MICHAEL CHESTER & PARTNERS Consulting Civil and Structural Engineers
8 Hale Lane London NW7 3NX tel 020 8959 9119 fax 020 8959 9662 mail@michaelchester.co.uk

Our Ref: 15094 16th October 2015

66 FITZJOHNS AVENUE, LONDON NW3

STRUCTURAL REPORT TO ACCOMPANY PLANNING APPLICATION

1.0 Project Information

1.1 The site is located on the east side of Fitzjohns Road, London NW3 just to the south of the junction with Lyndhurst Road. There are currently two traditionally built two-storey houses on the existing site. The proposals are to demolish the existing buildings and then to build two new three-storey houses each with a basement.

1.2 Michael Chester & Partners have been appointed to carry out an appraisal of the structural and slope stability aspects of the Basement Impact Assessment (BIA). The BIA follows the slope stability screening and scoping flowchart format as recommended by Arup in their report "Guidance for Subterranean Development" prepared for London Borough of Camden.

2.0 Questions arising from BIA Slope Stability Screening Flowchart

Following the flow chart for Slope stability the questions have been evaluated and the responses are as follows –

Q1: Does the existing site include slopes, natural or man-made, greater than 7 degrees (approximately 1 in 8)?

No. The site is essentially level.

Q2: Will the proposed re-profiling of the landscaping at site change slopes at the property boundary level to more than 7 degrees (approximately 1 in 8)?

No. The proposed levels around the building are to remain as existing.

Q3: Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately 1 in 8)?

No.

Q4: Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately 1 in 8)?

No. Fitzjohns Road runs south to north rising at approximately 1:16.

Q5: Is the London Clay the shallowest strata on the site?

No. British Geological Survey sheet 256 shows the Claygate Beds as the shallowest strata, over London Clay. A site investigation is to be commissioned to confirm.

Q6: Will any trees be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained?

Yes, a small fir and a small Silver Birch are to be removed as part of the works. These trees are too small to have any detrimental effect from a structural point of view.

Q7: Is there a history of seasonal shrinkage-swell subsidence in the local area, and/or evidence of such effects on the site?

Unknown, but, as Q5, the site is underlain by London Clay, as is a very large part of North London. Both the Claygate Beds and London Clay are a highly plastic materials readily susceptible to volume changes as a result of changes in its moisture content. There were, however, no obvious signs that the existing buildings or those directly adjacent were suffering from the effects of this.

Q8: Is the site within 100m of a watercourse or a potential spring line?

Yes. The historic Shepherds Hill Conduit watercourse ran some 20 to 40m to the west of the site and the southern boundary of the Claygate Beds is some 75m to the south. Refer to SLR Consulting's report on the hydrological aspects of the BIA.

Q9: Is the site within an area of previously worked ground?

The site investigation has shown between 2.9m and 3.8m of Made Ground along the access road to the basement site and approximately 1m of fill below the basement site itself. The access road runs alongside a Victorian basement so is consistent with the battered excavations of that type of construction. Other than that, the investigations do not suggest significant amounts of previously worked ground.

Q10: Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?

The basement will be within the Claygate Beds which have been shown by the site investigation to be water bearing.

Q11: Is the site within 50m of the Hampstead Heath ponds?

No.

Q12: Is the site within 5m of a highway or pedestrian right of way?

No.

Q13: Will the proposed basement significantly increase the differential depth of foundations relative to the neighbouring properties?

Yes. The new building will be on a piled foundation whilst the adjacent Victorian buildings is assumed to be on a traditional foundation.

Q14: Is the site over (or within the exclusion zone of) any tunnels, eg railway lines.

No.

3.0 Slope stability "scoping"

The screening process has identified the following slope stability issue to be of particular importance:

Q10: Standpipes installed as part of the site investigation have shown a water table level of approximately 900mm above structural slab level when they were monitored in September 2015. Seasonal fluctuations are anticipated so monitoring is set to continue to allow the full range to be assessed. In structural terms, secant piles are to be installed around the full perimeter of the basement before it is excavated, bored through the Claygate Beds and in to the London Clay. This will prevent water entering the excavation very quickly as digging proceeds and will allow efficient pumping of the working area with little impact on the surrounding buildings. The hydrological implications are addressed by SLR Consulting in their section of the BIA.

Q13: The excavation for the new basement will be approximately 4.1m deep below current external ground level and this is approximately 2.8m below the existing adjacent basement level. The difference in excavation levels, however, is not considered relevant from a structural point of view as the new and existing buildings are not joined so differential movement will not cause structural damage.

4.0 Basement Impact Assessment

4.1 The buildings that currently exist on the subject site do not have basements and Made Ground has been found locally to approximately 1.0m depth. This is underlain by approximately 3.5m of the Claygate Beds, over London Clay. Water levels were recorded in September 2015 at about 3.2m depth below existing ground level, so approximately 900mm above proposed structural slab level. The perimeter of the new basement is to be taken close to the existing site boundaries so secant piles are be installed all around to retain the adjacent soils. This will take place before any significant excavation takes place.

4.2 Once the piles are complete a reinforced capping beam will be cast on top of them to tie them together and a well point installed to allow the water within the boundaries of the site to be drained. Only then will the excavation for the basement itself take place.

4.3 The ground within the ring of piles will first be excavated by approximately one metre and horizontal props will be installed to brace the capping beam to ensure that any movements at the heads of the piles are kept to an absolute minimum. The bulk excavation for the basement will then take place. Once the finished levels are reached the basement slab and the perimeter retaining wall will be cast, followed by the ground floor slab. Only once the ground floor slab has had sufficient time to cure will the horizontal props be removed.

4.4 A typical section through the proposed basement with the relative levels of the soils and water is shown on drawing number 15094/SK01 and is contained within Appendix A. The above construction sequence is summarised on drawing number 15094/SK02 and is also appended.

4.5 Ground movements as a result of basement constructions are difficult to predict accurately but CIRIA Report 580 and MJ Tomlinson in his book “Foundation Design and Construction” provide guidance on empirical approaches to estimate them. CIRIA 580 states that differential movements are usually more important than total movements and that horizontal movements are usually more damaging than vertical ones. For this reason the two are considered separately below.

4.6 It is recognised that some inward yielding of the supported sides of strutted excavations may occur even if structurally stiff props are employed as movements are in large part a function of the supported soils rather than the props themselves. Empirical observations show predicted movements as a ratio of the retained heights and CIRIA 580 indicates a figure of 0.15% for walls wholly embedded in stiff clay such as we have here. The retained height is 3.8m so this gives a figure for the horizontal movement of about 5.7mm.

4.7 Similarly, CIRIA 580 provides a figure of 0.1% of the retained height for vertical movements beyond the piling boundary, giving a figure for settlement of approximately 3.8mm.

4.8 The settlement profile in cohesive soils is taken to taper to zero in a reasonably linear fashion over about 4 basement depths, so over approximately 15.2m in this instance. Horizontal strains are, therefore, approximately 0.04% which places the damage in Category 0 of Table 2.5 in CIRIA Report 580. Taking in to account the minor settlement also possible as a result of vertical movement it is possible that some damage may occur in Category 1.

4.9 Heave as a result of the removal of overburden is not expected to be an issue given the relatively small nature of the excavations. Damage to adjacent properties as a result of these works is, therefore, expected to be minimal.

4.10 Based on the above, monitoring of the buildings adjacent to the site is not considered necessary.

4.11 The new basement box will be designed and detailed in reinforced concrete as a water tight structure with drainage designed by others to allow subterranean water to flow around it. Water levels currently recorded on site suggest that overall floatation in not an issue, though conditions will need to be re-assessed once a full range of seasonal monitoring has been completed. Some local uplift of the basement floor slab may need to be considered, depending on final overall construction thicknesses. Floatation, if it becomes an issue, will be addressed either by installing basal drains to eliminate uplift or by making the structure heavier to compensate for the uplift, or, perhaps, a combination of both.

4.12 The basement will be tanked using a drained cavity system such as that by Delta Membrane.

Signed,

Duncan Mercer
MIStructE CEng MSc DIC BSc

MICHAEL CHESTER & PARTNERS Consulting Civil and Structural Engineers
8 Hale Lane London NW7 3NX tel 020 8959 9119 fax 020 8959 9662 mail@michaelchester.co.uk

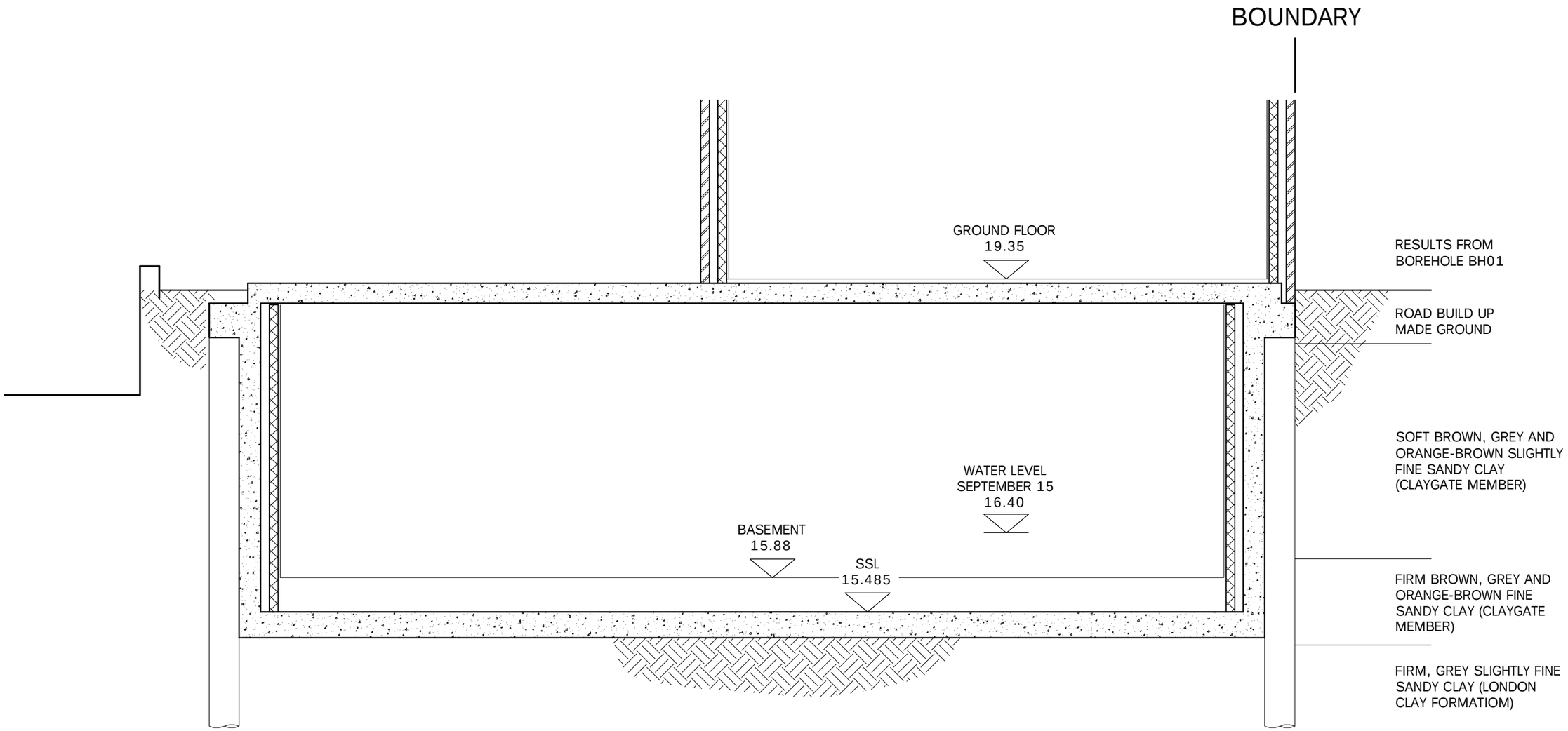
APPENDIX A

66 FITZJOHN ROAD, LONDON NW3

DRAWINGS BY MICHAEL CHESTER & PARTNERS

15094/SK01

15094/SK02



Rev	Date	Alteration

MICHAEL CHESTER & PARTNERS
Consulting Civil and Structural Engineers
8 Hale Lane London NW7 3NX tel 020 8959 9119 fax 020 8959 9662

Date SEPT 15
Drawn DM
Scale 1:50

Drg No 15094/SK01

Rev *

Project
66 FITZJOHNS AVENUE
LONDON NW3

TYPICAL SECTION THROUGH BASEMENT

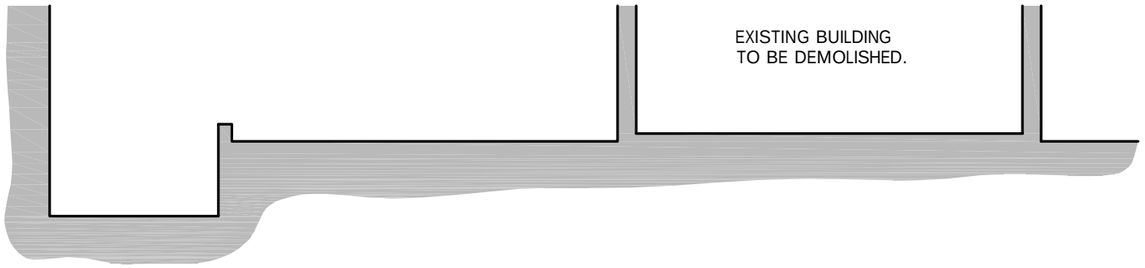
Do not scale from this drawing. Dimensions given are in millimetres unless noted otherwise.
This drawing must be read in conjunction with all relevant drawings and specifications.

PRELIMINARY

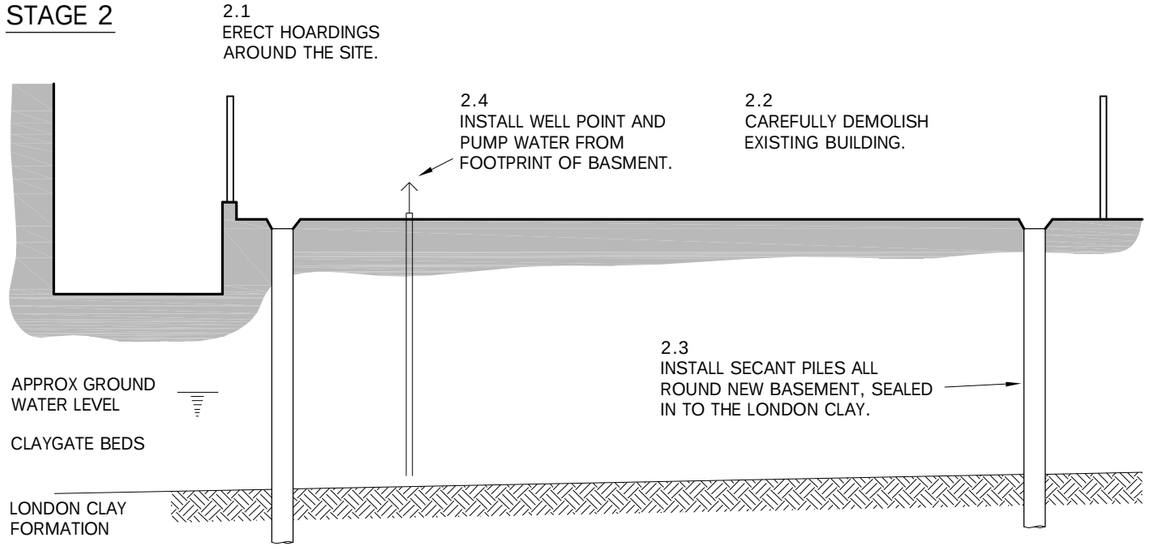
A3

STAGE 1

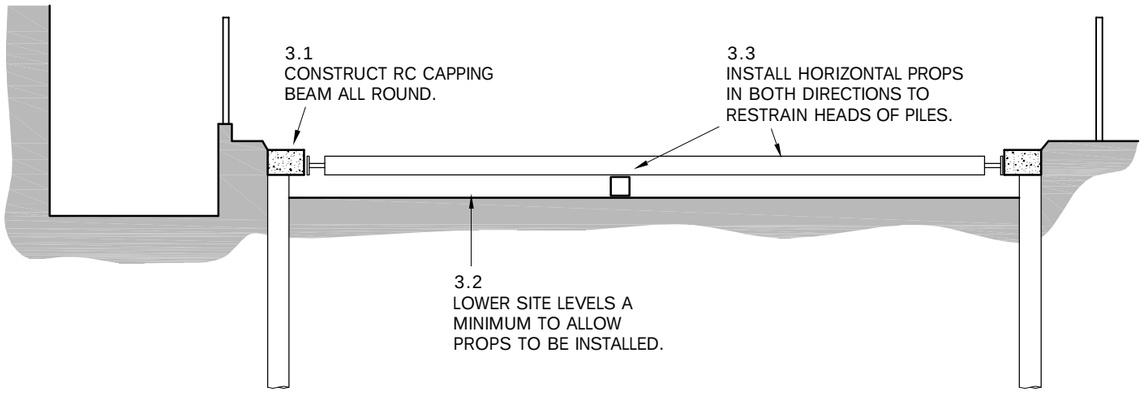
EXISTING.



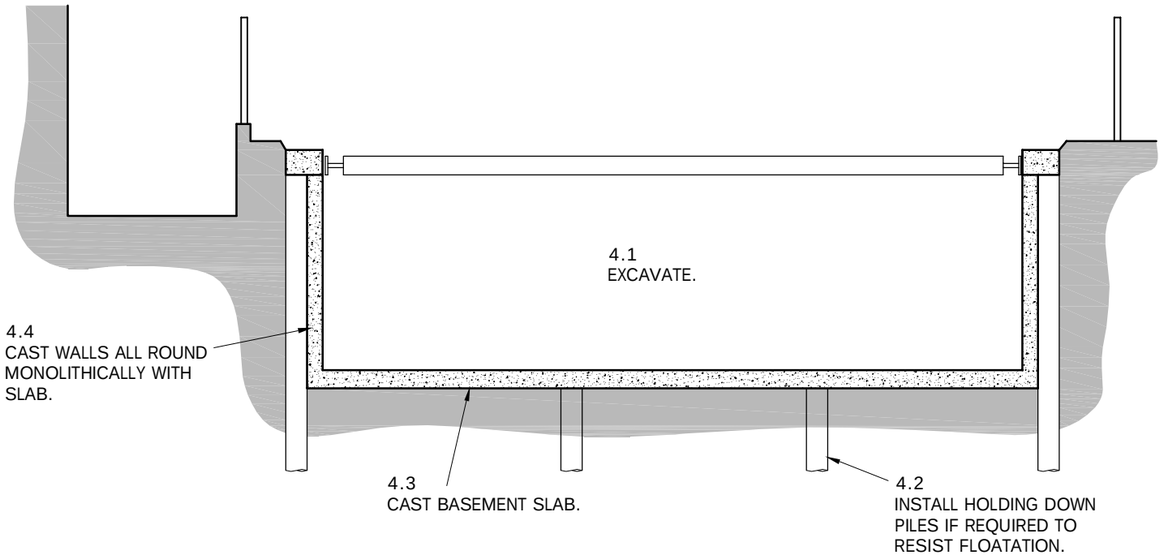
STAGE 2



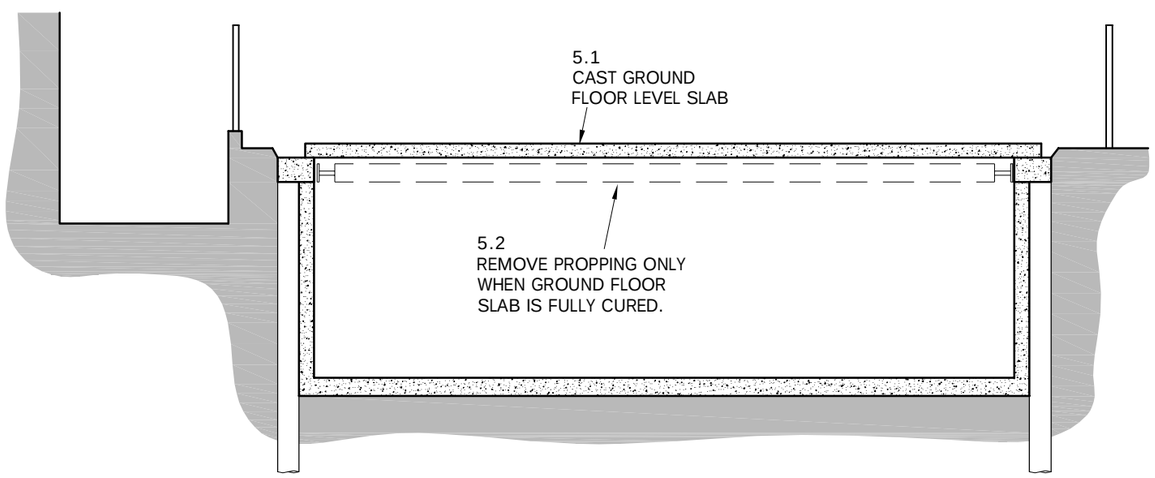
STAGE 3



STAGE 4



STAGE 5



Rev	Date	Alteration
A	SEPT 15	NOTES ADDED.

MICHAEL CHESTER & PARTNERS
Consulting Civil and Structural Engineers
8 Hale Lane London NW7 3NX tel 020 8959 9119 fax 020 8959 9662

Date	JULY 15
Drawn	DM
Scale	nts
Drg No	15094/SK02
Rev	A

Project
66 FITZJOHNS AVENUE
LONDON NW3

ASSUMED SEQUENCE OF CONSTRUCTION

PRELIMINARY

A3

MICHAEL CHESTER & PARTNERS Consulting Civil and Structural Engineers
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APPENDIX B

66 FITZJOHN ROAD, LONDON NW3

SITE INVESTIGATION BY CET INFRASTRUCTURE

SITE PLAN

BOREHOLE LOG BH01

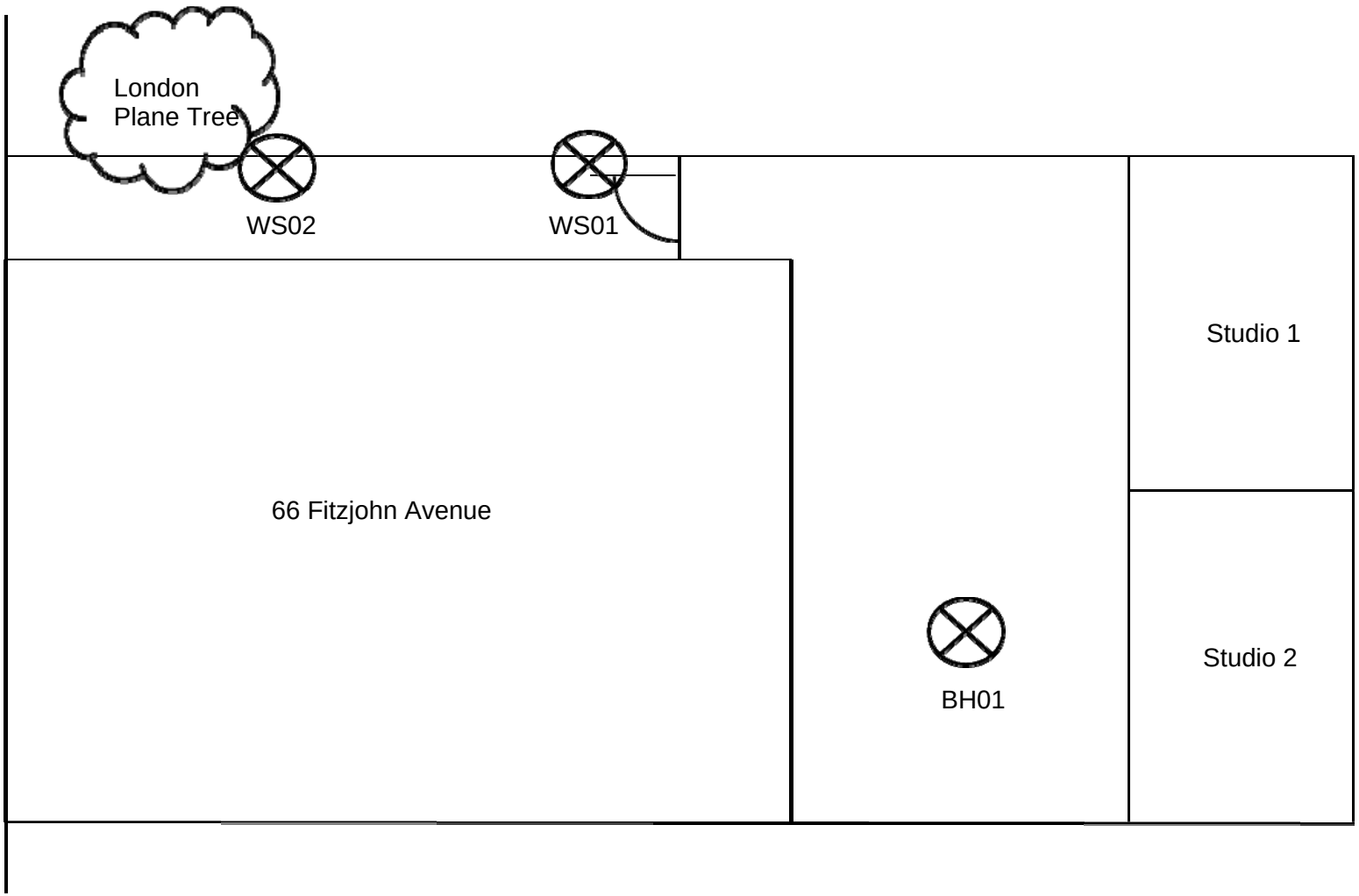
WINDOW SAMPLER LOGS WS01 & WS02

INFRASTRUCTURE
Giving our all

Northdown House, Ashford Road, Harrietsham, Maidstone
Kent, ME17 1QW
Telephone: 01622 858545 Facsimile: 01622 858544

66 Fitzjohn Avenue, Camden			Lead No. **240179**
Created By: **MIW**	Checked:	Approved:	Date: **August 2015**

A



Approximate Borehole Location Plan

Scale: Not to Scale

FIGURE 1

Client: **CP Plus Limited**	Hole Diameter (mm): 150 to 15.00m		BOREHOLE NUMBER **BH01** Sheet 1 of 2
Method: Cable Percussion	Casing Dia. (mm): 150 to 6.00m		
Date Started: 27/08/15	Co-ordinates E N	Ground Level (m AOD)	Ref. No: 240179

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
0.00								(0.20)	Granite Blocks (Driller's Description).	
0.20			0.20	D				0.20	Dark brown and black, slightly fine sandy, clayey GRAVEL. Gravel is angular and sub-angular, fine to coarse flint, brick, ash and concrete. (Made Ground)	
								(0.80)		
1.00			1.00	D				1.00	Soft, brown, grey and orange brown, slightly fine sandy CLAY. (Claygate Member)	
			1.50 - 1.95	D	S	N = 6				
			2.00	D						
								(2.50)		
			2.50 - 2.95	U						
			3.00	D						
			3.50 - 3.95	D	S	N = 13		3.50	Firm, brown, grey and orange brown, fine sandy CLAY. (Claygate Member)	
			4.00	D				(1.00)		
			4.50 - 4.95	U				4.50	Firm becoming stiff with depth, grey, slightly fine sandy CLAY with occasional selenite crystals and shell fragments. (London Clay Formation)	
5.00		4.90 5.00	5.00	D						
6.00			6.00 - 6.45	D	S	N = 12				
			7.00	D						
			7.00 - 7.45	U						
			7.50	D						
			8.00	D						
			8.50 - 8.95	D	S	N = 15				
			9.00	D				(10.50)		
									Continued on next sheet	

General Remarks:
1. Groundwater encountered at 5.0m, rising to 4.9m below ground level after 20 minutes.
2. Roots and rootlets observed to 2m below ground level.

Driller:	SL	BOREHOLE RECORD Scale1:50 See Key Sheet for explanation of symbols, etc.	CET INFRASTRUCTURE Giving our all
Logged:	MOV		
Checked:		66, Fitzjohns Avenue NW3	**FIG A1**
Appr'd:			

Client: **CP Plus Limited**	Hole Diameter (mm): 150 to 15.00m		BOREHOLE NUMBER **BH01** Sheet 2 of 2
Method: Cable Percussion	Casing Dia. (mm): 150 to 6.00m		
Date Started: 27/08/15 — Co-ordinates E N	Ground Level (m AOD)	Ref. No: 240179	

Backfill/Well		Water	Samples		In Situ Tests		Reduced	Depth &	Description of Strata	Legend
Depth (m)	Legend	Depth (m)	Depth (m)	Type	Type	Results	Level (mAOD)	*(Thickness)* (m)		
			10.00	D					Firm becoming stiff with depth, grey, slightly fine sandy CLAY with occasional selenite crystals and shell fragments.	
			10.00 - 10.45	U						
			10.50	D						
			11.00	D						
			11.50 - 11.95	D	S	N = 14				
			12.00	D						
			13.00	D						
			13.00 - 13.45	U						
			13.50	D						
			14.00	D						
			14.50 - 14.95	D	S	N = 17				
15.00			15.00	D				15.00	*End of Borehole at 15.00 m*	

General Remarks:

Driller:	SL	BOREHOLE RECORD Scale1:50 See Key Sheet for explanation of symbols, etc.	CET INFRASTRUCTURE Giving our all
Logged:	MOV		
Checked:		66, Fitzjohns Avenue NW3	**FIG A1**
Appr'd:			

Client: **CP Plus Limited**	Hole Diameter (mm): 90 tapering with depth to 7.00m	**BOREHOLE NUMBER** **WS01** Sheet 1 of 2
Method: Window Sampler		
Date: 27/08/15 Co-ordinates E N	Ground Level (m AOD)	Ref. No: 240179

Backfill/Well Legend (m)	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Results	Reduced Level (m AOD)	Depth & (Thickness) (m)	Description of Strata	Legend
						(0.10) 0.10	Asphalt.	
0.20		0.25		Vh = 31 pp = 2.0		(0.10) 0.20	Concrete.	
						(0.15) 0.35	Brick Cobbles.	
		0.50	D	Vh = 30 pp = 2.2		(0.45)	Firm, brown, fine to coarse sandy, slightly gravelly CLAY. Gravel is angular to rounded, fine to coarse brick, clinker, concrete and flint.	
		0.75		Vh = 35		0.80	(Made Ground)	
1.00		1.00	D				Stiff, brown, fine to coarse sandy CLAY. (Made Ground/Reworked Claygate Member?)	
		1.25				(1.00)		
		1.50	D					
		1.75				1.80		
		2.00 2.00 - 2.40	D	Vh = 59 pp = 5.0			Stiff, orange brown and mottled grey, fine sandy, slightly gravelly CLAY. Gravel is angular to well rounded, fine to coarse quartz and brown, black and orange brown flint. (Made Ground/Reworked Claygate Member?)	
		2.25		Vh = 140 pp = 6.0		(1.14)		
		2.50 2.50 - 3.00	D	Vh = 99 pp = 4.2				
		2.75		Vh = 60 pp = 2.5				
		3.00 3.00 - 3.50	D	Vh = 51 pp = 1.8		2.94	Firm, orange, ochre and mottled grey, fine sandy, possibly very thinly laminated CLAY. (Claygate Member)	
		3.25		Vh = 42 pp = 2.2				
		3.50 3.50 - 4.00	D	Vh = 29 pp = 1.8				
		3.75		Vh = 40 pp = 2.7		(1.56)		
		4.00		Vh = 80 pp = 2.8				
4.30		4.25		Vh = 40 pp = 3.8				
		4.50 4.50 - 5.00	D	Vh = 51 pp = 2.4		4.50	Firm, grey, slightly fine sandy CLAY. Selenite crystals observed. (London Clay Formation)	
		4.75		Vh = 50 pp = 3.0			*Continued on next sheet*	

General Remarks:
1. Service inspection pit hand dug to 1.2m and then furthered to 2.0m below ground level through the use of a hand auger due to service concerns prior to commencement of borehole.
2. Water ingress observed at 3.5m below ground level.
3. Roots and rootlets observed to 2.2m below ground level.

Driller:	CB	BOREHOLE RECORD Scale 1:25 See Key Sheet for explanation of symbols, etc.	CET INFRASTRUCTURE Giving our all
Logged:	MIW		
Chked:		66, Fitzjohns Avenue NW3	**FIG A2**
Appr'd:			

Client: **CP Plus Limited**	Hole Diameter (mm): 90 tapering with depth to 7.00m	**BOREHOLE NUMBER** **WS01** Sheet 2 of 2
Method: Window Sampler		
Date: 27/08/15	Co-ordinates E N	Ground Level (m AOD)
		Ref. No: 240179

Backfill/Well		Water	Samples		In Situ Tests	Reduced	Depth &	Description of Strata	Legend
(m)	Legend	Depth (m)	Depth (m)	Type	Results	Level (m AOD)	*(Thickness)* (m)		
			5.00 5.00 - 6.00	D	Vh = 50 pp = 2.5			Firm, grey, slightly fine sandy CLAY. Selenite crystals observed.	
			5.25		Vh = 50 pp = 2.6				
			5.50		Vh = 60 pp = 2.8				
			5.75		Vh = 50 pp = 3.0		*(2.50)*		
			6.00 6.00 - 7.00	D	Vh = 55 pp = 3.0				
			6.25		Vh = 50 pp = 2.6				
			6.50		Vh = 60 pp = 2.8				
			6.75		Vh = 55 pp = 2.6				
7.00			7.00		Vh = 50 pp = 2.8		7.00	*End of Borehole at 7.00 m*	

General Remarks:
1. Service inspection pit hand dug to 1.2m and then furthered to 2.0m below ground level through the use of a hand auger due to service concerns prior to commencement of borehole.
2. Water ingress observed at 3.5m below ground level.
3. Roots and rootlets observed to 2.2m below ground level.

Driller:	CB	BOREHOLE RECORD Scale 1:25 See Key Sheet for explanation of symbols, etc.	CET INFRASTRUCTURE Giving our all
Logged:	MIW		
Chked:		66, Fitzjohns Avenue NW3	**FIG A2**
Appr'd:			

Client: **CP Plus Limited**	Hole Diameter (mm): 90 tapering with depth to 7.00m	**BOREHOLE NUMBER**
Method: Window Sampler		**WS02**
Date: 27/08/15	Co-ordinates E N / Ground Level (m AOD) / Ref. No: 240179	Sheet 1 of 2

Backfill/Well		Water	Samples		In Situ Tests	Reduced	Depth &		
(m)	Legend	Depth (m)	Depth (m)	Type	Results	Level (m AOD)	(Thickness) (m)	Description of Strata	Legend
			0.00				(0.10)	Asphalt.	
							0.10		
0.20							(0.10)	Concrete.	
			0.25				0.20		
							(0.35)	Brick Cobbles.	
			0.50	D			0.55		
			0.75		Vh = 30 pp = 4.5			Light brown, slightly silty, slightly gravelly, fine to coarse SAND. Gravel is angular to well rounded, fine to coarse flint, concrete and brick. (Made Ground)	
			1.00	D	Vh = 59		(1.05)		
			1.25		Vh = 100				
			1.50	D	Vh = 110		1.60		
			1.75		Vh = 120 pp = 6.0			Very stiff, brown, fine to coarse sandy, slightly gravelly CLAY. Gravel is angular to well rounded, fine to coarse flint and clinker. (Made Ground/Reworked Claygate Member?)	
			2.00 2.00 - 2.50	D	Vh = 115 pp = 6.0		(0.70)		
			2.25		Vh = 88 pp = 4.4				
2.30							2.30		
			2.50 2.50 - 3.00	D	Vh = 120 pp = 5.4			Very stiff, orange brown and mottled grey, slightly fine sandy, slightly gravelly, possibly very thinly laminated CLAY. Gravel is angular to rounded, fine to coarse flint (brown, orange and black). (Made Ground/Reworked Claygate Member?)	
			2.75		Vh = 62 pp = 3.2		(1.05)		
			3.00		Vh = 45 pp = 3.0				
			3.25		Vh = 50 pp = 2.0				
			3.35 - 3.80	D			3.35		
			3.50		Vh = 50 pp = 2.5			Firm and locally soft, black, organic CLAY. Organic odour noted. (Made Ground/Reworked Claygate Member?)	
			3.75		Vh = 45 pp = 4.0		(0.45)		
							3.80		
			4.00 4.00 - 4.50	D	Vh = 50 pp = 2.3			Firm, orange brown and grey, slightly fine sandy CLAY. (Claygate Member)	
			4.25		Vh = 52 pp = 1.5				
							(1.20)		
			4.50		Vh = 45 pp = 2.4				
			4.75		Vh = 50 pp = 3.9				

Continued on next sheet

General Remarks:
1. Service inspection pit hand dug to 1.2m and then furthered to 2.0m below ground level through the use of a hand auger due to service concerns prior to commencement of borehole.
2. Roots and rootlets observed to 3.0m below ground level.

Driller:	CB	BOREHOLE RECORD Scale 1:25 See Key Sheet for explanation of symbols, etc.	CET INFRASTRUCTURE Giving our all
Logged:	MIW		
Chked:		66, Fitzjohns Avenue NW3	**FIG A3**
Appr'd:			

Client: **CP Plus Limited**	Hole Diameter (mm): 90 tapering with depth to 7.00m	**BOREHOLE NUMBER** **WS02** Sheet 2 of 2
Method: Window Sampler		
Date: 27/08/15	Co-ordinates E N	Ground Level (m AOD)	Ref. No: 240179

Backfill/Well		Water	Samples		In Situ Tests	Reduced	Depth &		
(m)	Legend	Depth (m)	Depth (m)	Type	Results	Level (m AOD)	*(Thickness)* (m)	Description of Strata	Legend
5.00			5.00		Vh = 50 pp = 4.0		5.00	Firm, grey, slightly fine sandy CLAY. (London Clay Formation)	
			5.25		Vh = 50 pp = 4.2				
			5.50 5.50 - 6.30	D	Vh = 50 pp = 2.8				
			5.75		Vh = 45 pp = 3.0				
			6.00		Vh = 50 pp = 3.5		*(2.00)*		
			6.25		Vh = 40 pp = 3.0				
			6.40 - 7.00	D					
			6.50		Vh = 70 pp = 2.8				
			6.75		Vh = 55 pp = 3.5				
7.00			7.00		Vh = 50 pp = 4.2		7.00	*End of Borehole at 7.00 m*	

General Remarks:
1. Service inspection pit hand dug to 1.2m and then furthered to 2.0m below ground level through the use of a hand auger due to service concerns prior to commencement of borehole.
2. Roots and rootlets observed to 3.0m below ground level.

Driller:	CB	BOREHOLE RECORD Scale 1:25 See Key Sheet for explanation of symbols, etc.	CET INFRASTRUCTURE Giving our all
Logged:	MIW		
Chked:		66, Fitzjohns Avenue NW3	**FIG A3**
Appr'd:			