16th December 2011

Jon Evans
Metropolitan Development Consultancy
66 Bickenhall Mansions
Bickenhall Street
LONDON
W1U 6BS

Our Ref: 401-3774-00001
Your Ref:

Dear Jon

RE: 9 DOWNSHIRE HILL – PLANNING CONDITIONS 8 AND 9

This letter is submitted in response to planning conditions 8 and 9 which state as follows:

8) '*No development shall commence until full details of the design, installation and maintenance of the proposed weir system have been submitted to and approved in writing by the LPA and the development shall be carried out and the weir system maintained in accordance with the approved details'*

9) '*No development shall commence until there has been submitted to and approved in writing by the Local Planning Authority a report which:*

a) *sets out the results of a groundwater flow model exercise;*
b) *includes a recommendation whether passive relief wells should be installed; and*
c) *includes full details of the design, installation and maintenance of any passive relief that it is recommended should be installed*'.

The background to these conditions is given in Section 19 (Groundwater) of the Appeal Decisions[1] which states:

'*There would be a general tendency for surface and groundwater to flow from the rear of the properties on the road, towards the front. The present buildings have been in place over a long period, albeit likely with shallow foundations. Later additions may involve deeper foundations, although the side addition at number 8 was constructed off ground beams on piles, which would have impeded water movement by a lesser amount. The proposed basement would create a 'dam' effect, causing water to disperse either side if no further action was taken. That dispersal by a single property may not be harmful to the wider hydrology, but evidence of the need to pump a basement nearby and the density of built form with cellars along the road indicates that measures should reasonably be taken on site to reduce the effect. The appellant proposes a system of weirs and wells to capture the water and dispose of it. This system, the full extent of which would be determined pursuant*

[1] Appeal Decisions APP/X5210/E/10/2129688-9, Planning Inspectorate, Decision Date 13 January 2011

to a condition, would require maintenance. As a first example in the vicinity, it is not possible to identify a serious risk of harm and Policy DP 27b) would be accorded with'.

It is considered most appropriate to first develop a groundwater flow model, after which the necessary groundwater mitigation measures required for the proposed development will be proposed. The detailed engineering design of the proposed mitigation measures has been prepared by Michael Alexander Consulting Engineers and is presented as Appendix C of this report.

1.0 GROUNDWATER FLOW MODEL

1.1 Conceptual Site Model

Published geological mapping[2] indicates that the site is on London Clay, approximately 50m west of the geological boundary with the Claygate Member silts and fine sands, as shown in Drawing 1. The geological boundary is a potential springline, and it is likely that the former pond indicated on 1870s historical maps on Pilgrims Lane (and shown in Drawing 1) was fed by such springs. Between the potential springline and the site the ground slopes down to the east or south-east.

1.2 Information from Site Investigation regarding Site Hydrogeology

Site investigation[3] carried out in 2009 indicated the following regarding the site geology and hydrogeology, as detailed in Tables 1 and 2 overleaf and in cross-sections in Drawing 2.

- the site geology is confirmed as London Clay, with a thickness of approximately 5-6m firm weathered London Clay overlying stiff unweathered London Clay;
- overlying the weathered London Clay is a proven thickness of up to 1.4m Made Ground, although the Geotechnical Report[4] states that cone penetration tests indicate that the Made Ground may extend up to 2.2m depth;
- much of the Made Ground is gravelly clay, however in parts of the site the upper portion of the Made Ground comprises a proven thickness of up to approximately 1m of sand or silt;
- groundwater levels measured between March and November 2009 found no water in the sand or silt portion of the Made Ground;
- groundwater levels were typically in the clay portion of the Made Ground (at OP04), or in the weathered London Clay (at WS02, WS03, BH1 and BH2B);
- the presence of groundwater in the weathered and Made Ground clay at levels up to 77.72 maOD may be partly responsible for the '*extensive evidence of damp and water ingress*' in the basement (current floor level ca. 75.3 maOD) as reported in the Assessment of Structure report[5];
- groundwater levels in the clay typically indicated a hydraulic gradient broadly following the site topography, with the highest levels consistently at upgradient monitoring point OP04;
- however, comparison of hydrographs for WS02 and WS03 (included in Appendix A) shows that sometimes groundwater levels were higher at WS02, and sometimes at WS03 – such patterns are typical of low permeability horizons; and

[2] British Geological Survey Sheet 256, North London and Figure 4 (North London Geological Map) in 'Guidance for Subterranean Development', London Borough of Camden, 2010

[3] Site Investigation Report: 9 Downshire Hill, Concept Site Investigations, April 2009 and Site Investigation Report: 9 Downshire Hill Phase 2, Concept Site Investigations, December 2009

[4] Geotechnical Report: 9 Downshire Hill, Ove Arup, January 2010

[5] 9 Downshire Hill: Assessment of Structure, Ove Arup, December 2008

- the Geotechnical Report[4] concluded from the site investigation results that '*possible ground surface springs associated with the edge of the Claygate Member are not present on the site'*.

Table 1
Made Ground and Groundwater Upgradient of Current Building

	OP04	OP05	BH2B	WS03	WS02
Location cf Proposed Development	Upgradient End of Lower Terrace		Ground Floor Terrace		Upper Storey Rear Facade
			Upgradient End	Downgradient End	
Ground Level (maOD)	78.35	78.35	77.41	78.03	77.58
Made Ground Sand/Silt Thickness	0.5m Sand	0.7m Sand	0.9m Sand with Clay horizons	0.3m Silt	0.6m Silt
Sand/Silt Base (maOD)	77.85	77.65	76.21	77.73	76.98
Base of Clay Made Ground	77.4	None	Horizons in sand	76.63	76.83
Slotted Casing (maOD)	None – trialpit only		72.2 – 74.2[b]	75.0 – 78.0	72.5 – 77.5
Water Strike (maOD)	Dry (Mar 09)	Dry (Nov 09)	Dry (Nov 09)	72.1 (Mar 09)	Dry (Mar 09)
Max Water Level (maOD)	77.72 (Apr 09)	<76.35 (Nov 09)[a]	72.41 (Nov 09)[a]	77.07 (Apr 09)	76.16[c] (Apr 09)

[a] – only installed in Nov 09; [b] - base of weathered London Clay at BH2 was 71.06 maOD; [c] – excluding one-off outlier of 76.78 maOD in Nov 09, when readings one week before and after were over 1m lower.

Table 2
Made Ground and Groundwater Downgradient of Current Building

	OP01	OP02	WS01	BH01
Location cf Proposed Development	Near Front Facade		Basement under Front Garden	
			NE Side	Downgradient End
Ground Level (maOD)	75.12	75.52	75.82	75.82
Made Ground Sand Thickness	Zero	0.83m Sand	Zero	Zero
Sand/Silt Base (maOD)	-	74.52	-	-
Base of Clay Made Ground	<74.7maOD	None	74.87 maOD	74.52 maOD
Slotted Casing (maOD)	None – trialpit only		None	65.8 – 73.8
Water Strike (maOD)	Dry (Mar 09)	Dry (Mar 09)	Dry (Mar 09)	Dry (Mar 09)
Max Water Level (maOD)	NA	NA	NA	73.37 (Nov 09)

1.3 Current Groundwater Flows

From the above information the following is inferred concerning current groundwater flows:

- groundwater flows in the clay are likely to broadly follow the site topography, with the highest levels typically at upgradient monitoring point OP04;
- groundwater levels measured at WS02 and WS03 were sometimes above the basal elevation of the nearby current basement (ca. 75.3 maOD), suggesting that at present groundwater flows in the clay may at times be partially obstructed by the current basement which extends across much of the width of the site as shown in Drawing 1;
- the observed range of groundwater gradients beneath the current rear garden was from 0.05 – 0.32 as indicated in Table 3 below; and
- these gradients are generally steeper than the ground slope in the back garden (which is ca.08), and the steepening may be due to the restriction of groundwater flowpath caused by the current basement.

Table 3
Groundwater Gradients at Upgradient End of Proposed Basement

Date	Groundwater Level (maOD)			Groundwater Gradient	
	OP04	WS03	WS02		
25 Mar 2009	77.72	77.07	75.19	0.08	OP04 to WS03
1 Apr 2009	77.66	76.65	75.26	0.13	
8 Apr 2009	76.57	75.97	75.15	0.08	
16 Apr 2009	77.7	75.25	76.16	0.31	
22 Apr 2009	77.63	75.07	75.22	0.32	
13 Nov 2009	77.35	<75.03	76.78	0.05	OP04 to WS02
20 Nov 2009	77.39	<75.03	75.34	0.19	
27 Nov 2009	77.55	<75.03	75.72	0.17	

Using the maximum observed gradient in Table 3 of 0.32, and assuming the permeability of the clay is 1 x 10^{-7} m/s (an assumed worst case maximum permeability) then the groundwater flow through the weathered and Made Ground clay immediately upgradient of the current basement can be estimated as follows:

- groundwater flow = permeability x gradient x flow width x thickness;
    - flow width is assumed as the site width i.e. 11m;
    - flow thickness is assumed as the saturated thickness of weathered London Clay and Made Ground clay i.e. approximately 6m;
- hence maximum groundwater flow in the weathered London Clay and Made Ground clay is estimated at approximately 0.0021 l/sec (0.18m^3/day).

Although currently groundwater flows in the weathered and Made Ground clay may at times be partially obstructed by the existing basement, as the current basement does not extend across the full width of the site and assuming that there are no other barriers, groundwater flows can still take place around the existing basement as indicated in Drawing 1.

The property immediately to the south-west (no.8 Downshire Hill) has an extension adjacent to the boundary with no.9, with a basement which is[6] '*thought to extend approximately 2.7m below the general basement level of no.8'.* Hence at present any subsurface water flows are likely to be significantly obstructed by the basement of no.8 Downshire Hill across the whole of the site width of no.8, and these flows may therefore currently be diverted to the 2m wide flow pathway along the south-western side of the current no.9 basement. Assuming similar ground conditions at no.8 to no.9, these diverted flows could currently be in the order of 0.002 l/sec. However, worst case estimates of these diverted flows are presented in section 1.4 below.

[6] Section 9.3 of Geotechnical Report: 9 Downshire Hill, Ove Arup, January 2010

The property to the north-east (no.10 Downshire Hill) is '*assumed to have a single level of basement*', which is shown in recent drawings provided by Metropolitan Development Consultancy as having a basal level of approximately 75.5 maOD at the site boundary with no.9.. Hence this would suggest that currently there is a flow pathway in the weathered and Made Ground clay approximately 3m wide along the north-eastern side of no.9 between the no. 9 basement and the site boundary.

1.4 Worst Case Estimate of Potential Subsurface Water Flows

As the existing information regarding subsurface water levels and flows at the site is limited, it is considered prudent to carry out a worst case estimate of potential flows e.g. after heavy winter rainfall. The potential sources for such flows could be:

- the potential springline at the eastern edge of the outcrop of the Claygate Member, c.50m to the west of the site;
- winter rainfall on back gardens immediately upgradient to the west-north-west of the site; and
- diversion of flows in the weathered clay and Made Ground caused by the basement of no.8 Downshire Hill.

The worst case scenario is that the weathered and Made Ground clay become fully saturated, and interflow occurs in the more permeable Made Ground sand horizon above the Made Ground clay. The current interflow capacity of the Made Ground sand horizon beneath the back garden of no.9 Downshire Hill can be estimated as follows:

- the highest permeability interflow flowpath is at ground surface along the north-eastern side of the back garden - 0.3m thickness of 'fine to coarse sand with fine to coarse gravel', underlain by 0.4m clayey sand (as proven at OP05);
- as a conservative worst case, that horizon can be assumed to be 6m wide and to have the maximum likely permeability for coarse gravel i.e. 0.03 m/sec[7];
- the highest permeability interflow flowpath along the south-western side of the back garden is 0.7m thickness of 'gravelly silty sand', underlain by stiff clay (as proven at BH2);
- as a conservative worst case, that horizon can be assumed to be 5m wide and to have the maximum likely permeability for fine sand i.e. 0.0002 m/sec[7]; hence
- assuming a hydraulic gradient of 0.08 based on the ground slope, the theoretical maximum interflow through these horizons if fully saturated could be 4.4 l/sec or 380m^3/day.

It is considered unlikely that such flow volumes would actually take place in the Made Ground sand for the following reasons:

- no water was detected in the Made Ground sand at the site during monitoring from March – November 2009;
- it is possible that the foundations and basements of the houses on the southern side of Pilgrims Lane may restrict or cut off the interflow pathway from the potential springline through the sand horizon in the Made Ground (it is also very unlikely that the sand horizon in the Made Ground extends a significant distance, given the typical heterogeneous composition of Made Ground);
- the total area of back gardens between upslope properties and the proposed development is approximately 600 m^2 (including the back garden of no.8 Downshire

[7] Value taken from Environment Agency R&D Publication 120

Hill, from which infiltration is likely to be diverted towards no.9 by the existing no.8 basement);

- the 10 year worst case[8] five day rainfall is 63mm, which assuming a runoff coefficient of 0.4 (which is considered appropriate for the relatively steep slopes) can be used to derive a worst case five day recharge to the subsurface totalling 22.7m^{3,} which only equates to 0.05 l/sec.

1.5 Potential Unmitigated Impact of Proposed Development

After construction of the proposed development, which has basements both wider and deeper than the current basement, flows beneath the south-western side of no.9 Downshire Hill would be obstructed as mentioned in the Appeal Decision document, and flows can be expected to be diverted to the north-eastern side of the property. The subsurface flow pathway along the north-eastern side of the property would be restricted by the proposed new basement to a width of 1m.

It is possible that the restriction of flows could over time cause water levels in the clay to rise above the maximum levels recorded in 2009 (77.72 maOD at OP04, i.e. 0.63m below ground level). If water levels rose, this could give rise to interflows in the more permeable Made Ground sand horizon. This could be exacerbated by extreme winter rainfall events as considered in section 1.4 above, and in the worst case this could result in flooding at ground level. As discussed in sections 1.3 and 1.4 above, the actual flows are likely to be less than 0.1 l/sec and restricted to the weathered and Made Ground clay. However, as a conservative worst case, mitigation measures are presented below to deal with potential flows in the sandy Made Ground.

2.0 PROPOSED MITIGATION OF WORST POTENTIAL SUBSURFACE FLOWS

2.1 Introduction

As discussed in section 1.4 above, the conservative worst case for which to consider mitigation measures is subsurface water flows of up to 4.4 l/sec, although the actual maximum flows are likely to be significantly less.

2.2 Initial Proposals for 'Weir-type System' in Planning Application

The Geotechnical Report[4] that was submitted with the planning application stated in section 9.7 as follows:

'*The presence of shallow groundwater on the site means that the walls of the basement and garden box could have a dam-like effect which might cause groundwater to accumulate on the uphill side of the development. This can be managed, maintaining a similar groundwater regime to the present, by suitable detailing of the back garden retaining wall, such as by providing a weir-type system to allow any excess groundwater to enter the sunken garden below the top of the retaining wall… This water would need to be disposed of from the sunken garden in a similar manner to any rain falling into the sunken garden area'.*

It is noted that at the time the Geotechnical Report was written a hydrogeological conceptual site model had not been developed, hence the potential flow volumes had not been estimated.

[8] MAFF Technical Bulletin 34 (Climate and Drainage) – Area 33W

2.3 Feasibility of 'Weir-type System'

The previously proposed 'weir-type system' is not considered the most feasible solution to deal with any excess subsurface water as outlined in sections 2.3.1 and 2.3.2 below.

2.3.1 Potential for Water from Subsurface to be Discharged to Drainage

If a 'weir-type system' were constructed to channel subsurface water flows into the lower ground sunken garden, as stated in the Geotechnical Report '*this water would need to be disposed of from the sunken garden in a similar manner to any rain falling into the sunken garden area'.* It would only be possible to discharge water from the subsurface to surface water drainage if the proposed development involves a decrease in discharge of surface water runoff to drainage.

Calculations by SLR using WINDES modelling software indicate that the proposed development would result in a decrease in discharge to drainage during a 30 year worst case rainfall event, even if an additional 4.4 l/sec of subsurface water flows (in an extreme worst case) also reached drainage via the 'weir-type system' or another route.

Thames Water have stated[9] that '*as long as the surface water runoff does not exceed current levels we will be happy with the site'*. However, it is possible that Thames Water might object to water from the subsurface being drained to surface water drainage via the weir-type structure, even though this water would effectively be interflow i.e. rainfall flowing through Made Ground rather than groundwater sensu stricto.

2.3.2 Sustainability Considerations

Given the possible range of subsurface water seepage volumes estimated in the hydrogeological conceptual site model, it is considered that the 'weir-type system' is unlikely to be the most sustainable solution. This is because there would be significant additional energy/costs involved in pumping water out of the lower ground terrace, compared with the alternative of this water being channelled away from the lower ground terrace and drained by a passive relief system.

2.4 Passive Relief Systems

Condition 9 (b) and (c) request the following:

'a recommendation whether passive relief wells should be installed; and

full details of the design, installation and maintenance of any passive relief that it is recommended should be installed'

The potential significant subsurface water flows to be relieved are only expected in the Made Ground sand within 1m of ground level. Hence any passive relief that is installed would not need to be wells, but shallow drains. Indeed, it is considered that passive relief wells would not operate effectively at this site, given the London Clay underlying the site.

A design for a passive relief system has been provided by Michael Alexander Consulting Engineers (MACE) and is presented in Drawing P1917-100, while in Appendix C of this report MACE has provided details of installation and maintenance of the system. In outline, this proposed passive relief system involves the following:

[9] Email from Paul Bowring (Developer Services, Thames Water) to Phil Slater (SLR) dated 26/9/11

- a trench filled with granular material constructed across the full width of the rear garden near the upgradient side of the proposed lower ground terrace, with a pipe to collect any subsurface water flows in the shallow Made Ground;
- this trench/pipe would be constructed with a slight downward gradient towards the north-east, in order to divert any subsurface water flows to a subsurface pipe running along the north-eastern side of the building;
- this pipe would discharge any flows into a granular storage medium emplaced across the whole width of the front garden, as shown in Appendix C;
- from the granular storage medium, any subsurface water flows should discharge into permeable horizons in the Made Ground nearby, as under current conditions prior to the proposed development;
- the storage medium would have a total porous capacity of approximately 30 m^3, which should allow storage of at least the worst case water volumes accruing after a 10 year worst case five day rainfall event of 63mm (as discussed in section 1.4 above);
- the worst case water volumes entering the storage medium have been estimated by adding two components as follows:
    - the worst case likely water volumes channelled from the rear garden during a 10 year worst case five day rainfall event would be approximately 23 m^3 (see section 1.4); plus
    - the worst case likely rainfall volume directly above the approximately 95 m^2 area of storage medium would be approximately 6 m^3.

3.0 CONCLUSIONS

This report has addressed Planning Conditions 8 and 9 as follows:

- results of a groundwater flow model exercise have been presented as required by condition 9a;
- based on the groundwater flow model, it has been concluded that the previously suggested weir system (details of which are required by condition 8) is unlikely to be the most sustainable solution to deal with any subsurface flows which could be obstructed by the proposed basement development;
- with reference to condition 9b, passive relief wells are not recommended; however
- an alternative passive relief system has been recommended, and details of the design, installation and maintenance of the proposed system have been provided by Michael Alexander Consulting Engineers in Appendix C, as required by condition 9c.

4.0 CLOSURE

This report has been prepared by SLR Consulting Limited with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. The content of this report is based on the interpretation of data and information provided by Metropolitan Development Consultancy and third parties which has been accepted in good faith as being accurate and valid.

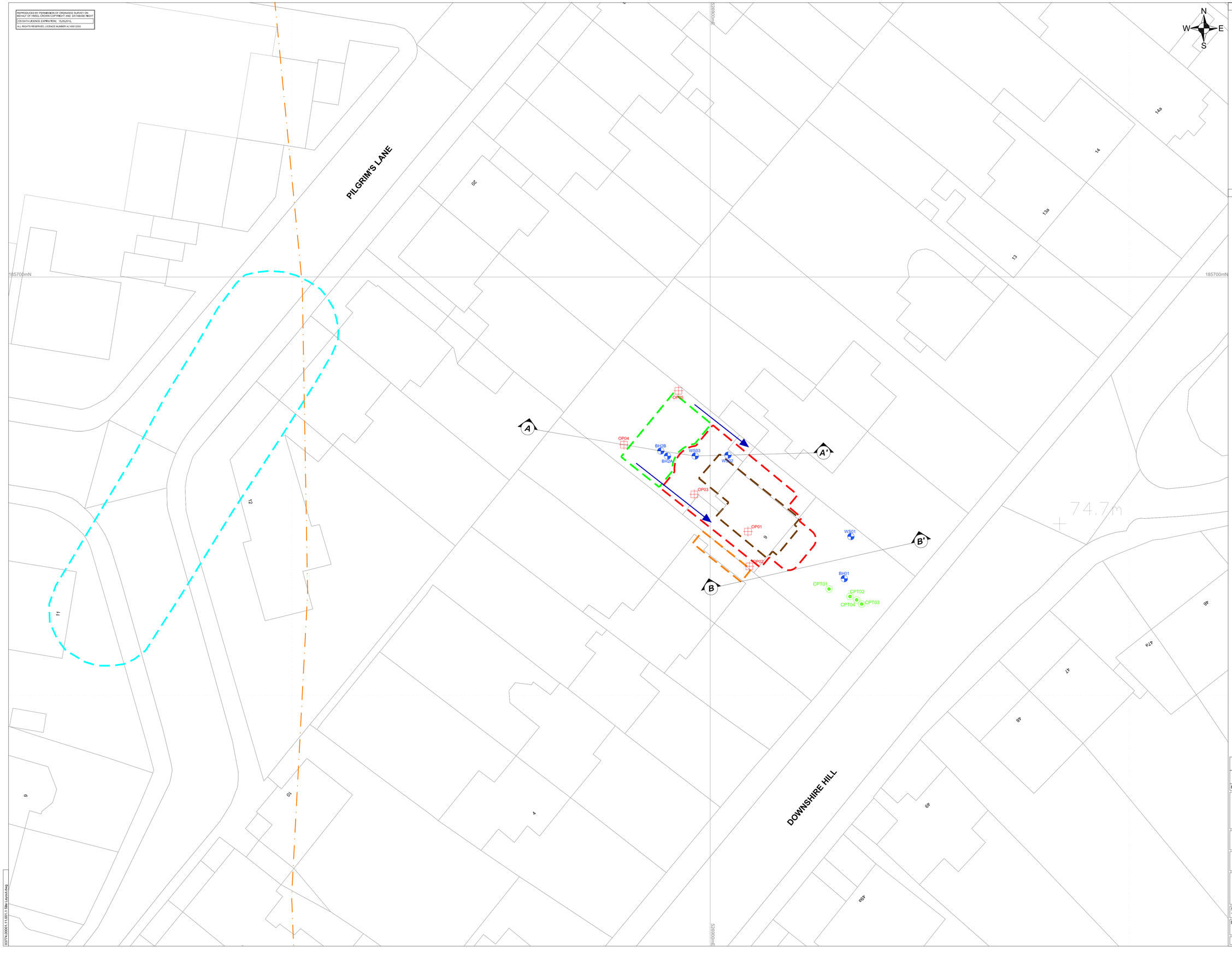
This report is for the exclusive use of Metropolitan Development Consultancy; no warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

Yours sincerely
SLR Consulting Limited

Phil Slater C Geol
Associate Hydrogeologist

cc Isaac Hudson, Michael Alexander Consulting Engineers (MACE)
Enc Drawing 1 – Site Layout
Drawing 2 – Hydrogeological Conceptual Model
Appendix A – Groundwater Hydrograph (Figure 5.18 from Geotechnical Report)
Appendix B – Logs for Boreholes/Trialpits (from Concept Site Investigation Reports)
Appendix C – Passive Relief System (prepared by MACE)
Drawing P1917-100 – Proposed Passive Relief Measures (prepared by MACE)



NOTES

1, DRAWING INFORMATION SUPPLIED BY METROPOLITAN DEVELOPMENT CONSULTANCY, REF: 7412 ADH 2126-24APR07-01_02 EX TOPOGRAPHIC SURVEY (SITE).DWG, & REF: 7412 11B_12B_13 PROPOSED SECTIONS & ELEVATIONS.DWG, & REF: 7412 ADH 2126-14OCT08_01 EX BASEMENT PLAN.DWG, DATE RECEIVED: 15.09.2011.

2, LOCATION OF EXISTING & PROPOSED LAYOUTS REFERRED TO IN NOTE 1 ORIENTATED TO BEST FIT ORDNANCE SURVEY COORDINATES.

3, BOREHOLE, OBSERVATION PIT & CONE PENETRATION TEST LOCATIONS TAKEN FROM INFORMATION SUPPLIED BY METROPOLITAN DEVELOPMENT CONSULTANCY, CONCEPT SITE INVESTIGATIONS DRAWING REF; 092238/01, DATE RECEIVED: 18.08.2011.

4, GEOLOGICAL BOUNDARY TAKEN FROM FIGURE 4 OF CAMDEN GEOLOGICAL, HYDROGEOLOGICAL & HYDROLOGICAL STUDY.

5, EXTENT OF POND TAKEN FROM 1879 ORDNANCE SURVEY MAP OBTAINED FROM LANDMARK INFORMATION GROUP LTD.

6, SEE DRAWING No. 002 FOR CROSS SECTIONS.

LEGEND

- OP01 — OBSERVATION PIT LOCATION & REFERENCE
- BH01 — GROUNDWATER MONITORING BOREHOLE LOCATION & REFERENCE
- CPT01 — CONE PENETRATION TEST LOCATION & REFERENCE
- BOUNDARY OF CURRENT LOWER GROUND FLOOR FOOTPRINT
- BOUNDARY OF No. 8 EXTENSION WITH DEEP BASEMENT
- BOUNDARY OF PROPOSED LOWER GROUND FLOOR FOOTPRINT
- BOUNDARY OF PROPOSED LOWER GROUND TERRACE
- GEOLOGICAL BOUNDARY - EASTERNMOST EXTENT OF CLAYGATE MEMBER
- EXTENT OF POND TAKEN FROM 1879 OS MAPPING
- CURRENT INFERRED GROUNDWATER FLOWS IN WEATHERED & MADE GROUND CLAY

Revision	By	Chk'd By	Date	Comments
1	KW	PS	12/11	REVISED SHEET SIZE & SCALE.
0	KW	PS	09/11	

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Project
HYDROLOGY

Drawing Title
SITE LAYOUT

Scale
1:200 @ A1

Date
SEPTEMBER 2011

Drawing Number
001

Revision
1

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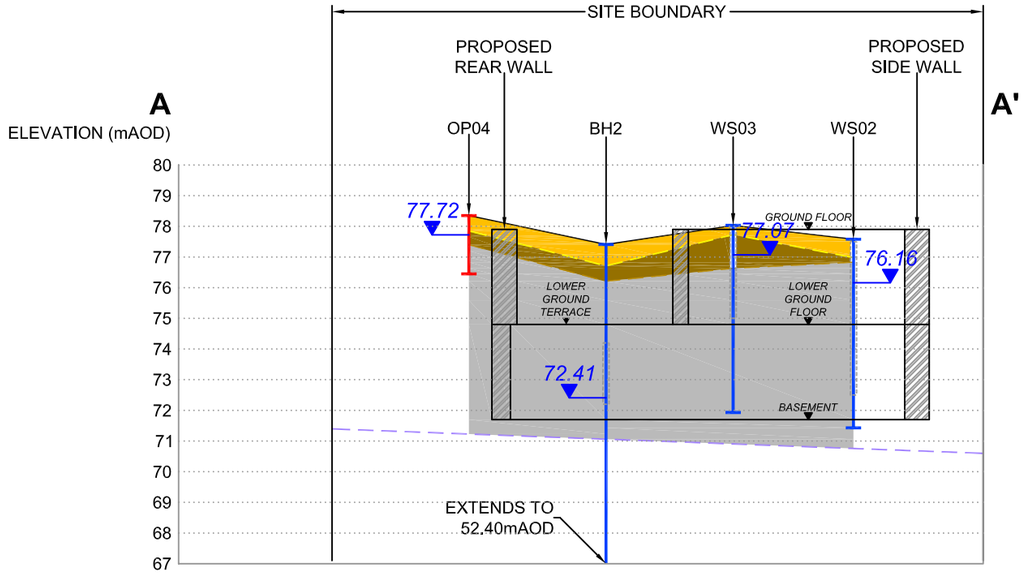
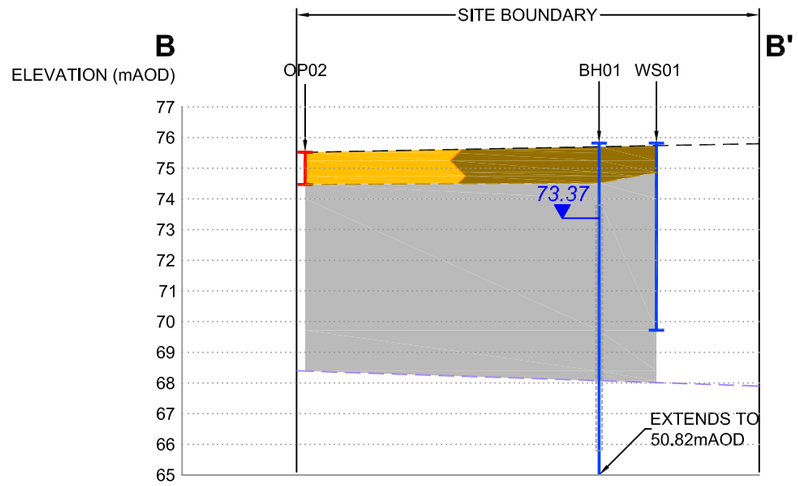


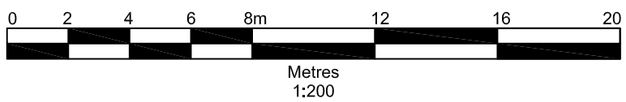
SECTION A-A'

HORIZONTAL SCALE	-	**1:200**
VERICAL SCALE	-	**1:200**



SECTION B-B'

HORIZONTAL SCALE	-	**1:200**
VERICAL SCALE	-	**1:200**



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3. BOREHOLE, OBSERVATION PIT & CONE PENETRATION TEST LOCATIONS TAKEN FROM INFORMATION SUPPLIED BY METROPOLITAN DEVELOPMENT CONSULTANCY, CONCEPT SITE INVESTIGATIONS DRAWING REF: 092238/01, DATE RECEIVED: 18.08.2011.

4. SEE DRAWING No. 001 FOR LOCATION OF CROSS SECTIONS.

LEGEND

- OP04 — OBSERVATION PIT LOCATION & REFERENCE
- OP04 — GROUNDWATER MONITORING BOREHOLE & REFERENCE
- 77.72 — MAXIMUM WATER LEVEL
- BOREHOLE SLOTTED CASING
- CURRENT GROUND ELEVATION (INDICATIVE IF DASHED)
- INFERRED BASE OF SAND / SILT MADE GROUND
- BASE OF CLAY MADE GROUND
- INFERRED BASE OF WEATHERED LONDON CLAY
- INFERRED EXTENT OF SAND / SILT MADE GROUND
- INFERRED EXTENT OF CLAY MADE GROUND
- INFERRED EXTENT OF WEATHERED LONDON CLAY
- INFERRED GEOLOGICAL BOUNDARY BETWEEN SAND & CLAY MADE GROUND

Revision	By	Chk'd By	Date	Comments
0	KW	PS	09/11	

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Project
HYDROLOGY

Drawing Title
HYDROGEOLOGICAL CONCEPTUAL MODEL

Scale
1:200 @ A3

Date
SEPTEMBER 2011

Drawing Number
002

Revision
0

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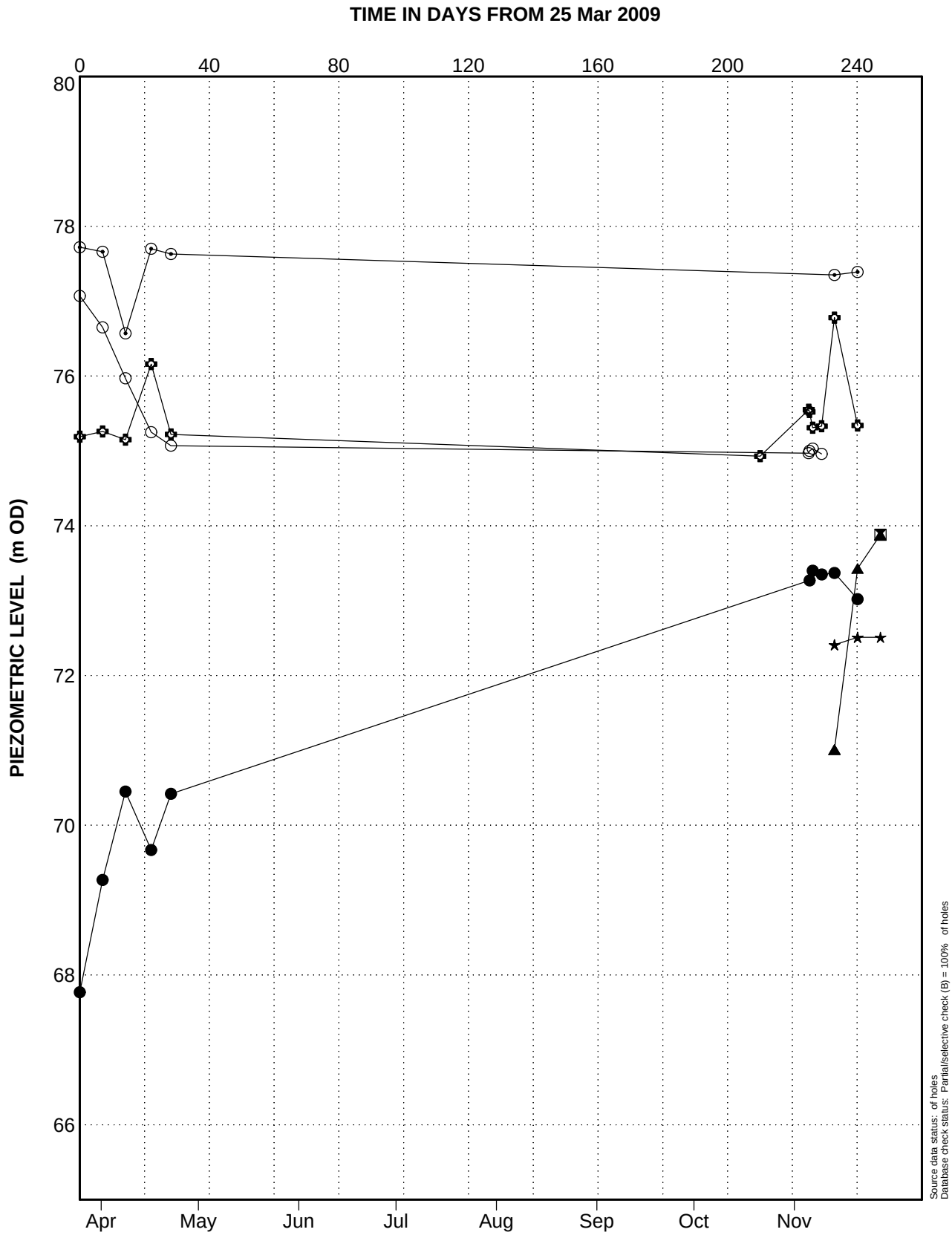

	Hole ID	Type	Date installed	Depth of tip and (response zone)	Tip Geol
●	BH01	SP	16-Mar-09	10 (2.0 to 10.0)	LC
⊠	BH02A	SP	06-Nov-09	5 (3.0 to 5.0)	WLC
▲	BH02A	SP	06-Nov-09	10 (7.0 to 10.0)	LC
★	BH02B	SP	07-Nov-09	5.2 (3.2 to 5.2)	WLC
⊙	OP04	SP	19-Mar-09	1.9 (0.2 to 1.9)	WLC
✿	WS02	SP	19-Mar-09	4.8 (0.2 to 4.9)	WLC
○	WS03	SP	19-Mar-09	3.1 (0.2 to 3.1)	WLC

9 Downshire Hill
PIEZOMETER READINGS - LEVEL

123323-02

FIGURE **5.18**

J:\120000\123323-00\50_DESIGN_ANALYSIS\52_INTERPRETATION\GINT\DRAWINGS\PHASE 2\WATERGDW.GDW

CONCEPT SITE INVESTIGATIONS

8 Warple Mews, Warple Way
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Borehole No

BH01

Project

9 Downshire Hill

Job No	Date Started	Ground Level (mOD)	Co-Ordinates	Final Depth
09/2188	13/03/09	75.82	E 526916.0 N 185663.9	25.00m
	Date Completed 16/03/09			

Client	Method/ Plant Used	Sheet
Ringline Properties Limited	Cable Percussion	1 of 3

PROGRESS			STRATA				SAMPLES & TESTS				
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result	Field Records	Instrument/ Backfill
13/03/09		Dry			(0.60)	Dark brown sandy CLAY with brick fragments and a toothpaste tube. (MADE GROUND)	0.20			... Occasional roots of live appearance encountered between ground level and 0.60m depth	
			75.22		0.60		0.50	B01			
					(0.45)	... with occasional pockets of brown mottle bluish grey clay, with brick and charcoal fragments at 0.50m	0.99			... Roots of live appearance (<5mm) encountered between 1.05m and 1.30m depth	
			74.77		1.05		1.00	T02			
13/03/09	1.20	Dry				Brown slightly gravelly slighty sandy CLAY with brick fragments and a clay smoking pipe stem. Gravel is subrounded to rounded fine to medium flint. (MADE GROUND)	1.00	T03			
			74.52		1.30		1.00	J04			
							1.00	V05			
							1.00	B06			
						Dark brown sandy CLAY with frequent brick fragments. (MADE GROUND)	1.20-1.70	B07			
							1.20	D08			
							1.20		N8	1, 2 / 1, 1, 2, 4	
						... with a siltstone nodule (120mm) at 1.10m	1.70-2.15	U09	32 blows		
						Firm, brown occasionally mottled grey slightly sandy CLAY with extremely to very closely spaced partings of orangish brown silty sand.	2.00	T10			
							2.00	T11			
13/03/09	2.70	Dry					2.00	J12			
							2.00	V13			
							2.20	D14			
						... becoming brown occasionally mottled bluish grey with black flecks below 2.20m	2.20-2.65	D15			
							2.20		N10	1, 1 / 2, 2, 3, 3	
						... with light grey sand at 2.70m	2.70-3.15	U16	28 blows		
							3.20	D17			
							3.20-3.65	D18			
							3.20		N9	1, 2 / 2, 2, 2, 3	
						... becoming very closely fissured at 3.70m	3.50	T19			
							3.50	T20			
							3.50	J21			
							3.50	V22			
						... with occasional selenite crystals below 4.20m	3.70-4.15	U23	28 blows		
					(6.40)		4.20	D24			
							4.20-4.65	D25			
						... becoming brown extremely to very closed fissured below 4.70m	4.20		N12	1, 2 / 2, 3, 3, 4	
							4.70-5.15	U26	34 blows		
						... with pyrite nodules (25mm) at 5.00m	5.00	T27			
							5.00	T28			
							5.00	J29			
							5.00	V30			
							5.20	D31			
							5.20-5.65	D32			
							5.20		N15	2, 2 / 3, 3, 4, 5	
							5.70-6.15	U33	40 blows		
							6.20	D34			
							6.20-6.65	D35			
							6.20		N17	2, 2 / 3, 4, 4, 6	
							6.70-7.15	U36	42 blows		
							7.00	T37			
						... becoming brownish grey below 6.90m	7.00	T38			
							7.00	J39			
						... becoming stiff with rare pockets of yellowish brown silt at 7.20m	7.00	V40			
							7.20	D41			
			68.12		7.70		7.20-7.65	D42			
						Stiff, grey CLAY with rare pyrite nodules.	7.20		N19	2, 2 / 4, 4, 5, 6	
							7.70-8.15	U43	50 blows		
							8.20	D44			
							8.20-8.65	D45			
						... becoming slightly sandy with rare pockets of dark grey fine sand and rare shell fragments at 8.20m	8.20-8.70	B46			
							8.20		N22	2, 4 / 4, 5, 6, 7	
							8.70-9.15	U47	54 blows		

Chiselling (m)			Water Added (m)	
From	To	Hours	From	To

GENERAL REMARKS

1. An inspection pit was hand excavated to 1.20m below ground level prior to boring commencing.
2. 150mm casing used from ground level to 2.70m below ground level.
3. 50mm monitoring well installed at 10.00m depth, slotted between 2.00m and 10.00m.
4. Borehole was backfilled with cement/bentonite grout between 25.00m and 11.00m, bentonite pellets between 11.00m and 10.00m, pea shingle between 10.00 and 2.00m and bentonite pellets between 2.00m and 0.50m. Concrete with locable raised cover installed from 0.50m to ground level.

Issue No.	Driller	
03	SW	

CONCEPT SITE INVESTIGATIONS

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Borehole No

BH01

Project

9 Downshire Hill

Job No	Date Started	Ground Level (mOD)	Co-Ordinates	Final Depth
09/2188	13/03/09	75.82	E 526916.0 N 185663.9	25.00m
	Date Completed 16/03/09			

Client	Method/ Plant Used	Sheet
Ringline Properties Limited	Cable Percussion	2 of 3

PROGRESS			STRATA				SAMPLES & TESTS				
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result	Field Records	Instrument/ Backfill
							9.20	D48			
							9.20-9.65	D49			
							9.20		N23	3, 4 / 5, 5, 6, 7	
							9.70-10.15	U50	58 blows		
							10.20	D51			
							10.20-10.65	D52			
						... becoming slightly sandy with rare pyrite nodules at 10.20m	10.20		N25	3, 4 / 5, 6, 7, 7	
13/03/09	2.70	Dry					10.70	D53			
16/03/09	2.70	Dry					11.20-11.65	U54	48 blows		
							11.70	D55			
							11.70-12.15	D56			
						... with occasional pockets of dark grey fine sand at 11.70m	11.70		N26	2, 4 / 5, 6, 7, 8	
							12.20	D57			
							12.70-13.15	U58	60 blows		
							13.20	D59			
							13.20-13.65	D60			
						... becoming extremely closely fissured, slightly sandy with rare bioturbation below 13.20m	13.20		N29	3, 4 / 6, 7, 8, 8	
							13.70	D61			
							14.20-14.65	U62	70 blows		
							14.70	D63			
							14.70-15.15	D64			
							14.70		N29	3, 5 / 6, 7, 8, 8	
							15.20	D65			
							15.70-16.15	U66	74 blows		
							16.20	D67			
							16.20-16.65	D68			
					(17.30)		16.20		N31	3, 5 / 6, 8, 8, 9	
							16.70	D69			
							17.20-17.65	U70	74 blows		
							17.70	D71			
							17.70-18.15	D72			
						... becoming very stiff with rare pyritised wood fragments at 17.70m	17.70		N32	4, 5 / 6, 8, 9, 9	

Chiselling (m)			Water Added (m)	
From	To	Hours	From	To

GENERAL REMARKS

Issue No.	Driller	
03	SW	

CONCEPT SITE INVESTIGATIONS

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Borehole No

BH01

Project

9 Downshire Hill

Job No	Date Started	Ground Level (mOD)	Co-Ordinates	Final Depth
09/2188	**Date Started** 13/03/09 **Date Completed** 16/03/09	75.82	E 526916.0 N 185663.9	25.00m

Client	Method/ Plant Used	Sheet
Ringline Properties Limited	**Cable Percussion**	3 of 3

PROGRESS			STRATA				SAMPLES & TESTS				
Date	Casing	Water	Level (mOD)	Legend	Depth *(Thickness)*	Strata Description	Depth (m)	Type No	Test Result	Field Records	Instrument/ Backfill
							18.20	D73			
							18.70-19.15	U74	90 blows		
							19.20	D75			
							19.20-19.65	D76			
						... with rare pockets of light brown and dark grey fine sand at 19.20m	19.20		N36	4, 5 / 8, 9, 9, 10	
							19.70	D77			
							20.20-20.65	U78	100 blows		
						... with rare pyrite nodules at 20.20m					
							20.70	D79			
							20.70-21.15	D80			
							20.70		N36	5, 8 / 8, 9, 9, 10	
							21.20	D81			
							21.70-22.05	U82	100 blows		
							22.10	D83			
							22.10-22.55	D84			
							22.10		N39	5, 7 / 9, 9, 10, 11	
							22.70	D85			
							23.20-23.60	U86	100 blows		
							23.65	D87			
							23.65-24.10	D88			
						... with occasional pockets of dark grey fine sand at 23.65m	23.65		N43	6, 7 / 9, 10, 12, 12	
							24.20	D89			
							24.50-24.95	U90	100 blows		
16/03/09	2.70	Dry	50.82		25.00		25.00	D91			
						End of Borehole					

Chiselling (m)			Water Added (m)	
From	To	Hours	From	To

GENERAL REMARKS

Issue No.	Driller	
03	SW	

CONCEPT SITE INVESTIGATIONS

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Borehole No

BH02A

Project

9 Downshire Hill, London NW3 1NR

Job No	Date Started	Ground Level (mOD)	Co-Ordinates	Final Depth
09/2238	05/11/09	77.41	E 526894.9 N 185678.6	25.00m
	Date Completed 06/11/09			

Client	Method/ Plant Used	Sheet
Ringline Properties Limited	Cable Percussion	1 of 4

PROGRESS			STRATA				SAMPLES & TESTS				
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result	Field Records	Instrument/ Backfill
05/11/09		Dry			(0.70)	Dark brown gravelly silty SAND with frequent brick and tile fragments. Gravel is subangular to well rounded fine to medium flint. (MADE GROUND)	0.20	T01			
							0.20	T02			
							0.20	J03			
							0.20	V04			
			76.71		0.70		0.20			... Roots and rootlets of life appearance encountered to 2.70m below ground level	
						Stiff, brown slightly mottled orange CLAY with occasional brick fragments. (MADE GROUND)	0.50	B05			
							0.60	T06			
			76.41		1.00		0.60	T07			
05/11/09		Dry	76.21		1.20	Stiff, brown slightly mottled yellow very gravelly CLAY and reddish brown SAND with occasional carbonaceous nodules (5mm). Gravel is well rounded medium flint and brick fragments. (MADE GROUND)	0.60	J08			
							0.60	V09			
							1.00	B10			
			75.91		1.50		1.00	T11			
							1.00	T12			
							1.00	J13			
							1.00	V14			
						Stiff, brown mottled orange slightly mottled greenish grey CLAY. (LONDON CLAY)	1.20-1.50	B15			
							1.50-1.95	B16	48 blows		
							2.00	D17			
						Firm to stiff, extremely closely fissured brown CLAY with rare lenses and pockets of orangish brown fine silty sand (up to 20 x 30mm), occasional selenite crystals and bluish grey staining along the fissures. (LONDON CLAY)	2.00-2.45	B18	46 blows		
05/11/09	2.50	Dry					2.50	D19			
							2.50-2.70	U20			
							2.70-2.95	U21	48 blows		
							3.00	D22			
							3.00-3.45	B23	52 blows		
						... with polished striated surfaces (38º-42º) at 1.50m	3.30				
						... with rare laminations of orangish brown silty sand between 1.50m and 1.95m	3.50	D24		... Semi-decayed root fragments encountered at 3.30m	
							3.50-3.95	B25	52 blows		
						... with black flecks and pockets of carbonaceous material 2 x 2mm) below 2.50m					
					(4.85)		4.00	D26			
						... becoming slightly sandy below 3.00m	4.00-4.20	U27	54 blows		
						... with pockets of yellow partially cemented silt (10 x 15mm) between 4.00m and 4.70m	4.20-4.45	U28			
							4.50	D29			
							4.50-4.95	B30	60 blows		
							5.00	D31			
							5.00-5.45	D32			
							5.00		N16	2, 3 / 3, 4, 4, 5	
							5.50-5.95	B33	62 blows		
						... becoming sandy at 5.80m	6.00	D34			
							6.00-6.45	D35			
							6.00		N15	2, 3 / 3, 3, 4, 5	
			71.06		6.35						
						Stiff, extremely closely to very closely fissured brownish grey and grey generally micaceous CLAY with occasional pockets of dark grey fine sand (20 x 40mm) and rare bioturbation. (LONDON CLAY)	6.50-6.70	U36	38 blows		
							6.70-6.95	B37			
							7.00-7.50	B38			
							7.00	D39			
						... becoming grey below 6.50m	7.00-7.45	D40			
							7.00		N19	2, 3 / 3, 5, 5, 6	
							7.50-7.70	U41	40 blows		
						... with selenite crystals and rare decayed organic matter at 7.50m	7.70-7.95	U42			
							8.00	D43			

Chiselling (m)			Water Added (m)	
From	To	Hours	From	To

GENERAL REMARKS

1. An inspection pit was hand excavated to 1.20m below ground level, prior to boring commencing.
2. Ø150mm casing used from ground level to 2.50m below ground level.
3. 2No Ø50mm monitoring wells installed at 5.00m and 10.00m below ground level, slotted between 3.00m and 5.00m and between 7.00m and 10.0mm respectively.
4. Borehole backfilled with cement/bentonite grout from 25.00m to 11.00m , with bentonite pellets from 11.00m to 10.00m, with pea shingle between 10.00m to 7.00m, with bentonite pellets from 7.00m to 5.00m, with pea shingle between 5.00m and 3.00m and with bentonite pellets from 3.00m to 0.50m depth. Concrete with double gas valve and lockable stopcock cover installed from 0.50m to ground level.

Issue No.	Driller	
02	SW	

CONCEPT SITE INVESTIGATIONS

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Borehole No

BH02A

Project

9 Downshire Hill, London NW3 1NR

Job No	Date Started	Ground Level (mOD)	Co-Ordinates	Final Depth
09/2238	05/11/09	77.41	E 526894.9 N 185678.6	25.00m
	Date Completed 06/11/09			

Client	Method/ Plant Used	Sheet
Ringline Properties Limited	Cable Percussion	2 of 4

PROGRESS			STRATA				SAMPLES & TESTS				
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result	Field Records	Instrument/ Backfill
							8.00-8.45	D44			
							8.00		N20	2, 3 / 4, 5, 5, 6	
							8.60-8.90	U45	48 blows		
							9.00	D46			
							9.00-9.45	D47			
							9.00		N23	2, 3 / 5, 5, 6, 7	
							9.70-9.95	U48	60 blows		
						... becoming slightly sandy at 9.70m	10.00	D49			
							10.00-10.45	D50			
							10.00		N26	3, 3 / 5, 6, 7, 8	
							10.50	D51			
							11.00-11.25	U52	62 blows		
							11.25-11.45	B53			
							11.50	D54			
							11.50-11.95	D55			
							11.50		N23	2, 4 / 4, 6, 6, 7	
							12.00	D56			
							12.50-12.70	U57	60 blows		
						... becoming very closely fissured with rare shell fragments and rare fossilised wood fragments at 12.50m	12.70-12.88	U58			
							13.00	D59			
							13.00-13.45	D60			
							13.00		N25	3, 4 / 5, 5, 7, 8	
							13.50	D61			
							14.00-14.45	U62	68 blows		
							14.50	D63			
							14.50-14.95	D64			
							14.50		N27	3, 4 / 5, 6, 8, 8	
05/11/09	2.50	Dry					15.00	D65			
06/11/09	2.50	Dry									
					(18.65)		15.70-15.95	U66	66 blows		
						... becoming stiff to very stiff at 15.70m	16.00	D67			

Chiselling (m)			Water Added (m)	
From	To	Hours	From	To

GENERAL REMARKS

Issue No.	Driller	
02	SW	

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Borehole No

BH02A

Project

9 Downshire Hill, London NW3 1NR

Job No	Date Started	Ground Level (mOD)	Co-Ordinates	Final Depth
09/2238	05/11/09	77.41	E 526894.9 N 185678.6	25.00m
	Date Completed 06/11/09			

Client	Method/ Plant Used	Sheet
Ringline Properties Limited	Cable Percussion	3 of 4

PROGRESS			STRATA				SAMPLES & TESTS				
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result	Field Records	Instrument/ Backfill
							16.00-16.45	D68			
							16.00		N28	3, 4 / 6, 7, 7, 8	
							16.50	D69			
							17.00-17.45	B70	74 blows		
							17.50	D71			
							17.50-17.95	D72			
						... becoming very stiff below 17.50m	17.50		N30	3, 5 / 6, 7, 8, 9	
							18.00	D73			
							18.50-18.70	U74	90 blows		
						... becoming very stiff with occasional pockets ofo dark grey fine sand at 18.50m	18.70-18.95	B75			
						... with occasional pockets of light brown fine sand (20 x 10mm) at 18.50m	19.00	D76			
							19.00-19.45	D77			
							19.00		N34	4, 5 / 7, 8, 9, 10	
							19.50	D78			
							20.00-20.25	U79	92 blows		
							20.25-20.45	B80			
							20.50	D81			
							20.50-20.95	D82			
							20.50		N37	4, 5 / 7, 8, 10, 12	
							21.00	D83			
							21.50-21.85	U84	100 blows		
							22.00	D85			
							22.00-22.45	D86			
							22.00		N37	4, 7 / 8, 8, 10, 11	
							22.50	D87			
							23.00-23.40	U88	100 blows		
							23.45	D89			
							23.45-23.95	D90			
							23.45		N39	5, 7 / 8, 8, 11, 12	
							24.00	D91			

Chiselling (m)			Water Added (m)	
From	To	Hours	From	To

GENERAL REMARKS

Issue No.	Driller	
02	SW	

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Borehole No

BH02A

Project

9 Downshire Hill, London NW3 1NR

Job No	Date Started	Ground Level (mOD)	Co-Ordinates	Final Depth
09/2238	**Date Completed** 05/11/09 06/11/09	77.41	E 526894.9 N 185678.6	25.00m

Client	Method/ Plant Used	Sheet
Ringline Properties Limited	**Cable Percussion**	4 of 4

PROGRESS			STRATA				SAMPLES & TESTS			Field Records	Instrument/ Backfill
Date	Casing	Water	Level (mOD)	Legend	Depth *(Thickness)*	Strata Description	Depth (m)	Type No	Test Result		
							24.50-24.75	U92	100 blows		
							24.75-24.95	B93			
06/11/09	2.50	Dry	52.41		25.00		25.00	D94			
						End of Borehole					

Chiselling (m)			Water Added (m)	
From	To	Hours	From	To

GENERAL REMARKS

Issue No.	Driller	
02	SW	

CONCEPT SITE INVESTIGATIONS

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Borehole No

BH02B

Project

9 Downshire Hill, London NW3 1NR

Job No	Date Started	Ground Level (mOD)	Co-Ordinates	Final Depth
09/2238	Date Completed 07/11/09	77.41	E 526894.9 N 185678.6	5.20m

Client	Method/ Plant Used	Sheet
Ringline Properties Limited	Cable Percussion	1 of 1

PROGRESS			STRATA				SAMPLES & TESTS				
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result	Field Records	Instrument/ Backfill
06/11/09		Dry			(0.50)	Dark brown gravelly silty SAND with frequent brick and tile fragments. Gravel is subangular to well rounded fine to medium flint.					
			76.91		0.50	Stiff, brown slightly mottled orange CLAY with occasional brick fragments.					
			76.71		0.70	Stiff, brown slightly mottled yellow very gravelly CLAY and reddish brown SAND with occasional carbonaceous nodules (5mm). Gravel is well rounded medium flint and brick fragments.					
					(0.50)						
06/11/09		Dry	76.21		1.20	Firm to stiff, extremely closely fissured brown CLAY with rare pockets of orangish brown and yellowish brown fine silty sand (up to 20 x 30mm), occasional selenite crystals and bluish grey staining along the fissures. (LONDON CLAY)	1.30-1.65	U01	24 blows		
						... with polished striated surfaces (40º - 45º) at 1.25m	1.70	D02			
						... with occasional selenite crystals at 1.30m	1.70-2.15	B03	28 blows		
						... with a band of dark brown and brown sandy clay with frequent organic material comprising (leaves, roots and plant remains) and rare angular flint gravel (possible animal burrow) between 1.70m and 1.75m	2.15				
06/11/09	2.20	Dry					2.20	D04		... Roots and rootlets of life appearance encountered to 2.15m below ground level	
07/11/09	2.20	Dry					2.20-2.65	B05	32 blows		
							2.70	D06			
							2.70-3.15	U07	30 blows		
							3.20	D08			
					(4.00)	... becoming mottled bluish grey below 1.95m	3.20-3.40	U09	32 blows		
							3.40-3.65	U10			
						... becoming stiff with occasional pockets of orangish red fine sand below 3.40m	3.70	D11			
							3.70-4.15	U12	36 blows		
							4.20	D13			
							4.20-4.65	U14	40 blows		
							4.70	D15			
							4.70-4.90	U16	46 blows		
							4.90-5.15	U17			
07/11/09	2.20	Dry	72.21		5.20	End of Borehole	5.20	D18			

Chiselling (m)			Water Added (m)	
From	To	Hours	From	To

GENERAL REMARKS

1. An inspection pit was hand excavated to 1.20m below ground level, prior to boring commencing.
2. Ø150mm casing used from ground level to 2.20m below ground level.
3. Ø50mm monitoring well installed at 5.20m slotted between 3.20m and 5.20m below ground level.
4. Borehole backfilled with pea single between 5.20m and 3.20m and with bentonite pellets from 3.20m and 0.50m. Concrete with lockable stopcock cover installed from 0.50m to ground level.

Issue No.	Driller	
02	SW	

CONCEPT SITE INVESTIGATIONS

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Borehole No

WS01

Project

9 Downshire Hill

Job No	Date Started	Ground Level (mOD)	Co-Ordinates	Final Depth
09/2188	17/03/09	75.82	E 526916.8 N 185669.0	6.10m
	Date Completed 17/03/09			

Client	Method/ Plant Used	Sheet
Ringline Properties Limited	Window Sampler	1 of 1

PROGRESS			STRATA				SAMPLES & TESTS				
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result	Field Records	Instrument/ Backfill
17/03/09		Dry			(0.50)	Dark brown sandy CLAY with occasional pockets of orange silt and occasional brick and concrete fragments. (MADE GROUND)	0.10 0.20	D01		... Roots encountered to 2.70m depth	
			75.32		0.50						
					(0.45)	Brown slightly sandy slightly gravelly CLAY with occasional brick and charcoal fragments. Gravel is subangular to subrounded fine to medium. (MADE GROUND)	0.60	D02			
			74.87		0.95		1.00	D03			
						Brown mottled light grey sandy CLAY.	1.00		PP63kPa		
						... becoming slightly sandy with occasional selenite crystals below 1.50m	1.50 1.50 1.50	D04 R05	PP88kPa		
							1.90 2.00 2.00	R06 D07	PP150kPa		
							2.50 2.50	D08	PP150kPa		
							3.00 3.00	D09	PP88kPa		
					(5.15)	... becoming brown occasionally mottled bluish grey with occasional pockets of orangish brown sand below 3.50m	3.50 3.50	D10	PP113kPa		
						... with occasional cemented silt and siltstone fragments below 3.60m	4.00 4.00	D11	PP138kPa		
							4.50 4.50	D12	PP125kPa		
							5.00 5.00	D13	PP138kPa		
						... with rare black flecks at 5.30m	5.30-5.60 5.30	D14	PP138kPa		
							5.80-6.10 5.80	D15	PP150kPa		
17/03/09		Dry	69.72		6.10	End of Borehole					

Chiselling (m)			Water Added (m)	
From	To	Hours	From	To

GENERAL REMARKS

1. An inspection pit was hand excavated to 1.20m below ground level prior to boring commencing.
2. Borehole backfilled with bentonite pellets upon completion.

Issue No.	Driller	
03	GJ	

CONCEPT SITE INVESTIGATIONS

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Borehole No

WS02

Project

9 Downshire Hill

Job No	Date Started	Ground Level (mOD)	Co-Ordinates	Final Depth
09/2188	17/03/09	77.58	E 526902.1 N 185678.7	6.15m
	Date Completed 17/03/09			

Client	Method/ Plant Used	Sheet
Ringline Properties Limited	Window Sampler	1 of 1

PROGRESS			STRATA				SAMPLES & TESTS				
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result	Field Records	Instrument/ Backfill
17/03/09		Dry	77.43		0.15	Paving slabs. (MADE GROUND)	0.10			... Roots encountered to 3.30m depth	
					(0.45)	Dark brown to reddish brown clayey sandy slightly gravelly SILT with frequent brick and concrete fragments. Gravel is subangular to well rounded medium flint gravel (MADE GROUND)	0.50	D01			
			76.98		0.60		0.65	D02			
			76.83		0.75	Brown mottled grey sandy CLAY with occasional brick fragments. (MADE GROUND)	1.00	D03			
							1.00		PP125kPa		
						Brown sandy CLAY with occasionally cemented silt.	1.50	D04			
							1.50	R05			
							1.50		PP150kPa		
							2.00	D06			
						... with pockets of orangish brown sand and occasional selenite crystals below 2.00m	2.00		PP150kPa		
							2.50	D07			
							2.50	R08			
						... with frequent pockets of orangish brown silty sand with occasional extremely closely partings of greenish grey sand below 2.50m	2.50		PP113kPa		
							3.00	D09			
							3.00		PP88kPa		
					(5.40)		3.50	D10			
						... with pockets of yellowish brown silt at 3.50m	3.50		PP125kPa		
							4.00	D11			
						... becoming brown mottled bluish grey slightly sandy with pockets of orangish brown sand at 4.00m	4.00		PP150kPa		
							4.50	D12			
							4.50		PP113kPa		
							5.00	D13			
							5.00		PP150kPa		
							5.30-5.60	D14			
							5.30		PP150kPa		
							5.80-6.15	D15			
							5.80		PP125kPa		
17/03/09		Dry	71.43		6.15						
						End of Borehole					

Chiselling (m)			Water Added (m)	
From	To	Hours	From	To

GENERAL REMARKS

1. An inspection pit was hand excavated to 1.20m below ground level prior to boring commencing.
2. 19mm monitoring well installed at 4.85m below ground level, slotted between 0.20m and 4.85m depth.
3. Borehole backfilled bentonite pellets between 6.15m and 4.85m, with pea shingle between 4.85m and 0.20m depth. Concrete with locable raised cover installed from 0.20m to ground level.

Issue No.	Driller	
03	GJ	

CONCEPT SITE INVESTIGATIONS

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Borehole No

WS03

Project

9 Downshire Hill

Job No	Date Started	Ground Level (mOD)	Co-Ordinates	Final Depth
09/2188	17/03/09	78.03	E 526898.2 N 185678.6	6.10m
	Date Completed 17/03/09			

Client	Method/ Plant Used	Sheet
Ringline Properties Limited	Window Sampler	1 of 1

PROGRESS			STRATA				SAMPLES & TESTS				
Date	Casing	Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth (m)	Type No	Test Result	Field Records	Instrument/ Backfill
17/03/09		Dry			(0.30)	Dark brown sandy clayey SILT with ash and frequent brick fragments. (MADE GROUND)	0.10			... Roots encountered to 3.20m depth	
			77.73		0.30						
					(0.65)	Brown slighty sandy slightly gravelly silty CLAY with occasional brick and charcoal fragments. Gravel is subangular to subrounded fine to medium. (MADE GROUND)	0.50	D01			
			77.08		0.95		1.00	D02			
					(0.45)	Brown mottled grey sandy CLAY with ash and occasional brick fragments. (MADE GROUND)	1.00		PP75kPa		
			76.63		1.40		1.50	D03			
						Brown mottled bluish grey sandy CLAY with occasional partings of orangish brown sand and cemented silt.	1.50	R04			
							1.50		PP88kPa		
							2.00	D05			
						... with occasional selenite crystals below 2.00m	2.00		PP63kPa		
							2.50	D06			
							2.50	R07			
							2.50		PP175kPa		
							3.00	D08			
						... becoming slightly sandy with frequent pockets of orangish brown sand below 3.00m	3.00		PP125kPa		
							3.50	D09			
					(4.70)		3.50		PP113kPa		
							4.00	D10			
							4.00		PP150kPa		
							4.50	D11			
						... with occasional pockets of yellow silt at 4.50m	4.50		PP175kPa		
							5.00	D12			
							5.00		PP188kPa		
							5.30-5.60	D13			
						... becoming brown below 5.30m	5.30		PP150kPa		
							5.80-6.10	D14			
							5.80		PP200kPa		
17/03/09		6.00	71.93		6.10						
						End of Borehole					

Chiselling (m)			Water Added (m)	
From	To	Hours	From	To

GENERAL REMARKS

1. An inspection pit was hand excavated to 1.20m below ground level prior to boring commencing.
2. Standing water level at 6.00m below ground level upon completion.
3. 19mm monitoring well installed at 3.10m below ground level, slotted between 0.20m and 3.10m depth.
3. Borehole backfilled bentonite pellets between 6.10m and 3.10m, with pea shingle between 3.10m and 0.20m depth. Concrete with locable raised cover installed from 0.20m to ground level.

Issue No.	Driller	
03	GJ	

CONCEPT SITE INVESTIGATIONS

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Trial Pit No

OP01

Project

9 Downshire Hill

Job No	Date Started	Ground Level (mOD)	Co-Ordinates	Final Depth
09/2188	**Date Started** 19/03/09 **Date Completed** 19/03/09	75.12	E 526904.5 N 185669.6	0.40m

Client	Method/ Plant Used	Sheet
Ringline Properties Limited	**Hand excavated**	1 of 1

Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth	Type No	Test Result	Field Records
	75.04		(0.08) 0.08	Concrete slab.				
			(0.32)	Brown mottled light grey CLAY with occasional partings of orange silty sand and rare medium angular to rounded flint gravel and occasional brick fragments. (MADE GROUND)	0.30	B1		
	74.72		0.40	End of Trial Pit				

GENERAL REMARKS

1. Weather was sunny.
2. Trial pit was stable and dry.
3. Trial pit dimensions: 0.52m x 0.40m x 0.40m.
4. Trial pit was backfilled with soil arisings.

Issue No.	Logged By	
03	JF	

CONCEPT SITE INVESTIGATIONS

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Trial Pit No

OP02

Project

9 Downshire Hill

Job No	Date Started	Ground Level (mOD)	Co-Ordinates	Final Depth
09/2188	19/03/09	75.52	E 526904.7 N 185665.4	1.05m
	Date Completed 19/03/09			

Client	Method/ Plant Used	Sheet
Ringline Properties Limited	Hand excavated	1 of 1

Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth	Type No	Test Result	Field Records
			(0.17)	Concrete slab.				
	75.35		0.17					
			(0.43)	Dark brown clayey silty SAND with ash, brick and concrete fragments. (MADE GROUND)				
				... becoming slighty gravelly very clayey SAND with frequent clods of brown clay at 0.50m. Gravel is subangular to rounded fine to coarse.	0.50	B1		
	74.92		0.60					
			(0.40)	Brown clayey SAND with frequent angular to well rounded flint gravel, brick and concrete fragments. (MADE GROUND)				... Roots of live appearance encountered between 0.60m and 1.05m depth
	74.52		1.00		1.00	B2		
	74.47		1.05	Brown mottled orangish brown CLAY with rare subangular to well rounded flint gravel.				
				End of Trial Pit				

GENERAL REMARKS

1. Weather was sunny.
2. Trial pit was stable and dry.
3. Trial pit dimensions: 0.46m x 0.40m x 1.05m.
4. Trial pit was backfilled with soil arisings.

Issue No.	Logged By	
03	JF	

CONCEPT SITE INVESTIGATIONS

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Trial Pit No

OP03

Project

9 Downshire Hill

Job No	Date Started	Ground Level (mOD)	Co-Ordinates	Final Depth
09/2188	19/03/09	77.80	E 526898.1 N 185674.0	0.52m
	Date Completed 19/03/09			

Client	Method/ Plant Used	Sheet
Ringline Properties Limited	Hand excavated	1 of 1

Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth	Type No	Test Result	Field Records
				STRATA	**SAMPLES & TESTS**			
			(0.52)	Dark grey silty SAND with rare clods of brown clay frequent brick and concrete fragments and ash. (MADE GROUND)				... Roots of live appearance encountered between ground level and 0.52m depth
				... becoming very gravelly with clods of brown clay with frequent brick and concrete fragments and occasional tile fragments at 0.30m	0.30	B1		
	77.28		0.52	End of Trial Pit				

GENERAL REMARKS

1. Weather was sunny.
2. Trial pit was stable and dry.
3. Trial pit dimensions: 0.26m x 0.30m x 0.52m.
4. Trial pit was backfilled with soil arisings.

Issue No.	Logged By
03	JF

CONCEPT SITE INVESTIGATIONS

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Trial Pit No

OP04

Project

9 Downshire Hill

Job No	Date Started	Ground Level (mOD)	Co-Ordinates	Final Depth
09/2188	19/03/09	78.35	E 526889.7 N 185680.0	1.90m
	Date Completed 19/03/09			

Client	Method/ Plant Used	Sheet
Ringline Properties Limited	Hand excavated/ Augered	1 of 2

Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth	Type No	Test Result	Field Records
				STRATA	**SAMPLES & TESTS**			
			(0.50)	Dark brown SAND with ash, gravel and brick fragments. (MADE GROUND)				... Roots of live appearance encountered between 0m and 0.95m depth
	77.85		0.50		0.50	B1		
			(0.45)	Brown mottled orange CLAY with rare medium flint gravel, frequent brick fragments and ash. (MADE GROUND)				
	77.40		0.95					...Rootlets encountered between 0.95m and 1.75m depth
				Brown mottled orangish brown CLAY with rare rounded medium flint gravel.	1.00	B2		

GENERAL REMARKS

1. Weather was sunny.
2. Trial pit was stable and dry.
3. Hand excavated to 1.02m prior to hand auger excavation to 1.90m.
4. 19mm standpipe installed to 1.90m depth, slotted between 0.20m and 1.90m.
5. Trial pit was backfield with pea shingle between 1.90m and 0.20m and bentonite pellets between 0.20m to the ground level.
5. Trial pit dimensions: 0.52m x 0.40m x 1.90m.

Issue No.	Logged By
03	JF

CONCEPT SITE INVESTIGATIONS

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Trial Pit No

OP04

Project

9 Downshire Hill

Job No	Date Started	Ground Level (mOD)	Co-Ordinates	Final Depth
09/2188	**Date Started** 19/03/09 **Date Completed** 19/03/09	78.35	E 526889.7 N 185680.0	1.90m

Client	Method/ Plant Used	Sheet
Ringline Properties Limited	**Hand excavated/ Augered**	2 of 2

STRATA					SAMPLES & TESTS			
Water	Level (mOD)	Legend	Depth *(Thickness)*	Strata Description	Depth	Type No	Test Result	Field Records
			(0.80)	Brown mottled orangish brown CLAY with rare rounded medium flint gravel.				
				...becoming brown CLAY with rare small partings of orange silt with occasional selenite crystals and rare rootlets	1.50	B3		
	76.60		1.75					
			(0.15)	Brown CLAY with frequent selenite crystals.				
	76.45		1.90		1.90	B4		
				End of Trial Pit				

GENERAL REMARKS

Issue No.	Logged By	
03	JF	

CONCEPT SITE INVESTIGATIONS

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Trial Pit No

OP05

Project

9 Downshire Hill, London NW3 1NR

Job No	Date Started	Ground Level (mOD)	Co-Ordinates	Final Depth
09/2238	Date Completed 05/11/09	78.35	E 526896.2 N 185686.4	2.00m

Client	Method/ Plant Used	Sheet
Ringline Properties Limited	Hand Excavated/Augered	1 of 1

Water	Level (mOD)	Legend	Depth (Thickness)	Strata Description	Depth	Type No	Test Result	Field Records
			(0.30)	Dark brown fine to coarse SAND and angular to well rounded fine to coarse GRAVEL with frequent brick fragments. (MADE GROUND)	0.20	B01		
	78.05		0.30					... Frequent roots of live appearance (20mm) encountered to 0.30m below ground level
			(0.40)	Brown clayey SAND with occasional subangular to well rounded flint gravel, clods of clay, frequent brick fragments and rare chalk fragments. (MADE GROUND)	0.50	B02		
	77.65		0.70					
			(1.30)	Firm to stiff brown mottled orangish brown and grey CLAY with rare pockets of carbonaceous material (<5mm) and occasional polished, undulating, smooth surfaces.				
				... with frequent polished, undulating, smooth surfaces below 1.00m	1.00	B03		
					1.10		V 152 kPa	
				... becoming extremely closely fissured locally mottled greenish grey with occasional pockets of orange silty clay (20mm x 30mm) and rare black flecks at 1.50m	1.50	B04		... Rootlets encountered up to 1.50m below ground level
				... becoming very stiff with frequent selenite crystals below 1.80m	1.80	D05		
	76.35		2.00		2.00	B06		
				End of Trial Pit	2.00		V >260 kPa	

GENERAL REMARKS

1. The weather was overcast but dry.
2. Trial pit was dry and stable.
3. Trial pit was hand excavated to 1.10m and hand augered to 2.00m below ground level.
4. Trial pit dimensions: 1.00m x 1.25m x 2.00m deep.
5. Ø19mm monitoring well installed at 2.00m below ground level, slotted between 1.10m and 2.00m depth.
6. Trial pit was backfilled with pea shingle between 2.00m and 1.10m depth, and with soil arising between 0.90m and ground level.

APPENDIX C

PASSIVE RELIEF SYSTEM

Our Ref - P1917

V1.1 **December 2011**

CONSULTING ENGINEERS

Foundation House, 4 Percy Road, London N12 8BU
Tel: 020 8445 9115 | Fax: 020 8446 9788
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1.00 INTRODUCTION

1.01 As part of our role as civil and structural engineers for the proposed new house at 9 Downshire Hill, we have been asked to design and incorporate the necessary passive relief measures for potential water interflow within the made ground. This report summarises the proposals and should be read in conjunction with our drawing P1917/100

1.02 We have developed our proposals based on the conclusions and input data provided by SLR Consulting in their letter report of December 2011

2.00 DESIGN & INSTALLATION

2.01 The proposed system comprises a rear collection trench, a subsurface pipe running in the ground between nos. 9 & 10 Downshire Hill and a granular storage medium within the front garden.

2.01 Rear Collection Trench

The rear collection trench is to be installed at the level of the interface between the upper sandy/silty made ground and the underlying clayey made ground. From site soil investigations this level has been determined to be approximately 77.5mOD.

The trench comprises a high void granular material surrounded by a geotextile membrane to prevent fines entering. Within the trench a pipe with the top half perforated will be laid to falls.

The top of the trench will be capped to avoid any surface water entering the trench, with a french drain above to actively collect surface run off and feed into the surface water drainage system.

The pipe size selected is oversized in respect of the maximum predicted interflow flow rates.

The perforated pipe will connect at its lower end to an inspection chamber from which the interflow will run into a subsurface pipe.

2.02 Subsurface Pipe

The subsurface pipe will be buried in the ground between the proposed basement and the boundary with no. 10 Downshire Hill.

The fall will vary to ensure adequate cover is maintained at all locations but will be at a minimum of 1 in 100.

To the front of the property the subsurface pipe will connect to an inspection chamber. From this inspection chamber, a perforated pipe will run into the granular storage medium.

2.03 Granular Storage Medium

After construction of the basement the ground over the ‘roof’ of the basement will be back-filled with a high void granular material over polystyrene filler blocks.

Based on the data given in the SLR letter report the design allows for the interflow channelled from the rear garden based on a 10 year worst case 5 day rainfall event, plus an additional allowance for rainfall which falls directly on the front garden. In reality this second component will be significantly reduced due to extent of the hardstanding areas which will be conventionally drained with gulleys connecting into the surface water collection system.

Based on a water input volume of 29 m^3 and a void ratio of 0.25, at least 116m^3 volume of granular material will be required to give adequate storage. This water will then connect into existing interflow routes as described in SLR's report.

The water will be distributed into the granular material by use of perforated pipes with open ends and then distributed within the granular medium using the high void ratio of the material selected.

3.00 MAINTENANCE

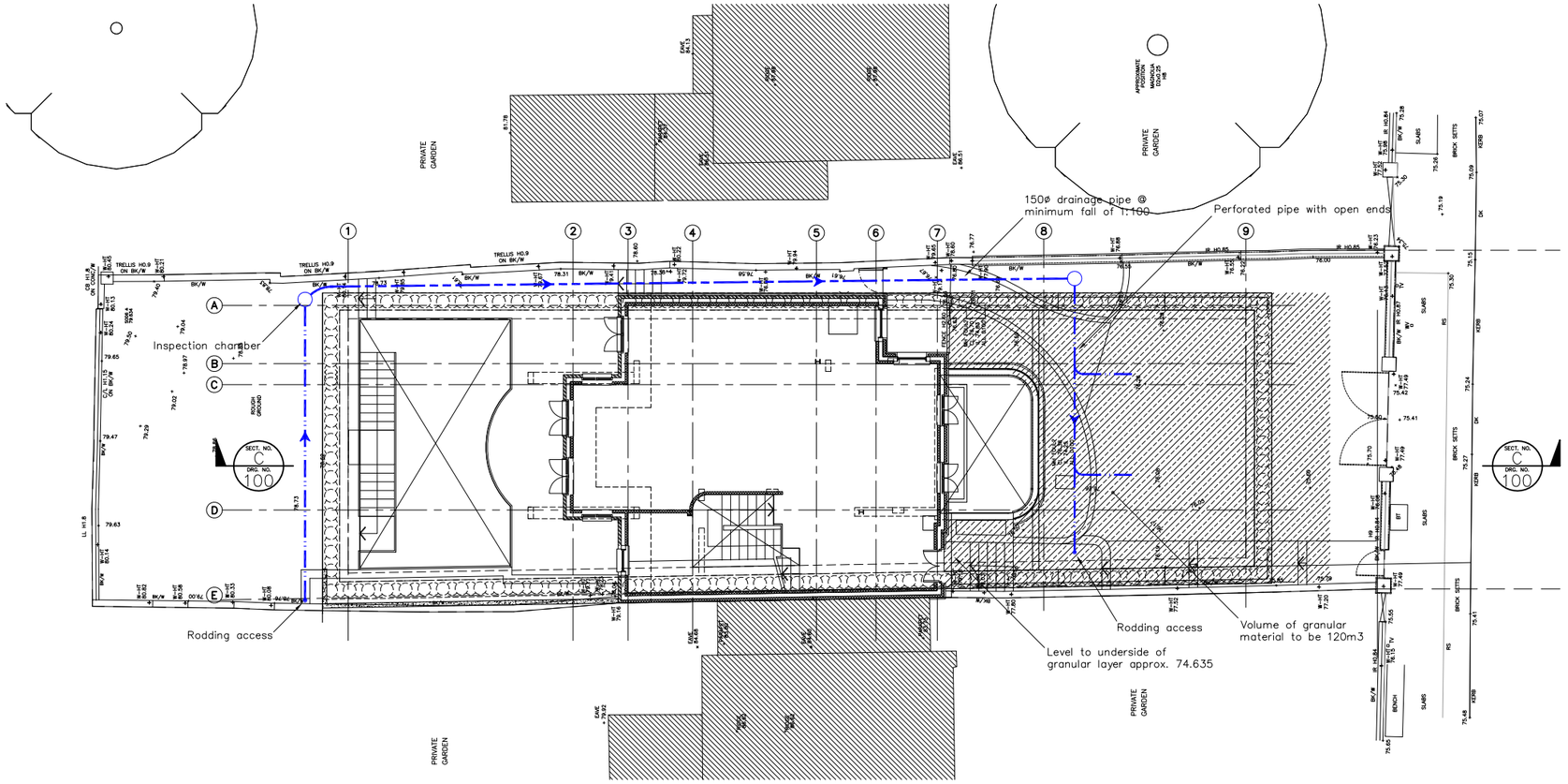
3.01 The passive relief approach has the advantage over the previously considered weir system that it should require minimal maintenance with no pumps our other components which would require scheduled maintenance works.

3.02 In principal the system should operate for many years without maintenance as for conventional surface water drainage systems.

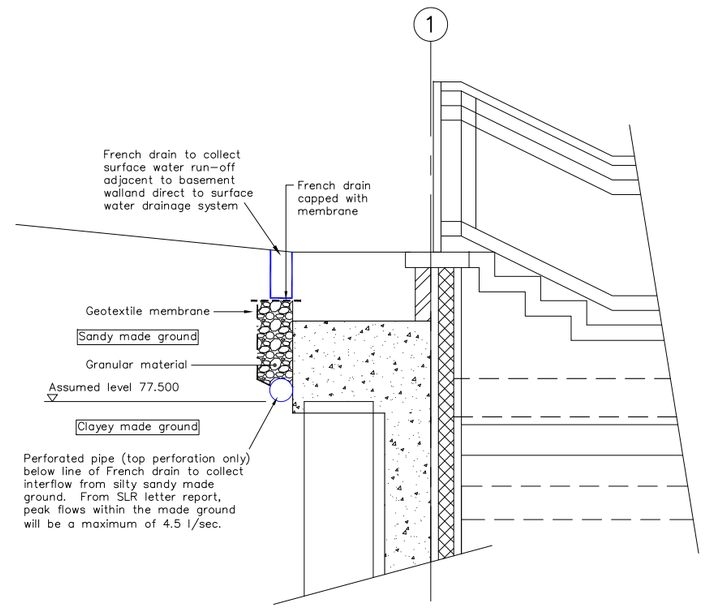
3.03 If it becomes apparent that there is a blockage in either the perforated pipes or the subsurface pipes, then this can be cleared from the rodding access points or the inspection chambers which have been provided for this purpose.

NOTES

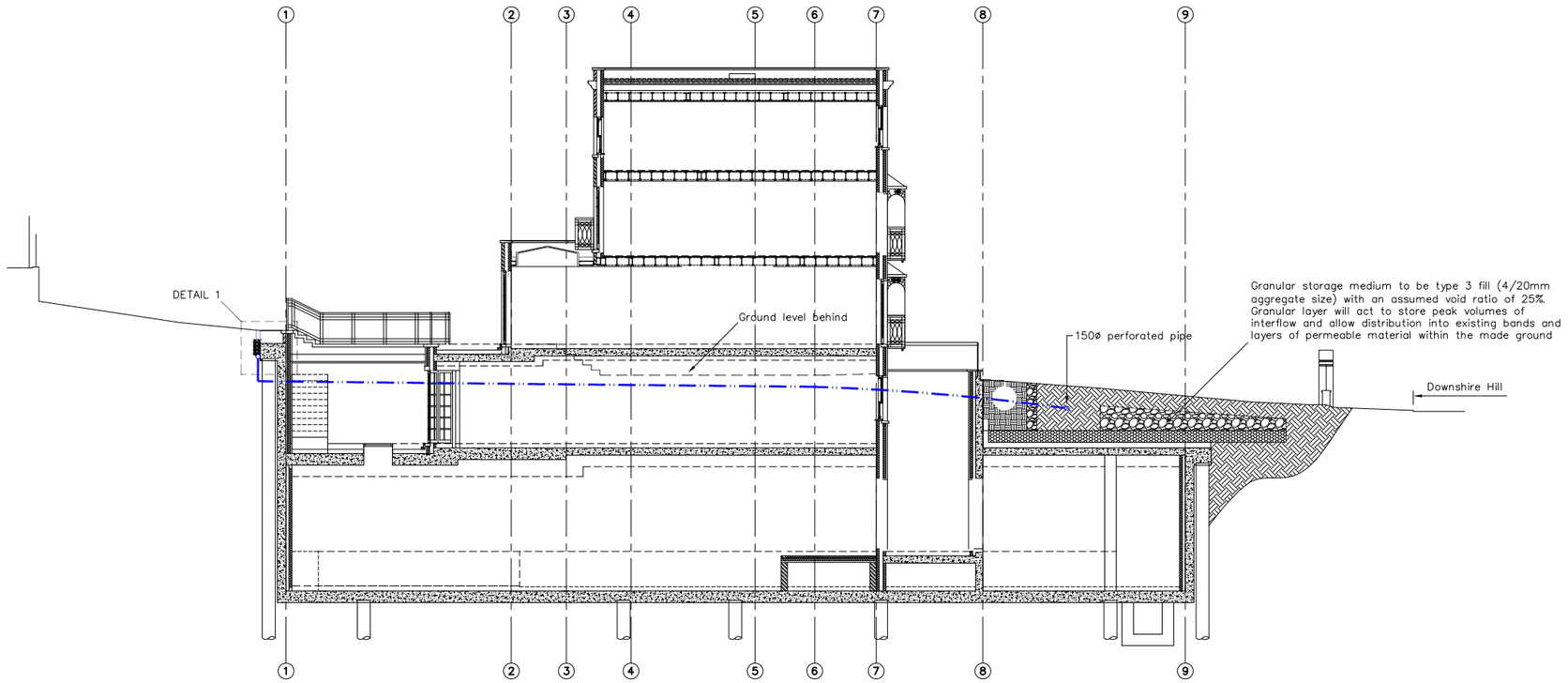
1. This drawing shall be read in conjunction with all relevant Architects & Engineers drawings and specifications.
2. Do not scale any dimensions. All dimensions to be checked on site.



GROUND FLOOR PLAN



DETAIL 1
Scale 1:20



SECTION C–C

Rev.	Date	Description	Signed

Client

Project Title
9 DOWNSHIRE HILL
LONDON NW3

Drawing Title
PROPOSED PASSIVE RELIEF MEASURES

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Drawn		Date
	RJC	Dec. 2011
Checked	IH	
Scale		Size
1:100	uno	A1
Project No.	Drawing No.	Rev.
P1917	100	P1

0 100mm WHEN PLOTTED @ 1:1 FOR A1 100 50mm WHEN PLOTTED @ 1:2 FOR A3 200