0.75	0.25	2.897		0.088	0.167619
	1	0.5	2.895		0.09	0.171429
	1.5	1	2.893		0.092	0.175238
	2	1.5	2.89		0.095	0.180952
	2.5	2	2.89		0.095	0.180952
	3	2.5	2.887		0.098	0.186667
	4	3.5	2.883		0.102	0.194286
	5	4.5	2.88		0.105	0.2
	7.5	7	2.872		0.113	0.215238
	10	9.5	2.867		0.118	0.224762
	15	14.5	2.852		0.133	0.253333
	20	19.5	2.839		0.146	0.278095
	30	29.5	2.812		0.173	0.329524
	60	59.5	2.735		0.25	0.47619
	150	149.5	2.54		0.445	0.847619
	180	179.5	2.46		0.525	1



WINDOW SAMPLE WS202	
GL – 0.40m	Dark brown silty clayey organic TOPSOIL. Damp
0.40 – 0.65m	Soft becoming firm mid brown silty CLAY.
0.65 – 1.50m	Firm becoming firm to stiff orangish brown fissured silty CLAY with occasional disseminated rootlets. Grey on fissures. Damp.
1.50 – 1.70m	Stiff orangish, greyish brown gravelly CLAY with trace thin rootlets. Gravel is sub rounded medium to coarse of flint.
1.70 – 2.30m	Stiff grey and orangish brown CLAY. Note occasional persistent sub-horizontal planar gleyed grey fissure surfaces. (HEAD)
2.30 – 5.00m	Stiff brown fissured laminated CLAY with occasional pockets of mineralisation. Trace rootlets noted to 2.70mbgl. From 3.00m with occasional sandy partings. Dry. 3.70m: orange brown coarse sandy parting noted Dry. (LONDON CLAY)
5.00m	*End of Window Sample*

- Upon completion a standpipe was installed in the borehole to 3.66m.
- No water was noted in the window sampler and the hole remained dry upon completion.
- Rootlets noted to maximum depth 2.70mbgl.

WINDOW SAMPLE WS203	
GL – 0.40m	MADE GROUND: Layer of pea shingle and vegetation barrier geotextile upon brown silty organic TOPSOIL Grading to: Mix of topsoil, reworked orange brown clay and gravel of brick.
0.40 – 1.30m	Stiff orangish brown very gravelly CLAY with occasional rootlets. Gravel is sub-rounded to rounded medium to coarse.
1.30 – 3.10m	Stiff greyish brown fissured silty CLAY No obvious roots noted. With localised and disseminated gypsum mineralisation. Becomes more damp with depth. 2.90m – small gravel size pocket of grey silt, dry.
3.10m	*End of Window Sample*

- Upon completion a standpipe was installed to 3.07m in the window sampler borehole.
- No water was noted in the window sampler.
- No live roots and rootlets recorded below 1.30mbgl

Job Number
32027

Sheet Number
1 of 1

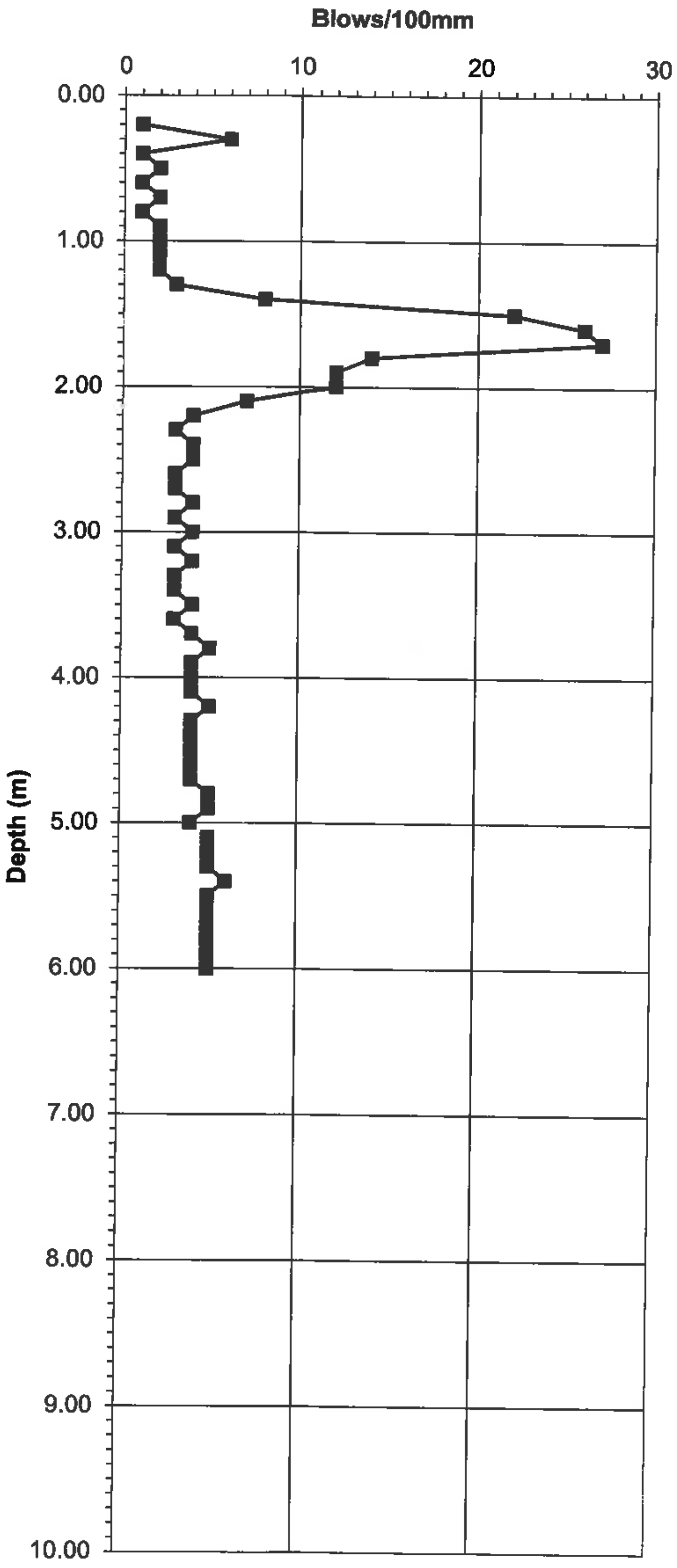
6 Antrim Grove

Dynamic Probe Record Sheet

Figure No.
1

Hole No.
DP1

Depth (m)	Blows (0-5m)	Depth (m)	Blows (5-10m)
0.10		5.10	5
0.20	1	5.20	5
0.30	6	5.30	5
0.40	1	5.40	6
0.50	2	5.50	5
0.60	1	5.60	5
0.70	2	5.70	5
0.80	1	5.80	5
0.90	2	5.90	5
1.00	2	6.00	5
1.10	2	6.10	
1.20	2	6.20	
1.30	3	6.30	
1.40	8	6.40	
1.50	22	6.50	
1.60	26	6.60	
1.70	27	6.70	
1.80	14	6.80	
1.90	12	6.90	
2.00	12	7.00	
2.10	7	7.10	
2.20	4	7.20	
2.30	3	7.30	
2.40	4	7.40	
2.50	4	7.50	
2.60	3	7.60	
2.70	3	7.70	
2.80	4	7.80	
2.90	3	7.90	
3.00	4	8.00	
3.10	3	8.10	
3.20	4	8.20	
3.30	3	8.30	
3.40	3	8.40	
3.50	4	8.50	
3.60	3	8.60	
3.70	4	8.70	
3.80	5	8.80	
3.90	4	8.90	
4.00	4	9.00	
4.10	4	9.10	
4.20	5	9.20	
4.30	4	9.30	
4.40	4	9.40	
4.50	4	9.50	
4.60	4	9.60	
4.70	4	9.70	
4.80	5	9.80	
4.90	5	9.90	
5.00	4	10.00	



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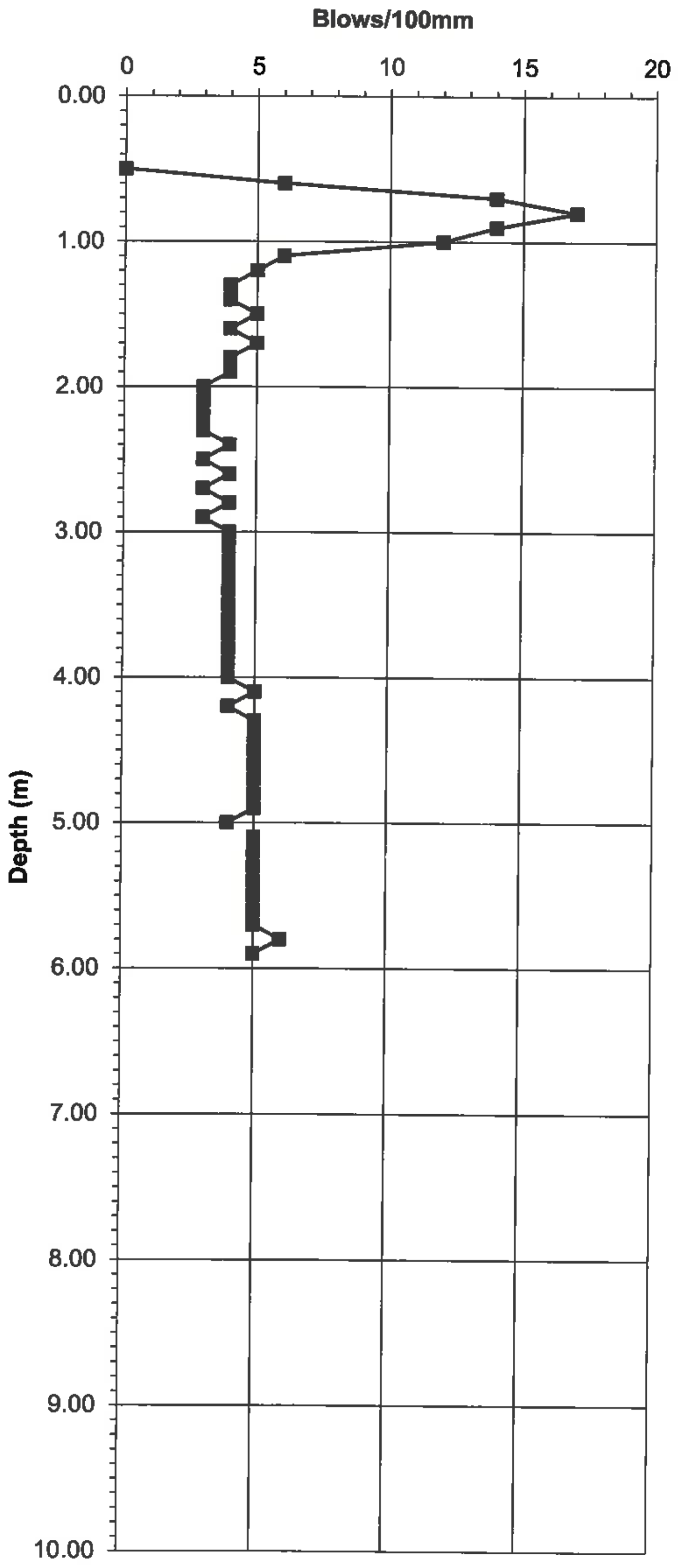
Job Number		Figure No.
32027	6 Antrim Grove	2
Sheet Number	Dynamic Probe Record Sheet	**Hole No.**
1 of 1		DP2

Depth (m)	Blows (0-5m)	Depth (m)	Blows (5-10m)
0.10		5.10	5
0.20		5.20	5
0.30		5.30	5
0.40		5.40	5
0.50	0	5.50	5
0.60	6	5.60	5
0.70	14	5.70	5
0.80	17	5.80	6
0.90	14	5.90	5
1.00	12	6.00	5
1.10	6	6.10	
1.20	5	6.20	
1.30	4	6.30	
1.40	4	6.40	
1.50	5	6.50	
1.60	4	6.60	
1.70	5	6.70	
1.80	4	6.80	
1.90	4	6.90	
2.00	3	7.00	
2.10	3	7.10	
2.20	3	7.20	
2.30	3	7.30	
2.40	4	7.40	
2.50	3	7.50	
2.60	4	7.60	
2.70	3	7.70	
2.80	4	7.80	
2.90	3	7.90	
3.00	4	8.00	
3.10	4	8.10	
3.20	4	8.20	
3.30	4	8.30	
3.40	4	8.40	
3.50	4	8.50	
3.60	4	8.60	
3.70	4	8.70	
3.80	4	8.80	
3.90	4	8.90	
4.00	4	9.00	
4.10	5	9.10	
4.20	4	9.20	
4.30	5	9.30	
4.40	5	9.40	
4.50	5	9.50	
4.60	5	9.60	
4.70	5	9.70	
4.80	5	9.80	
4.90	5	9.90	
5.00	4	10.00	



TRIAL PIT **TP1(2015)**	
Ground Level – 0.28m	Soft damp dark brown sandy clayey TOPSOIL with turf on top. Many roots and rootlets 1-20mm diameter. With occasional gravel of flint, traces of brick. 0.28m – layer of crushed brick and shell fragments
0.28m – 0.40m	MADE GROUND: Grading to slightly damp orangish brown slightly gravelly CLAY. Gravel is sub-rounded medium to coarse of flint with occasional brick fragments. Becoming more damp with depth.
0.40m – 0.65m	MADE GROUND: clayey gravelly SAND. Gravel is medium of brick, shell, flint, rare cinder and with many rootlets.
0.65m – 1.13m/1.30m	Firm to stiff orangish brown fissured silty CLAY. Grey on fissures with occasional persistent planar gleyed fissures. Rare fine sub-angular gravel of flint. Damp with roots which become smaller with depth. (HEAD) 1.00m – note slow seepage along fissures in base of pit and note becoming slightly sandy. Note strongest seepage is frpom rear end of garden. Sand is fine grained.
1.13m/1.30m – 1.57m/1.85m	NOTE: top and base of this stratum dips in southerly direction. Firm to stiff gravelly CLAY with roots and rootlets. Damp and becomes more damp towards base stratum. Gravel is sub-rounded medium to coarse of flint.
1.57m/1.85m – 3.70m	Stiff reddish brown and grey fissured CLAY. Rootlets persist to depth. Lumps break down to smaller angular lumps. Note dampness along fissures. 2.55m – irregular band of ironstone varies from 0mm to 60mm thick. Moderately strong. Possible slow seepage from this layer. From 3.50m: fissuring becomes less obvious.
3.70m	*End of Trial Pit*

- Upon completion the trial pit was backfilled with arisings with a standpipe installed in one corner.
- Groundwater was noted as slow seepage along fissures from 1.0mbgl. Please refer to the following notes for greater detail

11/2/2015 – start excavation. Base of pit (sump hole) at 1.70m. Rest of pit at 1.35mbgl

12/2/2015 – am: groundwater level standing at 1.54mbgl in sump hole in base of pit.

pm: 350mm sump in base of hole at 1.835mbgl. Rest of pit at 1.63mbgl

13/2/2015 - am: Groundwater level standing at 1.63mbgl.

Sump dimensions 1.2m wide x 200mm deep x 250mm width

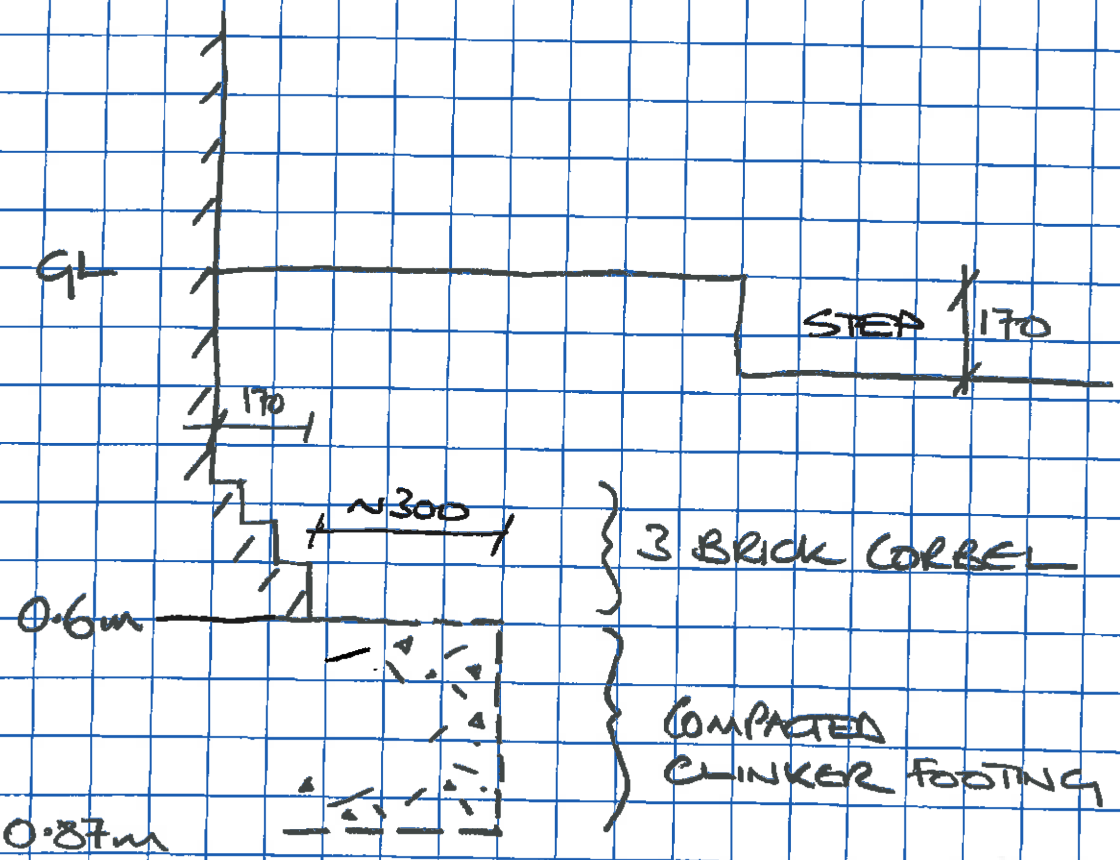
Groundwater baled out and groundwater level monitored as follows:

After 0 minutes - 0mm depth of water in base of sump
After 5 minutes – 4mm
After 10 minutes – 7mm
After 20 minutes – 20mm
After 40 minutes – 32mm

pm: base of sump at 1.90m, rest of pit at 1.65mbgl
16/2/2015 - am: 250mm water in sump in base of pit
pm: base of sump at 2.90m. Rest of pit at 2.65mbgl
17/2/2015 - am: sump full to 2.65mbgl.

Project: 6 ANTRIM GROVE		**Job Ref:** 32027	**Page No.** 1
Designed by:	**Date:**	**Checked by:**	**Date:**

TRIAL PIT TP2 (2015) – BY FRONT DOOR



Stiff orangish brown clay with rare gravel of flint, fine gravel.

1.05

COMPACT GRAVELLY CLAY / CLAYEY GRAVEL
(UNABLE TO PENETRATE EXCEPT WITH STEEL ROD)

1.40m

? CLAY ?

TP1(2015) 1.0m-1.2m Head Deposits (note occasional flint gravel and stable condition)

TP1(2015) – View of gravelly clay layer. Note dampness due to slow seepage.

TP1(2015) – View of clay at approx. 3.0mbgl

TP1(2015) View of clay at base of excavation

TP1(2015) – View of sump in base of pit. Typical quantity of water accumulated overnight.

TP1(2015) – View of base of excavation.
Note wet ground was as a result of heavy rainfall in addition to seepage.

TP2(2015) – View of pit location at front door at boundary wall with No4

TP2(2015) – View into pit showing brick corbel and underlying rubble foundation

TP2(2015) – View of pit. Note hand augered extension below base of foundation.

WINDOW SAMPLE AND TRIAL PIT LOGS (November 2013)

WINDOW SAMPLE WS1	
GL – 0.10m	Orangish brown GRAVEL. Gravel is subrounded to rounded, fine to coarse of flint. (MADE GROUND)
0.10 – 0.50m	Blackish brown clayey gravelly SAND. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of brick, clinker, concrete, flint, metal and tile. (MADE GROUND)
0.50 – 1.50m	Medium dense orangish brown clayey sandy GRAVEL. Sand is fine to coarse. Gravel is subangular to rounded, fine to coarse of flint. (RIVER TERRACE GRAVELS)
1.50 – 3.40m	Stiff to very stiff indistinctly fissured brown mottled blue CLAY. (LONDON CLAY)
3.40 – 5.60m	Very stiff indistinctly fissured brown CLAY. (LONDON CLAY)
5.60 – 7.40m	Very stiff indistinctly fissured greyish brown CLAY. (LONDON CLAY)
7.40m	*End of Window Sample*

- Upon completion the window sampler was backfilled with arisings.
- No water was noted in the window sampler.
- No live roots and rootlets recorded below 1.70mbgl, rotted rootlets noted to 3.00mbgl.
- SPT Results as follows:
    - 1.00m: N = 17 (1/2/4/4/4/5)
    - 2.00m: N = 6 (1/0/1/1/2/2)
    - 3.00m: N = 8 (1/1/1/2/2/3)
    - 3.80m: N = 10 (1/2/2/2/3/3)
    - 4.80m: N = 12 (1/2/3/3/3/3)
    - 5.60m: N = 17 (3/3/3/4/5/5)
    - 6.60m: N = 18 (4/5/4/5/4/5)

TRIAL PIT TP1	
GL – 0.10m	Orangish brown GRAVEL. Gravel is subrounded to rounded, fine to coarse of flint. (MADE GROUND)
0.10 – 0.38m	Blackish brown clayey gravelly SAND. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of brick, clinker, concrete, flint, metal and tile. (MADE GROUND)
0.38m	*End of Trial Pit – Terminated due to services.*

- Upon completion the trial pit was backfilled with arisings.
- No groundwater was noted during excavation.
- No roots or rootlets noted.
- Base of footing was not uncovered due to a number of services in the pit and in the vicinity of the pit, for details of foundation please see separate drawing.

TRIAL PIT TP2	GL – Approximately ~~1.50m~~ 0.80m above the ground level of the rest of the site.
GL – 0.60m	Dark brown very clayey gravelly SAND. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of brick and tile. (MADE GROUND)
0.60 – 1.80m	Firm brown mottled blue slightly sandy CLAY. Sand is fine to coarse. (HEAD DEPOSITS?)
1.80m	*End of Trial Pit – Refused on suspected gravels.*

- Upon completion the trial pit was backfilled with arisings.
- No water was noted in the trial pit.
- Rootlets were noted to the base of the trial pit.
- It was attempted to extend the trial pit using hand augering techniques, but the auger refused at the top of the gravels.

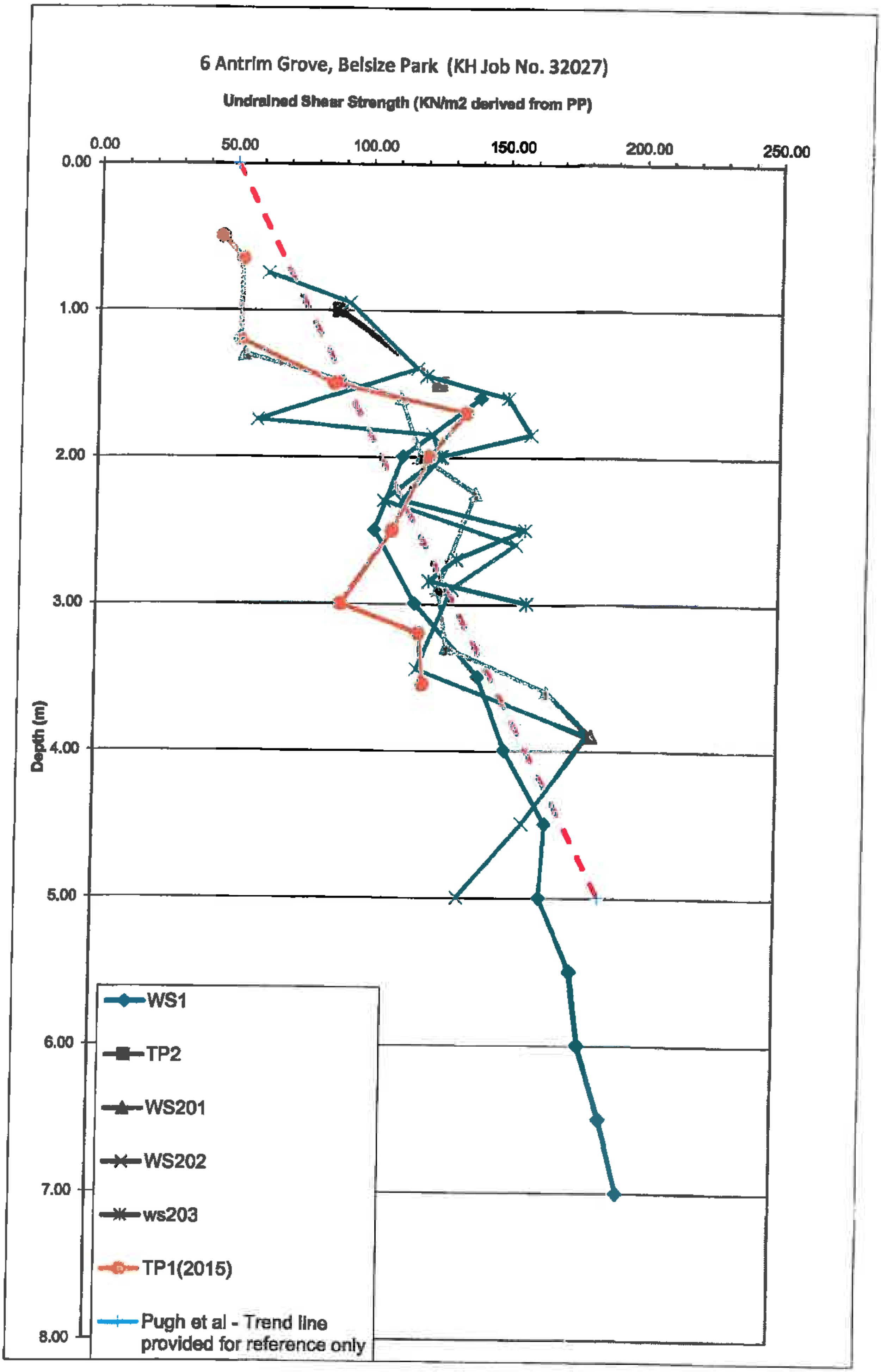
TRIAL PIT TP3	
GL – 0.01m	PAVING SLAB
0.01 – 0.35m	CONCRETE
0.35 – 0.60m	Very soft brownish black slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of concrete, brick and clinker. (MADE GROUND)
0.60m	*End of Trial Pit – Refused on suspected gravels.*

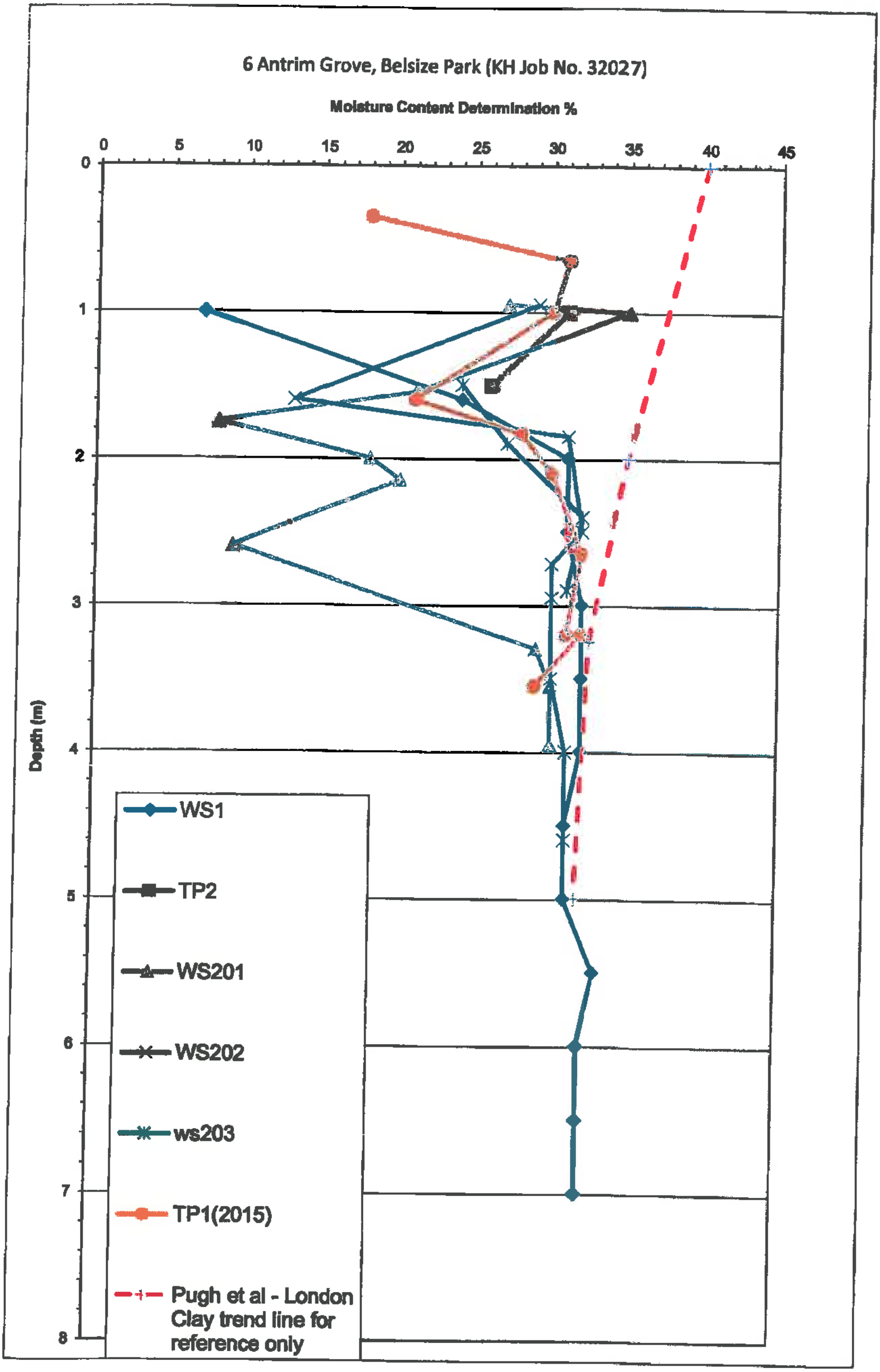
- Upon completion the trial pit was backfilled with arisings.
- No water was noted in the trial pit.
- No roots or rootlets noted.
- It was attempted to extend the trial pit using hand augering techniques, but the auger refused at the top of the gravels.

Groundwater Monitoring Record Sheet

Job Details:	45 Maresfield Gardens, London NW3
Job No:	32703
Site:	6 Antrim Grove, London NW3
Date:	14th April 2015
Operator:	RJM

Date				13 March 2015	31 March 2015	17 April 2015
Time				11:00	08:30	8:30
Monitoring Point	**Borehole Depth (mbgl)**	**Depth to tip (mbgl)**	**Reduced Ground Level (mAOD)**	**Groundwater Level (mbgl)**		
BH201	4.00	3.11		0.85	1.00	1.18
BH202	5.00	3.66		DRY	3.25	2.79
BH203	3.10	3.07		DRY	2.92	2.68
TP1(2015)	3.70	3.59		0.87	1.01	1.18


6 Antrim Grove, Belsize Park (KH Job No. 32027)
Undrained Shear Strength (KN/m2 derived from PP)
0.00
50.00
100.00
150.00
200.00
250.00
Depth (m)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
WS1
TP2
WS201
WS202
ws203
TP1(2015)
Pugh et al - Trend line provided for reference only


6 Antrim Grove, Belsize Park (KH Job No. 32027)
Moisture Content Determination %
0
5
10
15
20
25
30
35
40
45
Depth (m)
0
1
2
3
4
5
6
7
8
WS1
TP2
WS201
WS202
ws203
TP1(2015)
Pugh et al - London Clay trend line for reference only

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Client: Knapp Hicks & Partners Ltd

Address:
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Henwood, Ashford
Kent
TN24 8DH

Report No: 0681/07/MC2
Your Ref: 32027A
Report Date: 02/03/2015

Client Contact: Mr Richard Moore
Site: 5 Antrim Grove

Test Requested: Determination of Moisture Content, Liquid, Plastic Limits & Plasticity Index
Test Method: BS 1377-2: 1990, Test Nos. 3.2; 4.4 (1 point LL); 5.3; & 5.4

Sample Details:
Sampled and submitted by: Client
Date Sampled: N/K
Date Received: 20/02/2015
Date Tested: 23/02/2015

TEST RESULTS:

Laboratory Reference	Client Reference	MC (%)	L.L (%)	P.L (%)	P.I (%)	% Retained on 425µm sieve	Condition of Test	Sample Type
0681/07/06	TP101 @ 1.8-2.4m	30	-	-	-	-	-	Disturbed
0681/07/07	TP101 @ 2.4-2.9m	32	74	26	48	0	Natural	Disturbed
0681/07/08	TP101 @ 2.9-3.5m	31	71	26	45	0	Natural	Disturbed
0681/07/09	TP101 @ 3.20m	32	-	-	-	-	-	Disturbed
0681/07/11	TP101 @ 3.5-3.8m	29	-	-	-	-	-	Disturbed

Visual Descriptions:

Laboratory Reference	Client Reference	Description
0681/07/06	TP101 @ 1.8-2.4m	Brown CLAY
0681/07/07	TP101 @ 2.4-2.9m	Brown mottled grey CLAY
0681/07/08	TP101 @ 2.9-3.5m	Brown mottled grey CLAY with rootlets
0681/07/09	TP101 @ 3.20m	Brown CLAY
0681/07/11	TP101 @ 3.5-3.8m	Brown mottled grey CLAY

......END OF TEST REPORT......

Signed: ______________________ Kwaku Beah - Laboratory Manager

For and on behalf of PBA Laboratories

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Report No: 0681/07/MC1
Your Ref: 32027A
Report Date: 02/03/2015

Client Contact: Mr Richard Moore
Site: 6 Antrim Grove

Test Requested: Determination of Moisture Content, Liquid, Plastic Limits & Plasticity Index
Test Method: BS 1377-2: 1990, Test Nos. 3.2; 4.4 (1 point LL); 5.3; & 5.4

Sample Details:
Sampled and submitted by: Client
Date Sampled: N/K
Date Received: 13/02/2015
Date Tested: 13/02/2015

TEST RESULTS:

Laboratory Reference	Client Reference	MC (%)	LL (%)	P.L (%)	P.I (%)	% Retained on 425µm sieve	Condition of Test	Sample Type
0681/07/01	TP101 @ 0.35m	18	-	-	-	-	-	Disturbed
0681/07/02	TP101 @ 0.65m	30	-	-	-	-	-	Disturbed
0681/07/03	TP101 @ 1.00m	30	48	19	29	0	Natural	Disturbed
0681/07/04	TP101 @ 1.60m	21	55	20	35	1	Natural	Disturbed
0681/07/05	TP101 @ 1.83m	28	-	-	-	-	-	Disturbed

Visual Descriptions:

Laboratory Reference	Client Reference	Description
0681/07/01	TP101 @ 0.35m	Brown sandy CLAY with gravel
0681/07/02	TP101 @ 0.65m	Brown CLAY
0681/07/03	TP101 @ 1.00m	Brown mottled grey CLAY with rootlets
0681/07/04	TP101 @ 1.60m	Brown CLAY and a little gravel
0681/07/05	TP101 @ 1.83m	Brown CLAY

......END OF TEST REPORT......

Signed: ______________________ Kwaku Baah - Laboratory Manager

For and on behalf of PBA Laboratories

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Client: Knapp Hicks & Partners Ltd

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Kent
TN24 8DH

Report No: 0681/07/CH1
Your Ref: 32027A
Report Date: 02/03/2015

Client Contact: Mr Richard Moore
Site: 6 Antrim Grove

Test Requested: Determination of pH Value and Sulphate Content
Test Method: BS 1377-3: 1990, Clauses 5.5 & 9.5

Sample Details:
Sampled and submitted by: Client
Date Sampled: N/K
Date Received: 20/02/2015
Date Tested: 26/02/2015

TEST RESULTS:

Laboratory Reference	Client Reference	Soil Sulphates as SO_4		Water Sulphates as SO4	pH	CLASS*	Dry Mass Passing 2mm test sieve	Description
		Total (%)	Water Soluble (g/L)	(g/L)			(%)	
0681/07/06	TP101 @ 1.8-2.4m	-	0.4	-	7.5	DS-1	100	Brown CLAY
0681/07/10	TP101 @ 3.3-3.5m	-	0.4	-	8.5	DS-1	100	Brown mottled grey CLAY

* Classification based on Tables C1 & C2: BRE Special Digest 1:2005

……END OF TEST REPORT……

Signed: ______________________ Kwaku Baah - Laboratory Manager

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-9 APR 2015
RECEIVED

Client: Knapp Hicks & Partners Ltd

Address:
Prospect House
1 Highpoint Business Village
Henwood, Ashford
Kent
TN24 8DH

Report No: 0681/07/MC3
Your Ref: 32027A
Report Date: 02/04/2015

Client Contact: Mr Richard Moore
Site: 6 Antrim Grove

Test Requested: **Determination of Moisture Content, Liquid, Plastic Limits & Plasticity Index**
Test Method: BS 1377-2: 1990, Test Nos. 3.2; 4.4 (1 point LL); 5.3; & 5.4

Sample Details:
Sampled and submitted by: Client
Date Sampled: 11/03/2015
Date Received: 18/03/2015
Date Tested: 19/03/2015

TEST RESULTS:

Laboratory Reference	Client Reference	MC (%)	LL (%)	P.L (%)	P.I (%)	% Retained on 425µm sieve	Condition of Test	Sample Type
0681/07/12	WS201 @ 0.9-1.0m	27	0	-	-	-	Natural	Disturbed
0681/07/13	WS201 @ 0.9-1.05m	35	0	-	-	-	Natural	Disturbed
0681/07/14	WS201 @ 1.5-1.60m	21	0	-	-	-	Natural	Disturbed
0681/07/15	WS201 @ 1.68-2.00m	8	0	-	-	-	Natural	Disturbed
0681/07/16	WS201 @ 2.00m	18	0	-	-	-	Natural	Disturbed
0681/07/17	WS201 @ 2.0-2.30m	20	0	-	-	-	Natural	Disturbed
0681/07/18	WS201 @ 2.45-2.75m	9	0	-	-	-	Natural	Disturbed
0681/07/19	WS201 @ 3.30m	29	0	-	-	-	Natural	Disturbed
0681/07/20	WS201 @ 3.4-3.70m	30	0	-	-	-	Natural	Disturbed
0681/07/21	WS201 @3.9-4.00m	30	0	-	-	-	Natural	Disturbed

Visual Descriptions:

Laboratory Reference	Client Reference	Description
0681/07/12	WS201 @ 0.9-1.0m	Brown mottled grey CLAY
0681/07/13	WS201 @ 0.9-1.05m	Brown CLAY
0681/07/14	WS201 @ 1.5-1.60m	Brown mottled grey slightly sandy CLAY with rootlets
0681/07/15	WS201 @ 1.68-2.00m	Brown sandy CLAY with rounded GRAVEL
0681/07/16	WS201 @ 2.00m	Brown CLAY with rounded gravel
0681/07/17	WS201 @ 2.0-2.30m	Brown CLAY with rounded flint
0681/07/18	WS201 @ 2.45-2.75m	Brown slightly clayey sandy GRAVEL
0681/07/19	WS201 @ 3.30m	Brown CLAY
0681/07/20	WS201 @ 3.4-3.70m	Brown CLAY
0681/07/21	WS201 @3.9-4.00m	Brown CLAY

……END OF TEST REPORT……

Signed: ______________________________ Peter Baxter - Quality Manager

For and on behalf of PBA Laboratories

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Client:	Knapp Hicks & Partners Ltd	**Report No:**	0681/07/MC4
Address:	Prospect House 1 Highpoint Business Village Henwood, Ashford Kent TN24 8DH	**Your Ref:**	32027A
		Report Date:	02/04/2015

Client Contact: Mr Richard Moore
Site: 6 Antrim Grove

Test Requested: **Determination of Moisture Content, Liquid, Plastic Limits & Plasticity Index**
Test Method: BS 1377-2: 1990, Test Nos. 3.2; 4.4 (1 point LL); 5.3; & 5.4

Sample Details:
Sampled and submitted by: Client
Date Sampled: 11/03/2015
Date Received: 18/03/2015
Date Tested: 19/03/2015

TEST RESULTS:

Laboratory Reference	Client Reference	MC (%)	L.L (%)	P.L (%)	P.I (%)	% Retained on 425µm sieve	Condition of Test	Sample Type
0681/07/22	WS202 @ 0.9-1.00m	29	-	-	-	-	Natural	Disturbed
0681/07/23	WS202 @ 1.5-1.70m	13	-	-	-	-	Natural	Disturbed
0681/07/24	WS202 @ 1.75-1.95m	31	78	24	54	0	Natural	Disturbed
0681/07/25	WS202 @ 2.4-2.60m	32	79	25	54	0	Natural	Disturbed
0681/07/26	WS202 @ 2.6-2.85m	30	-	-	-	-	Natural	Disturbed
0681/07/27	WS202 @ 2.9-3.00m	30	-	-	-	-	Natural	Disturbed
0681/07/28	WS202 @ 3.4-3.60m	30	-	-	-	-	Natural	Disturbed
0681/07/29	WS202 @ 4.00m	31	-	-	-	-	Natural	Disturbed
0681/07/30	WS202 @ 4.60m	31	-	-	-	-	Natural	Disturbed

Visual Descriptions:

Laboratory Reference	Client Reference	Description
0681/07/22	WS202 @ 0.9-1.00m	Brown CLAY
0681/07/23	WS202 @ 1.5-1.70m	Brown mottled grey CLAY with rounded gravel
0681/07/24	WS202 @ 1.75-1.95m	Brown CLAY
0681/07/25	WS202 @ 2.4-2.60m	Brown CLAY
0681/07/26	WS202 @ 2.6-2.85m	Brown CLAY
0681/07/27	WS202 @ 2.9-3.00m	Brown CLAY
0681/07/28	WS202 @ 3.4-3.60m	Brown CLAY
0681/07/29	WS202 @ 4.00m	Brown CLAY
0681/07/30	WS202 @ 4.60m	Brown CLAY

......END OF TEST REPORT......

Signed: ______________________ Peter Baxter - Quality Manager

For and on behalf of PBA Laboratories

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ME8 6PL

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Client: Knapp Hicks & Partners Ltd

Address:
Prospect House
1 Highpoint Business Village
Henwood, Ashford
Kent
TN24 8DH

Report No: 0681/07/MC5

Your Ref: 32027A

Report Date: 02/04/2015

Client Contact: Mr Richard Moore
Site: 6 Antrim Grove

Test Requested: **Determination of Moisture Content, Liquid, Plastic Limits & Plasticity Index**
Test Method: BS 1377-2: 1990, Test Nos. 3.2; 4.4 (1 point LL); 5.3; & 5.4

Sample Details:
Sampled and submitted by: Client
Date Sampled: 11/03/2015
Date Received: 18/03/2015
Date Tested: 19/03/2015

TEST RESULTS:

Laboratory Reference	Client Reference	MC (%)	L.L (%)	P.L (%)	P.I (%)	% Retained on 425μm sieve	Condition of Test	Sample Type
0681/07/31	WS203 @ 1.50m	24	-	-	-	-	Natural	Disturbed
0681/07/32	WS203 @ 1.90m	27	-	-	-	-	Natural	Disturbed
0681/07/33	WS203 @ 2.40m	32	-	-	-	-	Natural	Disturbed
0681/07/34	WS203 @ 2.90m	31	-	-	-	-	Natural	Disturbed

Visual Descriptions:

Laboratory Reference	Client Reference	Description
0681/07/31	WS203 @ 1.50m	Brown CLAY
0681/07/32	WS203 @ 1.90m	Brown CLAY
0681/07/33	WS203 @ 2.40m	Brown CLAY
0681/07/34	WS203 @ 2.90m	Brown mottled grey CLAY

......END OF TEST REPORT......

Signed: ______________________________ Peter Baxter - Quality Manager

For and on behalf of PBA Laboratories

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Client:	Knapp Hicks & Partners	**Report No:**	0681/07/15
Address:	Suite 7 1 Highpoint Business Village Henwood, Ashford Kent TN24 8DH	**Your Ref:**	32027A
		Report Date:	02/04/2015

Client Contact: Mr Richard Moore
Site: **6 Antrim Grove**

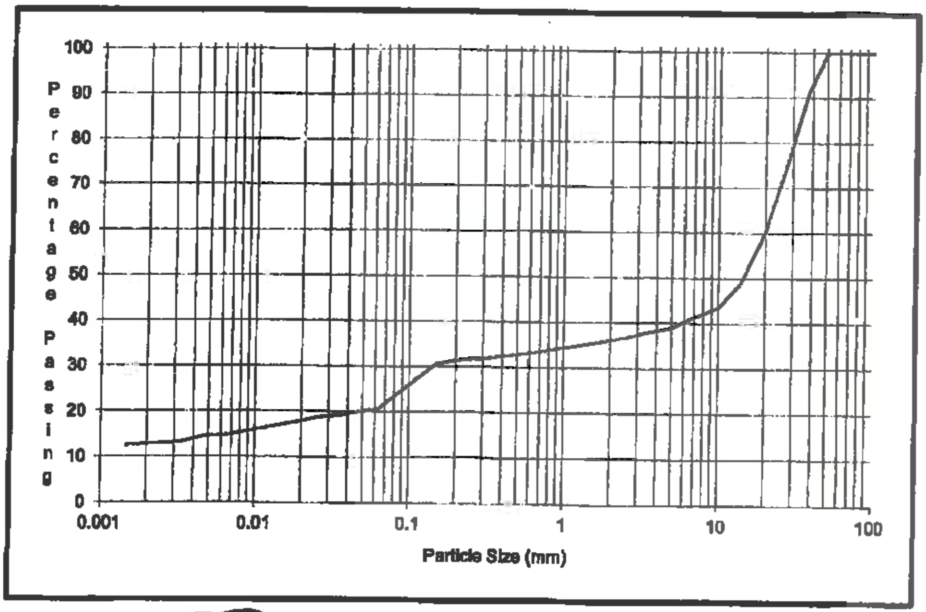
Test Requested: **Particle Size Distribution**
Test Method: BS 1377-2 : 1990 : Clauses 9.2 & 9.5

Sample Details:

Sampled and submitted by:	Client		
Client Ref:	WS201 @ 1.68-2.00m	Date Tested:	25-26/03/2015
Laboratory Ref:	0681/07/15	Date Sampled:	11/03/2015
Date Received:	18/03/2015	Type of Sample:	Bulk

Visual Description: Brown sandy CLAY with rounded GRAVEL

Preparation Method : In accordance with BS 1377-1:1990
Assumed Particle Density: 2.70 Mg/m³



Material Type	Percentage Passing
Cobbles	
Gravel	64
Sand	15
Silt	8
Clay	13

Comments :

Signed : ______ Kwaku Baah - Laboratory Manager

For and on behalf of PBA Laboratories

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Client:	Knapp Hicks & Partners	**Report No:**	0681/07/17
Address:	Suite 7 1 Highpoint Business Village Henwood, Ashford Kent TN24 8DH	**Your Ref:**	32027A
		Report Date:	02/04/2015

Client Contact: Mr Richard Moore
Site: **6 Antrim Grove**

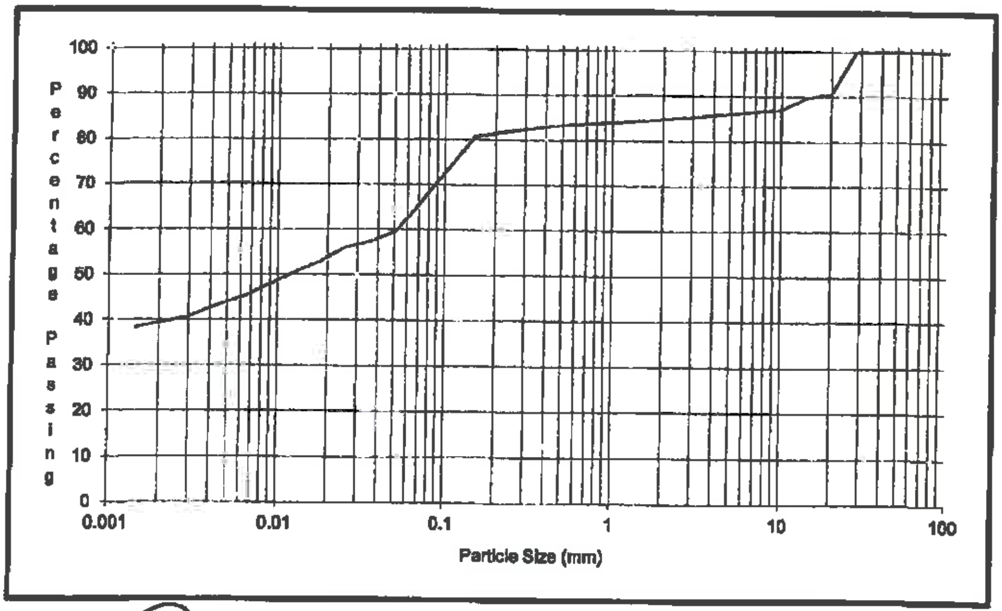
Test Requested: **Particle Size Distribution**
Test Method: BS 1377-2 : 1990 : Clauses 9.2 & 9.5

Sample Details:

Sampled and submitted by:	Client		
Client Ref:	WS201 @ 2.0-2.30m	Date Tested:	25-26/03/2015
Laboratory Ref:	0681/07/17	Date Sampled:	11/03/2015
Date Received:	18/03/2015	Type of Sample:	Bulk

Visual Description: Brown CLAY with rounded flint

Preparation Method : In accordance with BS 1377-1:1990
Assumed Particle Density: 2.70 Mg/m³



Material Type	Percentage Passing
Cobbles	
Gravel	15
Sand	21
Silt	25
Clay	39

Comments :

Signed : ______________________ Kwaku Baah - Laboratory Manager

For and on behalf of PBA Laboratories

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Client: Knapp Hicks & Partners

Address:
Suite 7
1 Highpoint Business Village
Henwood, Ashford
Kent TN24 8DH

Report No: 0681/07/18

Your Ref: 32027A

Report Date: 02/04/2015

Client Contact: Mr Richard Moore
Site: **6 Antrim Grove**

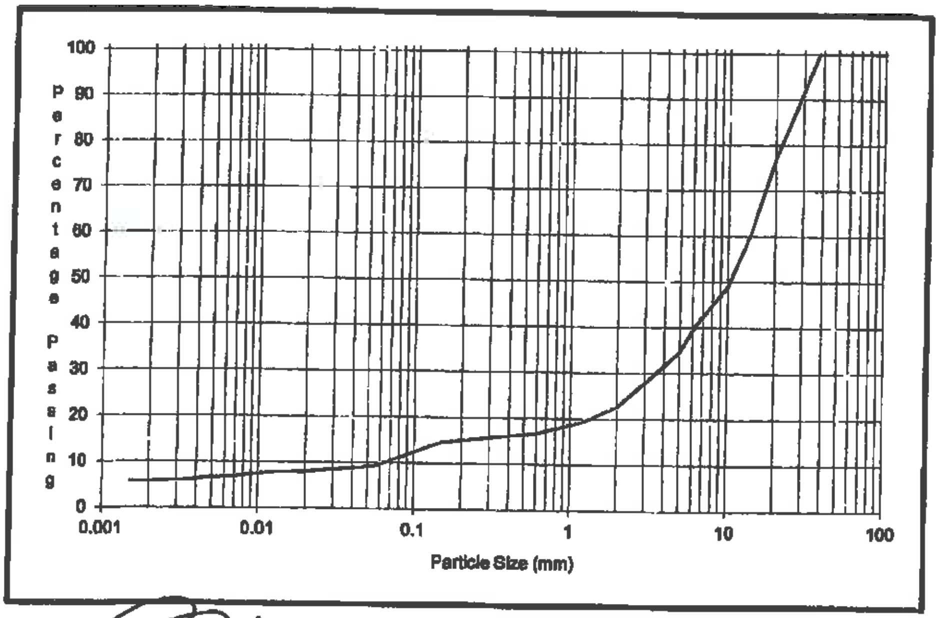
Test Requested: **Particle Size Distribution**
Test Method: BS 1377-2 : 1990 : Clauses 9.2 & 9.5

Sample Details:
Sampled & submitted by: Client
Client Ref: WS201 @ 2.45-2.75m
Laboratory Ref: 0681/07/18
Date Received: 18/03/2015

Date Tested: 25-26/03/2015
Date Sampled: 11/03/2015
Type of Sample: Bulk

Visual Description: Brown slightly clayey sandy GRAVEL

Preparation Method : In accordance with BS 1377-1:1990
Assumed Particle Density: 2.70 Mg/m³



Material Type	Percentage Passing
Cobbles	
Gravel	77
Sand	13
Silt	4
Clay	6

Comments :

Signed : ______________ Peter Baxter - Quality Manager

For and on behalf of PBA Laboratories

PETER BAXTER ASSOCIATES

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UKAS

Client: Knapp Hicks & Partners

Address: Suite 7
1 Highpoint Business Village
Henwood, Ashford
Kent TN24 8DH

Report No: 0681/07/23

Your Ref: 32027A

Report Date: 02/04/2015

Client Contact: Mr Richard Moore
Site: **6 Antrim Grove**

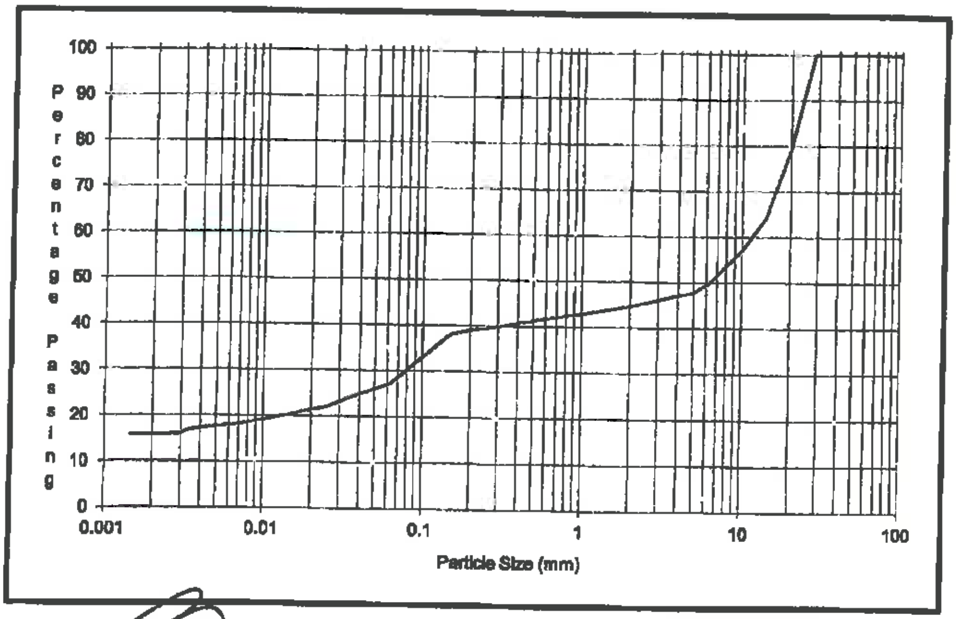
Test Requested: **Particle Size Distribution**
Test Method: **BS** 1377-2 : 1990 : Clauses 9.2 & 9.5

Sample Details:
Sampled and submitted by: Client
Client Ref: WS202 @ 1.5-1.70m
Laboratory Ref: 0681/07/23
Date Received: 18/03/2015

Date Tested: 25-26/03/2015
Date Sampled: 11/03/2015
Type of Sample: Bulk

Visual Description: Brown mottled grey CLAY with rounded gravel

Preparation Method : in accordance with BS 1377-1:1990
Assumed Particle Density: 2.70 Mg/m³



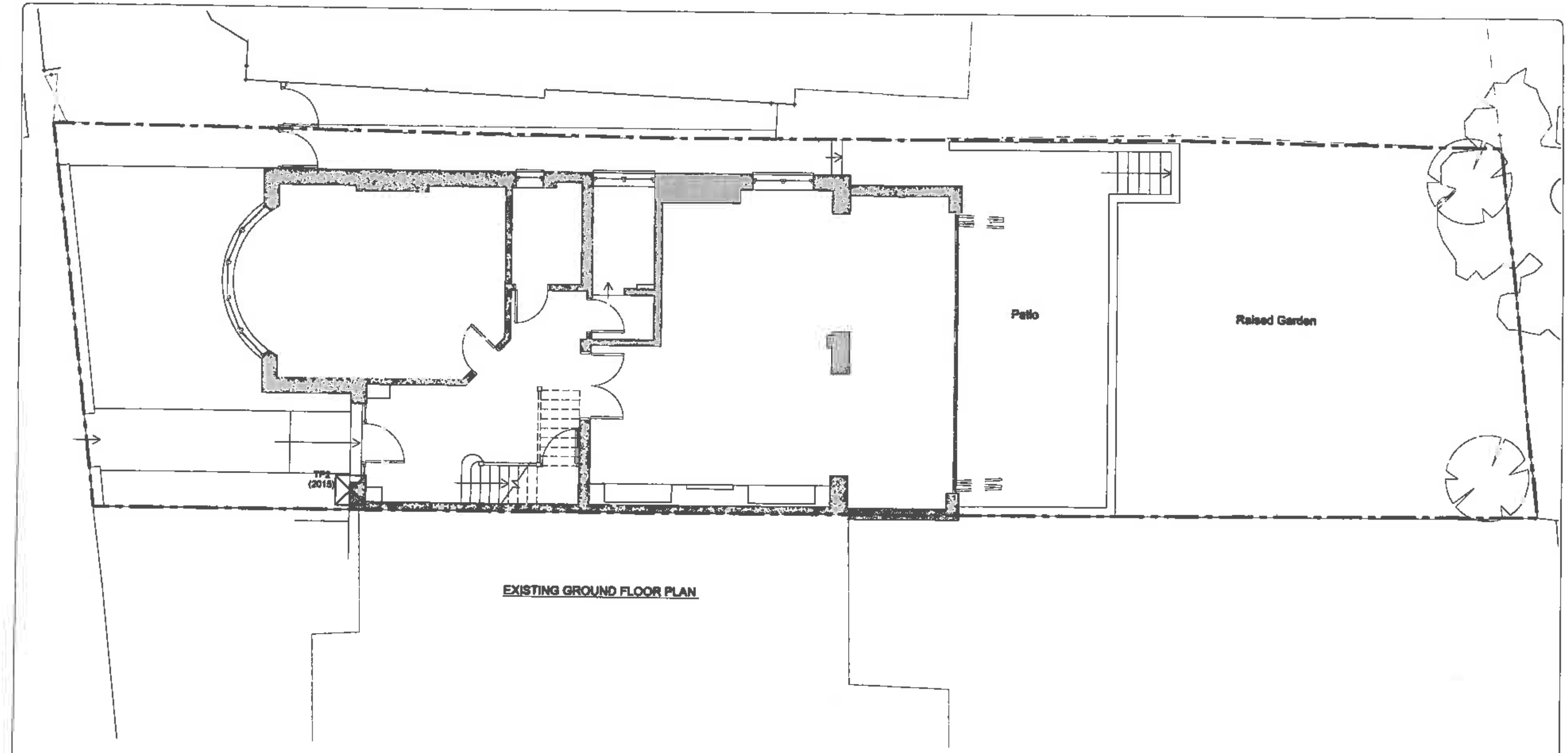
Material Type	Percentage Passing
Cobbles	
Gravel	55
Sand	18
Silt	11
Clay	16

Comments :

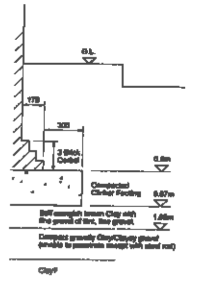
Signed : ______________________ Kwaku Baah - Laboratory Manager

For and on behalf of PBA Laboratories

B. Preliminary Structural Drawings (32842/01-06), Knapp Hicks & Partners



EXISTING GROUND FLOOR PLAN



TRIAL PIT TP2 (2015) - BY FRONT DOOR

Scale 1:20

Use figured dimensions only. Do not scale from drawing.
All levels and dimensions are to be checked on site.
This drawing is to be read in conjunction with all relevant documents.

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NOTES

1) GENERAL

A) These drawings to be read in conjunction with all relevant drawings produced by the Architect, M&E consultant and all other specialists drawings.

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C) All setting out information and levels are to be obtained from the Architect's drawings.

D) Details of all non-structural items, ie ventilation, insulation, services, waterproofing, fire protection, dampproofing, finishes etc. are to be obtained from the Architect's drawings.

E) All structural work is to be to the satisfaction of the Building Inspector and/or Knapp Hicks & Partners. The Contractor is responsible for contacting Building Control in good time to allow for all structural works to be inspected, particularly excavations for foundations.

F) The Contractor is to inform Knapp Hicks & Partners of all builders work holes required to be formed in structural members (eg holes in steel beams, floor joists etc.) and await Knapp Hicks & Partners comments prior to ordering materials, installation of member or formation of holes.

G) All works are to be in accordance with the current British Standard and Building Regulations.

H) The Contractor must exercise due care and attention in any disturbed ground with regards to contamination or pollution or deleterious material.

I) The lengths of all pre-fabricated elements are to be obtained from the Architects drawings and/or site measurements.

2) HEALTH & SAFETY

A) Prior to works commencing, the Contractor must notify the local Health & Safety executive area office of the work, using Form F10, in accordance with the CDM Regulations 1994.

B) The Contractor is responsible for the stability of the existing structure and all adjacent earth works, both on the site and on adjoining sites and must take all necessary precautions to safeguard their stability. All temporary works and the stability of the works in general during construction is the responsibility of the Contractor.

C) The Contractor is to obtain relevant C.O.S.H.H. information with regards to the materials he proposes to use in the works and is to ensure that all operatives are aware of the requirements stated in the C.O.S.H.H. regulations.

D) The Contractor is to comply with the requirements of the Health & Safety at Work Act 1974 in terms of the Employer's responsibilities.

E) Where appropriate suitable lifting equipment including craneage is to be used for the moving or hoisting of individual building elements and materials. All lifting equipment and cranes are to be operated and supervised by suitably qualified personnel and restricted areas of work shall be designated during these operations.

CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS 2007

DESIGNERS HAZARD INFORMATION FOR CONSTRUCTION

1. SERVICES TO BE LOCATED
2. MANUAL LIFTING
3. HOT MATERIAL WORKING
4. CUTTING/DUST
5. CONCRETE, HANDING, LIFTING, PLACEMENT
6. DEEP EXCAVATIONS, COLLAPSE/FALLING
7. SERVICE VOIDS/RISERS, FALLING

PRELIMINARY

Rev	Date	Revision	By	Chk

Client
PETER BRASLAVSKY

Project
6 ANTRIM GROVE
BELSIZE PARK
LONDON NW3 4XR

Title
TRIAL PIT
LOCATION & DETAILS

KNAPP HICKS AND PARTNERS LTD.

CONSULTING STRUCTURAL, CIVIL
AND GEOTECHNICAL ENGINEERS
Prospect House, 67-69 St. John's Road,
Isleworth, Middlesex TW7 6NL

T: [illegible]
W: [illegible]
F: [illegible]
E: [illegible]

Prospect House, 1 HighPoint Business Village, Henwood, Ashford, Kent TN24 8DH
T: 01233 [illegible] F: 01233 [illegible]

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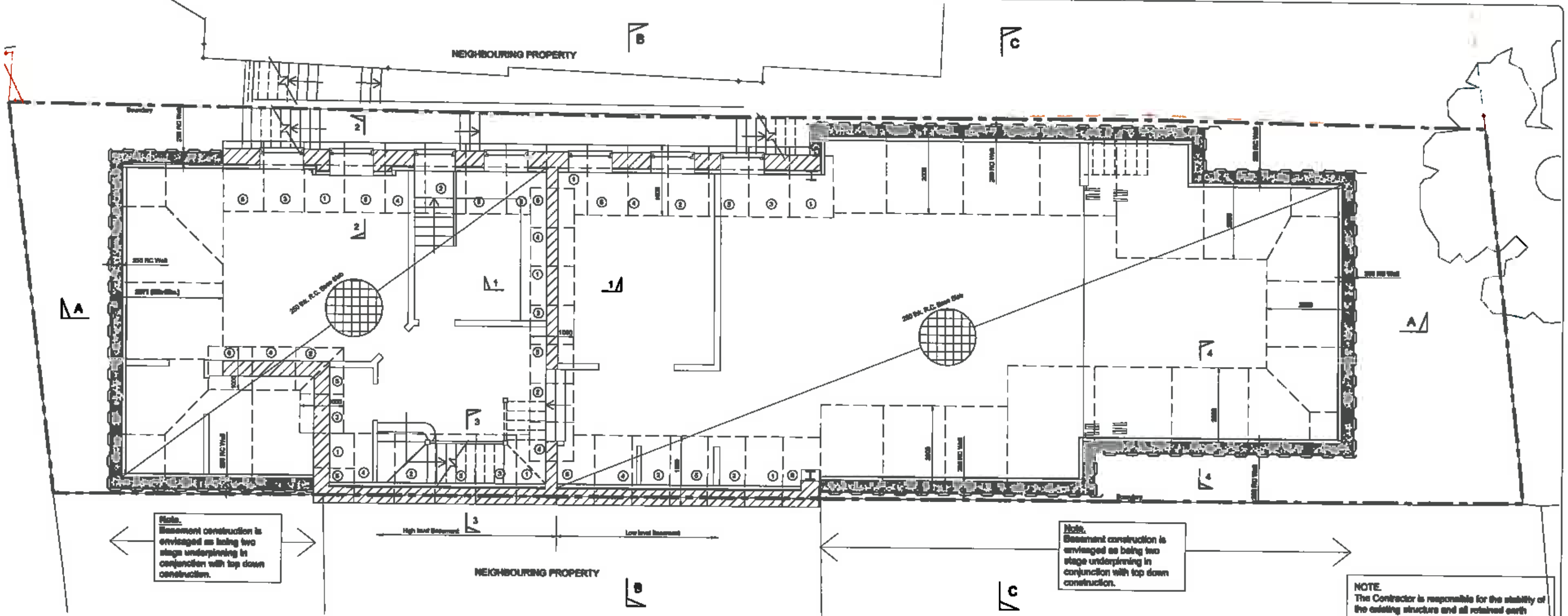
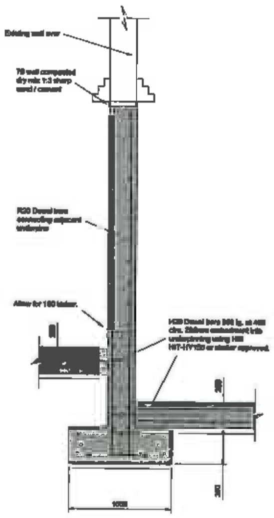


Note.
Basement construction is envisaged as being two stage underpinning in conjunction with top down construction.

Note.
Basement construction is envisaged as being two stage underpinning in conjunction with top down construction.

NOTE.
The Contractor is responsible for the stability of the existing structure and all retained earth works, both on the site and on adjoining sites and must take all necessary precautions to safeguard their stability. All temporary works and the stability of the works in general during construction is the responsibility of the Contractor.



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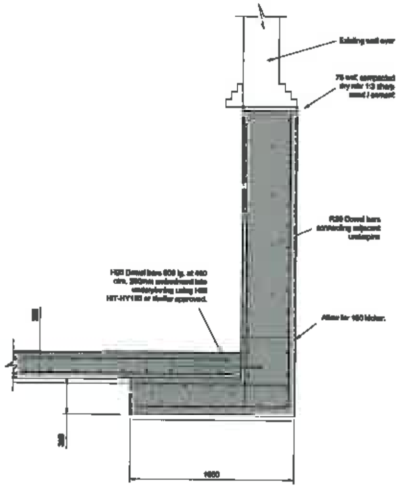

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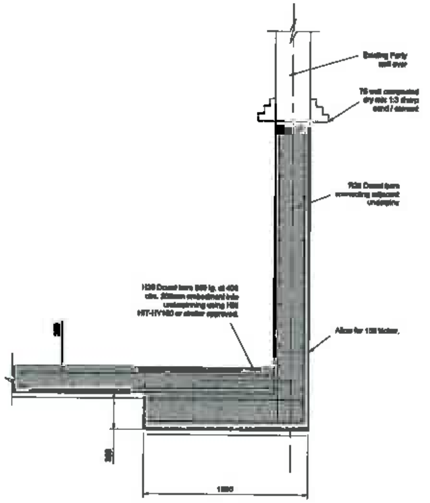

3 - 3

Main House Underpinning Sequence

1) Each leg is to be excavated in bays not exceeding 1.0m in length, concreted and pinned tight to existing footing before commencing next leg. Similarly numbered bays (shown thus : ③) can be carried out simultaneously.

2) The construction of each underpinning block shall be commenced immediately after the bottom of the excavation has been exposed. In all cases where the bottom is likely to be affected by exposure to the atmosphere, the last few millimetres of excavation shall not be taken out unless concreting can proceed forthwith. The bottom shall be sealed with concrete blinding immediately after inspection has shown it to be satisfactory

3) The underside of the existing footing to be thoroughly cleaned and if found to be very irregular, carefully trimmed to create an essentially flat and horizontal surface that will not impede the placement of dry pack mortar.

4) Reinforcement to have a minimum 50mm cover to external faces.

5) RC35 concrete to be placed and well vibrated within 75mm of underside of existing footing.

6) At least 24 hours after mass concrete pour, semi-dry pinning sand / cement pack to be rammed in hard

7) At least 24 hours shall elapse before excavation for the next leg in the sequence.

8) Sides of previously poured underpinning legs to be thoroughly cleaned and joined together with dowel bars before pouring adjoining area

9) New underpins to be dowelled into sides of adjacent underpin with 3R20 dowel bars - 1.0m long (Base) & at 500mm ctrs. vertically in stem.

10) All drainage and services are to be properly protected to avoid damage. Any damage to drainage must be made good prior to backfilling.

11) Temporary supports during excavations to be carried out in accordance with Contractor's method statement.

[illegible]

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NOTES

1) GENERAL

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B) Knapp Hicks & Partners drawings are not to be scaled to obtain dimensions. All dimensions are to be obtained from the Architect's drawings and site measurement.

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D) Details of all non-structural items, ie ventilation, insulation, services, waterproofing, fire protection, dampproofing, finishes etc. are to be obtained from the Architect's drawings.

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G) All works are to be in accordance with the current British Standard and Building Regulations.

H) The Contractor must exercise due care and attention to any disturbed ground with regards to contamination or pollution or deleterious material.

I) The lengths of all pre-fabricated elements are to be obtained from the Architect's drawings and/or site measurements.

2) HEALTH & SAFETY

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D) The Contractor is to comply with the requirements of the Health & Safety at Work Act 1974 in terms of the Employer's responsibilities.

E) Where appropriate suitable lifting equipment including cranage is to be used for the moving or locating of individual building elements and materials. All lifting equipment and cranes are to be operated and supervised by suitably qualified personnel and restricted areas of work shall be designated during these operations.

CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS 2007

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2. MANUAL LIFTING
3. HOT MATERIAL WORKING
4. CUTTING/DUST
5. CONCRETE, HANDING, LIFTING, PLACEMENT
6. DEEP EXCAVATIONS, COLLAPSE/FALLING
7. SERVICE VOIDS/RISERS, FALLING

PRELIMINARY

Rev.	Date	Revision	By	Chk

Client
PETER BRASLAVSKY

Project
6 ANTRIM GROVE
BELSIZE PARK
LONDON NW3 4XR

Title
PROPOSED BASEMENT
PLAN

KNAPP HICKS AND PARTNERS LTD.
CONSULTING STRUCTURAL, CIVIL
AND GEOTECHNICAL ENGINEERS
Prospect House, 57-63 St. John's Road,
Isleworth, Middlesex TW7 6NL
[illegible]

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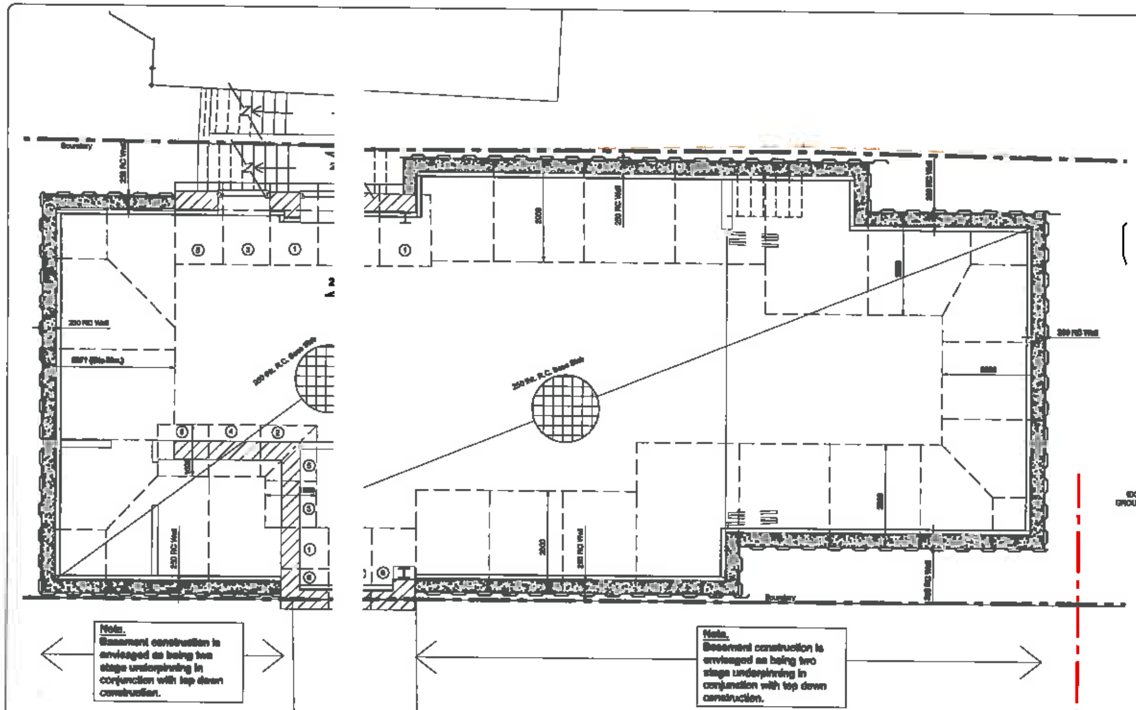
DATE APR'15 CHECK SH
A1

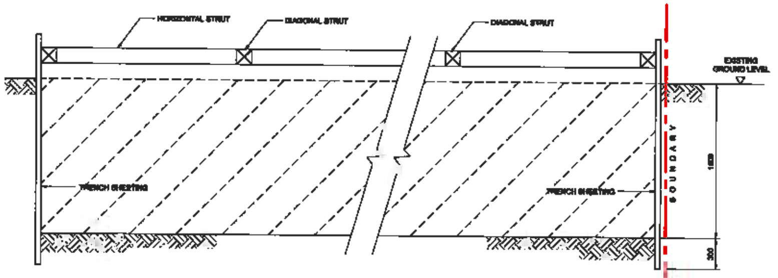
32842 / 02 / -

Version 6 (09/12)



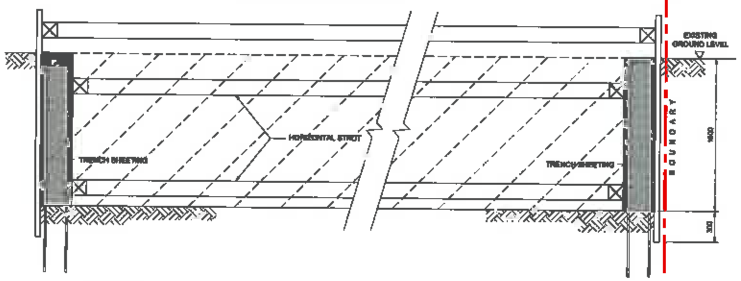
Note.
Basement construction is envisaged as being two stage underpinning in conjunction with top down construction.

Note.
Basement construction is envisaged as being two stage underpinning in conjunction with top down construction.



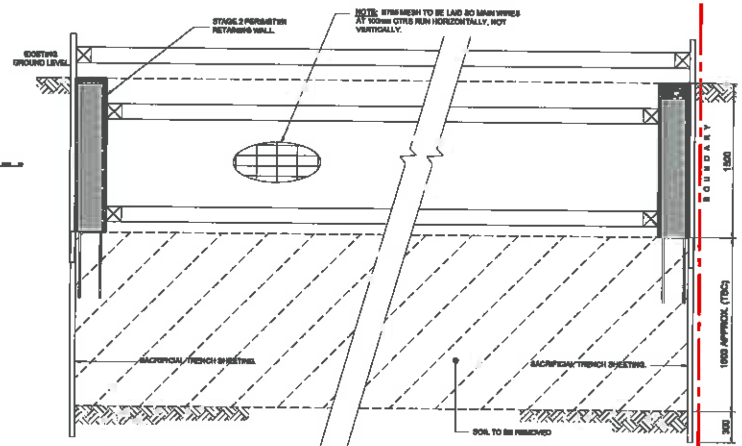
STAGE 1

- TRENCH SHEETS TO BE INSTALLED BY EXCAVATING AND PLACING IN POSITION WITH 300MM EMBEDMENT.
- HORIZONTAL STRUTS TO BE INSTALLED ABOVE GROUND LEVEL FIXED TO HORIZONTAL WALLING ACROSS HEAD OF TRENCH SHEETS.
- EXCAVATE 2000MM WIDE STRIPS ACROSS SITE DOWN TO 1500MM BELOW GROUND LEVEL.



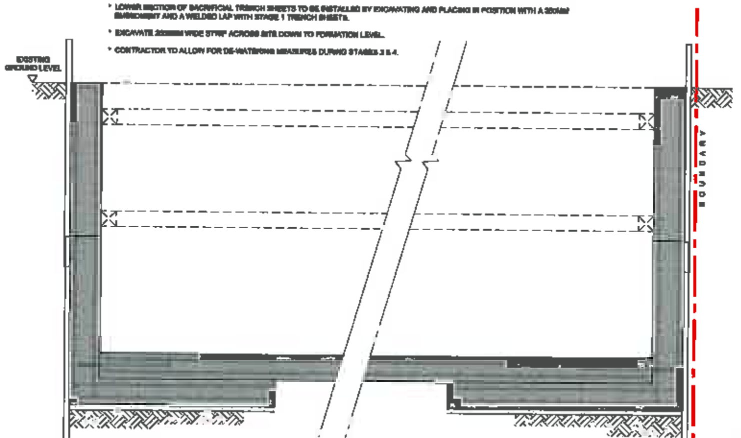
STAGE 2

- CAST 2000 SECTIONS OF R.C. WALL AGAINST TRENCH SHEETS WITH MAIN BARS EMBEDDED INTO SOIL.
- INSTALL HORIZONTAL PROPS BETWEEN R.C. WALL PANELS ONCE CURED.
- REPEAT STAGE 1 & 2 FOR REMAINING STRIPS UNTIL ALL PERIMETER WALLS DOWN TO 1500MM BELOW GROUND LEVEL ARE CAST.



STAGE 3

- LOWER SECTION OF SACRIFICIAL TRENCH SHEETS TO BE INSTALLED BY EXCAVATING AND PLACING IN POSITION WITH A 300MM EMBEDMENT AND A WELDED LAP WITH STAGE 1 TRENCH SHEETS.
- EXCAVATE 2000MM WIDE STRIP ACROSS SITE DOWN TO FORMATION LEVEL.
- CONTRACTOR TO ALLOW FOR DE-WATERING MEASURES DURING STAGES 3 & 4.



STAGE 4

- PREPARE FOUNDING LEVEL AND BLIND WITH 50MM LEAN MIX CONCRETE.
- INSTALL 1200G POLYTHENE D.P.M.
- CAST 2000MM WIDE BASE SLAB WITH STARTERS FOR R.C. WALL.
- CAST LOWER SECTIONS OF R.C. WALL LAPPING REBAR WITH STAGE 2 CAST SECTIONS.
- HORIZONTAL PROPS TO BE REMOVED AFTER 48 HOURS OF CURING TIME.

Version 8 (09/13)

[illegible]

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NOTES

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CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS 2007

DESIGNERS HAZARD INFORMATION FOR CONSTRUCTION

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2. MANUAL LIFTING
3. HOT MATERIAL WORKING
4. CUTTING/DUST
5. CONCRETE, HANDING, LIFTING, PLACEMENT
6. DEEP EXCAVATIONS, COLLAPSE/FALLING
7. SERVICE VOIDS/RISERS, FALLING

PRELIMINARY

Rev.	Date	Revision	By	Chk

Client
PETER BRASLAVSKY

Project
6 ANTRIM GROVE
BELSIZE PARK
LONDON NW3 4XR

Title
PROPOSED BASEMENT
WALL CONSTRUCTION

KNAPP HICKS AND PARTNERS LTD.
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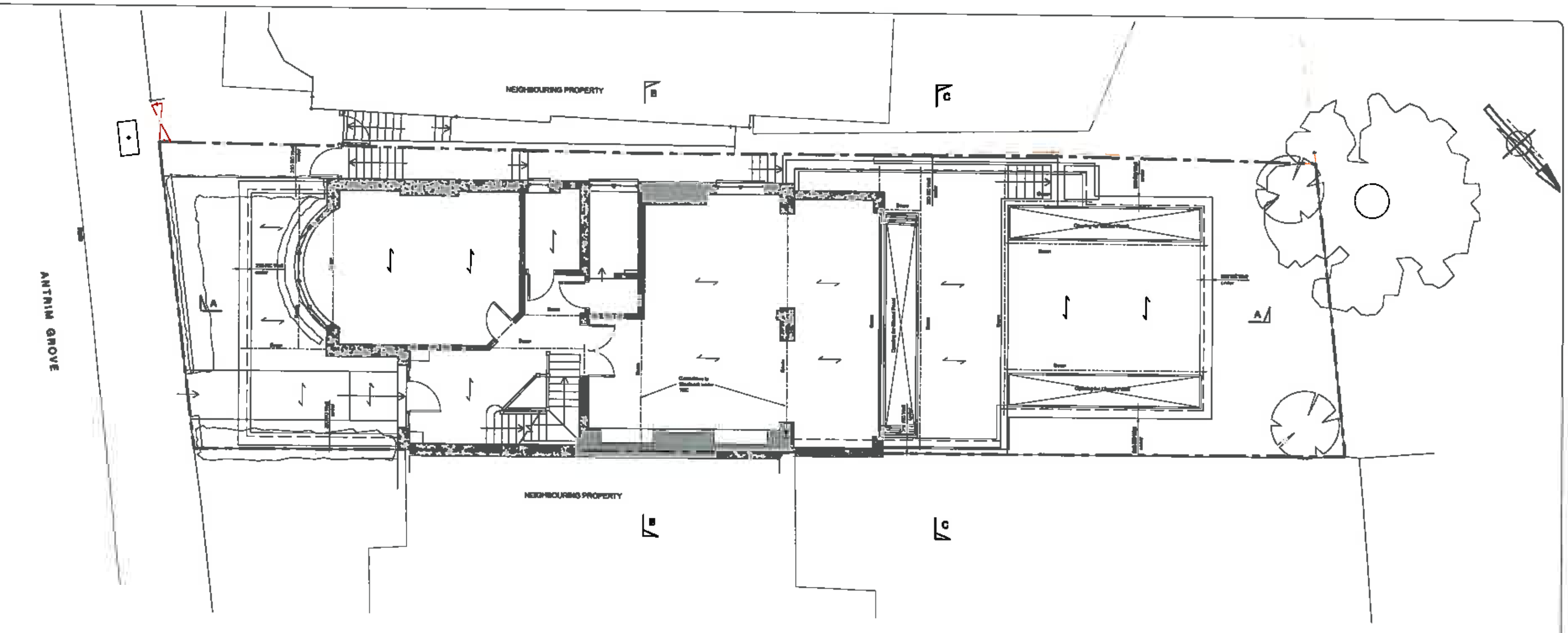

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PRELIMINARY

Rev	Date	Revision	By	Chk

Client
PETER BRASLAVSKY

Project
8 ANTRIM GROVE
BELSIZE PARK
LONDON NW3 4XR

Title
PROPOSED GROUND
FLOOR PLAN

KNAPP HICKS AND PARTNERS LTD.
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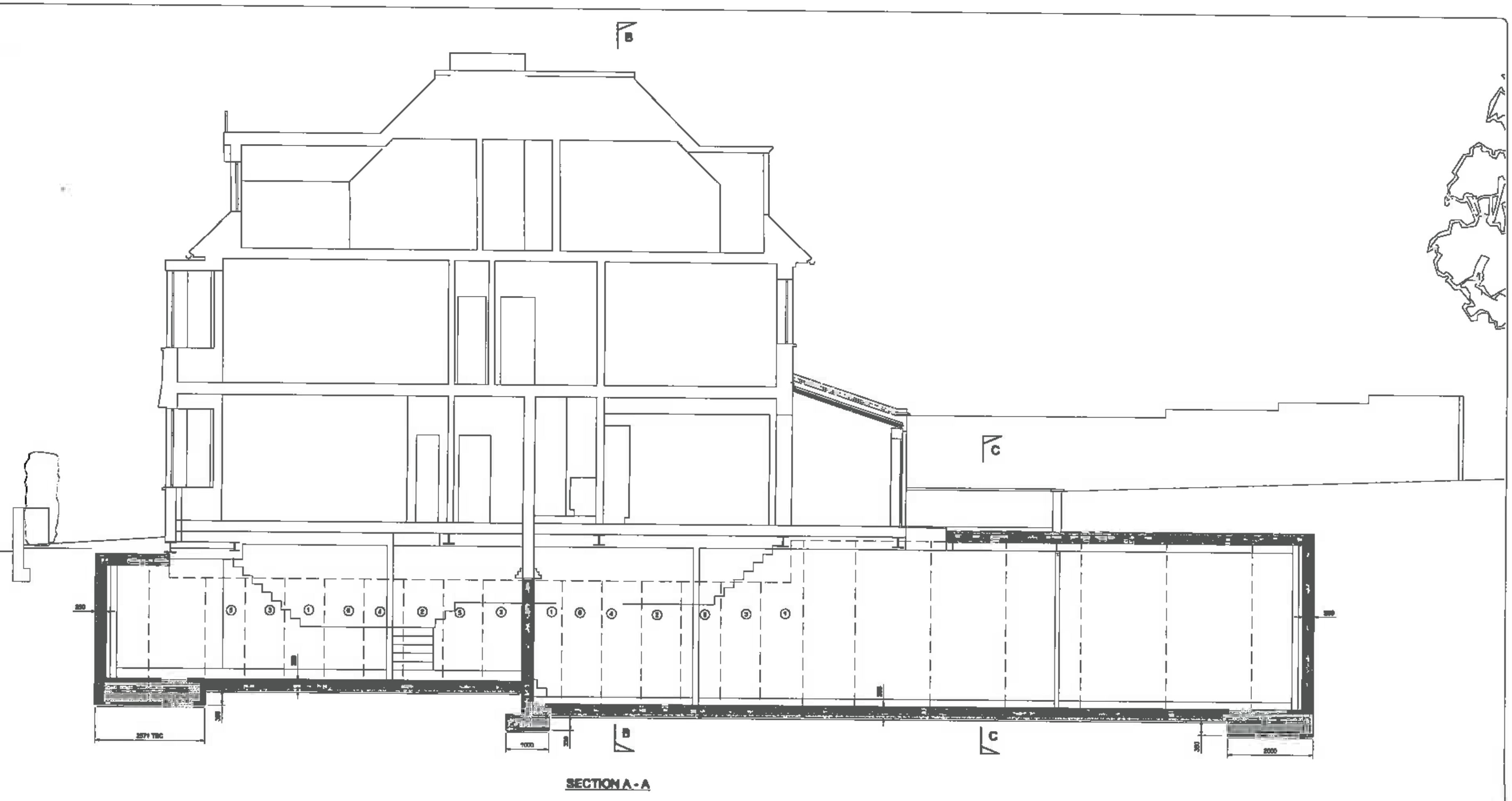

SECTION A - A

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PRELIMINARY

No.	Date	Revision	By	Chk

Client
PETER BRASLAVSKY

Project
8 ANTRIM GROVE
BELSIZE PARK
LONDON NW3 4XR

Title
SECTION A - A

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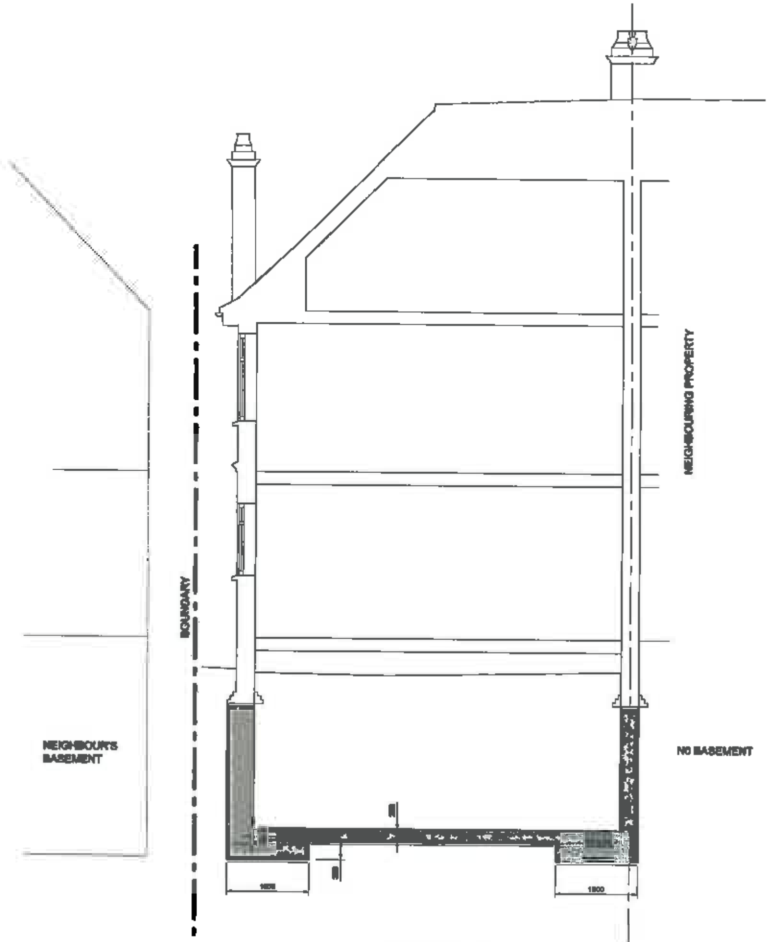
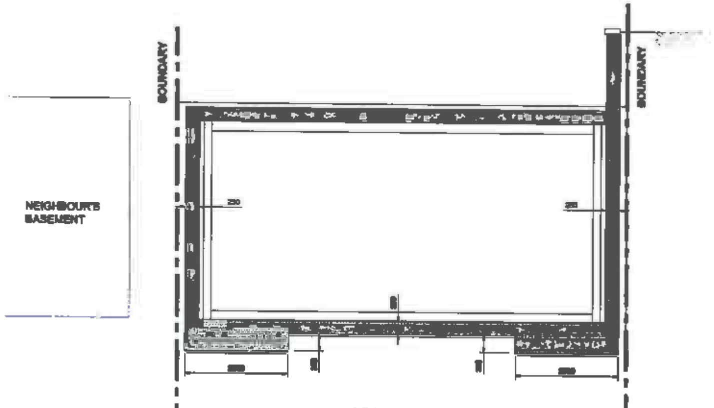


SECTION B - B



SECTION C - C

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PRELIMINARY

Rev.	Date	Revision	By	Chk

Client
PETER BRASLAVSKY

Project
6 ANTRIM GROVE
BELSIZE PARK
LONDON NW3 4XR

Title
SECTIONS B - B & C - C

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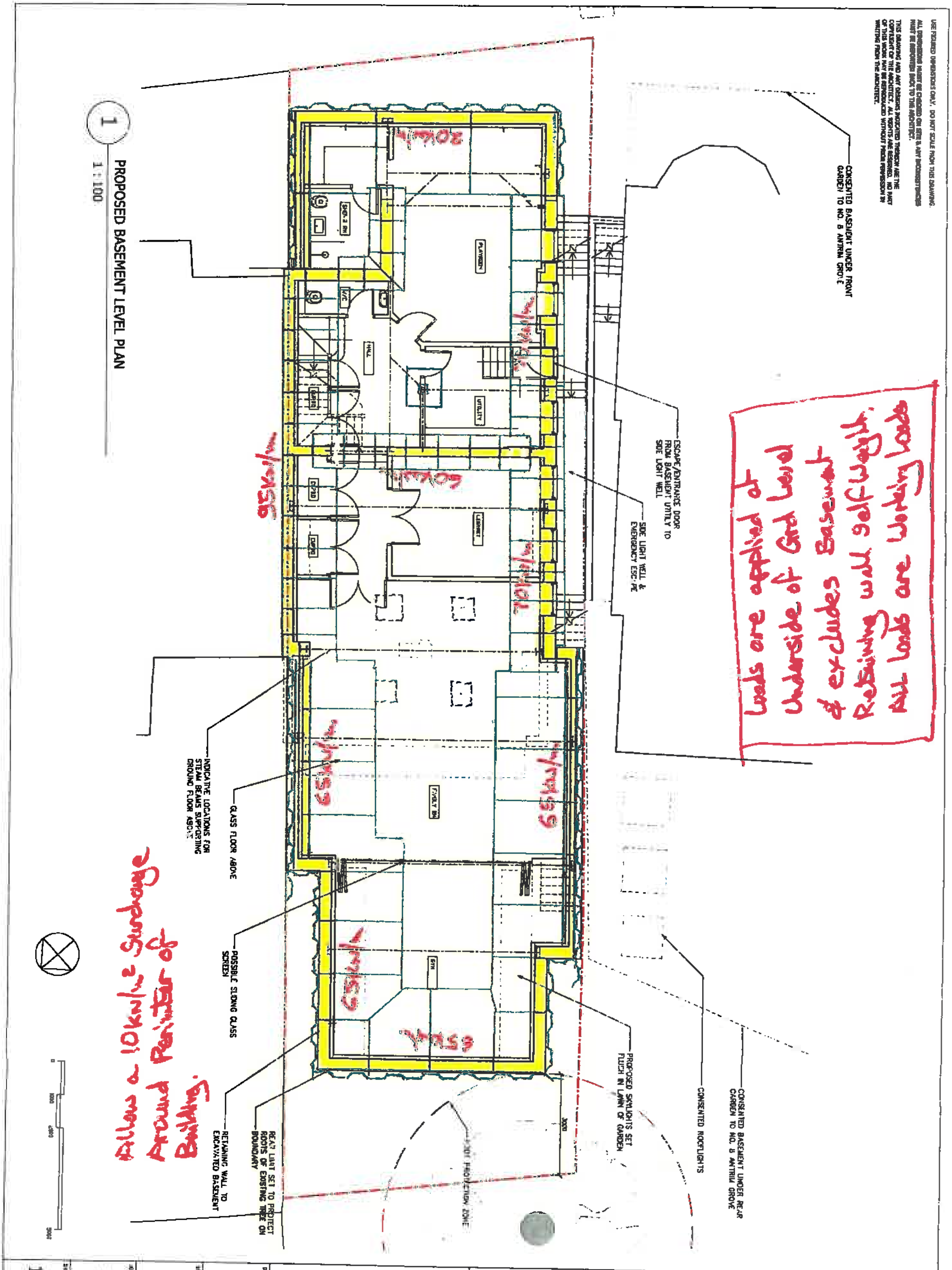

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Loads are applied at Underside of Grd Level Beam & excludes Basement Retaining wall selfweight. All loads are working loads.

Allow a 10kN/m² Surcharge Around Perimeter of Building.

Bchitecture
11A Beresford Road London N2 8AT
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6 Antrim Grove, Belsize Park
London NW3 4XR

PROPOSED PLANS

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C. Groundwater Flow Screening and Scopinjg BIA Assessment, dated 19th may 2015, by Stephen Buss Environmental Consulting Ltd

Stephen Buss
Environmental Consulting Ltd

6 Antrim Grove: Subsurface flow Basement Impact Assessment

Version control log

Document number	Date	Issued by	Issued to	Comments
2015-009-005-002	08/06/15	Steve Buss	Knapp Hicks	Final draft
2015-009-005-001	19/05/15	Steve Buss	Knapp Hicks	First draft

Client: Knapp Hicks and Partners

Dated: May 2015

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Registered in England and Wales number 08595273

DISCLAIMER

This report has been prepared by Stephen Buss Environmental Consulting Ltd (SBEC) in its professional capacity as hydrogeologist, in a manner consistent with the level of care and skill ordinarily exercised by members of the geological and engineering professions practising at this time, within the agreed scope and terms of contract, and taking account of the manpower and resources devoted to it by agreement with its client.

The advice and opinions in this report should be read and relied on only in the context of the report as a whole. As with any environmental appraisal or investigation, the conclusions and observations are based on limited data. The risk of undiscovered environmental impairment of the property cannot be ruled out. SBEC cannot therefore warrant the actual conditions at the site and advice given is limited to those conditions for which information is held by SBEC at the time. The findings are based on the information made available to SBEC at the date of the report (and will have been assumed to be correct) and on current UK standards, codes, technology and practices as at that time.

This report is provided to the client addressed above. Should the client wish to release this report to any other third party for that party's reliance, SBEC accepts no responsibility to any third party to whom this report or any part thereof is made known. SBEC accepts no responsibility for any loss or damage incurred as a result, and the third party does not acquire any rights whatsoever, contractual or otherwise, against SBEC except as expressly agreed with SBEC in writing.

The findings do not purport to include any manner of legal advice or opinion. New information or changes in conditions and regulatory requirements may occur in future, which will change the conclusions presented here.

TABLE OF CONTENTS

Figures

Tables

1. Introduction

1.1 Background

This report presents the subsurface flow (groundwater) component of a basement impact assessment, to be submitted in support of a planning application for the basement development at 6 Antrim Grove, Belsize Park, London (Figure 1.1; postcode NW3 4XR, national grid reference TQ 2751 8488). The local planning authority is Camden Borough Council.

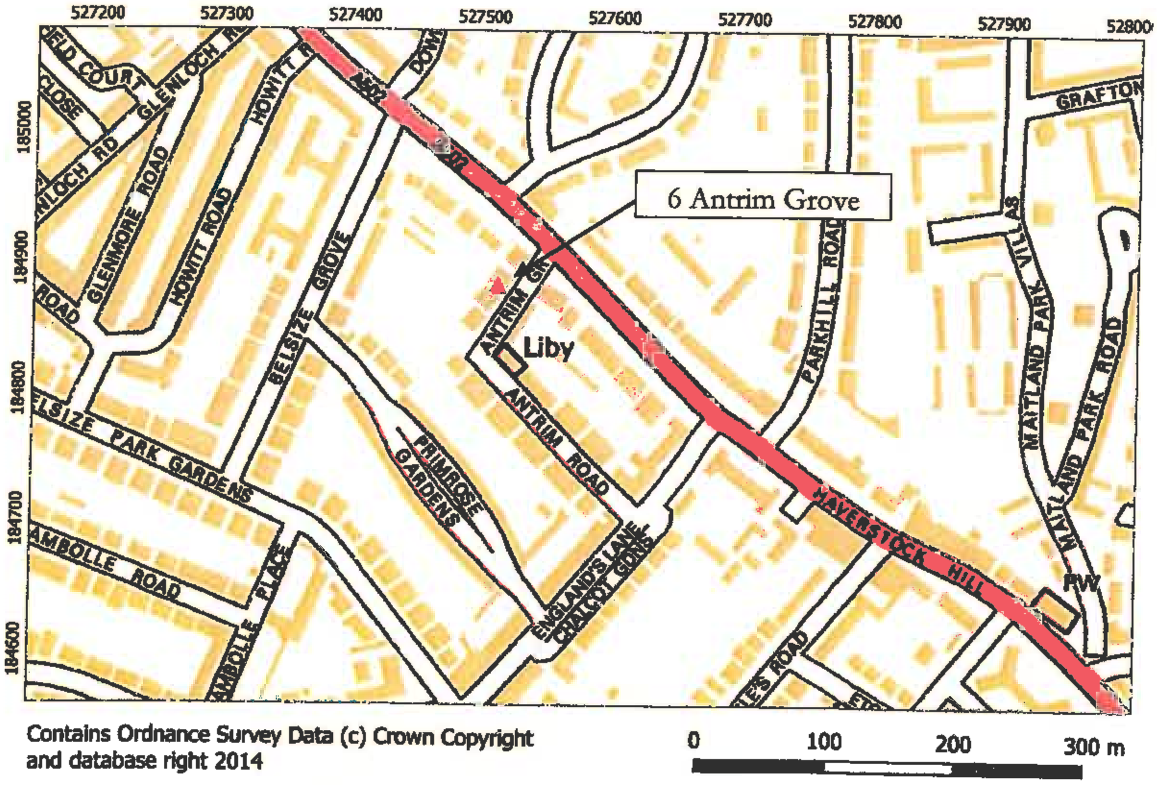

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Figure 1.1 Location of 6 Antrim Grove

1.2 Basement works

The site comprises 6 Antrim Grove, Belsize Park, which is a two-storey semi-detached house on the north west side of Antrim Grove. To the east, south, west and north of the site are neighbouring residential properties. Number 4 Antrim Grove adjoins the property, to the north east. There is a recent basement development at number 8, to the south west, and at number 10.

Plans for the new basement extension at 6 Antrim Grove involve extending downwards, forwards and backwards. The basement is to be rectangular, with length c. 28.8 m and width c. 8.6 m. The finished floor level of the basement will be about 3 m below Antrim Grove, and about 3.8 m below garden level (which is about 800 mm above the level at the front of the house).

Figure 1.2 shows scans of: the basement plan (with Antrim Grove to the left side of the page), section A-A' adjacent to number 4 Antrim Grove (now with Antrim Grove on the right), and section B-B' which is the side elevation (again with Antrim Grove on the right).

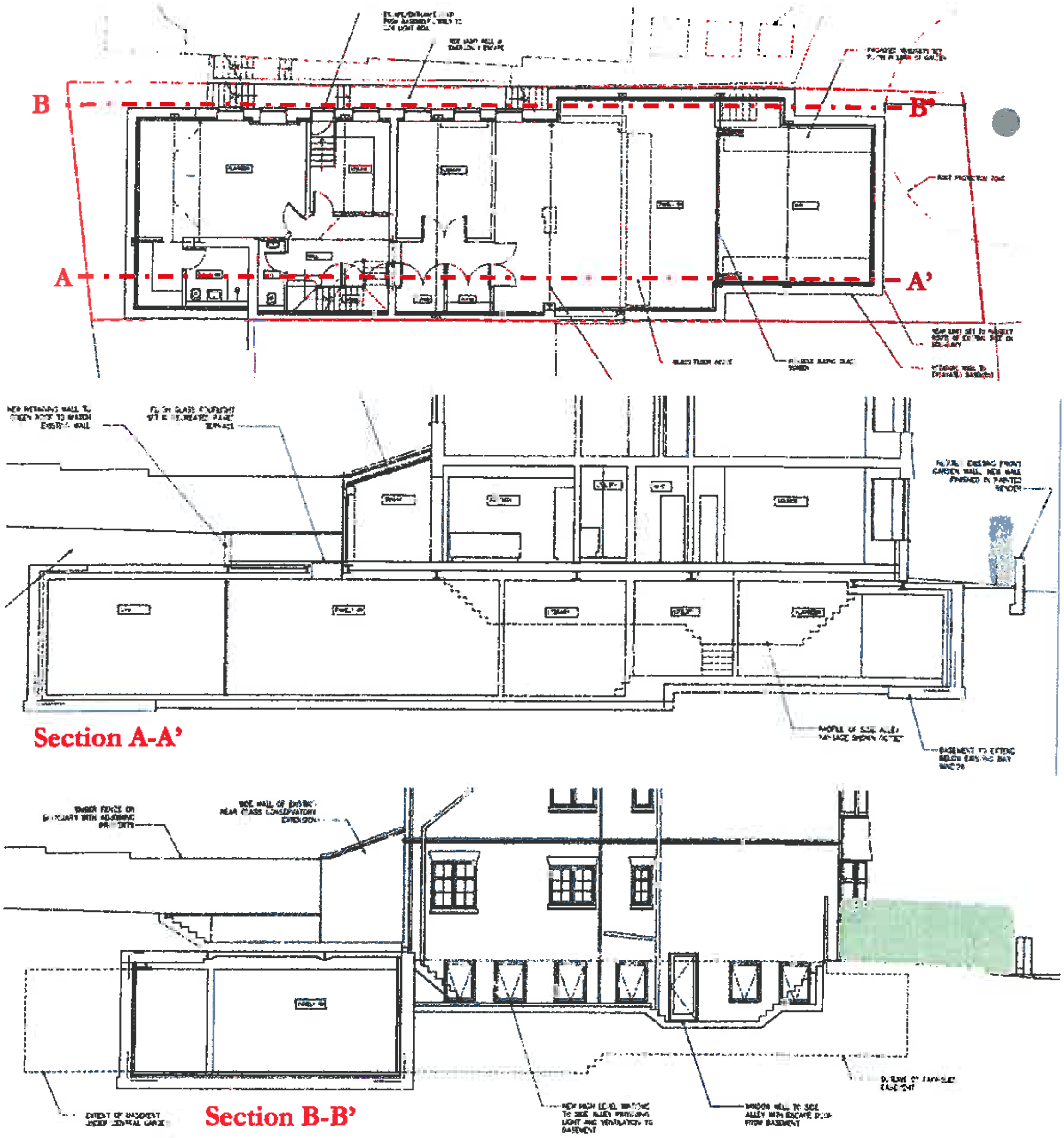

Figure 1.2 Plan and sections of the proposed development (do not scale)

1.3 Scope of Report

This report presents the sub-surface screening, scoping and impact assessment, for a basement development, that complies with CPG4 screening and scoping stages, and makes reference to the basement impact assessment guidance of ARUP (2010)[1]. Site investigation results are presented in full in Knapp Hicks and Partners (2015) but the borehole and trial pit logs are reproduced in Appendix A of this document.

1.4 Authorship of Report

Stephen Buss Environmental Consulting Ltd was instructed in May 2015 to complete this report. This report has been prepared by Dr Stephen Buss MA MSc CGeol. Dr Buss is a UK-based independent hydrogeologist with more than 15 years' consulting experience in solving groundwater issues for regulators, water companies and other private sector organisations. **Dr Buss is a Chartered Geologist with the Geological Society of London.** Dr Buss's CV and publications list is available at www.hydro-geology.co.uk.

---

[1] ARUP, 2010. Camden geological, hydrogeological and hydrological study. Guidance for subterranean development.

2. Basement Impact Assessment Screening: Groundwater

Subterranean (groundwater) screening follows the procedure outlined in Figure 1: Subterranean (ground water) flow screening chart of the Camden Planning Guidance 4 (CPG4) entitled Basements and Lightwells dated 2013. These findings have been informed by ground investigations undertaken at the site in November 2013 and April 2015 (Knapp Hicks, 2014 & 2015).

1a) Is the site located directly above an aquifer?

NO. The geological map, on site boreholes and the nearest off-site boreholes indicate that a continuous layer of permeable superficial deposits is not present beneath the site. Site investigation boreholes show less than 1 m of made ground, over a layer of head (albeit gravelly for the most part), above London Clay. None of these can be considered an aquifer. Beneath made ground a considerable thickness of London Clay isolates the deeper aquifer units of the London Basin aquifer from the surface.

1b) Will the proposed basement extend beneath the water table surface?

YES. Seepages were noted during the ground investigations, and groundwater was monitored in standpipes to within 0.85 m of ground surface.

2) Is the site within 100m of a watercourse, well (used/disused) or potential spring line?

NO. There are no current surface water bodies within 100 m of the site. The site lies between former tributaries of the 'lost' River Tyburn (c. 300 m to the west) and the River Fleet (c. 750 m to the east). The Tyburn tributary is quite high up in the catchment of the river. It flowed southwards and (if it still exists) is now culverted beneath roads.

There are no known water wells within 100 m of the site.

Geological conditions indicate that there is potential for development of a spring line in the vicinity of the property, as the 1:50 000 geology map indicates that it is located at the lower boundary of the Claygate Beds. This is discussed further in Section 3.6.

3) Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?

NO. There has been no additional surface expression of the basement development, so surface water flows will be unchanged.

4) As part of the site drainage, will more surface water (e.g. rainfall and runoff) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?

NO. Discharge to the ground is not proposed.

5) Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond or spring line?

NO. The nearest water body is Hampstead Number 1 Pond, about 950 m to the north. This is too far from the site to be a concern, especially given that there are not permeable superficial deposits beneath the site.

3. Conceptual Site Model

3.1 Drainage and Topography

Elevation of Antrim Grove is about 59.25 m above Ordnance Datum (m AOD). Ground surface around the site slopes gently south eastwards (gradient from Ordnance Survey contours is about 0.027).

Historically, two brooks rose near the site, but these have been culverted beneath developments. These were tributaries of the 'lost' River Tyburn (c. 300 m to the west) and the River Fleet (c. 750 m to the east)[2] (Figure 2.1). The nearest current surface water feature is Hampstead No. 1 pond, about 950 m to the north of the site.

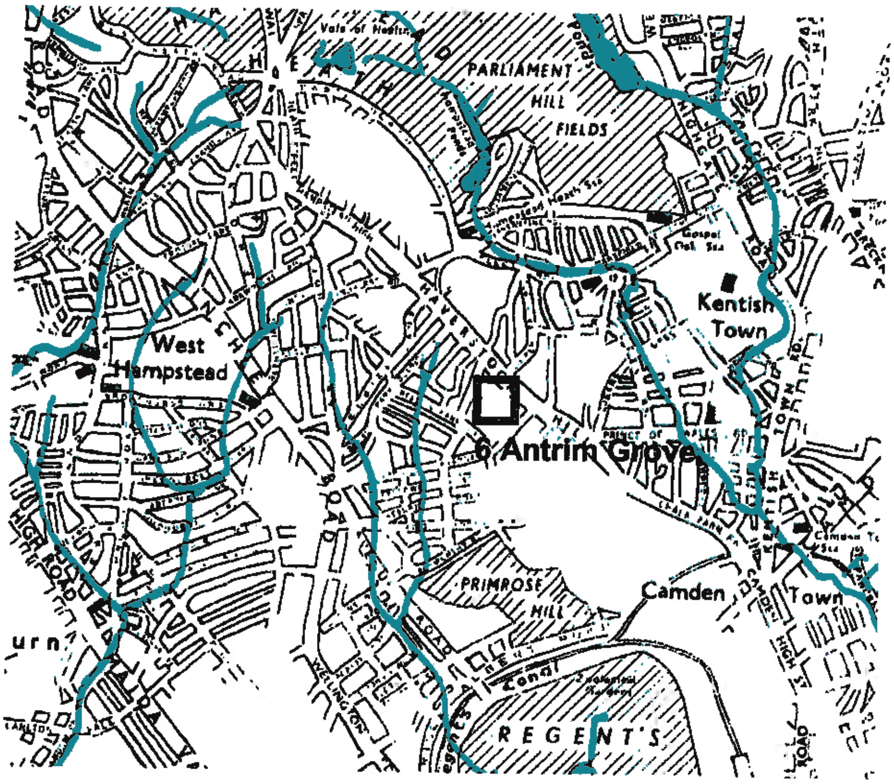

Figure 3.1 Location of tributaries of the River Tyburn (west) and River Fleet (east)

3.2 Geology and hydrogeology

Bedrock at the site comprises London Clay. The base of the London Clay is at least 43 m below ground level at the Belsize Park Station borehole[3] (about 250 m to the north west of the site) and isolates the main aquifer of the London Basin from the surface.

Nearby shallow borehole records available from the British Geological Survey show the presence of sandy silty clay near surface (borehole TQ28SE2337[4] is the closest of seven from a site investigation about 120 m south east of Antrim Grove.)

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[2] Barton, N.J., 1993. The Lost Rivers of London 3rd edition.
[3] http://scans.bgs.ac.uk/sobi_scans/boreholes/590636
[4] http://scans.bgs.ac.uk/sobi_scans/boreholes/18393270

Referring back to the screening, a detailed assessment of the near-surface geology reinforces the view that there is not an aquifer directly beneath the site, and there is no water table in the low permeability near-surface formations.

3.3 Site Geological Information

Two phases of intrusive investigation have been undertaken on site (Knapp Hicks and Partners, 2014 & 2015). In total four boreholes were advanced by window sampling and five trial pits were excavated. Approximate locations are shown on Figure 3.2.

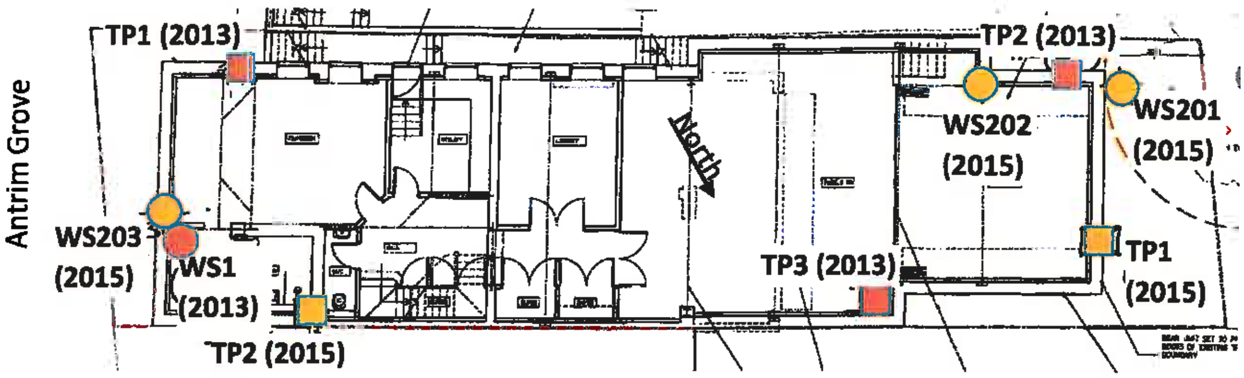

Figure 3.2 Locations of boreholes (in relation to proposed basement plan)

Most of the boreholes intercepted a common lithological sequence.

- Made Ground was generally encountered to about 55 cm depth, but maximum thickness was 0.87 m depth (in the house footings of TP2 (2015)).
- Orange-brown silty clay often (but not always) formed the uppermost natural stratum at the site. This could be a little sandy or gravelly and tended to reach about 1.0 to 1.5 m below ground level.
- Below this is a sandy gravelly clay, sometimes described as a clayey sandy gravel, to typically 1.9 m depth, though it reaches 3.25 m depth in WS201 (2015).
- Beneath the gravelly clay layer there is often London Clay, but sometimes a thin superficial silty clay horizon.

3.4 Site Groundwater Information

Standpipes were installed in boreholes WS201, WS202, WS203 and TP1 during the 2015 investigation. The data collected from these is tabulated in Table 3.1. Whilst WS201 and TP1 seemed to settle down quickly, WS202 and WS203 reacted much slower to installation. (Ground level at the rear garden is about 800 mm above that at the front – the levels are referenced to garden ground level.)

Table 3.1 Groundwater level data (m below ground level at the rear of the house)

	WS203	WS201	WS202	TP1
Tip level:	3.87	3.11	3.66	3.59
13/3/2015	dry	0.85	dry	0.87
31/3/2015	3.72	1.00	3.25	1.01
17/4/2015	3.48	1.18	2.79	1.18

Whilst WS202 and WS203 were dry on completion, groundwater strikes in the other boreholes (including the 2013 boreholes) are also worth noting.

- In WS201 groundwater was encountered during drilling: when the sampler tube was withdrawn from the 3-4m interval (the base of the gravelly clay), groundwater rose quickly to 1.67 m below ground level (bgl). A rising head test was undertaken in the standpipe in WS201 and hydraulic conductivity range of 0.15 to 0.04 m/day was determined.
- In TP1 (2015) groundwater was noted as a small seepage along fractures from 1 m depth. A sump was constructed in the pit to manage this inflow, since the rate of flow was c. 0.24 litres per minute, so the sump had to be emptied frequently.
- WS1 (2013) like its neighbour WS203 (2015) was dry on completion, but a standpipe was not installed. (The 2013 trial pits were too shallow to encounter any of the groundwater noted above.)

3.5 Local basements

Numbers 8 and 10 Antrim Grove have had basements developed recently. Details have been obtained for these, from previous planning applications:

- Number 8 is south west of number 6 and now has a full basement. The lithological sequence at number 6 is observed here (Knapp Hicks and Partners, 2011). Three boreholes were constructed on the site. Like WS1 and WS203 at number 6, the borehole at the front of number 8 was dry and a standpipe was not installed. Two boreholes at the rear of the property did yield groundwater, which on one occasion in one borehole, rose to within 1.5 m of ground surface.
- Number 10 is to the south west of number 8, and has a basement extension. In a 2011 ground investigation two boreholes were completed dry but four weeks later groundwater had reached 1.32 m and 1.16 m below ground level.

3.6 Conceptual Model of Groundwater Flow

Superficial deposits identified on site are probably solifluction ('head') deposits that are formed by the erosion and down-slope movement of in-situ materials. Head deposits tend to be heterogeneous and discontinuous, and lithology ranges from clays, through silts, to sand and gravel. Dominantly clayey head is found on-site appears to be about 1.7 m thick, with the bottom metre containing gravel to varying degrees.

Groundwater level across the site appears to be about 1.0 to 1.5 m below ground level. Varying response times of standpipes support the observation of geological heterogeneity and suggests that this translates to hydrogeological heterogeneity. Nevertheless a range of hydraulic conductivity values, which seems appropriate for a gravelly clay or clayey sandy gravel, has been obtained from one standpipe.

A schematic cross-section is presented as Figure 3.3, which shows the planned depth of the basement floor and slab, maximum observed groundwater levels and the lithological sequence observed. This drawing makes it clear that the likely reason that the water level in standpipes nearest Antrim Grove respond slowly to groundwater is that WS202 and WS203 have their tips in the clay, and WS201 has its tip in the (unusually deep) gravelly clay. TP1 may have a good vertical hydraulic connection because it has been backfilled with arisings rather than completed with, for example, a bentonite seal.

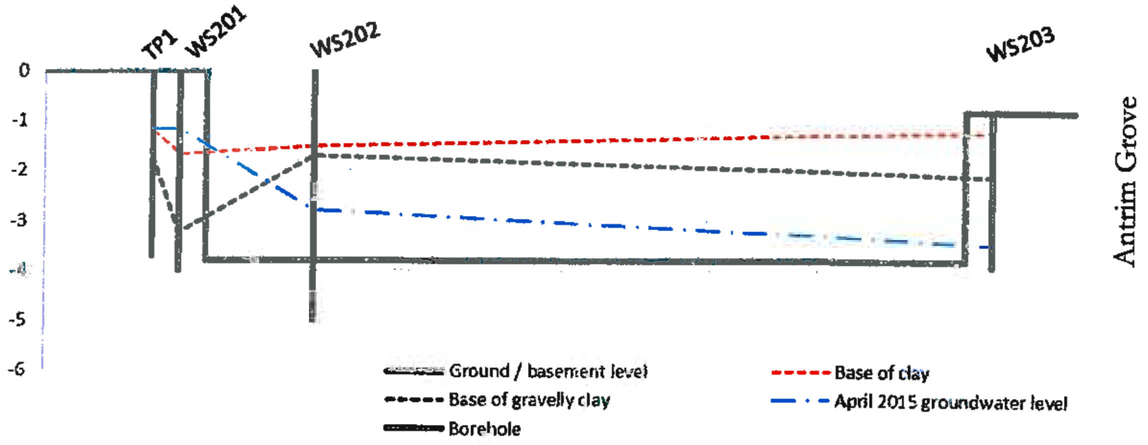

Figure 3.3 Schematic north-west to south-east cross-section

A south-eastward slope of the water table (i.e. with the topography) is expected (and is what is observed, though the borehole levels may not have reached equilibrium in April 2015). The water table most likely intersects a sewer or road drain somewhere down-gradient, where the groundwater discharges. (There is a sewer along Antrim Grove which may gain water if it is below the water table.) Flow in the low permeability head deposits is nevertheless likely to be rather low.

Seasonal fluctuations in groundwater level are likely to be observed in the aquifer in response to infiltration recharge over the winter period. There is no evidence available for estimating a typical range of groundwater level in this part of London. Groundwater levels at Westminster locations away from the Thames, in 1990-91, had a seasonal range between 0.30 and 0.75 m (CIRIA, 1993)[5]. While this geological environment is not likely to be representative of the aquifer beneath Antrim Grove, it indicates the likely order of magnitude of groundwater level fluctuation.

The period of monitoring at 6 Antrim Grove, March to April, is probably around the time at which groundwater level were at their annual maximum. Locally groundwater levels were probably starting to decline again after the winter. This was observed in the fast-reacting boreholes TP1 and WS201, but rising water levels WS202 and WS203 were probably still stabilising after drilling in the low permeability head deposits.

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[5] CIRIA, 1993. A study of the Impact of Urbanisation on the Thames Gravels Aquifer. Report number 129.

Because the groundwater level is higher than the base of the excavation, the introduction of concrete-lined space beneath 6 Antrim Grove is likely to lead to an increase in groundwater level up-gradient of the basement, and a reduction in groundwater level down-gradient.

Pre-construction groundwater already has a number of obstacles to flow around: a full length basement at number 8 being the main obstacle, with the basement of number 10 down-gradient of this. A numerical groundwater model is the best way to assess the extent of change in groundwater levels around any obstructions in its flow path. The following sections describe how a groundwater model has been developed for the site.

4. Impact Assessment

4.1 Model Set-up

The area of the model is set at 150 m x 150 m to ensure that the effects of boundary conditions are distant from the basement area. This sets up a uniform flow field around the site. The grid has been rotated by 45 degrees so that the basement walls are parallel to model cells.

Two steady-state models are run that describe the conditions before extension of the basement, and the conditions a long time afterwards. A description of the rate of change of groundwater levels is not required for the assessment (i.e. a transient model) – just the end points.

Geological layering

In the absence of geological data from the local area the observed geology has been simplified. The model is constructed with two layers that represent the whole thickness of the head deposits, and a basal layer of London Clay. Their bases slope at 0.027 (i.e. they are assumed to be parallel with topography). The top of the model at the centre of the basement is set at ground level and slopes with topographic gradient.

The base of the head beneath the basement is set at -2 m bgl. This is a typical thickness observed in the window samples. The thickness of the lower layer, representing the more permeable gravelly clay, is set at 1 m. The thickness of London Clay represented in the model is set at 2 m (so that the standpipe tips are approximately in the centre of this layer).

Heads and head gradients

There is no consistent pattern in the head distribution, partly because the water levels in WS202 and WS203 probably had not stabilised on the most recent measurement, and because they were completed in clay. The highest water levels in TP1 and WS201 are about 0.85 m bgl, so in the base case model, groundwater level at the centre of the basement is set at 0.85 m bgl.

Hydraulic gradient in the base case model is estimated at 0.027 towards the south east (again, parallel with the topographic slope). Constant head cells are set at the northern and southern ends of the model to simulate the selected regional gradient.

A summary section through the centre of the model, from north west to south east, is shown in Figure 4.1.

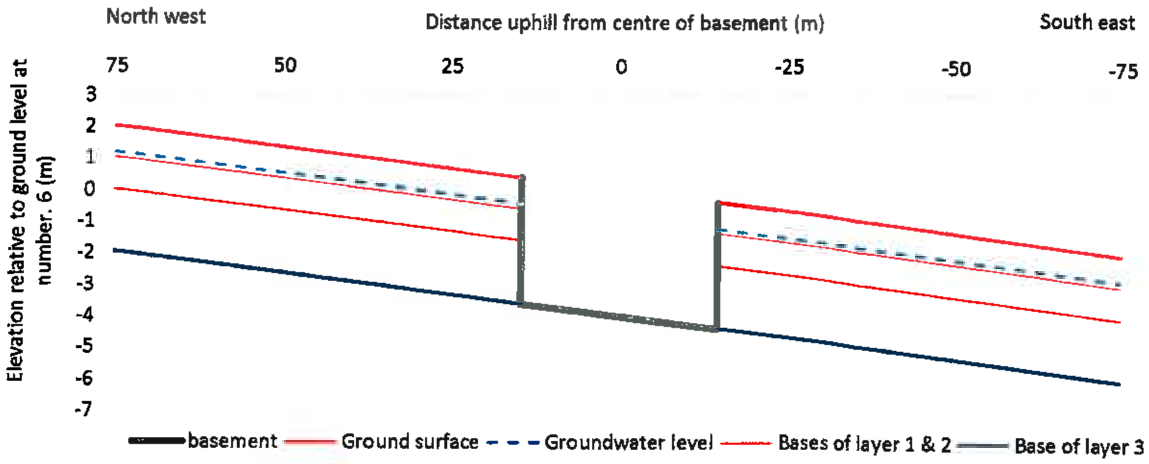

Figure 4.1 Section through the model (post-development)

Aquifer properties

Aquifer properties are assumed to be constant across the model. Hydraulic conductivity has been measured in WS201, with a range of 0.15 to 0.04 m/day. This is a reasonable range for a clayey sandy gravel/gravelly clay when compared with literature. Since the value of 0.04 m/day provides the least amount of drainage (and therefore the highest feasible change in water level) this value is conservatively chosen.

The lowest clay unit (silty clay superficial deposits and London Clay) is not impermeable as demonstrated by the slow response from the standpipes in WS202 and WS203. Hence a hydraulic conductivity range of 0.004 m/day has been chosen (as 0.1 times the lowest value of the gravelly clay).

Combinations of other values are appraised in sensitivity testing (Section 4.4).

4.2 Base case results

Results of this simple model, showing the effects of flow around the pre-development basements, are illustrated in Figure 4.2. Groundwater contours highlight the assumed south-eastward flow of groundwater here, and pre-existing deflections in groundwater level contours around the basements at number 8 and number 10.

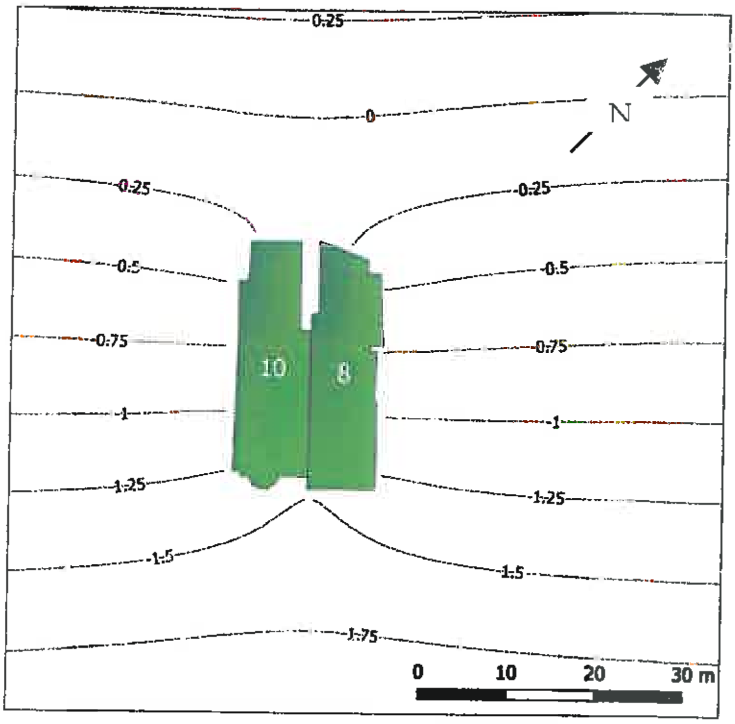

Figure 4.2 Expected water table elevation pre-basement extension (m AOD)

4.3 Model Results

Figure 4.3 shows how the contours of the elevation of the water table are further distorted by the addition of the basement at number 6. There is clearly some deflection of the contours (new contours are solid, old contours are dashed) but it is difficult to see the actual change in groundwater level. Change in level is shown in Figure 4.4.

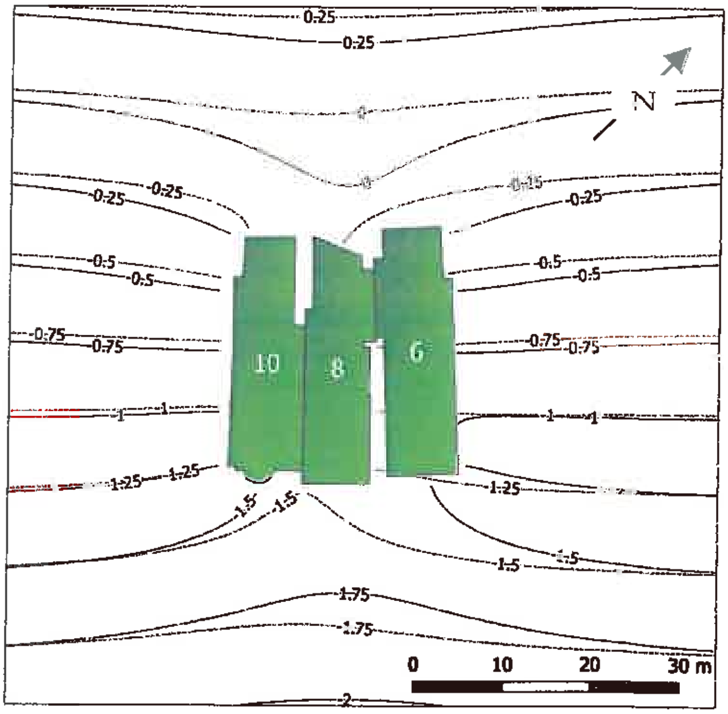

Figure 4.3 Movement of contours with basement extension (m AOD)

Figure 4.4 shows that the biggest change in water table elevation, up-gradient of the basements of numbers 6 and 8, is estimated to be about +25 cm. The differences outside of the immediate vicinity of the new basement are minor, and there is a reduction in head downhill of the extended basement.

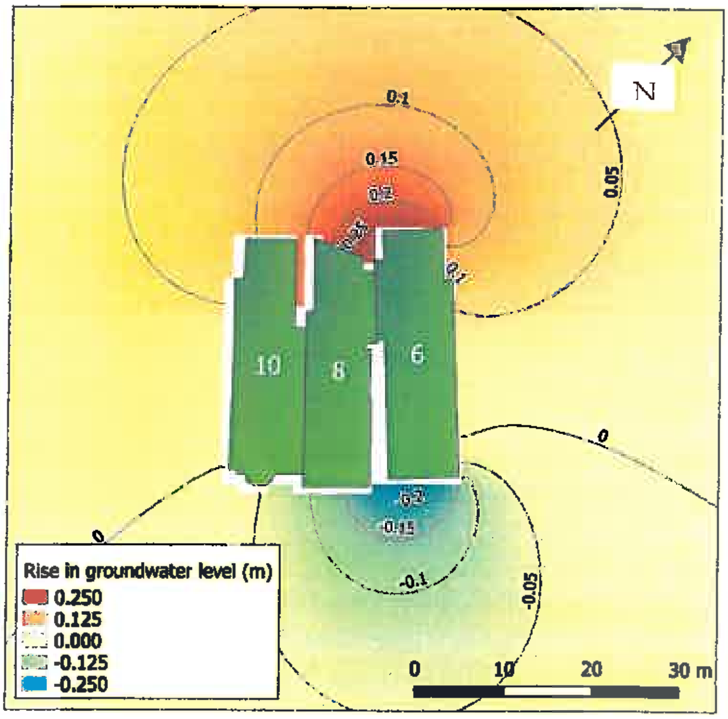

Figure 4.4 Difference in groundwater level after basement construction (m)

Given that the groundwater levels adjacent to the existing concrete-lined basements at numbers 8 and 10 are probably about 0.85 m below ground level a rise of only 0.25 m would not bring the water table to within a significantly closer distance of the ground surface. Modelled effects of basement construction on the water table are shown in detail in Figure 4.5, which is a section line through the centre of number 8.

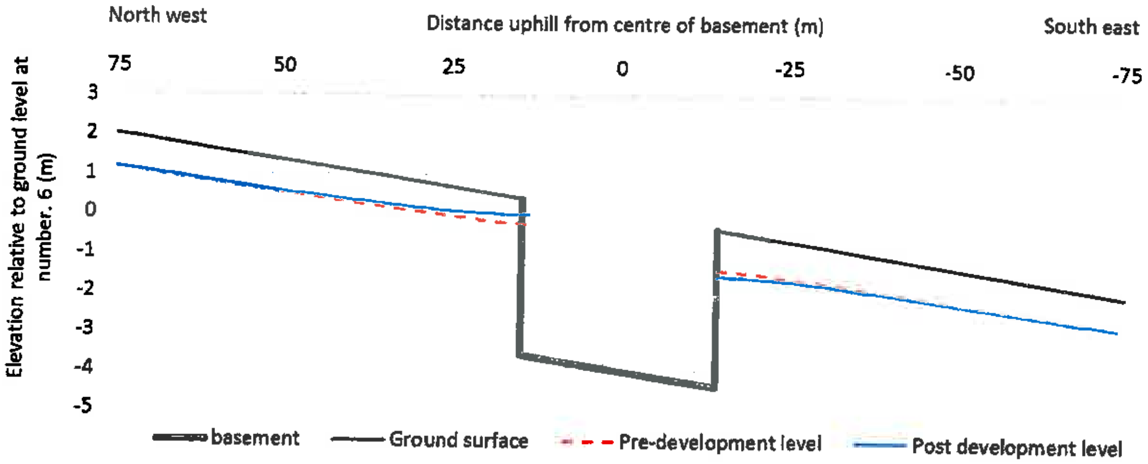

Figure 4.5 Section showing expected groundwater levels before and after basement extension

4.4 Sensitivity Analysis

The most conservative value of hydraulic conductivity has already been used so the risk assessment is quite conservative already. Hence further sensitivity analysis on hydraulic parameters is not undertaken.

A key uncertainty is expected to be the extent of the head deposits. The observed variation in thickness of these suggests that they may be heterogeneous and quite discontinuous. Mapped outcrops of head deposits are often narrow in extent so perhaps the full modelled width of aquifer is not available for flow.

Figure 4.6 shows the effect of basement construction in an aquifer that has a width of only 70 m. This leaves only about 20 m either side of the three basements for displaced water to move through, which is 32% of the width available for flow in the model above. The rise in groundwater level is higher than before but is still only 30 cm.

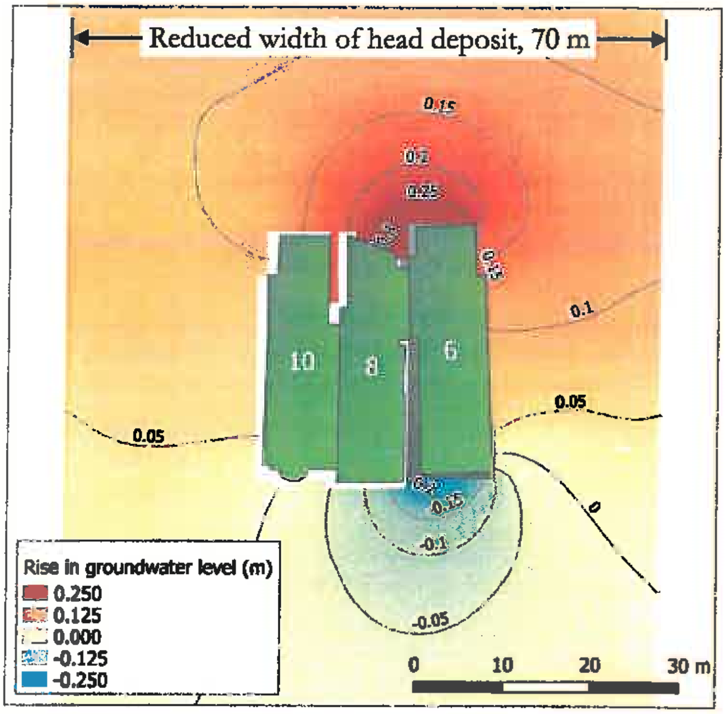

Figure 4.6 Difference in groundwater level after basement construction in an aquifer with limited extent (m)

5. Conclusions

Potential environmental impacts of the basement extension at 6 Antrim Grove have been considered. The following summary conclusions are made:

- There will be no increase in man-made impermeable area so the amount, timing and quality of surface water runoff will not be affected by the development. No water will go to ground as a result of the basement development.
- Available geological and hydrogeological information indicates that there is a weakly permeable aquifer beneath the site, comprising clayey gravels. Groundwater level monitoring data indicates that the water table rises to a level of up to 0.85 m below ground.
- Modelling changes in groundwater level indicates that the likely impact of basement extension is minor. A rise in groundwater level is expected up-gradient of the new basement, which is not expected to exceed 25 cm adjacent to basement of the adjacent 8 Antrim Grove. This basement is new, concrete-lined, and has been designed to exclude water as the water table is already high. The small simulated change in groundwater level is not considered to be a risk factor. Water levels at 10 Antrim Grove are expected to rise a little, but still rather less than at number 8.

  This assessment is expected to be robust and conservative. Modelled groundwater levels represent the values that were measured in late winter/early spring, when groundwater levels are typically highest. Hence it is likely that the average water level through the year is rather lower. A low value of hydraulic conductivity has been used to simulate poor drainage around the basements. Sensitivity analysis has been undertaken to consider the worst case of a very narrow aquifer hosting groundwater flow.
- With the groundwater level within 0.85 cm of ground level, inflows will need to be managed during the works.

These conclusions are considered to be robust and no further investigations on hydrogeological risk are recommended.

Appendix A

Borehole logs from Knapp Hicks (2013 and 2015)

D. Ground Movement Assessment, dated 22nd May 2015, by Gabriel GeoConsulting Ltd

GabrielGeo Consulting

Report

Ground Movement Assessment for Basement

at

6 Antrim Grove,
London, NW3 4XR

for

Knapp Hicks & Partners Ltd

Ref: 15389/R1.1

June 2015

Gabriel GeoConsulting Limited
Highfield House, Rolvenden Road, Benenden, Kent TN17 4EH
Company No. 6455714, registered in England and Wales. Registered office as above.
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e: info@gabrielgeo.co.uk
www.gabrielgeo.co.uk

Project:	**Ground Movement Assessment for Basement**
Site:	**6 Antrim Grove, London, NW3 4XR**
Client:	**Knapp Hicks & Partners Ltd**

Foreword

This report has been prepared in accordance with the scope and terms agreed with the Client, and the resources available, using all reasonable professional skill and care. The report is for the exclusive use of the Client and relevant regulatory authorities, shall not be relied upon by any third party without explicit written agreement from Gabriel GeoConsulting Ltd.

This report is specific to the proposed site use or development, as appropriate, and as described in the report; Gabriel GeoConsulting Ltd accept no liability for any use of the report or its contents for any purpose other than the development or proposed site use described herein.

This assessment has involved consideration, using normal professional skill and care, of the findings of ground investigation data obtained from the Client and other sources. Ground investigations involve sampling a very small proportion of the ground of interest as a result of which it is inevitable that variations in ground conditions, including groundwater, will remain unrecorded around and between the exploratory hole locations; groundwater levels/pressures will also vary seasonally and with other man-induced influences; no liability can be accepted for any adverse consequences of such variations.

This report must be read in its entirety in order to obtain a full understanding of our recommendations and conclusions.

Contents

Figures

Appendix

1. INTRODUCTION

1.1 A planning application has been submitted to the London Borough of Camden (LBC) for the construction of single storey basement beneath No.6 Antrim Grove (application 2014/3835/P). The proposed basement extends beneath the full footprint of the building, as well as below the front and rear gardens. This report is for planning and scheme development purposes and is not a design document.

1.2 A ground movement assessment, including damage category assessment, has been requested in accordance with the requirements set out in LBC's guidance document CPG4 'Basements and Lightwells' (2013) and the associated 'Camden, geological, hydrogeological and hydrological study – Guidance for subterranean development" (Camden GHHS, Arup, November 2010). This report presents the analyses undertaken and the required damage category assessment.

1.3 The following architectural drawings which were prepared by Bchitecture (Architects) have been referred to in preparing this report.

Existing Drawings

• Drg No.1310-100/A	Location Plan
• Drg No.1310-101/C	Existing Plans
• Drg No.1310-102/-	Existing Elevations
• Drg No.1310-103/A	Existing Elevations
• Drg No.1310-104/A	Existing Sections

Proposed Drawings

• Drg No.1310-110/C	Proposed Plans
• Drg No.1310-111/C	Proposed Plans
• Drg No.1310-112/A	Proposed Plans
• Drg No.1310-113/A	Proposed Elevations
• Drg No.1310-114/A	Proposed Elevations
• Drg No.1310-115/A	Proposed Sections

These drawings have been referred to primarily for factual information purposes.

1.4 The structural design for the proposed scheme was prepared by Knapp Hicks & Partners. The following structural drawings have been referred to:

• Drg No. 32842/01	Trial Pit Location & Details
• Drg No. 32842/02	Proposed Basement Plan (& Sections 1-1 to 3-3)
• Drg No. 32842/03	Proposed Basement Wall Construction
• Drg No. 32842/04	Proposed Ground Floor Plan
• Drg No. 32842/05	Section A-A
• Drg No. 32842/06	Sections B-B & C-C

Load takedown details were also provided on hand-annotated copies of Drg No.1310-110/C, as appended.

1.5 This assessment has been prepared by Keith Gabriel, a UK Registered Ground Engineering Adviser and Chartered Geologist with an MSc degree in Engineering Geology. The author has previously undertaken assessments of basements in several London Boroughs including Barnet, Enfield, Lambeth, Hammersmith & Fulham, Haringey, Kensington & Chelsea, Kingston, Richmond, Southwark, Wandsworth and Westminster, as well as Camden. He also undertakes independent reviews of BIA reports on behalf of the London Borough of Camden.

2. GROUND MOVEMENT ASSESSMENT

2.1 Basement Geometry and Stresses:

2.1.1 Analyses of vertical ground movements (heave or settlement) have been undertaken using PDISP software, in order to assess the potential magnitudes of movements which may result from the changes of vertical stresses caused by excavation of the basement. These preliminary analyses for planning purposes have not modelled the horizontal forces on the retaining walls, so have simplified the stress regime significantly.

2.1.2 The attached Figure 1 illustrates the layout of the proposed basement taken from the 'Proposed Basement Plan' by Knapp Hicks & Partners (KHP, Drg No.32842/02). A hand-annotated load takedown summary provided by KHP on a copy of Drg No.1310-110/C is also appended, along with details of the column loadings, which are provided on a separate copy of the same drawing. The four columns which act onto individual pads within the central area of the basement are temporary supports for the rear wall, so have been modelled only in Stage 2 (see 2.1.4 and 2.3.1 below for details).

2.1.3 The plan dimensions of the basement are approximately 28.51m long by 7.72-8.44m wide. A proposed basement finished floor level (FFL) of 2.91m below the base of the ground floor was measured within the front part of the basement, from Knapp Hicks & Partners' 'Section A-A' (Drg No.32842/05), whereas a proposed basement FFL of 3.50m below the base of the ground floor was measured within the rear part of the basement. With an allowance of 0.30m/0.23m for screed, insulation, cavity drainage and floor structure, within the front and rear sections of the basement respectively, and a 0.25m thick basement slab (as given on Drg No.32842/02), excavation depths of 3.46m/3.98m have been allowed for the front/rear basement slabs. These slabs will overlap the 0.35m thick underpin bases to the perimeter retaining walls, so the depths of excavation will increase to 3.81m/4.33m for the front/rear underpins.

2.1.4 Table 1 presents the co-ordinates of the zones used to input the main elements of the basement's geometry into PDISP, as shown on the illustration in Figure 2, together with the net changes in vertical pressure for the four main stages of the stress changes which will result from excavation and construction of the basement (see 2.3.1 below for details).

Table 1: Net changes in pressure in Zones used for PDISP analyses

ZONE	Centroid		Dimensions		Net change in vertical pressure (kPa)		
#	Xc(m)	Yc(m)	X(m)	Y(m)	Stage 1	Stage 2	Stages 3 and 4
1	19.52	7.51	7.04	2.00	-40.42	-40.42	-34.92
2	24.05	7.03	2.02	2.96	-63.86	-63.86	-58.36
3	26.79	6.55	3.45	2.00	-44.03	-44.03	-38.53
4	27.51	4.29	2.00	2.53	-63.86	-63.86	-58.36
5	25.55	2.02	5.92	2.00	-52.30	-52.30	-46.80
6	21.58	1.54	2.02	2.96	-45.12	-45.12	-39.62
7	18.43	1.06	4.29	2.00	-44.86	-44.86	-39.36
8	13.45	0.51	5.67	1.60	-8.75	-8.75	-3.25
9	10.11	0.21	1.00	1.00	49.11	49.11	54.61
10	7.13	0.51	4.95	1.60	19.16	19.16	24.66
11	4.50	0.66	0.32	1.32	-38.93	-38.93	-33.43
12	2.17	1.15	4.34	2.29	-42.87	-42.87	-37.37
13	1.12	2.79	2.24	1.00	-49.55	-49.55	-44.05
14	1.29	5.51	2.57	4.43	-44.54	-44.54	-39.04
15	6.09	7.19	7.04	1.60	-6.27	-6.27	-0.77
16	10.11	7.49	1.00	1.00	38.73	38.73	44.23
17	13.31	7.19	5.40	1.60	-12.11	-12.11	-6.61
18	3.29	2.79	2.10	1.00	45.94	45.94	51.44
19	4.84	2.31	1.00	1.98	8.94	8.94	14.44
20	10.11	3.85	1.00	6.28	7.61	7.61	13.11
21	3.96	4.84	2.77	3.10	0.00	-65.74	-59.49
22	7.48	3.85	4.27	5.08	0.00	-65.74	-59.49
23	13.45	3.85	5.67	5.08	0.00	-75.62	-69.37
24	16.15	6.45	0.27	0.12	0.00	-75.62	-69.37
25	18.43	4.28	4.29	4.44	0.00	-86.07	-79.82
26	21.82	4.77	2.49	3.49	0.00	-86.07	-79.82
27	24.79	4.28	3.45	2.52	0.00	-104.12	-97.87
28	16.01	7.19	1.00	1.60	0.00	0.00	87.50
29	16.01	0.21	1.00	1.60	0.00	0.00	87.50
30	15.00	5.30	1.00	1.00	0.00	70.00	0.00
31	15.00	3.00	1.00	1.00	0.00	70.00	0.00
32	17.70	5.30	1.00	1.00	0.00	70.00	0.00
33	17.70	3.00	1.00	1.00	0.00	70.00	0.00

2.2 Ground Conditions:

2.2.1 The ground profile used for the analyses were based on the site-specific ground investigation by Knapp Hicks & Partners together with knowledge from other nearby sites. The boreholes and trial pits indicated rather variable ground conditions, with a layer of Head Deposits recorded up to a maximum depth of 2.3m below ground level in WS202, and GRAVELS/gravelly CLAY recorded up to a maximum depth of 3.25m in WS201. Underlying these superficial deposits was the London Clay Formation, described predominantly as stiff, silty (occasionally sandy) CLAY. Based on the thickness of the superficial deposits recorded during the site-specific ground investigation, it is anticipated that the basement will be founded within the London Clay Formation.

2.2.2 The short-term and long-term geotechnical properties of the soil strata used for the PDISP analyses are summarised in Table 2. They were based on the findings of the site-specific investigation and data from previous projects.

Table 2: Soil parameters for PDISP analyses

Strata	**Level** (m bgl)	**Undrained Shear Strength,** Cu (kPa)	**Short term, undrained Young's Modulus,** Eu (MPa)	**Long term, drained Young's Modulus,** E' (MPa)
Stiff, silty CLAY (London Clay Fm)	3.0 20.0	80 207.5	40 104	24 62.5

Where:

Undrained shear strength, Cu assumed as Cu = 80 + 7.5z kPa
where z = depth below the top of the stratum (3.0m bgl)
Undrained Young's Modulus, Eu = 500 * Cu
Drained Young's Modulus, E' = 0.6 Eu

2.3 PDISP Analyses:

2.3.1 Three dimensional analyses of vertical displacements have been undertaken using PDISP software and the basement geometry, loads/stresses and ground conditions outlined above in order to assess the potential magnitudes of ground movements (heave or settlement) which may result from the vertical stress changes caused by excavation of the basement. PDISP analyses have been carried out as follows:

- Stage 1 – Construction of underpins & retaining walls – Short-term condition
- Stage 2 – Bulk excavation of floor areas to basement formation level, and installation of temporary props (columns) to support the rear wall of the house (Zones 30-33) – Short-term condition
- Stage 3 – Construction of basement slab, construction of columns to support the rear wall of the house (Zones 28 & 29), and removal of props introduced at Stage 2 – Short-term (undrained) condition
- Stage 4 – As Stage 3, except – Long-term (drained) condition.

2.3.2 The results of the analyses for Stages 2 to 4 are presented as contour plots on the appended Figures 3 to 5 respectively.

2.4 Heave Assessment

2.4.1 Excavation of the basement will cause immediate elastic heave in response to the stress reduction, followed by long-term plastic swelling as the underlying clays take up groundwater. The rate of plastic swelling in the in-situ clays will be determined largely by the availability of water and as a result, given the low permeability of the clays in the London Clay Formation, can take decades to reach full equilibrium. The basement slab will need to be designed so as to enable it to accommodate the swelling displacements/pressures developed underneath it.

2.4.2 The ranges of predicted short-term and long-term movements for each of the main areas of the basement are summarised in Table 3 below. All values are approximate owing to the simplification of the stress regime.

2.4.3 The analyses indicated that small magnitudes of heave are likely to develop beneath both the flank wall of the house, and the No.6/4 Party Wall. Increased heave is expected within the basement beneath the rear garden, especially beneath the basement slab. In general the magnitude of heave is greater towards the rear of the proposed basement, with only small magnitudes of heave predicted beneath the front wall of the house, and within the basement beneath the front garden.

Table 3: Summary of predicted displacements

Location	**Stage 2 (Figure 3)**	**Stage 3 (Figure 4)**	**Stage 4 (Figure 5)**
Front garden retaining walls	1 – 3mm Heave	1 – 3mm Heave	2 – 4mm Heave
Flank wall of forward projection	2 – 4mm heave	2 – 3mm heave	3 – 5mm heave
West flank wall	2 – 5mm Heave	1 – 4mm Heave	2 – 7mm Heave
No.6/4 party wall	1.5 – 5mm Heave	1 – 4mm Heave	2 – 7mm Heave
Rear garden retaining walls	2 - 6mm Heave	2 - 6mm Heave	3 - 10mm Heave
Basement slab below house (within u/pin bases)	3 – 6mm Heave	2 – 6mm Heave	4 – 10mm Heave
Basement slab beneath rear garden (within u/pin bases)	6 – 8mm Heave	5 – 7mm Heave	8 – 12mm Heave

2.4.4 All the short term elastic heave would have occurred before the basement slabs were cast, so only the post-construction incremental heave is likely to be experienced by to the slab design. The analyses indicated that the maximum predicted post-construction displacements beneath the basement slab are expected to be around 5mm heave. However, if the slabs are bonded tightly to the underpin bases then the deflection from edge of slab to centre could be in the order of up to 8mm.

3. Underpinning Methods and associated Ground Movements

Basement Retaining Wall Construction:

3.1 KHP's drawings show that the basement will be constructed using underpinning techniques beneath the original building, together with reinforced concrete (RC) retaining walls beneath the front and rear gardens. These RC retaining walls are shown on KHP's drawings as being cast in-situ in similar panels of limited width as used for the underpins. The underpins involve excavation of the ground in short lengths in order to enable the stresses in the ground to 'arch' temporarily onto the ground or completed underpins on both sides of the excavation, with the structural wall above similarly spanning the excavation for the underpin. The RC retaining walls in the front and rear gardens will be constructed within open excavations support by trench sheets or sheet piles.

3.2 Some ground movement is inevitable when basements are constructed. When underpinning methods are used the magnitude of the movements in the ground being supported by the new basement walls is dependent primarily on:

- the geology,
- the adequacy of temporary support to both the underpinning excavations and the partially complete underpins prior to installation of full permanent support;
- the quality of workmanship when constructing the permanent structure.

A high quality of workmanship and use of best practice methods of temporary support are therefore crucial to the satisfactory control of ground movements alongside basement excavations (see 3.4 to 3.6 below). Any cracks in load-bearing walls which have weakened their structural integrity should be fully repaired in accordance with recommendations from the appointed structural engineers before any underpinning is carried out.

3.3 Under UK standard practice, the contractor is responsible for designing and implementing the temporary works, so it is considered essential that the contractor employed for these works should have completed similar schemes successfully. For this reason, careful pre-selection of the contractors who will be invited to tender for these works is recommended. Full details of the temporary works should be provided in the contractor's method statements.

3.4 In accordance with normal health and safety good practice, the requirements for temporary support of any excavation must be assessed by a competent person at the start of every shift and at each significant change in the geometry of the excavations as the work progresses. London Clay is usually fissured; such fissures can cause seemingly strong, stable excavations to collapse with little or no warning. Thus, in addition to normal monitoring of the stability of the excavations, a suitably competent person should check whether such fissuring is present and, if encountered, should assess what support is appropriate.

3.5 For the proposed basement at No.6 Antrim Grove:

- It should be assumed that full support will be required to the Made Ground and any natural granular soils exposed in the excavations. The site-specific ground investigation encountered a significant thickness of GRAVELS/gravelly CLAY, as well as Head Deposits, both of which will require full support.
- Closely spaced support should be used where any firm clay is present at the top of the London Clay.
- More widely spaced temporary support may be adequate in the stiff or very stiff clays of the London Clay Formation, depending on the degree of fissuring, except at corner excavations where closely spaced support should be provided.
- Temporary support must also be installed to support all the new underpins and RC retaining wall panels and must be maintained until the full permanent support has been completed, including allowing time for the concrete to gain adequate strength.

All temporary support should use high stiffness systems installed in accordance with best practice in order to minimise the ground movements.

3.6 The unloaded clays at/beneath formation level will readily absorb any available water which would lead to softening and loss of strength. It will therefore be important to ensure that the clays at formation level are protected from all sources of water, with suitable channelling to sumps for any groundwater seeping into the excavations. The formation clays should be inspected and then blinded with concrete immediately after completion of final excavation to grade. Any unacceptably soft/weak areas must be excavated and replaced with concrete.

3.7 The construction sequence will be covered in the Construction Method Statement.

4. Damage Category Assessment

4.1 When underpinning it is inevitable that the ground will be un-supported or only partially supported for a short period during excavation of each pin, even when support is installed sequentially as the excavation progresses. This means that the behaviour of the ground will depend on the quality of workmanship and suitability of the methods used, so calculations of predicted ground movements can never be rigorous. However, provided that the temporary support follows best practice as outlined in Section 3 above, then extensive past experience has shown that the bulk movements of the ground alongside the basement caused by underpinning for a single storey basement (typical depth 3.5m) should not exceed 5mm in either horizontal or vertical directions.

4.2 In order to relate these typical ground movements to possible damage which adjoining properties might suffer, it is necessary to consider the strains and the angular distortion (as a deflection ratio) which they might generate using the method proposed by Burland (2001, in CIRIA Special Publication 200, which developed earlier work by himself and others).

4.3 No's 8 & 10 are the next pair of semi-detached houses to the west of No.6. No.8 has a recently constructed single storey basement under its full footprint, founded at a similar depth to the proposed basement beneath No.6, so no damage category assessment is relevant for these houses.

4.4 No.6 is attached to No.4 which together form a pair of semi-detached houses at a uniform level. Ground movements associated with the construction of retaining walls in clay soils have been shown to extend to a distance up to 4 times the depth of the excavation. The width of No.4 is approximately 7.95m. The depths of the proposed basement, and hence the depths of excavation, differ at the front and rear of the house (see paragraph 2.1.3 above), so separate damage category calculations have been undertaken for the front and rear walls of No.4.

4.5 Front wall of No.4:

The relevant geometries are as follows:

Footing depth = 0.7m (=0.87 - 0.17m step, based on TP2, 2015)
Depth of excavation = 3.81 - 0.7 = 3.11m below footing.
Movement zone = 3.1 x 4 = 12.4m, so the ground movements will extend across the full width of No.4, hence:
Width (L) = 7.95m
Height (H) = approx. 6.7m to eaves
Hence L/H = 1.25

Thus, for an anticipated 5mm maximum horizontal displacement the strain beneath No. 4's front wall would, theoretically, be in the order of $\varepsilon_h = 4.03 \times 10^{-4}$ (0.040%).

The 2.0mm heave predicted by the PDISP analysis may be subtracted from the typical settlement caused by relaxation of the ground alongside the basement in response to excavation of the underpins, giving a 3mm total predicted settlement of the ground at the assumed level of No.4's footings. The settlement profile is expected to be convex with a worst case (low stiffness) deflection, Δ = 17% of the predicted combined settlement profile. Hence, Δ = 0.5mm, which represents a deflection ratio, Δ/L = 6.29×10^{-5} (0.006%).

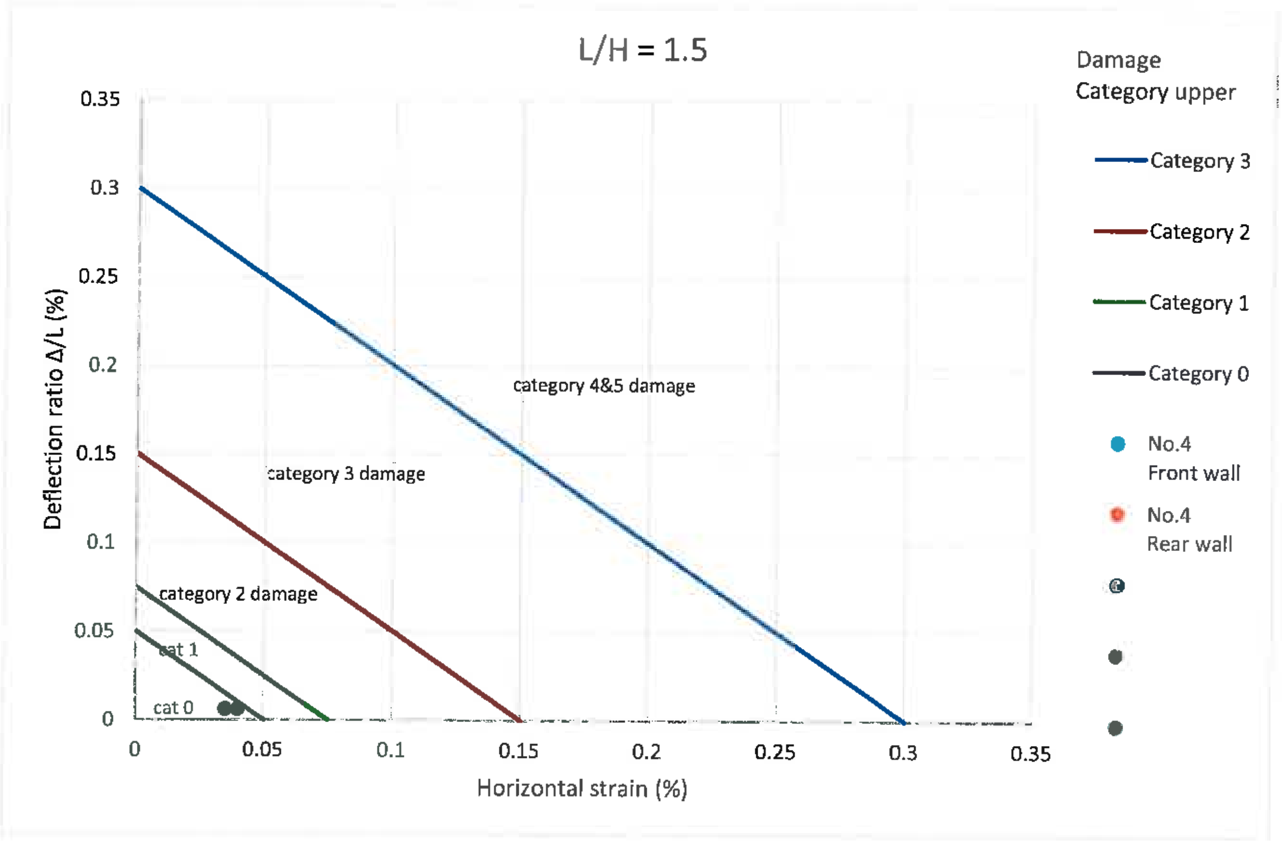


Figure 6: Damage category assessments for front & rear walls of No.4.

Using the graphs for L/H = 1.5, which is conservative, these deformations represent a damage category of 'negligible' (Burland Category 0, ε_{lim} = <0.05%) as given in CIRIA SP200, Table 3.1, and illustrated in Figure 6 above.

4.6 Rear wall to No.4:

The relevant geometries are as follows:

Footing depth = 0.7m (Assumed same as front wall)
Depth of excavation = 4.33 – 0.7 = 3.63m
Movement zone = 3.63 x 4 = 14.5m
Width (L) = 7.95m (as above)
Height (H) = approx. 6.5m to eaves
Hence L/H = 1.22

Thus, for the anticipated 5mm maximum horizontal displacement, the strain beneath No. 45's rear wall would, theoretically, be in the order of $\varepsilon_h = 3.45 \times 10^{-4}$ (0.035%).

Once again, the 2.0mm heave predicted by the PDISP analysis may be subtracted from the typical settlement caused by relaxation of the ground alongside the basement in response to excavation of the underpins, giving a 3mm total predicted settlement of the ground at the assumed level of No.4's footings. Hence, as for the front wall, Δ = 0.5mm, which represents a deflection ratio, $\Delta/L = 6.29 \times 10^{-5}$ (0.006%).

Thus, once again, these deformations represent a damage category of 'negligible' (Burland Category 0, ε_{lim} = <0.05%) as given in CIRIA SP200, Table 3.1, and illustrated in Figure 6 above.

4.7 Use of best practice construction methods, as outlined in Section 3 above, will be essential to ensure that the ground movements are kept in line with the above predictions.

5. CONCLUSIONS

5.1 These conclusions consider only the primary findings of this assessment; the whole report should be read to obtain a full understanding of the matters considered.

5.2 Analyses have been undertaken using PDISP software of the likely heave/settlement in response to the net changes in vertical stress resulting from the construction of the proposed basement. The underpins to the house walls were predicted to undergo 2-7mm of heave, whereas 3-10mm of heave was predicted below the perimeter basement walls beneath the rear garden (see Table 3). The soils beneath the basement floor were predicted to experience in the order of 4-12mm of heave, although the RC floor slab will only experience the post-construction incremental heave of up to about 5mm, although the differential movement across the slab could be up to 8mm (Section 2.4). All these values are approximate owing to the required simplification of the stress changes.

5.3 No damage category assessment is required for the adjacent No.8 because that already has a basement to a similar depth to the one now proposed beneath No.6.

5.4 A preliminary damage category assessment for the adjoining No.4 indicated that damage, if any, is likely to fall within Burland Category 0, 'negligible', provided that best practice methods of basement construction are used (Section 4).

K.R. Gabriel

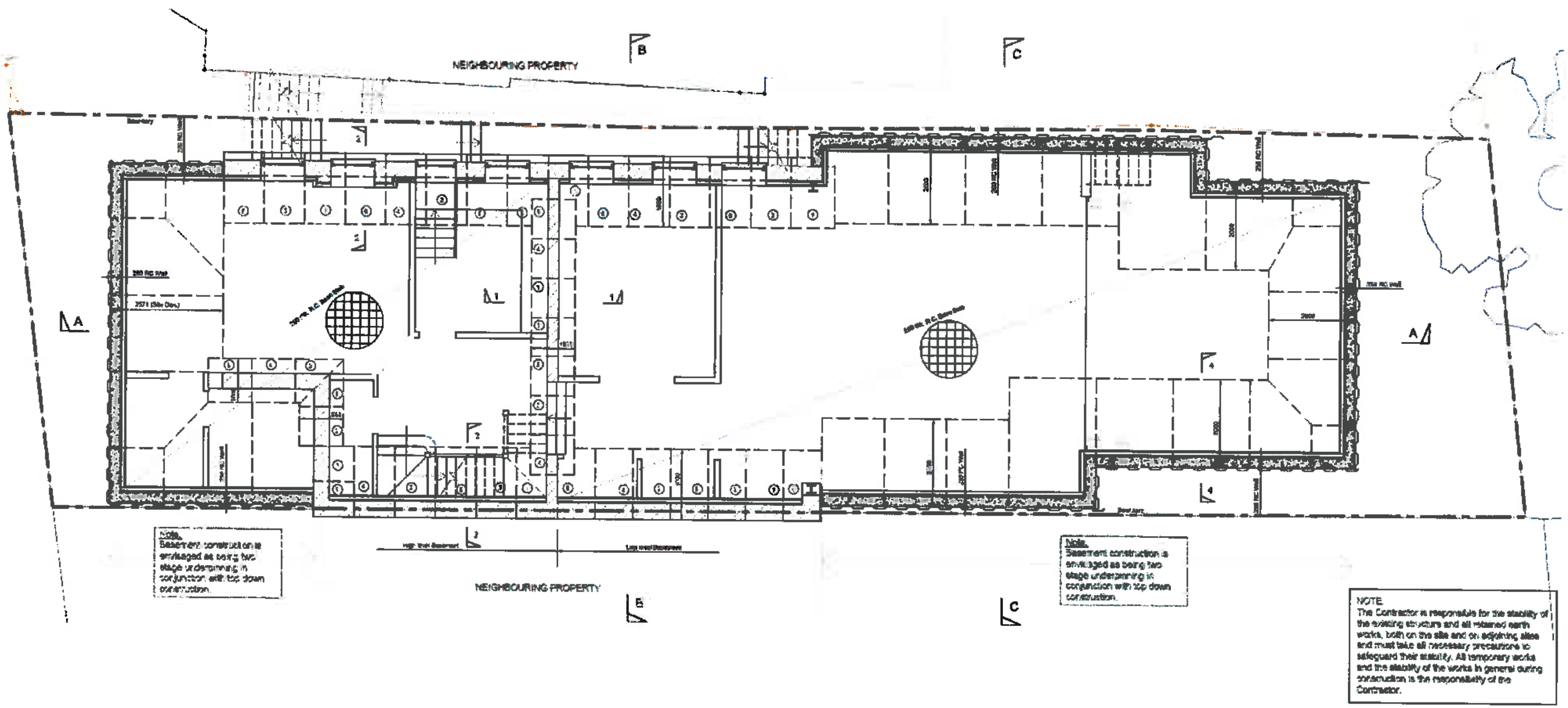
Keith Gabriel
MSc DIC CGeol FGS
UK Registered Ground Engineering Adviser

References

Arup (November 2010) Camden geological, hydrogeological and hydrological study – Guidance for subterranean development. Issue 01. London.

BS EN 1997-1 (2004) Eurocode 7: Geotechnical Design – Part 1: General rules. British Standards Institution.

London Borough of Camden (2013) Camden Planning Guidance CPG4– Basements and lightwells.

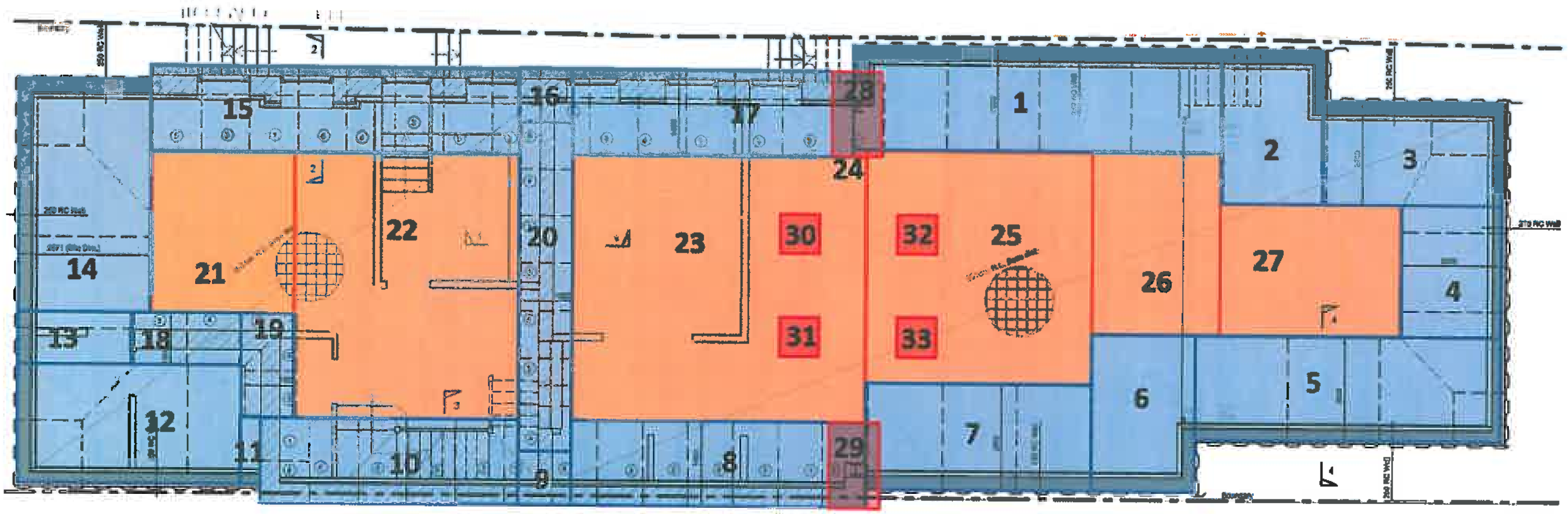


Extract from Knapp Hicks & Partners' Proposed Basement Plan (Drg No.32842/02)

Project: 6 Antrim Grove, London, NW3 4XR
15389

Title: Layout of the proposed basement foundation plan
Figure: 1
Date: May 2015
Checked: AG
Approved: KRG
Scale : Not to scale

GabrielGeo Consulting



🟥 **Column**

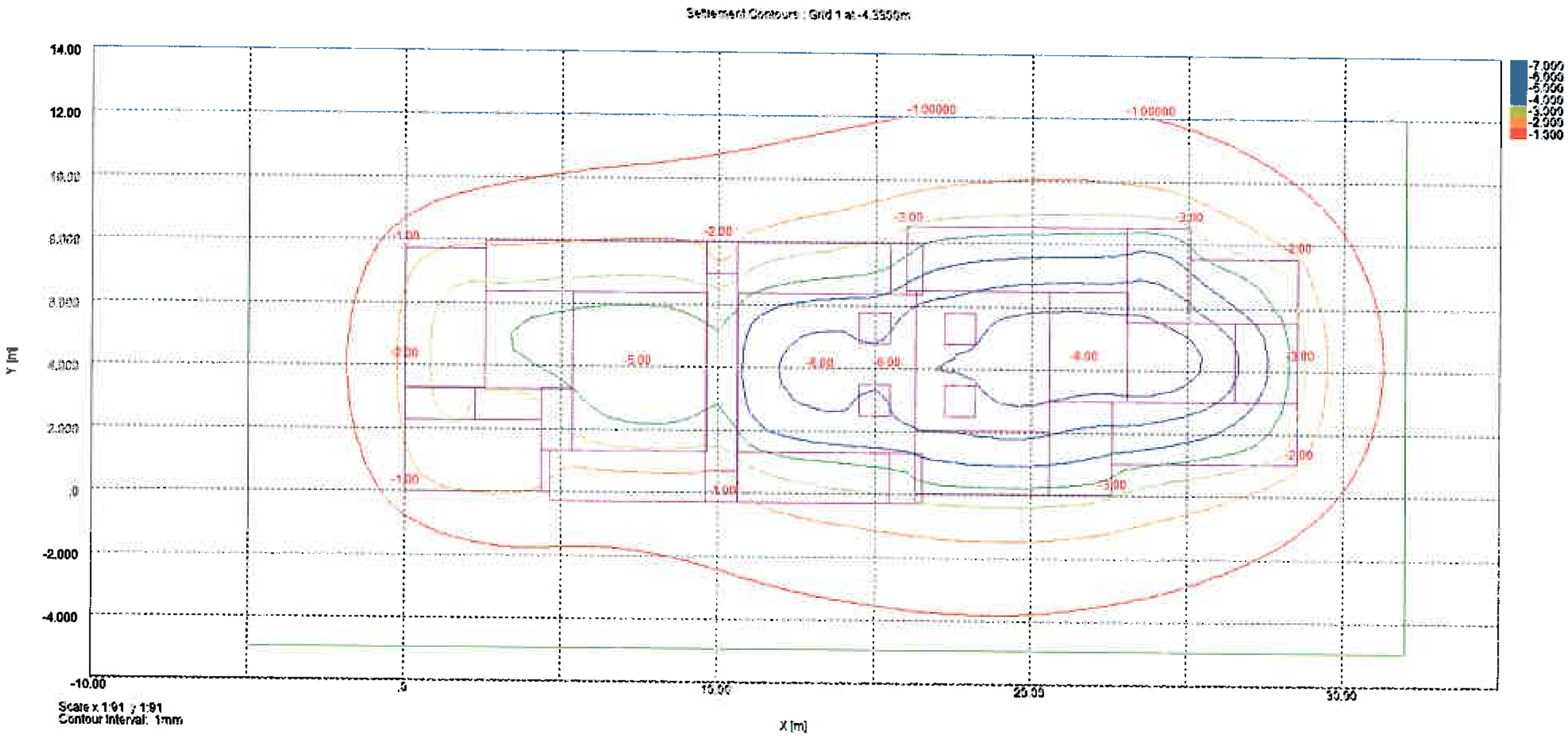
🟦 **Underpin**

🟧 **Basement slab**

9 **Zone number**

Project:	6 Antrim Grove, London, NW3 4XR	Title:	**Geometry of Zones used for PDISP analyses**			Figure:	2
15389		Date:	May 2015	Checked: AG	Approved: KRG	Scale :	Not to scale

GabrielGeo Consulting



Project: 6 Antrim Grove, London, NW3 4XR

15389

Title: **PDISP output - Short term (Stage 2) displacements**

Figure: 3

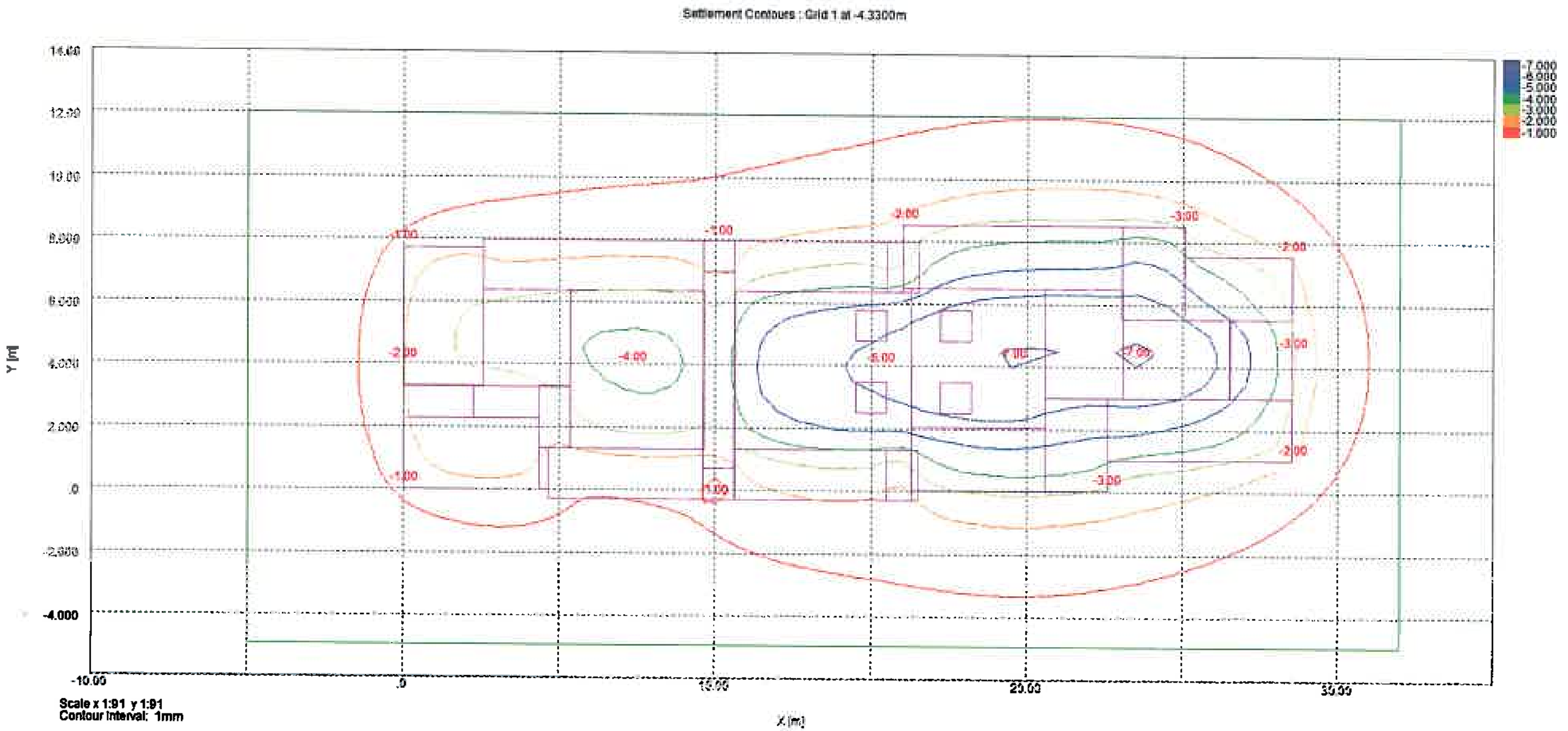
Date: May 2015

Checked: AG

Approved: KRG

Scale : Not to scale

GabrielGeo Consulting



Project: 6 Antrim Grove, London, NW3 4XR

15389

Title: PDISP output - Short term (Stage 3) displacements

Figure: 4

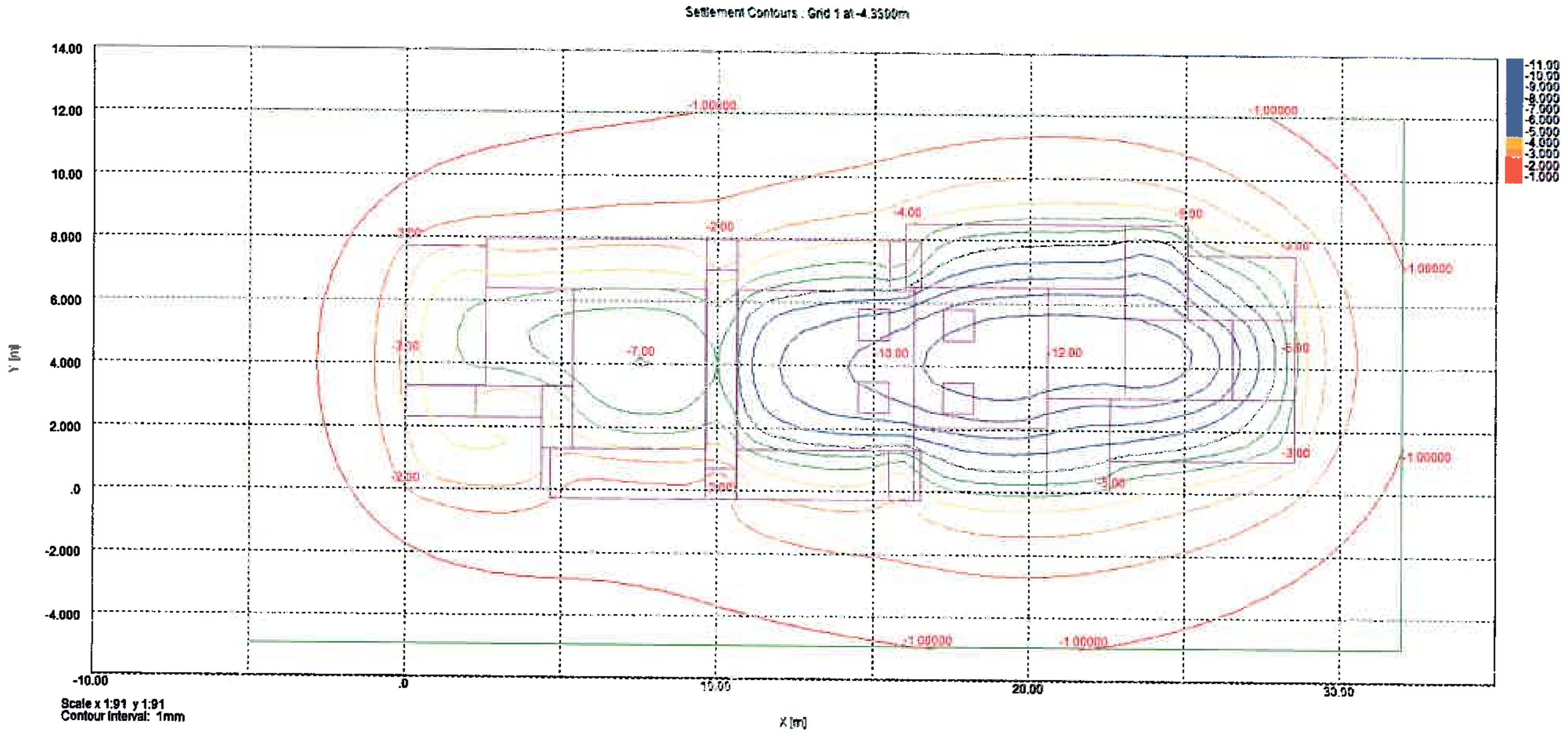
Date: May 2015

Checked: AG

Approved: KRG

Scale : Not to scale

GabrielGeo Consulting



Project: 6 Antrim Grove, London, NW3 4XR

15389

Title: **PDISP output - Long term (Stage 4) displacements**

Figure: 5

Date: May 2015

Checked: AG

Approved: KRG

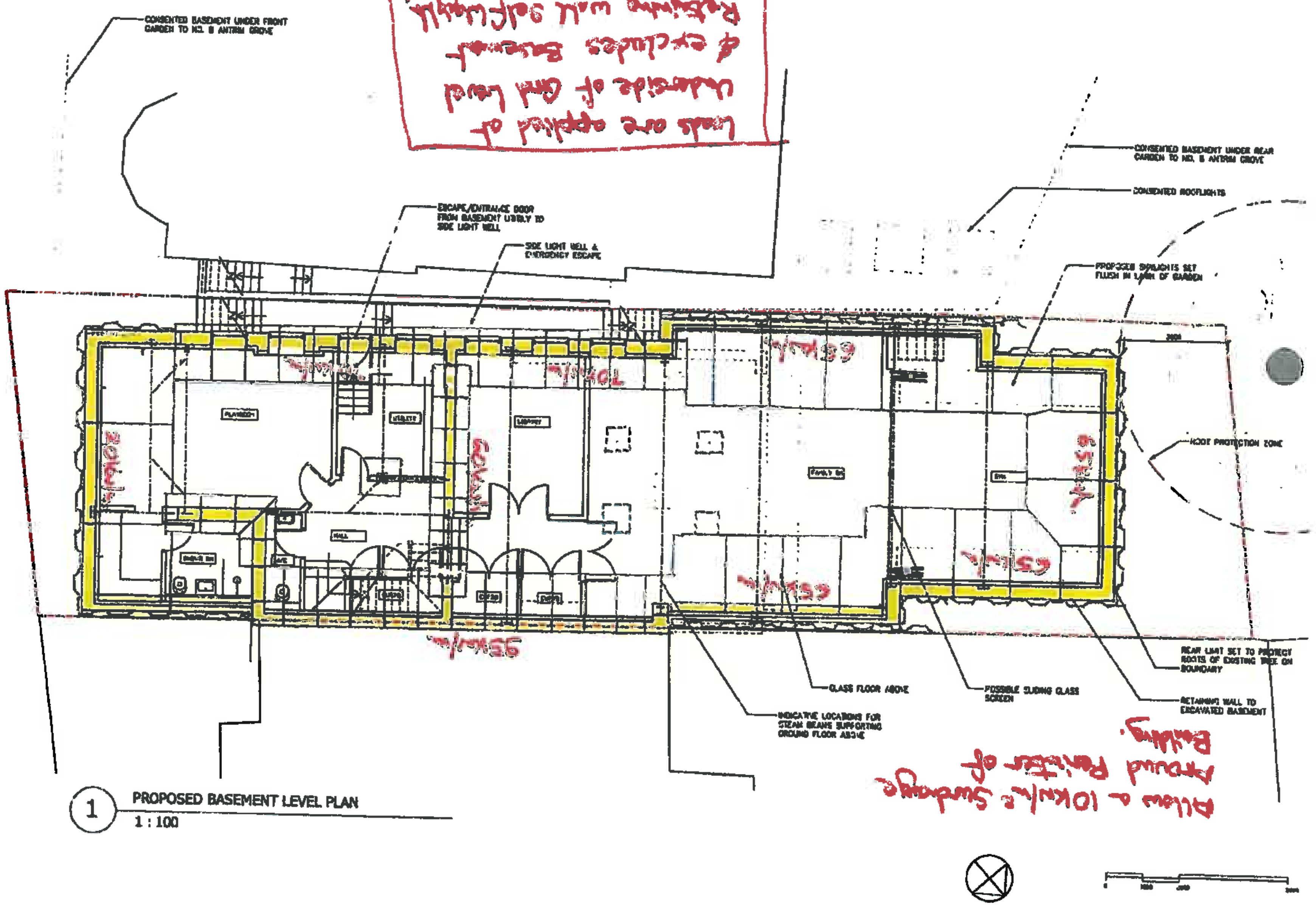
Scale : Not to scale

GabrielGeo Consulting

APPENDIX

Load Takedown data from Knapp Hicks & Partners
Drg No.1310-110/C with hand-annotated load takedown – walls
Drg No.1310-110/C with hand-annotated load takedown – columns

USE FIGURED DIMENSIONS ONLY. DO NOT SCALE FROM THIS DRAWING.
ALL DIMENSIONS MUST BE CHECKED ON SITE & ANY DISCREPANCIES MUST BE REPORTED BACK TO THE ARCHITECT.
THIS DRAWING AND ANY DESIGNS INDICATED THEREON ARE THE COPYRIGHT OF THE ARCHITECT. ALL RIGHTS ARE RESERVED. NO PART OF THIS WORK MAY BE REPRODUCED WITHOUT PRIOR PERMISSION IN WRITING FROM THE ARCHITECT.



Loads are applied at Underside of Grnd Level & excludes Basement Retaining wall Self Weight. All loads are Working loads

Allow a 10kN/m² Surcharge Around Perimeter of Building.

1 PROPOSED BASEMENT LEVEL PLAN
1 : 100

B chitecture
11A Bansford Road London N2 8AT
t 07932 793 437 e Bchitecture@gmail.com

6 Antrim Grove, Belsize Park
London NW3 4XR

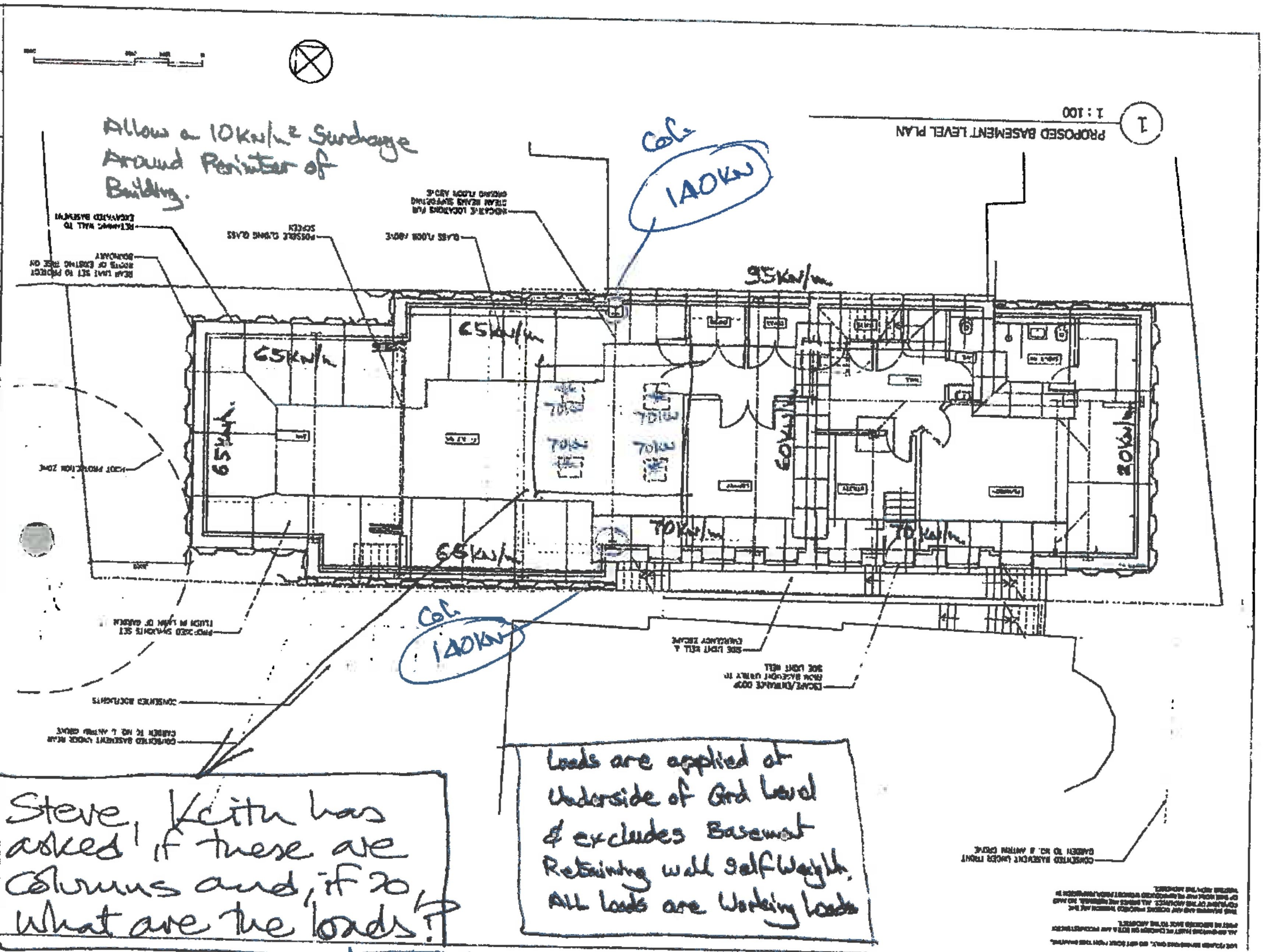
PROPOSED PLANS

DEC 2013

1:100@A3

1310

110/C



Allow a 10kN/m² Surcharge Around Perimeter of Building.

Loads are applied at Underside of Grd Level & excludes Basement Retaining wall Self Weight. ALL loads are Working loads

Steve, Keith has asked if these are Columns and, if so, What are the loads?

These are temporary Works short term loads

110/C	1310	1:100@A3	DEC 2013	PROPOSED PLANS	6 Antrim Grove, Belsize Park London NW3 4XR	Bchitecture 11A Beresford Road London N2 8AT t 07832 798 407 e bchitecture@gmail.com

E. Basement Construction Plan, 510/BCP rev B, dated 29th May 2015, by PWY Consultancy

Basement Construction Plan for development

at

6 Antrim Grove, London, NW3 4XR

for

Peter Bravlavsky

Document ref:	510/BCP
Revision:	A
Date issued:	29th May 2015
Author:	Peter Young

This report has been prepared in accordance with the appointment from Peter Bravlavsky to prepare and issue a Basement Construction Plan as detailed in London Borough of Camden S106 excerpt for the proposed basement development at 6 Antrim Grove, London, NW3 4XR with the resources available, using all reasonable professional skill and care.

The report is for the exclusive use of the Client and relevant regulatory authorities, shall not be relied upon by any third party without explicit written agreement from pwy consultancy ltd.

This report is specific to the proposed development as described in the report; pwy consultancy ltd accept no liability for any use of the report or its contents for any purpose other than the development use described herein.

This report has been prepared using normal professional skill and care based upon the drawings and reference documents listed in this report together with a site visit to the property to inspect the external frontage and road. The proposals are prepared solely for consideration of London Borough of Camden to assess the impact of the development in the decision with regard to issuing planning approval for the development.

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07766 467465 pwy@talktalk.net

Reference documents

Bchitecture (Architects) drawings

1310-100/A	Location Plan
1310-101/C	Existing Plans
1310-102/-	Existing Elevations
1310-103/A	Existing Elevations
1310-104/A	Existing Sections
1310-110/C	Proposed Plans
1310-111/C	Proposed Plans
1310-112/A	Proposed Plans
1310-113/A	Proposed Elevations
1310-114/A	Proposed Elevations
1310-115/A	Proposed Sections

Knapp Hicks & Partners drawings

32842/01	Trial Pit Location & Details
32842/02	Proposed Basement Plan (& Sections 1-1 to 3-3)
32842/03	Proposed Basement Wall Construction
32842/04	Proposed Ground Floor Plan
32842/05	Section A-A
32842/06	Sections B-B & C-C

Knapp Hicks & Partners documents

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Assorted documents detailing the ground water levels, borehole and trial pit locations

Stephen Buss Environmental Consulting Ltd

Screening and Scoping BIA Assessment dated 19th May 2015

Gabriel GeoConsulting Limited

Ground Movement Assessment dated 22nd May 2015

Basement Construction Plan for the proposed basement construction works at 6 Antrim Grove, Belsize Park, London, NW3 4XR

This statement outlines the schematic proposal for the construction methodology to form the single storey basement which extends beneath the full footprint of the building, as well as below the front and rear gardens, at 6 Antrim Grove and will be developed in detail by the contractor appointed to carry out the work.

This plan details the information relating to the construction of the basement including mitigating measures to contain the impact of the basement construction on the structural stability of the property and neighbouring properties.

The plan should be read in conjunction with the Basement Impact Assessment and other related documents listed under the Reference Documents on the previous page.

Condition surveys should be carried out and agreed with the owners to 4 and 8 Antrim Grove, the public footpath and road prior to any works commencing. The surveys should be in accordance with any Party Wall Awards or agreements and incorporate detailed monitoring regimes of the existing structures with pre-determined allowable movements and written action plans to be implemented in the event that these movements are exceeded.

The works are to be installed in accordance with Knapp Hicks & Partners construction status drawings giving due consideration to the Basement Impact Assessment, Site Investigation Report and Ground Movement Assessment. The contractor is to produce a written safe system of work consisting of detailed installation method statements and risk assessments for all elements of the basement construction.

In the event that the contractor uncovers any item not referenced or encounters ground water flows in excess of those predicted or ground conditions not referred to in the Site Investigation Report or expected or elements of structure not previously know the variation is to be reported to the Structural Engineer for their review of the work.

To minimise the impact of the basement construction on the neighbours and other local residents substantial enabling works will be carried out prior to the bulk excavation of the basement commences. This approach should enable the construction of the basement and lower ground floor to be completed within six months of the bulk excavation of the basement starting.

Infiltration of ground water from perched water tables based on the investigation reports is expected to be low and can be controlled by construction of local sumps and pumping via settlement tanks for removal from site. The system of dewatering and method of construction will be reviewed by the geotechnical specialist and structural engineer respectively as the work proceeds, especially if unexpected ground conditions are encountered.

6 Antrim Grove is to be vacated due to the restrict site access, working areas and safety reasons for the duration of the basement construction.

Party Wall Awards will be agreed with the neighbours which will contain a detailed monitoring regime and contingency plan specifying the action to be taken to ensure the safety of the adjoining structures if delays are encountered to the maximum six month bulk excavation phase of the works.

Method Statement **Basement Construction**

The work will be carried out in the sequence of the following phases:

1. Enabling works
2. Basement walls to front garden
3. Underpinning to existing building
4. Bulk excavation (to be completed within a six month period)
5. Basement walls to rear garden
6. Drainage and below slab services
7. Basement slab construction

1. Enabling works

(i) The permanent structural steel beams to support the existing masonry walls of 6 Antrim Grove, to allow open spaces within the basement and the removal of the existing foundations, as detailed on KHP drg no. 32842/04 will be installed within the walls by using back to back steel channels bolted together. The overall length of the beams will be increased to ensure they extend as far as the boundary walls. Where the masonry walls are one brick or more thick this can be achieved by cutting in half the depth of the wall and inserting the first channel before dry packing above and below the channel and allowing to cure. After 24hrs the second channel can be installed in a similar manner and the pair bolted together.

(ii) The specific underpins below the walls containing the ends of the support beams will be constructed at this time in single depth underpins (refer to the underpinning to existing building section for detailed method). The length of these underpins will be justified to carry the temporary construction loads from the support beams supporting the masonry walls above.

(iii) The design opening to the basement spine wall should be temporarily increased with the support beam over re-justified to enable a wide enough opening for excavation plant to pass through. The opening will be subsequently partially filled in to the size shown on the construction drawings.

2. Basement walls to front garden

(i) Excavate a 400mm wide trench of at least 1.5m depth to the top surface of the London Clay to enable sacrificial sheets to be installed to the outside face of the trench and driven to a minimum depth of 300mm into the London Clay by the excavator. Backfill the trench with compacted granular fill.

(ii) Construct the 2m wide sections of wall as detailed on KHP drg no. 32842/03 by propping the heads of the sheets using a waling and local props to the existing ground on each side. The ground to the sides of the pit should be supported using temporary shoring until the section of wall is poured.

(iii) The excavation and construction of the initial sections of walls will be will be observed by a geotechnical specialist to assess the stability, soil and groundwater conditions to assess and review the width of the wall sections.

(iv) Once poured each section of wall can be propped at the head using horizontal props back to either the existing masonry walls at strong points or the ends or node points of the new structural steel support beams.

(v) On completion of all the high level section of wall and horizontal props to the heads of the walls the lower sections can be excavated through the London Clay in the 2m sections. A sufficient depth of toe should be allowed at the base of the wall to resist the lateral forces and the sequence carefully chosen to allow different sections of wall and base to prop against each other to lock the whole assemble into place.

3. Underpinning to existing building

(i) The underpinning to the existing building will be carried out in accordance with the sequence detailed on KHP drg no. 32842/02.

(ii) Access to each underpin should be carried out from ground level. The ground to the sides of the pit should be supported using temporary shoring until the section of underpinning is poured.

(iii) A sufficient depth of toe should be allowed at the base of each underpin to resist the lateral forces at the basement slab level. The newly installed structural steel support beams will act as a prop at the head of each underpin, with temporary knee braces below them to the underpin. The permanent reinforced concrete wall will be designed to span horizontally between the support beams.

4. Basement walls to rear garden

(i) A heading can be formed directly under the existing ground floor construction of sufficient size and depth to enable excavation plant to access the rear land locked garden.

(ii) Excavate a 400mm wide trench of at least 1.5m depth to the top surface of the London Clay to enable sacrificial sheets to be installed to the outside face of the trench and driven to a minimum depth of 300mm into the London Clay by the excavator. Backfill the trench with compacted granular fill.

(iii) Construct the 2m wide sections of wall as detailed on KHP drg no. 32842/03 by propping the heads of the sheets using a waling and local props to the existing ground on each side. The ground to the sides of the pit should be supported using temporary shoring until the section of wall is poured.

(iv) The excavation and construction of the initial sections of walls will be will be observed by a geotechnical specialist to assess the stability, soil and groundwater conditions to assess and review the width of the wall sections, with particular attention paid to the wall sections within the perched water table.

(v) By carefully sequencing the work commencing with those sections of wall supporting a new horizontal structural steel beam each section of wall can be propped at the head using the new support beams detailed on KHP drg no. 32842/04. Temporary knee braces can be installed below the new support beams to the base of the upper sections of wall. The remaining sections of wall can now be completed with the wall designed to span between the support beam positions.

(iv) On completion of all the high level section of wall and horizontal support beams to the walls the concrete ground floor slab can be poured from a formwork deck constructed off the ground below.

(v) The lower sections of wall can be excavated through the London Clay in the 2m sections. A sufficient depth of toe should be allowed at the base of the wall to resist the lateral forces.

5. Bulk excavation

(i) On completion of the underpinning and new basement wall construction in the rear garden the bulk excavation of the basement spoil can commence.

(ii) The spoil will be excavated and transported to the front garden basement and stockpiled in this location for removal by grab lorry.

(iii) A banksman will be present at all times when the grab lorry is lifting the spoil from the basement area onto the lorry parked against the kerb. No pedestrians will be allowed to pass underneath the working lorry. If pedestrians wish to pass by on the pavement work will be stopped to allow this to happen.

6. Drainage and below slab services

(i) As the excavation proceeds a sand/cement blinding will be laid to the formation level to avoid deterioration of the clay surface.

(ii) The underslab drainage and services will be installed in accordance with the construction details.

7. Basement slab construction

(i) The basement slab will be constructed in accordance with KHP drg no. 32842/02 to lock the base of the sections of wall and underpins.

(ii) The temporary knee braces can be removed when the basement slab has reached sufficient strength.

(iii) The waterproofing solution and architectural finishes can now be installed.

F. Construction Management Plan, 510/CMP rev B, dated 29th May, 2015, by PWY Consultancy

Construction Management Plan for development

at

6 Antrim Grove, London, NW3 4XR

for

Peter Bravlavsky

Document ref:	510/CMP
Revision:	A
Date issued:	29th May 2015
Author:	Peter Young

This report has been prepared in accordance with the appointment from Peter Bravlavsky to prepare and issue a Basement Construction Plan as detailed in London Borough of Camden S106 excerpt for the proposed basement development at 6 Antrim Grove, London, NW3 4XR with the resources available, using all reasonable professional skill and care.

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Stephen Buss Environmental Consulting Ltd

Screening and Scoping BIA Assessment dated 19th May 2015

Gabriel GeoConsulting Limited

Ground Movement Assessment dated 22nd May 2015

Construction Management Plan for the proposed basement construction works at 6 Antrim Grove, Belsize Park, London, NW3 4XR

This statement will be developed to contain all the information requested in London Borough of Camden pro-forma and agreed with the council prior to the construction works commencing.

The statement will give consideration to the following;

(i) This statement gives environmental protection, highways, safety and community liaison measures to be adopted by the developer in order to mitigate and offset potential or likely effects and impacts arising from the building out of the development. The development is to follow the recommendations stated in this report unless agreed in writing with the London Borough of Camden.
(ii) As the development is not a Major Sites Framework the requirements of the First Schedule will not be considered or incorporated into this development.
(iii) Please refer to the section below for the provisions covered in the Second Schedule.
(iv) Effects on the health and amenity of local residences, site construction workers, local businesses and adjoining developments undergoing construction.
(v) Monitoring measures over construction traffic including procedures for notifying the owners or occupiers of the residences and businesses in the locality in advance of major operations, delivery schedules and amendments to normal traffic arrangements.
(vi) A defined waste management strategy for handling and disposal of construction waste.
(vii) A means of ensuring the provision of information to the council and provision of a mechanism for monitoring and review.

Second Schedule

b) 6 Antrim Grove is a semi-detached three storey property with a rear garden that is land locked, the proposed development is for the construction of single storey basement which extends beneath the full footprint of the building, as well as below the front and rear gardens. Antrim Grove is a residential road with a number of multi occupancy properties together with single residency houses. Antrim Grove lies to the south-west of Haverstock Hill, approximately 250m to the south-east of Belsize Park tube station and becomes Antrim Road when the road bends to the south-east. Haverstock Hill is a main thoroughfare with a combination of residential and commercial properties. Antrim Grove and Road is predominantly residential although it contains a local library and lead's to England's Lane at the south which contains a parade of shops.
c) The work will be carried out in distinct phases, details of each section of work and duration are shown in the Basement Construction Plan.
d) The proposed working hours for this project are Monday to Friday between 8am and 5pm and Saturdays between 8am and 1pm. Delivery vehicles will only be permitted to arrive and depart during these times.
e) Due to the size of the development there will be no access for vehicles onto the site. Deliveries will be required to park on the road at the kerb to be offloaded

or loaded. For this reason the parking bays outside of number 4 and 6 Antrim Grove should be suspended whilst the major construction elements of the development are in progress.

f) Site traffic delivering materials and removing spoil will access from Haverstock Hill and continue around the loop to egress back onto Haverstock Hill using only England's Lane, Antrim Road and Antrim Grove to minimise the time spent on the local residential side roads. The vehicles will pull up against the kerb within the two suspended parking bays outside of 6 Antrim Grove. Delivery and collection vehicles will be controlled by banksmen to aid reversing, traffic flows and safety of pedestrians during the operations. Vehicles will stay on Haverstock Hill or major roads until on the Transport for London Road Network.
g) The typical sizes of vehicles accessing the site will be standard flat bed eight wheel lorries with grab facilities to collect the spoil, rigid delivery lorries and small vans. Deliveries will be timed to avoid the busiest times of the day, namely rush hour and school run. Due to the limited size of the site the frequency of vehicles will be low with care taken to ensure that vehicles arrive singularly to avoid queuing or unnecessary waiting. The maximum frequency of lorry movements will be during the 6 month bulk excavation phase of the basement and is estimated to be a maximum of four number spoil removal lorries removing 10m^3 of bulked soil each and two number delivery lorries per day.
h) Vehicles will not access the site or be asked to reverse or turn with the exception of reversing back against the kerb outside of the site to enable other vehicles to pass during deliveries and collections. Companies delivering materials to the site using large lorries will attend site to view the corners of England's Lane/Antrim Road and Antrim Road/Antrim Grove to ensure the proposed vehicles can access and safely pass through the route.
i) There are no requirements of any highway works necessary to enable construction to take place.
j) No parking will be allowed on the site. The vehicles will pull up against the kerb within the two suspended parking bays outside of 6 Antrim Grove for delivery and loading of materials and plant to the site.
k) Two number standard parking bays outside of number 4 and 6 Antrim Grove should be suspended whilst the major construction elements of the development are in progress. The solo m/c's and disabled parking bays will not be affected. No other temporary traffic management orders will be necessary.
l) There are no proposals for any element of scaffold, crane or other construction element to overhang the public highway.
m) The site hoarding will be kept at the property boundary with the public footpath and not extend onto the pavement.
n) A banksman will be present to aid delivery and collection vehicles parking against the kerb, control vehicle movements to ensure the safety of pedestrians and cyclists and supervise material and plant movements from the delivery and collection vehicles to the site.
o) Vehicles delivering and collecting from the site will be parked against the kerb to allow other traffic to pass to reduce congestion. Construction site operatives will be encouraged to use public transport to the site, those who need to deliver tools to the site will be given details of local public parking facilities suitable for their use.
p) Due to the size of the development no other measures are deemed necessary to reduce the impact of associated traffic.

q) As no vehicles will access the site no significant amounts of dirt or dust are anticipated being spread onto the public highway. The banksman will be tasked with ensuring the pavement and road outside the site is kept clean of dirt, dust, debris or any other items likely to cause danger or nuisance.

r) Prior to construction commencing and allowing sufficient time to enable comments received to be actioned the draft Construction Management Plan will be offered to local residents, businesses, local groups (eg residents/tenants and business associations) and Ward Councillors for consultation. The proposed consultation will be advised to the Council before being undertaken. The Construction Management Plan will be amended based on the comments received where appropriate or a reason given as to why not, the summary of comments and actions taken included in the amended Construction Management Plan.

s) Due to the size of the development no Construction Working Groups are deemed necessary. Details of the development including prominent persons and contact details for any comments, complaints or information to be directed will be included in a newsletter which will be circulated to local residents prior to the construction works commencing.

t) Contractors will follow and comply with "Guide for Contractors Working in Camden" referred to as "Camden's Considerate Contractor's Manual". Contractors will be encouraged to be members of or sign up to the "Considerate Constructors Scheme".

u) Should the development obtain planning approval and a known commencement date be established then details of other construction sites in the local area will be obtained and the Construction Management Plan reviewed to consider the cumulative effects of construction local to the site.

v) All contractors and sub-contractors operating large vehicles over 3.5 tonnes will meet the following requirements:-
Operators must be a member of TfL's Fleet Operator Recognition Scheme or similar at the Bronze level.
All drivers must have undertaken cycle awareness training such as the Safe Urban Driver module through FORS or similar.
Vehicles must have Side Guards fitted, unless it can be demonstrated that the lorry will not perform the function for which it was built if Side Guards are fitted, a close proximity warning system fitted comprising of a front mounted, rear facing CCTV camera (or Fresnel Lens where this provides reliable alternative), a Close Proximity Sensor, an in-cab warning device (visual or audible) and an external warning device to make the road user in close proximity aware of the driver's planned manoeuvre, a Class VI Mirror and bear prominent signage on the rear of the vehicle to warn cyclists of the dangers of passing the vehicle on the inside.

w) No other information regarding traffic and transport is deemed relevant to this Construction Management Plan.

x) The agreed contents of the Construction Management Plan must be complied with unless otherwise agreed with the Council. The project manager shall work with the Council to review this Construction Management Plan if problems arise in relation to the construction of the Development. Any future revised plan must be approved by the Council and complied with thereafter.