soiltechnics

environmental and geotechnical consultants

New basement and extensions
81 Fordwych Road
West Hampstead
London
NW2 3TH

Basement Impact Assessment Report

(updated 2nd March 2016)

Cedar Barn, White Lodge, Walgrave, Northamptonshire NN6 9PY

t: 01604 781877 **e**: mail@soiltechnics.net
f: 01604 781007 **w**: www.soiltechnics.net

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Soiltechnics Ltd. Cedar Barn, White Lodge, Walgrave, Northampton. NN6 9PY.
Tel: (01604) 781877 Fax: (01604) 781007 E-mail: mail@soiltechnics.net

Report originators

Prepared by

Nigel Thornton
B.Sc (Hons)., C.Eng., M.I.C.E., M.I.H.T., F.G.S

nigel.thornton@soiltechnics.net
Director, Soiltechnics Limited

Aerial photograph of property

Approximate property boundaries edged in red.

Report status and format

Report section	Principal coverage	Report status	
		Revision	Comments
1	Introduction and brief		Updated to address audit comments by Campbell Reith.
2	Description of the property and project proposals		
3	Desk study information and site observations		
4	Ground investigations		
5	External ground movements around the basement		
6	Hardened areas		
7	Tree removal		
8	Damage to adjacent buildings		
9	Subterranean (Groundwater flow) screening		
10	Summary of scoping and screening		
11	Stability impact identification		
12	Surface flow and flooding impact identification		
13	Summary and Conclusion.		
14	Audit query tracker		

List of appendices

Appendix	Content
A	Copy of drawings illustrating proposal.
B	Copy of CV of Nigel Thornton and examples of Soiltechnics commissions on basement investigations and analysis.
C	Copy of comments on this report by Chartered Geologist.
D	Borehole and trial pit records and plan showing location of exploratory points
E	Plan showing estimated surface settlement contours as a result of basement excavations (drawing BIA 01a)
F	Calculations to determine tensile strains in masonry and prediction of damage to adjacent buildings
G	Architect's plan showing extent of basement with respect to consented rear extension
H	Copy of response from Thames Water

1 Introduction and brief

1.1 Objectives

This report presents a Basement Impact Assessment (BIA) for a proposed development at 81 Fordwych Road in London.

The principal objective of the assessment is to present evidence to support a planning application for the project as required by Camden Planning Guidance (CPG4) '*Basements and lightwells'*.

1.2 Client instructions and confidentiality

This report has been produced following instructions received from through Zyntax (Chartered Architects).This report has been updated following receipt of comments received as a result of an audit report by Campbell Reith dated February 2016 . Amendments to the report text are highlighted with a single vertical line adjacent to the paragraph. Amendments dated 24th February 2016 are marked with a red line in the left hand margin. Amendments dated 2nd March 2016 are marked with a blue line.

This report has been prepared for the sole benefit of our above named instructing client, but this report, and its contents, remains the property of Soiltechnics Limited until payment in full of our invoices in connection with production of this report.

1.3 Author qualifications

This report has been prepared by a Chartered Civil Engineer, (C.Eng., M.I.C.E) who is also a Fellow of the Geological Society (FGS). The Author is a practising Civil Engineer with specialist experience (34 years) in geotechnical engineering (including basement construction), flood risk and drainage. A copy of my CV and examples of my experience in basement construction is presented in Appendix B. This report has been reviewed by John Evans of Chord Environmental who is a Chartered Geologist and expertise in hydrogeology. A copy of his comments are presented in appendix C.

1.4 Guidance used

As described in paragraph 1.1.2 above we have followed Camden Planning Guidance (CPG4) '*Basements and lightwells'*, and Camden geological, hydrogeological and hydrological study report '*Guidance for subterranean development,*' produced by Arup on behalf of the London Borough of Camden. We have also referred to the '*Strategic Flood Risk Assessment Report for North London*' dated August 2008 prepared by Mouchel, as well as other readily available information on websites. This report has considered all four stages of the BIA process as described in CPG4. This report has also been prepared to satisfy the following parts of Camden's policy DP27, on basements and lightwells:

a) Maintain the structural stability of the building and neighbouring properties;

b) Avoid adversely affecting drainage and run-off or causing other damage to the water environment;

c) Avoid cumulative impacts upon structural stability or the water environment in the local area;

In order to satisfy part a) a construction method statement has been prepared by a Structural Engineer which is separately presented.

1.5 Format of this report in relation to CPG4

Sections 3 to 8 of this report describes project proposals and presents desk study and investigation data, information required to answer flow chart questions posed in figures 1, 2 and 3 of GPG4. Answers for these flow chart questions are provided in sections 9 to 11.

2 Description of the property and project proposals

2.1 Description of the property

The site is currently occupied by a three storey semi-detached house and includes 'room in the roof' accommodation. Based on inspection of old Ordnance Survey maps the house was constructed in the late 1800's. There are gardens both to the front and rear principally laid to grass with some trees. General ground levels in the area fall in a southerly direction by about 2 degrees generally following Fordwych Road. The property is located on the 61m contour with Fordwych road falling to Maygrove Road to the south (about 400m distant) located around the 45m contour (based on Ordnance Survey mapping). Garden levels are reasonably uniform but the ground floor level is about 0.6 to about 0.8m above footway levels in Fordwych Road. There is a partial basement some 2m deep within the central part of the property.

In the recent past it has become apparent that both nos 81 and 83 have been subject to subsidence damage evidenced by a structural report prepared by B.H Maule and Partner s in November 2007 for the occupier of no 81 at that time. The report advises that original foundations to no83 were underpinned to a depth of 3m between August and October 2007. The report also recommends foundations to no 81 are underpinned to 3m to match those of no 83. The cause of adverse movement was reported as shrinkage of clay soils below foundations promoted by water demands of trees in rear gardens and in the highway (Fordwych Road). The foundation underpinning scheme to no 81 was not implemented but some tree removal was completed.

2.2 Project proposals

Proposals are to extend the ground floor footprint into rear gardens by a distance of around 5.1m from the rear north facing elevation of an existing single storey extension building. In addition a single storey deep basement is proposed below the proposed ground floor footprint, but extending about 8.2m from rear north facing elevation of an existing single storey extension building. It is important to note that planning consent has been granted for a rear extension building to extend a distance of 8.7m from the rear north facing elevation of an existing single storey extension building. Plans showing the extent of the new basement and outline of the current consented extension are presented in appendix G.

A 'sunken garden' is proposed to the rear of the property providing access and light to the rear basement and a lightwell proposed providing light to the front basement. The completed lower ground floor will provide bedroom accommodation. The basement will extend to a depth of around 3m below ground floor levels (say 3.2m to allow for floor construction).

Underpinning will be required to perimeter and load bearing walls to the existing building allowing basement excavation. A structural retaining wall will be constructed to allow excavation of the light wells both to the front and rear elevations.

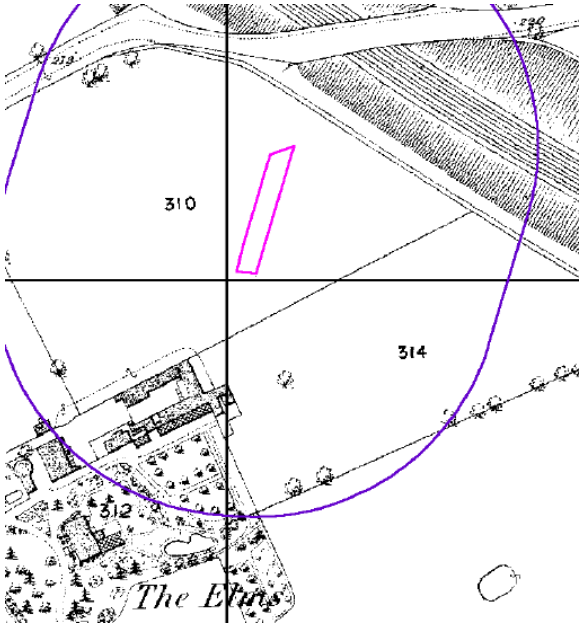
The front south facing elevation of the property is about 8m distance from the highway.

Copies of our client's Architects drawings showing project proposals are presented in Appendix A.

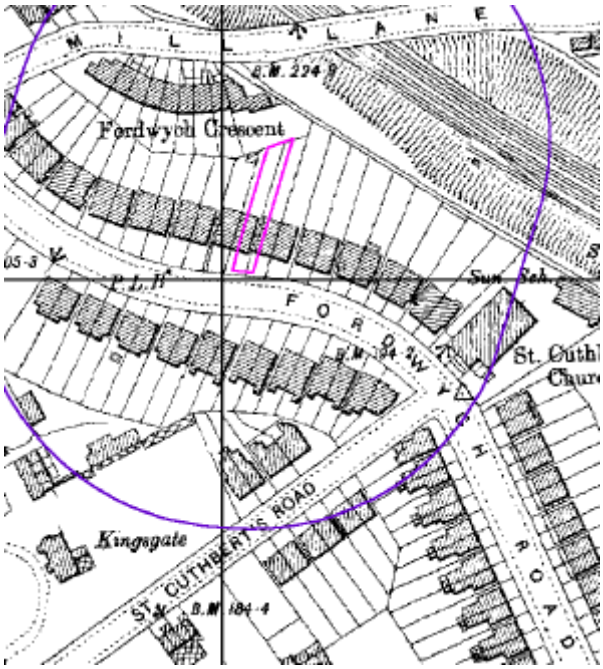
3 Desk study information and site observations

3.1 Site history

Review of Ordnance Survey and London town maps dating back to 1850s indicate the property was located within open fields until the late 1800s when the current footprint of the property and surrounding buildings is recorded. Deep railway cutting under Mill Lane is located to the north east but some 30m distant. Extract copies of key mapping is presented below with property position defined by a pink boundary.



Extract copy of 1879 map



Extract copy of 1896 map

At this stage is important to note there are no water courses recorded on the 1879 predevelopment map close to the property, and no evidence of any opencast quarrying activities in the locality.

3.2 Geology and geohydrology of the area

3.2.1 Geology

Inspection of the geological map of the area published by the British Geological Survey (BGS) indicates the following sequence of strata. The thickness of the strata has been obtained from a combination borehole record data formed within 500m of the property available on the BGS website, and geological sections shown on the BGS map.

Summary of Geology and likely aquifer containing strata					
Strata	**Bedrock or drift**	**Approximate thickness**	**Typical soil type**	**Likely permeability**	**Likely aquifer designation**
London Clay Formation	Bedrock	80	Clays	Low	Unproductive
Lambeth Group	Bedrock	16	Clays occasionally sandy	Low	Unproductive
Thanet sands	Bedrock	10	Fine sands	Low/moderate	Secondary Aquifer
Chalk	Bedrock	200	Chalk	High	Principal

Table 3.2

Soil types and assessments of permeability are based on geological memoirs, in combination with our experience of investigations in these soil types.

An extract copy of the geological map is presented below, with brown shading representing the outcrop of the London Clay Formation (LC). The property position is shown by the pink edging.

Based on the above any excavations within the property will be located within London Clays, however is it is acknowledged that a covering of made ground is inevitable associated with development of the area.

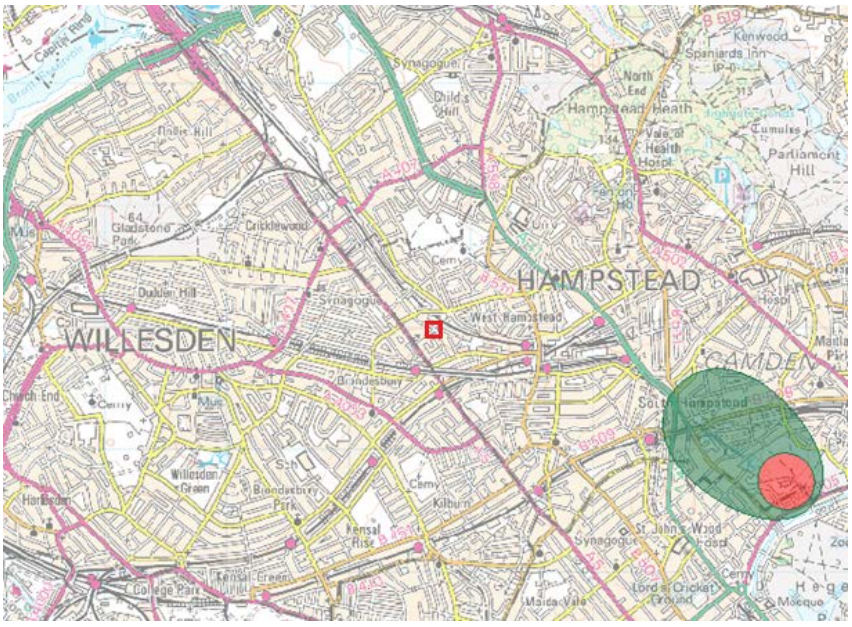
3.2.2 Geohydrology

The London Clay is classified as unproductive and regarded as not containing groundwater in exploitable quantities.

Chalk is classified a Principal Aquifer. Principal aquifers are defined as deposits exhibiting high permeability capable of high levels of groundwater storage. Such deposits are able to support water supply and river base flows on a strategic scale.

3.2.3 Source protection zone

The site is not recorded as being located within or close to a zone protecting a potable water supply abstracting from a principle aquifer (i.e. a source protection zone). An extract of the plan recording source protection zones is presented below, with green shading representing outer protection zones and red inner protection zones. The property is located within the red square and remote from source protection zones.



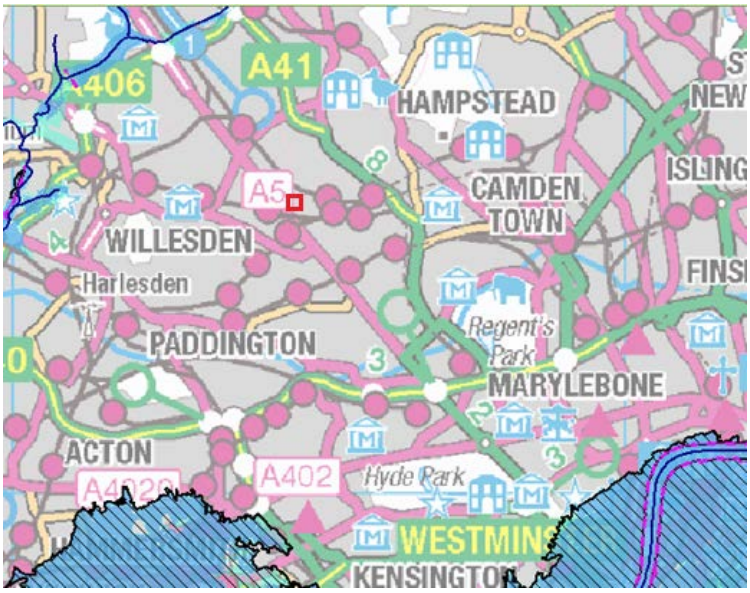
3.3 Quarrying/mining

3.3.1 With reference to the coal mining and brine subsidence claims gazetteer for England and Wales, available on the Coal Authority web site, the area has not been subject to exploitation of coal or brine. Inspection of old Ordnance Survey maps dating back to the first editions (late 1800s) does not record any quarrying activities within 250m of the property.

3.4 Flood risk

3.4.1 Fluvial/tidal flooding

The Environment Agency website indicates the site is not located within a fluvial or tidal flood plain. An extract copy of the flood risk map is presented below which shows no blue shading representative of flooding. The property is located within the red square.



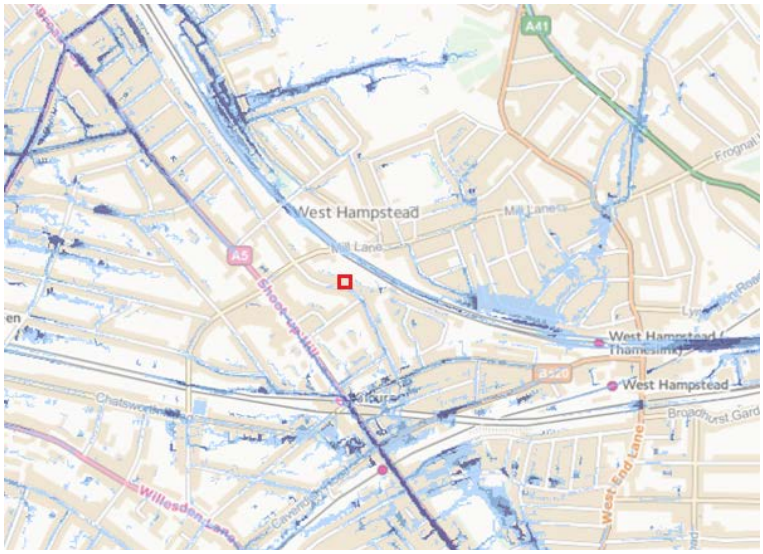
3.4.2 Flooding from Reservoirs, Canals and other Artificial Sources

The Environment Agency website indicates the site is not located within an area considered at risk of flooding from breach of reservoir containment systems. An extract copy of the flood risk map is presented below which shows no blue shading representative of flooding as a result of failure of containment systems close to the site. The property is located within the red square.

3.4.3 Flooding from Groundwater and surface waters

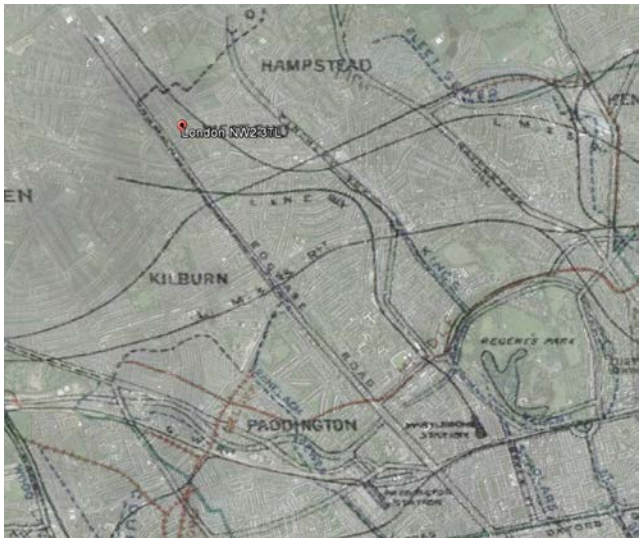
The site is underlain with a substantial thickness (80m) of relatively impermeable London Clay Formation. On this basis groundwater is not likely to be available at the site and thus is unlikely to present a risk of causing groundwater flooding.

We have viewed the Environment Agency web site which provides maps showing areas a risk of flooding from surface waters. An extract of the map is presented below. The property is located within the red square and blue shading represents areas at risk of surface water flooding. The property is remote from blue shaded areas.



An extract of figure 11 from the Camden Geological, Hydrogeological and Hydrological Study (referenced in Section 1.4) is presented below. The blue lines show the locations of branches of the former River Westbourne (immediately to the south of the property). The property is located within the red box. The property seems to be at the head waters of an upper branch of the Westbourne.

With reference to old mapping of the area described in section 3.1 above, the 1879 map (predevelopment) does not record any water courses close to or within the immediate area of the property. The Westbourne was a natural stormwater drainage system for this area of London prior to urbanisation. Development of London has resulted in original watercourses being culverted. The following is an extract plan showing main sewers installed between 1856 and 1930 to drain London. The nearest main sewers recorded on the map (in blue or brown) are located at least 2km distant from the property.



There are no major culverts in Fordwych Road recorded on Thames Water Asset register, an extract copy of which is presented below. There is a 965mm x 584mm combined sewer in the road following an easterly route.

An extract of figure 15 from the Camden Geological, Hydrogeological and Hydrological Study (referenced in Section 1.4) is presented below (property marked in a red box). The map records Fordwych Road was subject to flooding in 1975, but not in 2002. Importantly Fordwych Road falls in a southerly direction at a reasonably consistent gradient to Maygrove Road. The property is located on the 61m contour with Fordwych Road falling to Maygrove Road to the south (about 400m distant) located around the 45m contour (based on Ordnance Survey mapping). Thus there is a fall of some 6m to Maygrove Road to the south. Although Fordwych Road may have been subject to some flooding in 1975 it is considered very unlikely (given the gradient of the Road) and elevated position of the property above the Road that flooding would have affected the subject property.

Extract copy of figure 15 from the Camden Geological, Hydrogeological and Hydrological Study

Ground floor levels are raised above levels of Fordwych Road by about 0.6 to 0.8m which is illustrated in the adjacent photograph taken from the side passage adjacent to the east facing wall

We have obtained a copy of a report on sewer flooding from Thames Water which is presented in appendix H. The report advises there have been no incidences of flooding at the subject property as a result of sewer surcharging.

In conclusion, although flooding may have been recorded in Fordwych Road in 1975, (but not in 2002), any such flooding will not have caused flooding of the property due to its elevated position above Fordwych Road, and indeed the gradient of Fordwych Road in a Southerly direction.

There will be below ground water supply pipes operated by Thames Water in public highways around the property. These are generally relatively small diameter pipes. It is considered that the property is unlikely to be at enhanced risk of flooding due to ruptures in the potable water supply system in the area.

3.4.4 Conclusions

Based on the above, in our opinion, the property is considered unlikely to be at enhanced risk of being flooded by exceedences in capacity of foul and stormwater drainage or water supply pipes. Evidence presented above demonstrates the property is not at an enhanced risk of being affected by tidal or fluvial flooding or indeed from artificial sources. The property and indeed proposals will not be affected by groundwater flooding.

A pumped stormwater drainage system is proposed to accommodate water accepted by lightwells. This will be a sealed system and in combination with the fact that London Clays below the lightwells are effectively impermeable and no groundwater was detected in boreholes extending in the London Clays below lightwell excavations pumping will have no impact on lowering groundwater levels or on foundations to neighbouring properties.

4 Ground investigations

4.1 Scope

Two boreholes have been excavated at the property; one in rear gardens to 7m depth (DTS01) and one in front gardens to 3.5m depth (DTS02). Two hand dug trial pits have been excavated to determine foundation arrangements to the building

Fieldwork records are presented in appendix D. The location of boreholes and trial pits are shown on drawing BIA01 in appendix E.

4.2 Ground conditions encountered

Each of the two boreholes encountered a similar soil profile of naturally deposited London Clays capped in front gardens with 1m of made ground (absent in rear gardens). The London Clays essentially comprised medium strength brown grey silty clays. No groundwater was encountered in the excavations. A water level monitoring standpipe was installed to full depth of each borehole

Following a recent visit to site (29th October 2015) no groundwater was observed in the water levelling stand pipe.

The investigations confirmed published geological maps for the near surface geology.

4.2 Foundations

Based on investigations completed to date we are of the opinion that the London Clays will adequately support new spread type foundations including traditional underpinning to existing spread type foundations to facilitate lowering of existing basement floor levels.

4.3 Summary of basement retaining wall design parameters

4.3.1 The following table provides soil parameters for foundation design purposes

Parameter	Value	Origin
Presumed bearing value for underpin L section (as proposed) assuming 1m wide base (temporary scenario)	200kN/m^2	Based on undrained shear strength measurements and section of underpinning
Earth pressure at rest	1	Typical (published value)
Bulk density and saturated density	19kN/m^3	Derived from BS8002;1994
Moisture content	31%	Measured
Dry density	14.4 kN/m^3	Derived from above
Critical state angle of shearing resistance	20^o	Derived from BS8002;1994

4.4 Monitoring of ground conditions during construction

Following the requirements of the audit, the shear strength of the London clays will be monitored to check consistency against ground investigation data, and if any changes are observed then the foundation design reviewed to suit actual ground conditions.

5 External ground movements around basement

5.1 Construction proposals

Proposals are to extend the ground floor footprint into rear gardens by a distance of around 3m from the rear north facing elevation of the . In addition a single storey deep basement is proposed below the proposed ground floor footprint. A 'sunken garden' is proposed to the rear of the property providing access and light to the rear basement and a lightwell proposed providing light to the front basement. The completed lower ground floor will provide bedroom accommodation. The basement will extend to a depth of around 3m below ground floor levels (say 3.2m to allow for floor construction).

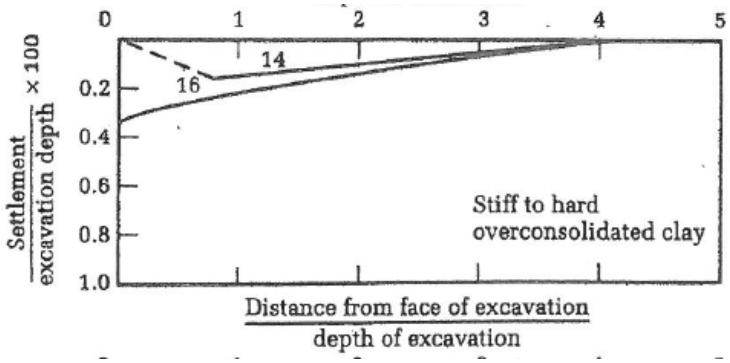
Underpinning will be required to perimeter and load bearing walls to the existing building allowing basement excavation. A structural retaining wall will be constructed to allow excavation of the light wells both to the front and rear elevations.

5.2 Settlement around and inward yielding of basement excavations

The following analysis is based on observations of ground movements around basement excavations in clays as reported in Tomlinson '*Foundation design and construction*' (seventh Edition)

It is recognised that some inward yielding of supported sides of strutted excavations and accompanying settlement of the retained ground surface adjacent to the excavation will occur even if structurally very stiff props / strutting is employed. The amount of yielding for any given depth of excavation is a function of the characteristics of the supported soils and not the stiffness of the supports. Based on observations of other excavations in over consolidated clay soils (which is the case at this site) the average maximum yield / excavation depth (%) was 0.16, with a range of 0.06 to 0.3. Assuming a maximum excavation depth of 3.2m then the likely inward yield will be in the order of 3.2 x 0.16/100 x 1000 = 5mm. Taking a worst case upper bound factor (0.3%) then the inward yield would be about 9mm.

Coincidental with the inward yield of embedded perimeter piles, some settlement of the retained soils around the excavation will occur.



The above relationship has been extracted from Tomlinson which reports the ratio of surface settlement to excavation depth in over consolidated clays (0.3%) and the distance from the excavation face over which surface settlement will occur. For a 3.2m deep excavation surface settlement in the order of 3.2 x 0.3/100 x 1000 = 9mm will occur adjacent to the excavation face diminishing in value for a distance of some 4 x 3.2m = 13m in a reasonably linear fashion.

We have produced a plan showing estimated surface settlement contours as a result of the basement excavation which is presented on drawing BIA01a in appendix E.

The adjoining property at No83 will be most affected (in terms of the effects of surface settlement) by the basement excavations. No 83 extends to a width of about 7m. Considering surface settlement of 9mm which diminishes over a horizontal distance of 13m, we estimate the horizontal strain will be about 0.04% on the main rear elevation of No83. This would suggest damage would fall into category 0 as described in the following table (extract from CIRIA report 580). Taking into account the combined effects of inward yield and settlement, category 2 damage may occur.
We have also considered the rear single storey projection building to no 83 and again taking into account the combined effects of inward yielding and surface settlement, category 2 damage could occur.

We have also considered the front elevation of no 79 which results in the same consclusion for no 83 (as outlined above). A copy of our calculations are presented in appendix F

In order to reduce this risk of damage to adjacent (neighbouring) properties we have considered limiting damage to Burland category 1 (very slight). Again our calculations are presented in appendix F. It is proposed to monitor inward yielding (horizontal movement) of basement walls (underpinning / retaining walls) which will be propped with adjustable props. If horizontal movement exceeds 2mm (refer calculation sheet 4) then props will require adjustment to compensate for this movement and maintain potential damage to adjacent properties within damage category 0 or 1. It should be noted that monitoring (and subsequent compensatory works as descibed above) will negate the effects of worst case inward yield movements.

We are aware that original foundations to number 83 have previously been underpinned to a reported depth of 3m, and this may reduce the effects of the basement excavation at number 81.

Whilst it is acknowledged that settlement and inward yielding movement observations are generally for embedded piled or diaphragm retaining walls, we are not aware of any published observational data for underpinning walls and insitu concrete retaining walls, but consider a propped embedded piled wall would afford more onerous movements. The value of making a finite element analysis to determine the amount of inward yielding of excavation supports in all routine cases of basement excavations is questionable requiring estimates of soil moduli and other factors such as poisons ratio.

Table 2.5 *Classification of visible damage to walls (after Burland et al, 1977, Boscardin and Cording, 1989; and Burland, 2001)*

Category of damage	Description of typical damage (ease of repair is underlined)	Approximate crack width (mm)	Limiting tensile strain ε_{lim} (per cent)
0 Negligible	Hairline cracks of less than about 0.1 mm are classed as negligible.	< 0.1	0.0–0.05
1 Very slight	Fine cracks that can easily be treated during normal decoration. Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection.	< 1	0.05–0.075
2 Slight	Cracks easily filled. Redecoration probably required. Several slight fractures showing inside of building. Cracks are visible externally and some repointing may be required externally to ensure weathertightness. Doors and windows may stick slightly.	< 5	0.075–0.15
3 Moderate	The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable linings. Repointing of external brickwork and possibly a small amount of brickwork to be replaced. Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired.	5–15 or a number of cracks > 3	0.15–0.3
4 Severe	Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Windows and frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Service pipes disrupted.	15–25 but also depends on number of cracks	> 0.3
5 Very severe	This requires a major repair involving partial or complete rebuilding. Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion. Danger of instability.	usually > 25 but depends on number of cracks.	

Notes

1. In assessing the degree of damage, account must be taken of its location in the building or structure.
2. Crack width is only one aspect of damage and should not be used on its own as a direct measure of it.

6 Hardened areas

The proposed basement footprint will extend over the full ground floor footprint of the current building and marginally less than the current consented extension buildings. On this basis the will be no increase in hardened and drained areas from current consented footprints. Details of footprints are shown on our client's architect's drawing in appendix G. The property is underlain with a substantial thickness of relatively impermeable London Clays, which is not amenable to disposal of stormwater using soakaways.

7 Tree removal

No major vegetation will be removed to accommodate the extension building.

8 Damage to adjacent buildings

In the recent past it has become apparent that both nos 81 and 83 have been subject to subsidence damage evidenced by a structural report prepared by B.H Maule and Partner s in November 2007 for the occupier of no 81 at that time. The report advises that original foundations to no83 were underpinned to a depth of 3m between August and October 2007. The report also recommends foundations to no 81 are underpinned to 3m to match those of no 83. The cause of adverse movement was reported as shrinkage of clay soils below foundations promoted by water demands of trees in rear gardens and in the highway (Fordwych Road). The foundation underpinning scheme to no 81 was not implemented but some tree removal was completed.

9 Summary of scoping and screening

Based on the above we have followed procedures described in CPG4 which are summarised in the following table.

Topic	CPG4 stage	Methodology	Impacts (CPG stage 4)
Flooding	Screening	Review of desk study information Correspondence with Thames Water	No detrimental impacts identified. No cause for concern. No requirement for scoping further investigations.
Groundwater	Screening	Review of desk study information	No detrimental impacts identified. Confirmation of ground conditions required to inform BIA
	Scoping stage 2	Borehole investigation required	
	Scoping stage 3	Ground investigation complete Ground water monitoring complete	Ground investigations confirm desk study information No detrimental impacts identified. No cause for concern
Land stability	Screening	Review of desk study information	No detrimental impacts identified. No cause for concern. No requirement for scoping further investigations.

10 Subterranean (Ground water) flow screening

10.1 General overview.

The property is positioned on locally high ground to the north-west of central London. The property is outside areas considered to be at risk of being affected by tidal and fluvial flooding associated with the Thames or its tributaries, or artificial water sources (canals/reservoirs). In addition the property is not considered to be at enhanced risk of flooding from sewers or water supply pipes.

Geological records indicate the site is underlain by deposits of London Clay Formation extending to depths of approximately 80m. The property (being underlain with a substantial thickness of London Clay Formation) is not considered to be at risk of flooding from groundwater and the proposals will not affect any groundwater flows.

10.2 Responses to flow chart questions

The following provides site specific responses to questions posed in figure 1 of CPG4

Question and response		Text reference
Question 1a	Is the site located directly above an aquifer?	
Response.	No. The property is directly underlain by over 80m thickness of London Clays which are classified Unproductive Strata (formerly Non Aquifer) by the Environment Agency.	3.2
Question 1b	Will the proposed basement extend beneath the water table surface?	
Response	No. The London Clay Formation comprises reasonably homogenous relatively impermeable clays which are not able to transmit groundwater under normal hydraulic gradients.	3.2
Question 2	Is the site within 100m of a watercourse, well or potential spring line?	
Response.	No. The site is remote (in excess of 100m) of any known watercourse. The geology of the area is not conducive to spring lines or wells for extraction of water. Based on this there are no matters of concern.	3.4.3

Question and response		Text reference
Question 3	Is the site within the catchment of the pond chains on Hampstead Heath?	
Response	No. Based on figure 14 within the Camden geological, hydrogeological and hydrological study report, the property is not within the catchment of the pond chains on Hampstead Heath. The property is located about 1.4km distance from the pond chains on Hampstead Heath	3.4.2
Question 4	Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?	
Response	No. The proposed basement footprint will extend over the full ground floor footprint of the current building and marginally less than the current consented extension buildings. On this basis the will be no increase in hardened and drained areas from current consented footprints Based on this there are no matters of concern.	5
Question 5	As part of the site drainage, will more surface water (e.g. rainfall and run off) than present be discharged to the ground (e.g. via soakaways/SUDS)?	
Response	No. The site is underlain by London Clays which are not amenable to disposal of stormwater using infiltration systems. Rainwater falling onto the garden area will be disposed of using natural absorption and natural run off (which is currently the case).	5
Question 6	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 (not just the pond chains on Hampstead Heath) or spring line?	
Response	No. The London Clay Formation comprises reasonably homogenous relatively impermeable clays which are not able to transmit groundwater under normal hydraulic gradient. Basement excavations will be formed in the London Clays. Based on this there are no matters of concern.	3.4.3

11 Stability impact identification

11.1 General overview.

The property is positioned on locally high ground to the north-west of central London. Ground levels in the area fall in a general southerly direction (down Fordwych Road) at a slope of 2 degrees.

No trees will be removed as part of the development

Proposals are to extend the ground floor footprint into rear gardens by a distance of around 5.1m from the rear north facing elevation of an existing single storey extension building. In addition a single storey deep basement is proposed below the proposed ground floor footprint, but extending about 8.2m from rear north facing elevation of an existing single storey extension building. It is important to note that planning consent has been granted for a rear extension building to extend a distance of 8.7m from the rear north facing elevation of an existing single storey extension building. Plans showing the extent of the new basement and outline of the current consented extension are presented in appendix G.

A 'sunken garden' is proposed to the rear of the property providing access and light to the rear basement and a lightwell proposed providing light to the front basement. The completed lower ground floor will provide bedroom accommodation. The basement will extend to a depth of around 3m below ground floor levels (say 3.2m to allow for floor construction).

11.2 Responses to flow chart questions

The following provides site specific responses to questions posed in figure 2 of CPG4

Question and response		Text reference
Question 1	Does the existing site include slopes, natural or manmade greater than 7^{o} (approximately 1 in 8).	
Response.	No. The topography of the area falls by about 2.3 degrees in a southerly direction. Based on this there are no matters of concern.	2.1
Question 2	Will the proposed profiling of landscaping at the site change slopes at the property boundary to more than 7^{o}?	2.2
Response	No. The proposed basement will not change the current topographical conditions. Based on this there are no matters of concern.	

Question and response		Text reference
Question 3	Does the development neighbour land including railway cuttings and the like with slopes greater than 7^{o} (approximately 1 in 8)?	
Response.	No. The topography of the area falls by about 2.3 degrees in a southerly direction. There is a railway cutting under Mill Lane located to the north east but some 30m distant but there are other residential properties between the subject property and the edge of the railway cutting. The basement construction will have no effect on the stability of the railway cutting. Based on this there are no matters of concern.	2.2
Question 4	Is the site within a wider hillside setting in which the slope is greater than 7^{O}?	
Response	No. The topography of the area falls by about 2 degrees in a southerly direction with the slope (down Fordwych Road) being reasonably uniform. Based on this there are no matters of concern.	2.1
Question 5	Is the London Clay the shallowest strata at the site?	
Response	Yes. The property is underlain with London Clays, extending to depths of around 80m in the area. Given the shallow (natural) slope angles in the area, the property is not considered to be at risk of slope instability. Based on this there are no matters of concern.	2.1
Question 6	Will any trees be felled as part of the development and/or are there any works proposed within any tree protection zones where trees are to be retained?	
Response	No trees will be removed as part of the development.	6

Question and response		Text reference
Question 7	Is there a history of any seasonal shrink swell subsidence in the local area and/or evidence of such effects on site?	
Response	Yes. No 83 has been underpinned to a depth of 3m and trees removed. No evidence of damage to other neighbouring building. Based on this there are no matters of concern.	
Question 8	Is the site within 100m of a watercourse, well or potential spring line.	
Response	No. The site is remote (in excess of 100m) of any known watercourse. The geology of the area is not conducive to spring lines or wells for extraction of water. Based on this there are no matters of concern.	3.4
Question 9	Is the site within an area of previously worked ground?	
Response	No. There is no evidence to indicate the site has been subject to quarrying activities in the area. Based on this there are no matters of concern.	3.1
Question 10	Is the site located above an aquifer? If so will the proposed basement extend beneath the water table such that dewatering may be required during construction?	
Response	No. The property is directly underlain by over 80m thickness of London Clays which are classified Unproductive Strata (formerly Non Aquifer) by the Environment Agency. The London Clay Formation comprises reasonably homogenous relatively impermeable clays which are not able to transmit groundwater under normal hydraulic gradient. New basement excavations will be formed in the London Clays. Based on this there are no matters of concern.	3.2
Question 11	Is the site within 50m of Hampstead Heath ponds?	
Response	No. The property is located about 1.4km to the west of the pond chain on Hampstead Heath. Based on this there are no matters of concern.	3.4.2

Question and response		Text reference
Question 12	Is the site within 5m of a public highway or pedestrian right of way?	
Response.	No. The proposed basement will not be located within 5m of a public highway/footway. Based on this there are no matters of concern.	2.2
Question 13	Will the proposed basement significantly increase the differential depth of foundations relative to adjacent properties?	
Response	No. Traditional underpinning will be used to extend existing foundations down to proposed lower ground floor levels, possibly extending existing foundation depths down by around 2m. Although there will be differences in ground / basement level floors between the new build and adjacent properties (but not no 83), the proposed basement construction solution will not affect neighbouring properties, and estimates of movements which may occur during the construction phase are described in section 5 which indicate acceptable levels of differential movement. Based on this there are no matters for concern.	5
Question 14	Is the site over (or within the exclusion zone of) any tunnels e.g. Railway lines.	
Response	No. The property is not located within 50m of an underground railway. Based on this there are no matters of concern.	

12 Surface flow and flooding impact identification

12.1 General overview.

The proposed basement footprint will extend over the full ground floor footprint of the current building and marginally less than the current consented extension buildings. On this basis the will be no increase in hardened and drained areas from current consented footprints. Details of footprints are shown on our client's architect's drawing in appendix G. The property is underlain with a substantial thickness of relatively impermeable London Clays, which is not amenable to disposal of stormwater using soakaways.

12.2 Responses to flow chart questions

The following provides site specific responses to questions posed in figure 3 of CPG4

Question and response		Text reference
Question 1	Is the site within the catchment of the pond chains on Hampstead Heath?	
Response.	No. The property is not located within the catchment of the pond chains.	3.4.2
Question 2	As part of the site drainage, will surface water flows (e.g. rainfall and run off) be materially changed from the existing route?	
Response	No. Proposals will not have a material impact on surface water flows.	5
Question 3	Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?	
Response.	No. Refer 12.1 above.	12.1
Question 4	Will the proposed basement result in changes to the profile of the inflows (instantaneous and long term) of surface water being received by adjacent properties or downstream water courses?	
Response	No. Proposals will have no impact on surface water received by adjacent properties or downstream watercourses.	12.1

Question and response		Text reference
Question 5	Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream water courses?	
Response	No. Proposals will have no impact on surface water flows to adjacent properties or downstream water courses.	12.1
Question 6	Is the site in an area known to be at flood risk from surface water flooding ,such as South Hamstead, West Hamstead, Gospel Oak and Kings Cross, or is it at risk of flooding, for example because the proposed basement is below the static water level of a nearby surface water feature?	
Response	The site is not at flood risk from fluvial or tidal flooding or indeed from artificial sources. The property is considered unlikely to be at enhanced risk of being flooded by exceedences in capacity of foul and stormwater drainage or water supply pipes.	3.4

13 Summary and Conclusions

13.1 A new basement is proposed extending over the full footprint of the building and rear extension. There is already a partial basement in the centre of the building. Light wells will be provided both in front and rear gardens. Proposals include the addition of a small single storey extension at ground level which has the benefit of a planning consent.

13.2 Old mapping of the area records the site in open fields with the property first recorded on maps published in the late 1800s. There is no evidence of any watercourses or ponds close to the site.

13.3 Published BGS maps of the area record topography local to the property is formed in deposits of London Clays which probably extend to depths in the order of 80m in the area. The London clays are classified as unproductive strata (formerly Non Aquifer) by the Environment Agency. Boreholes formed at the site confirm the site is directly underlain with London Clays. The London Clay Formation comprises reasonably homogenous relatively impermeable clays which are not able to transmit groundwater under normal hydraulic gradient. Basement excavations will be formed in the London Clays and based on the above, not affected by groundwater. Similarly, installation of the proposed basement will not affect any subterranean ground water flows.

13.4 Ground levels do fall in a southerly direction by about 2.3 degrees, and slope instability is not considered to present a risk. Installation of the basement will not induce any slope instability.

13.5 There is reported evidence of subsidence damage to both no83 and 81 Fordwych Road. No 83 has been underpinned to 3m depth including the party wall between 83 and 81.

13.6 No trees will be removed as part of the development.

13.7 Installation of the basement will generate some ground movement close to the perimeter of the basement excavation. The amount of movement has been predicted based on records of observed movement in other basements during construction. Calculations have been produced to determine lateral movement which would limit damage to adjacent properties to category 1, and monitoring is proposed to check and mitigate any adverse movements.

13.8 The property is considered to be at no enhanced risk of being subject to flooding.

13.9 The proposed basement footprint will extend over the full ground floor footprint of the current building and marginally less than the current consented extension buildings. On this basis the will be no increase in hardened and drained areas from current consented footprints. Details of footprints are shown on our client's architect's drawing in appendix G. The property is underlain with a substantial

thickness of relatively impermeable London Clays, which is not amenable to disposal of stormwater using soakaways. Based on the above, the development will not increase that rate of discharge to stormwater to sewers and thus not contribute to flood risk downstream of the property.

13.10 The site is remote from underground tunnels.

13.11 In overall conclusion there are no outstanding issues of concern (singularly or cumulatively) from a stability, groundwater or surface water perspective.

14 Audit Query tracker

14.1 The following table is an extract from Campbell Reith identifying resolution to queries raised by the audit.

Query no	Subject	Query	Responsibility for resolution	Status	Response in report section
1	Qualifications	Confirmation required	MDM	Open	N/A
2	BIA	Impact of surface water discharges	Soiltechnics	Open	Section 6 Page 15
3	Basement dimensions	Confirmation required	Zyntax	Open	Section 2.2 Page 3 and appendix G
4	Hydrogeology	Groundwater monitoring	Soiltechnics	Closed	N/A
5	Surface water	Sewer flood risk	Soiltechnics	Open	Section 3.4.3 pages 10 and 11
6	Surface water drainage	Impact of surface water discharges		Open	Section 6 Page 15
7	Stability	Structural calculations	MDM	Open	N/A
8	Stability	Methodology	MDM	Closed	N/A
9	Drainage of light wells	Effects on groundwater table	Soiltechnics/MDM	Closed	N/A
10	Stability	Re-assessment of movement analysis	Soiltechnics	Open	Section 5.2 Page 14 And appendix F
11	Monitoring	Limits identified	MDM	Closed	N/A
12	Precondition survey of no83		Party wall surveyor	Closed	N/A
13	Soil strength testing	During construction		Closed	N/A
Other	Soil parameters		Soiltechnics		N/A

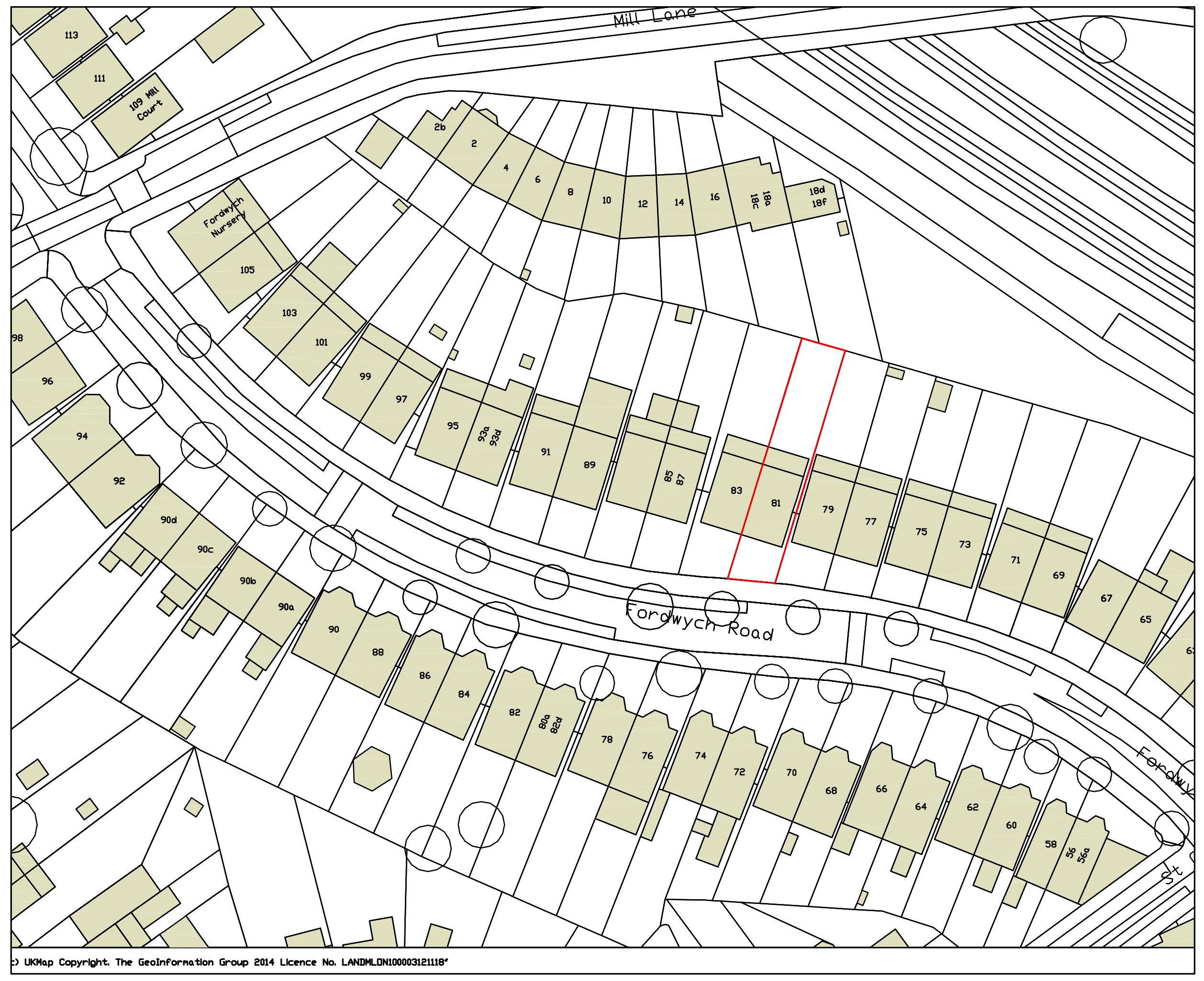
EXISTING ELEVATIONS PLANS scale 1:100

© check all dimensions and report all errors and omissions

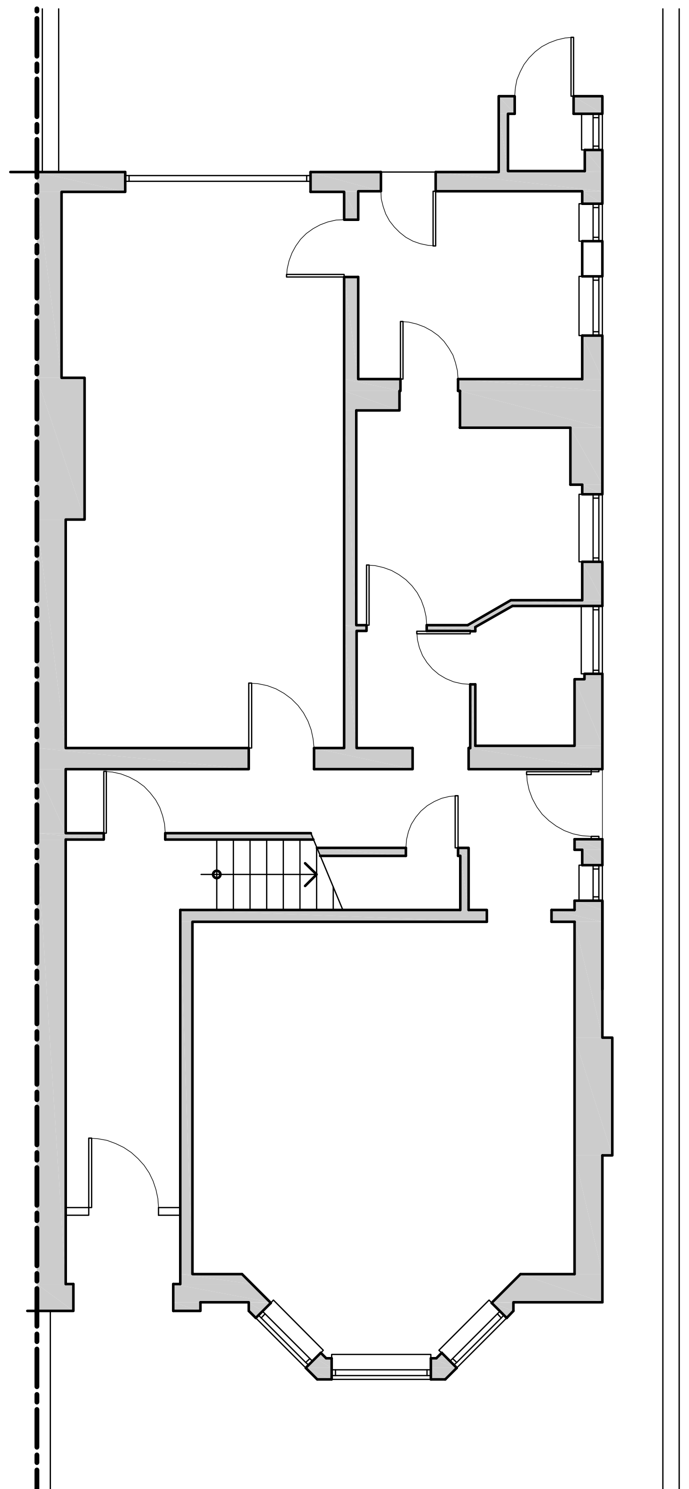
Front Elevation

Side Elevation

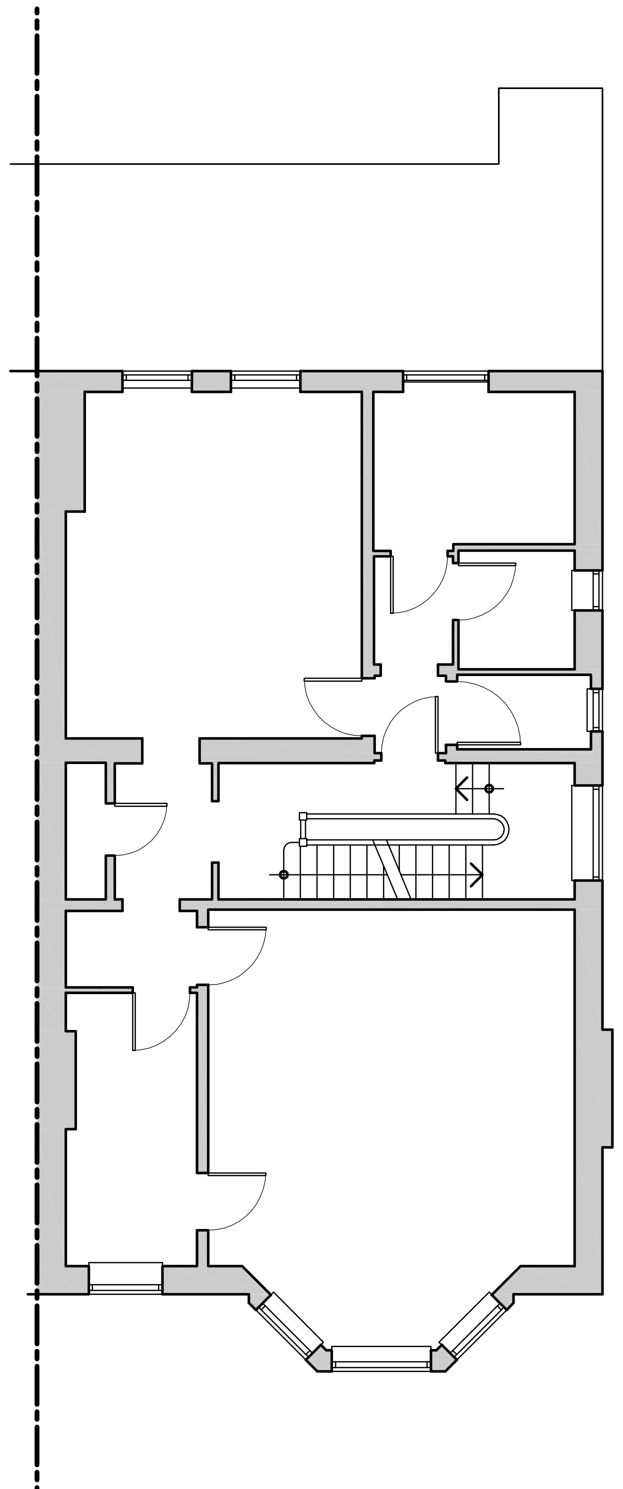
Rear Elevation



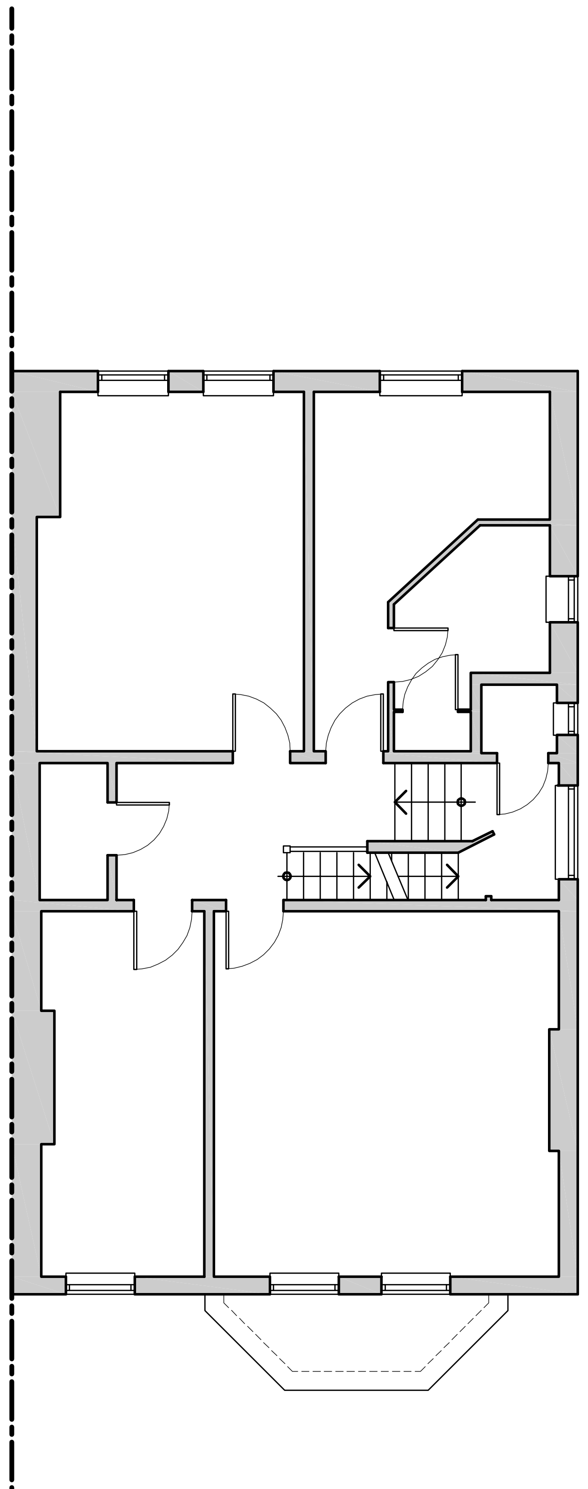
Site Plan 1:1250



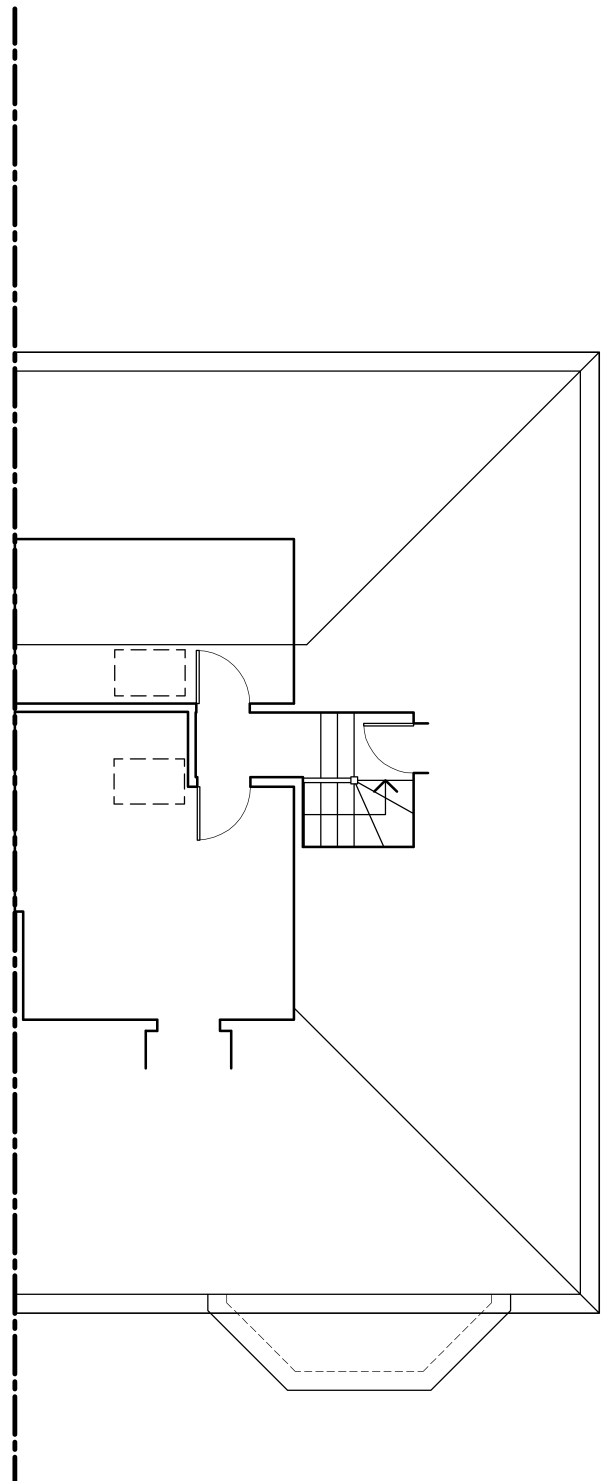
Ground Floor Plan



First Floor Plan



Second Floor Plan



Third Floor Plan

Alterations and Extension to
81 Fordwych Road West Hampstead
London
Project :

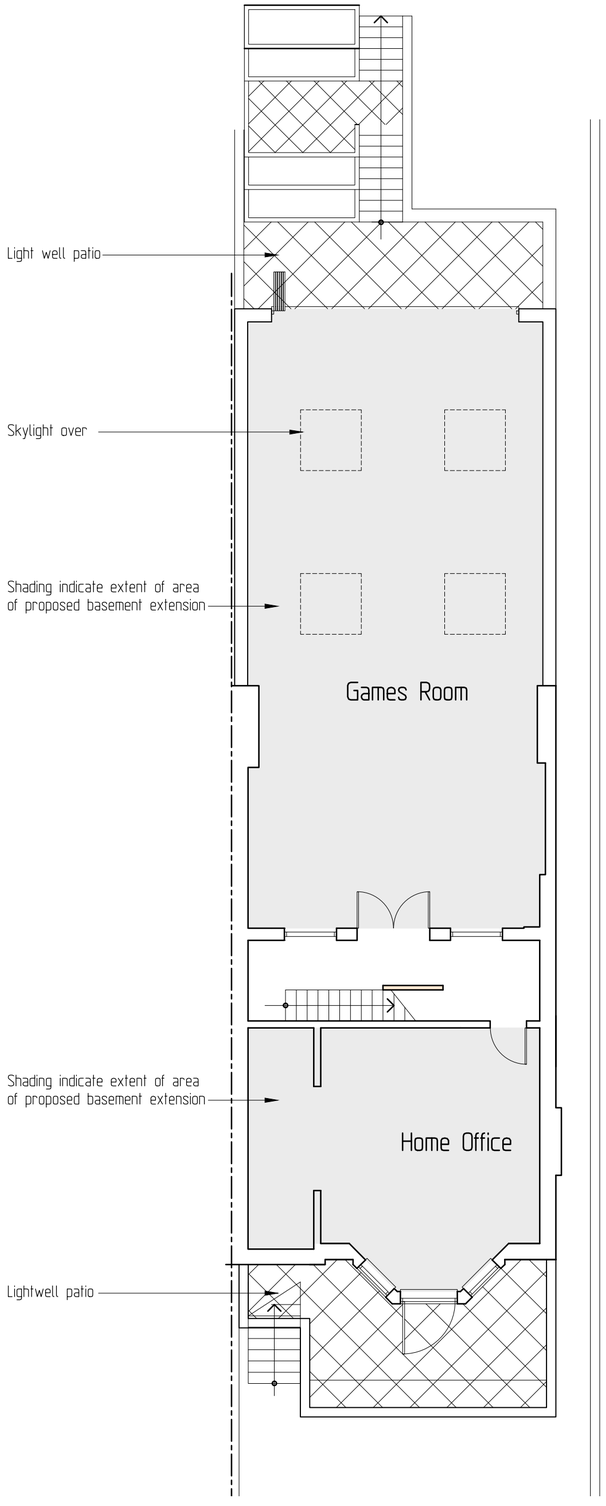
Existing Survey

Title :

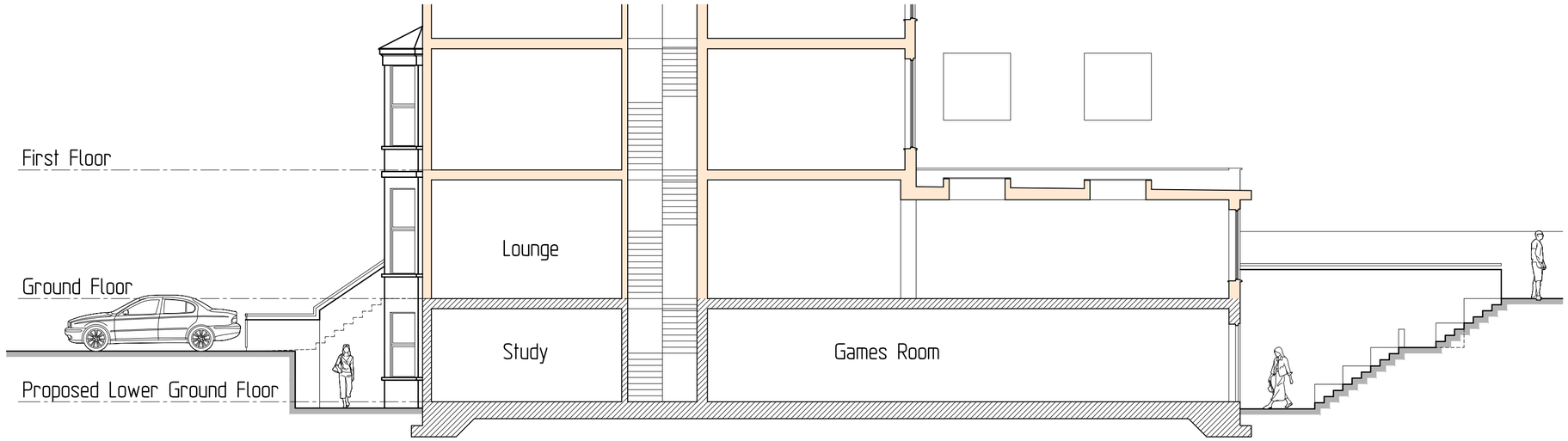
Client :

Zyntax
Chartered Architect
8 Arborfield Close, Slough
Berkshire SL1 2JW
Tel 01753 522944
reception@zyntaxarchitects.com

Date :	Scale :	Drawing No. :	Revision :
Sept14	1:100	31-14-01	



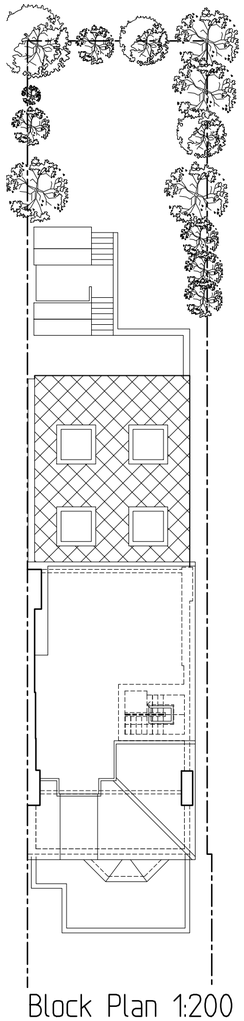
Proposed Lower Ground Floor Plan



Proposed Section

Rear Elevation

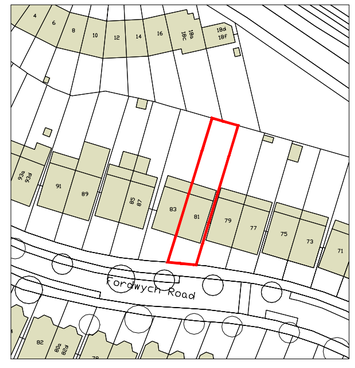
Front Elevation



Block Plan 1:200

0 .5m 1m 2m 3m 4m 5m 6m

Scale 1:100



Site Plan 1:1250

Basement Extension to
81 Fordwych Road West Hampstead
London

Project :

Basement Extension
Scheme Proposal

Title :

Client :

Zyntax
Chartered Architect
8 Arborfield Close, Slough
Berkshire SL1 2JW
Tel 01753 522944
reception @ zyntaxarchitects.com

Date :	Scale :	Drawing No. :	Revision :
Mar.14	1:100	31-14-Ex12	

Statement of experience on basements

Soiltechnics have carried out a large number of investigations for basement constructions throughout the UK and in more recent years outside the UK

The following table provides a limited number examples (for illustration purposes) of investigations carried out for basements which include interpretative reports providing parameters for detailed design such as settlement / heave, ground movements around basements, hydrological effects and in some cases preliminary design of piles.

Location	ground conditions	Basement	Approx size (m)	Date
Northamptonshire	Glacial Till	Single storey archive store for Rolls Royce. Part open excavation for construction of reinforced concrete box subsequently backfilled	10 x 8	Circa 1992
Central London (Kings Road)	Terrace sands and gravels over London Clays	Two storey deep car park with gardens at ground level. Contiguous pile wall with subsequent insitu concrete box	40 x 20	Circa 2000
Central London (Finsbury square)	Terrace sands and gravels over London Clays	Two storey deep basement below multi storey building with adjacent buildings. Contiguous pile wall with subsequent insitu concrete box	30 x 20	Circa 2002
Central London (Union Street)	Terrace sands and gravels over London Clays	Two storey deep basement below multi storey building with adjacent buildings including tube tunnels. Contiguous pile wall with subsequent insitu concrete box	40 x 30	2009
Central London (Blackfriars)	Terrace sands and gravels over London Clays	Two storey deep basement below multi storey building with adjacent buildings including railway viaduct . Contiguous pile wall with subsequent insitu concrete box	40 x 20	2005
Central London (Imperial College)	Terrace sands and gravels over London Clays	Single storey deep basement below multi storey residential block. Sheet pile walls with subsequent insitu concrete box	60 x15	2005
Coventry University	Mercia Mudstones	Single storey deep basement with three storey building over. Part cut and part sheet piled with subsequent insitu concrete box	50 x50	2010
Rabat Grand theatre Bouregrerg Morrocco	Alluvial gravels over sandstone	Single storey deep basement. Open excavations and sheet piles walls with subsequent insitu concrete box. Piled foundation for super structure. Area subject to earthquakes and liquefaction. Outline design of piles, specification for piling and testing.	50 x50	2012
Central London (various locations)	London Clays occasionally overlain with terrace sands and gravels	Various existing terraced semi and detached domestic properties. New single and two storey deep basements under building foot prints and extending into gardens. Construction using traditional underpinning techniques and contiguous / secant piled walls	Various	2000 to date
Central London (Holland Park)	London Clays	Two locally three storey deep basement below new four storey block of flats. Secant piled walls and insitu concrete box	70 x 20	2014

Curriculam Vitae
Nigel Thornton
B.Sc, C.Eng, MICE, MCIHT, FGS.

soiltechnics
environmental and geotechnical consultants

Qualifications

- Awarded degree in Civil Engineering., City University, London in 1980
- Elected Member of the Institution of Civil Engineers in 1983 (Chartered Civil Engineer)
- Member of the Chartered Institution of Highways and Transportation since 1984
- Fellow of the Geological Society since 1986

Employment History

• Northampton Borough Council	1975 - 1980
• Northamptonshire County Council	1980 - 1989
• The John Parkhouse Partnership	1989 - 1989
• Associate Partner	1989 - 1993
• Partner	1993 - 2005
• JPP Consulting (Director)	2005 to date
• Soiltechnics (Director)	1993 to date

Note

- In 2005, the John Parkhouse Partnership was incorporated into JPP Consulting Ltd (current complement 28 staff)
- Founding Director of Soiltechnics Ltd, a company specialising in geotechnical and geo-environmental matters. (Current complement 27 staff)

Relevant Experience

Bridgeworks

General design, contract administration and site supervision of various highway bridges and retaining structures.

Geotechnical and Geo-environmental

As Geotechnical Project Manager for Engineering Services Laboratory at NCC (ESL). (1985 - 1989)

Control of ground investigations for major highway schemes for local authority including implementation of fieldwork, direction of laboratory testing and production of factual and interpretative reports, following and satisfying geotechnical certification procedures for Department of Transport (schemes up to £15m)

Generally, at ESL, Soiltechnics and JPP.

Design and specification of earthworks, including determination of slope stability. Investigation and remediation of unstable slopes.

Control, implementation of fieldwork and production of geotechnical reports for industrial and commercial developments, housing schemes and water authority infrastructure (scheme values up to £80m).

Investigations for outline designs of landfill sites. Investigations for redevelopment of chemically contaminated sites, assessment of the same, design and verification of remediation works. Production of tender and contract documents for ground investigations.

	Investigations into mine workings and assessment of their stability. Specifications for ground improvement works (vibrotreatment) and piling. Investigations and reporting on a wide range of basement constructions for commercial and residential buildings 1 to 4 stories deep. Producing basement impact reports. Lecturing to other professionals on the investigation assessment and remediation of contaminated land, and EPA part IIA Lectures to local ICE branch on geotechnical aspects.
Materials Management	Production of construction material specifications, primarily in concrete, aggregates and bituminous mixtures, but including masonry, timer, steel and protective systems. Control and implementation of investigations into failures of construction materials including scheduling and analysing test data, and production of technical reports providing specifications for appropriate remedial measures.
Building Structures	Structural inspections and surveys on a wide range of commercial, domestic, industrial and military buildings including direction of appropriate investigations and production of details repairs/construction specifications. Design and checking of building structures in timber, steel, concrete and masonry including supervision of works on site. Design works carried out both manually and using computerised systems following current British Standards and other recognised design standards.
Road Pavement Structures	Direction and implementation of condition surveys and investigations of road pavement using falling weight deflectometer, deflectograph bump integrator and coring. Direction of testing regimes for bituminous and cement bound and unbound pavement materials. Production of reports on condition and assessment of load carrying capacity of existing roadways and specification and structural design for new roadways for both highway and industrial use. Design of various road pavement structures (flexible and rigid) using Highways Agency guidelines and British Ports Federation guidelines.
Drainage and Flood Risk Assessments	Design of main (adoptable) and private foul and stormwater infrastructure for housing, commercial and industrial schemes, including detention basins, infiltration systems, pumping stations etc. Production of flood risk assessment reports.
Quality Assurance	Assisting in production of main laboratory procedures to obtain NAMAS accreditation for large spectrum of soils and materials testing. Geotechnical contributions to Quality Assurance Manual for Soiltechnics/JPP and implementation of procedures.
CPD and Health and Safety	Attendance of in house CPD Seminars and production of Health and Safety Plans/files for building works. Author of in house risk assessment and Practice policies.
Litigation	Acting as expert witness on numerous construction related matters.
Publications	Co-author of a book entitles 'Cracking and Building Movement' published by the Royal Institution of Chartered Surveyors, in late 2004.

Chord Environmental Ltd

Nigel Thornton
Soiltechnics Ltd
Cedar Barn
White Lodge
Walgrave
Northampton
NN6 9PY

Your Ref: 81 Fordwych Road
Our Ref: 1127/LJE060515

For the attention of: Nigel Thornton

6th May 2015

81 Fordwych Road BIA Review

Dear Nigel,

Further to our discussions and the instruction to proceed on behalf your client (Zyntax Chartered Architects) I have undertaken a review of the Basement Impact Assessment (BIA) prepared by Soiltechnics Ltd for the proposed basement development at 81 Fordwych Road.

I have reviewed the design of the proposed basement development, together with the information presented within the above documents, against the requirements of the Camden BIA guidance set out within DP27 and CPG4.

Chord Environmental specialise in the provision of hydrogeological services with extensive experience in the UK supporting both private and public sector clients. I am a geologist and hydrogeologist and have a BSc. in geology from the University of Bristol, a MSc. in hydrogeology from the University of East Anglia and am also a Chartered Geologist and fellow of the Geological Society. I am Managing Director at Chord Environmental and was previously a Technical Director with Paulex Environmental Consulting and managed Hyder Consulting (UK) Ltd's groundwater team.

I have been a hydrogeologist for 17 years. During that time I have advised on over 80 basement developments. Much of my career has been spent assessing the impact of development on the quality and quantity of groundwater resources. I have worked for both promoters and regulators of schemes and have acted as an expert witness for the Highways Agency and on BIA schemes.

Development proposal

The site is occupied by a three storey semi-detached house with a partial basement c.2m deep within the central part of the property. I understand the proposed development comprises the 3m extension of the ground floor footprint into the rear gardens and the construction of a single storey, 3.2m deep basement, fully extending beneath the ground floor footprint. A 'sunken garden' is proposed to the rear of the property providing access and light to the rear basement and a lightwell proposed providing light to the front basement.

Environmental Site Setting

The BIA screening assessment and site investigation interpretation has identified 81 Fordwych Road to be underlain by the Eocene London Clay as shown on the British Geological Survey 1:50,000 scale map (Sheet 256 – North London) to a depth of c.80m. The London Clay is classified as Unproductive Strata by the Environment Agency, strata with low permeability that have negligible significance for water supply or river base flow. The very low permeability of the London Clay results in very low rates of rainfall infiltration and correspondingly, very high rates of rainfall runoff.

The London Clay, together with the clays of the Lambeth Group, acts as an effectively impermeable confining layer over the Chalk which lies at a depth of over 100m beneath the site.

There are no surface water features within 500m of the site. Figure 11 of the "Camden Geological, Hydrogeological and Hydrological Study", shows a headwater tributary of the former Westbourne watercourse to have run just over 500m to the southeast of Fordwych Road. The Westbourne is now culverted beneath West Hampstead and discharges to the Thames.

Fordwych Road does not lie within an area of flood risk as designated by the Environment Agency. However, Fordwych Road was affected by the surface water flooding of the area which occurred during 1975 but not during the 2003 flooding event.

Surface Flow and Flooding Assessment

The BIA screening, scoping and risk assessments have followed the CPG4 guidance criteria and screening questions. The potential surface flow and flooding issue raised by the screening and scoping exercises have been appropriately addressed by Soiltechnics within the report and no areas of concern relating to the proposed development were identified.

Subterranean (Groundwater) Flow Screening Assessment

The BIA screening, scoping and risk assessments have followed the CPG4 guidance screening questions. I have commented on the answer to each question below.

- **Question 1a: Is the site located directly above an aquifer?**

  As the Site is mapped as being underlain by a significant thickness of London Clay, designated as Unproductive Strata by the Environment Agency, I agree it is not located above an aquifer. The geology of the areas is well understood and the published geological map is based on extensive borehole data.

- **Question 1b: Will the proposed basement extend beneath the water table surface?**

  No. The London Clay is not capable of transmitting groundwater but because it is predominantly clay, it does hold water. As such there is not generally a water table present within it. Monitoring boreholes drilled within the London Clay do slowly fill with groundwater over time; however there is little or no hydraulic continuity between boreholes due to the very low permeability of the clay and ability of the clay matrix to hold or adsorb water.

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

  No surface water features are present within 500m of the site The London Clay is not capable of providing groundwater baseflow to watercourses and is classified Unproductive Strata. The proposed basement would therefore not act to prevent groundwater flow to any watercourses, wells or spring lines.

- **Question 3: Is the site within the catchment of the pond chains on Hampstead Heath?**

  No. The Site is located more than 2.5 km west, and down topographic gradient, of the Hampstead Heath ponds and therefore lies outside their hydrological catchment area.

- **Question 4: Will the proposed development result in a change in the proportion of hard surfaced / paved area?**

  The proposed basement development would result in a small net increase in building footprint. In relation to the assessment of the proposed development on groundwater flow, the purpose of this question is to determine whether rainfall recharge to an underlying aquifer would be reduced. However, the London Clay's low permeability results in a negligible rate of rainfall infiltration and a correspondingly high rainfall runoff rate, therefore the proposed basement would not have an impact on groundwater resources.

- **Question 5: As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to ground (e.g. via soakaways and/or SUDS)?**

  No. The lowly permeable nature of the London Clay strata is unsuitable for receiving surface water discharge to ground due to extremely low infiltration rates. The current drainage condition would be maintained.

- **Question 6: 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 (not just the pond chains on Hampstead Heath) or spring line?**

  I agree there are no mapped local groundwater dependent ponds or spring lines present within 100m of the Site. This is consistent with the geology and hydrogeology of the area.

Slope Stability Assessment

The BIA screening, scoping and risk assessments have followed the CPG4 guidance criteria and screening questions. The potential slope stability issues raised by the screening and scoping exercises have been appropriately addressed by Nigel Thornton (C.Eng) of Soiltechnics Ltd within the BIA report and no areas of concern relating to the proposed development were identified.

Conclusions

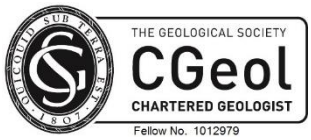
The BIA report has appropriately characterised 81 Fordwych Road with respect to its geological and groundwater site setting. As the site is underlain by low permeability London Clay, the geological and hydrogeological setting of 81 Fordwych Road is not sensitive with respect to groundwater resources or flow.

The purpose of the Basement Impact subterranean or groundwater flow assessment is to identify the potential for the proposed basement development to cause groundwater impacts and subsequently identify areas which require further investigation. The proposed development would be sited within a significant thickness of London Clay and no potential adverse impacts have been established by these assessments.

Yours sincerely,

John Evans BSc MSc CGeol.

Director



soiltechnics
environmental and geotechnical consultants

Key to legends

Composite materials, soils and lithology

Topsoil	Made Ground	Boulders
Chalk	Clay	Coal
Cobbles	Cobbles & Boulders	Concrete
Gravel	Limestone	Mudstone
Peat	Sand	Sand and Gravel
Sandstone	Silt	Silt / Clay
		Siltstone

Note: Composite soil types are signified by combined symbols.

Key to 'test results' and 'sampling' columns

Test result	
Depth	Records depth that the test was carried out *(i.e.: at 2.10m or between 2.10m and 2.55m)*
Result	PP – Pocket penetrometer result (kN/m^2) HVP – Hand held shear vane result (kN/m^2) *PP result converted to an equivalent undrained shear strength by applying a factor of 50. Where at least 3 results obtained at same depth then an average value may be reported.*
	SPT – Standard Penetration Test result (uncorrected) *SPT(c) – Standard Penetration Test result (solid cone) (uncorrected)*

Sampling		
From (m) To (m)	Records depth of sampling	
Type	D	Disturbed sample
	B	Bulk disturbed sample
	J	Disturbed sample placed in sealed jar
	ES	Environmental sample comprising plastic and glass container
	W	Water sample
	U (32)	Undisturbed sample 100mm diameter sampler with number of blows of driving equipment required to obtain sample

Water observations

Described at foot of log and shown in the 'water strike' column.

▼ = water level observed after specified delay in drilling

▽ = water strike

Standpipe details

Gravel filter

Arisings

Bentonite

Slotted pipe

Unslotted pipe

Density

Density recorded in brackets inferred from density testing and soil descriptions from across the site (i.e.: [Medium dense]).

81 Fordwych Road,
West Hampstead, London

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WELL	DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Dark brown clayey gravelly SAND with ash and fragments of brick noted. MADE GROUND						0.10		D
	Medium strength orange brown CLAY with occasional brick fragments and frequent rootlets noted. MADE GROUND		0.25		PP 0.30	79	0.30		D
					PP 0.50	63	0.50		D
					PP 0.70	71	0.70		D
					PP 0.90	54	0.90		D
	Medium strength orange brown mottled grey silty CLAY. LONDON CLAY		1.00		PP 1.10	63	1.10		D
					PP 1.30	71	1.30		D
					PP 1.50	79	1.50		D
	...between 1.7m and 2m depth, gravels of sub-angular fine to coarse carbonate concretions noted.				PP 1.70	96	1.70		D
					PP 1.90	83	1.90		D
	. . from 2m depth, becoming weakly indistinctly laminated with grey silt partings.				PP 2.10	96	2.10		D
					PP 2.30	117	2.30		D
					PP 2.50	104	2.50		D
					PP 2.70	117	2.70		D
					PP 2.90	121	2.90		D
					PP 3.10	63	3.10		D
					PP 3.30	163	3.30		D
					PP 3.50	142	3.50		D
					PP 3.70	138	3.70		D
					PP 3.90	133	3.90		D
	High strength brown slightly fine sandy silty CLAY. LONDON CLAY		4.00		PP 4.10	138	4.10		D
					PP 4.30	167	4.30		D
					PP 4.50	167	4.50		D
					PP 4.70	163	4.70		D
					PP 4.90	167	4.90		D
	CONTINUED ON NEXT SHEET								

Notes: Standpipe installed to 7m depth. For Dynamic Cone Penetration testing, refer to DCP01.

Ground level (mAOD)

Co-ordinates

Title
Driven tube sampler borehole record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Date of excavation (range if applicable)
08/04/2015

Appendix
-

Location plan on drawing number
02

DTS01

81 Fordwych Road,
West Hampstead, London

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WELL	DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS		SAMPLING		
					TYPE/ DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
					PP 5.10	129	5.10		D
					PP 5.30	100	5.30		D
					PP 5.50	175	5.50		D
					PP 5.70	200	5.70		D
					PP 5.90	208	5.90		D
					PP 6.10	204	6.10		D
					PP 6.30	171	6.30		D
					PP 6.50	183	6.50		D
					PP 6.70	213	6.70		D
					PP 6.90	196	6.90		D
	BOREHOLE TERMINATED AT 7.00m		7.00						

Notes: Standpipe installed to 7m depth. For Dynamic Cone Penetration testing, refer to DCP01.

Ground level (mAOD)

Co-ordinates

Title
Driven tube sampler borehole record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Date of excavation (range if applicable)
08/04/2015

Appendix
-

Location plan on drawing number
02

DTS01

81 Fordwych Road,
West Hampstead, London

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WELL	DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS		SAMPLING		
					TYPE/ DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Medium strength orange brown CLAY. LONDON CLAY				PP 0.10	96	0.10		D
					PP 0.30	83	0.30		D
					PP 0.50	67	0.50		D
					PP 0.70	88	0.70		D
					PP 0.90	75	0.90		D
					PP 1.10	92	1.10		D
					PP 1.30	108	1.30		D
					PP 1.50	121	1.50		D
					PP 1.70	113	1.70		D
					PP 1.90	96	1.90		D
	Medium strength brown mottled grey silty CLAY with occasional weak indistinct lamination. LONDON CLAY		2.00		PP 2.10	96	2.10		D
	...from 2.2m depth, selenite crystal noted.				PP 2.30	92	2.30		D
					PP 2.50	104	2.50		D
					PP 2.70	104	2.70		D
					PP 2.90	113	2.90		D
							3.00		D
					PP 3.10	83			
							3.20		D
					PP 3.30	88			
							3.40		D
	BOREHOLE TERMINATED AT 3.50m		3.50		PP 3.50	96			

Notes: Standpipe installed to 3m depth. Borehole undertaken with in excavation 0.6m below ground level.

Ground level (mAOD)

Co-ordinates

Title
Driven tube sampler borehole record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Date of excavation (range if applicable)
08/04/2015

Appendix
-

Location plan on drawing number
02

DTS02

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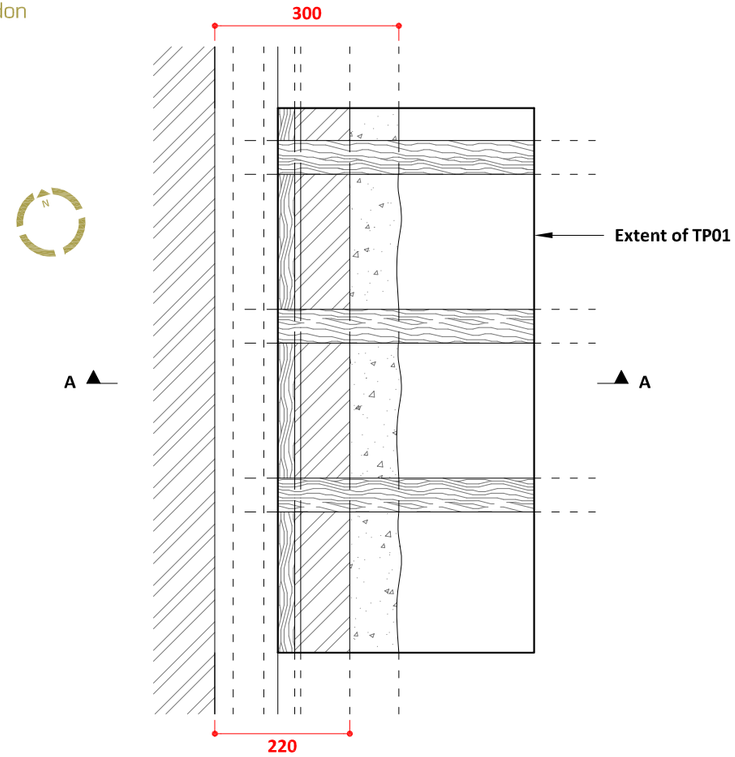
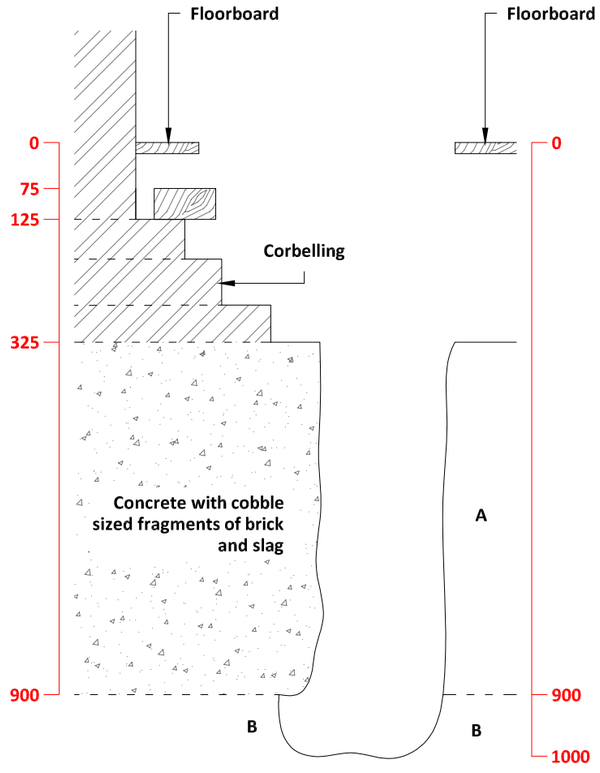
Plan



Section A-A



Photographic record

Key

A. Medium strength grey brown sandy gravelly CLAY with angular cobbles of brick, slag, ash and concrete. Gravel consists of brick, slag, ash and concrete.
(MADE GROUND)

B. Medium strength brown CLAY reworked with fragments of brick rubble.
(MADE GROUND)

Observed features
Assumed features

Denotes brickwork
Denotes concrete
Denotes timber
Denotes timber *(section)*

Notes

1. All dimensions shown in millimetres
2. Disturbed samples taken from 0.5m and 0.95m depths
3. Pocket penetrometer testing:
   - P 0.95m - 46 (kN/m²)

Method of excavation		Title	Location reference
Hand tools		Trial pit record	TP01
Dimensions		Date of works	Location plan on drawing number
As shown		08.04.2015	02
Groundwater observations		Scale	Appendix
No groundwater encountered		1:10 at A3	D

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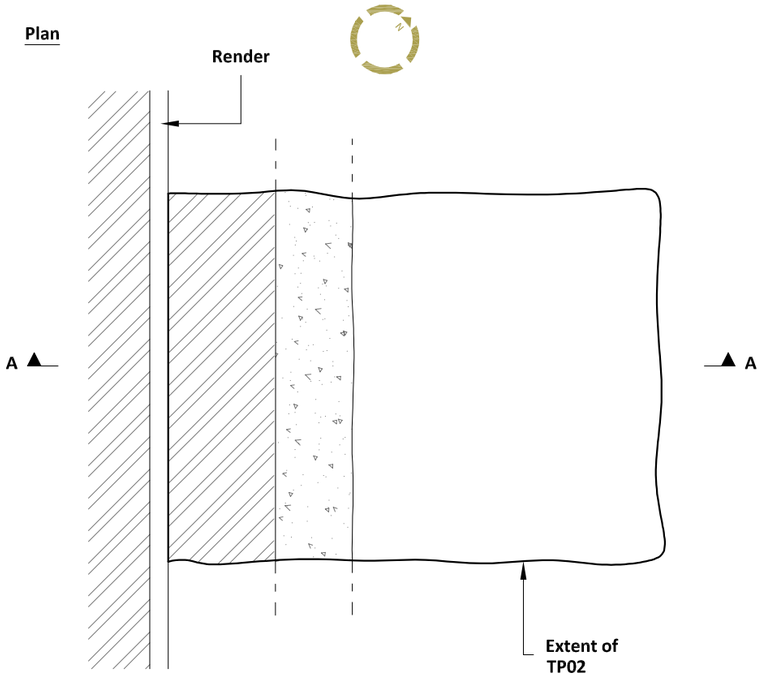
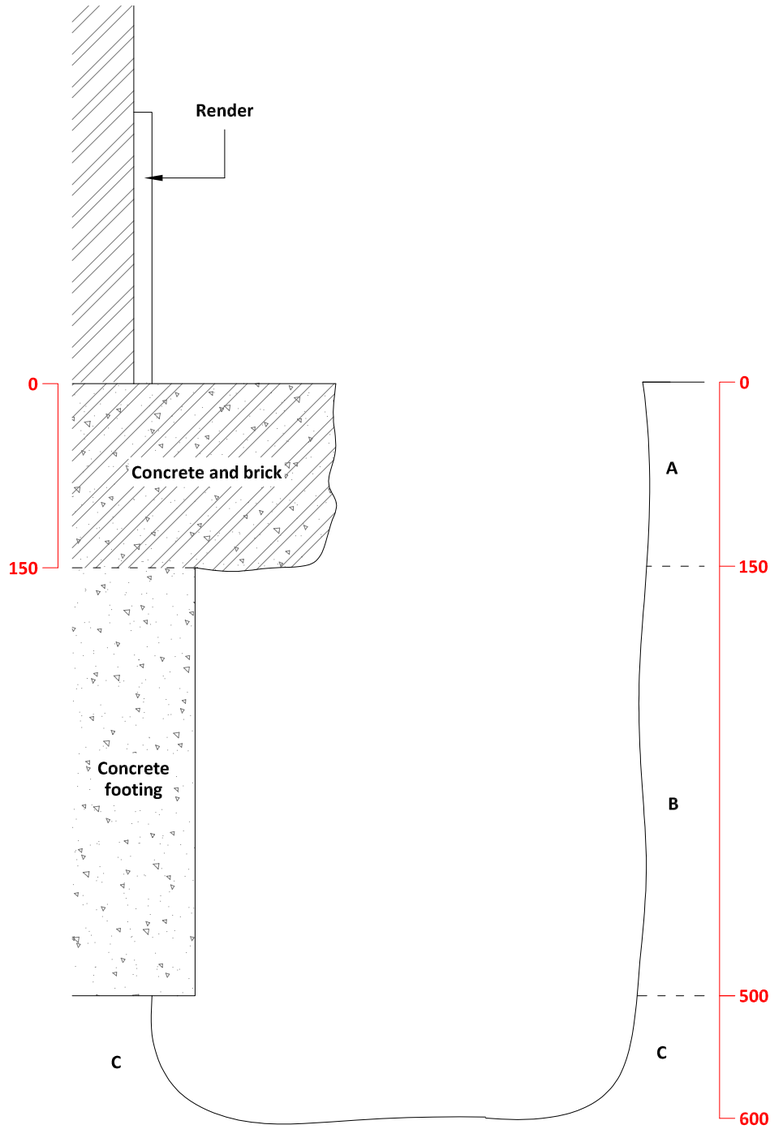
Plan



Section A-A



Key

A. Reinforced concrete. Reinforcement comprises of 7mm diameter steel at 75mm depth.
(MADE GROUND)

B. Brown sandy CLAY reworked with brick and coal fragments.
(MADE GROUND)

C. Medium strength brown CLAY.
(LONDON CLAY)

———— Observed features
– – – – – Assumed features

Denotes brickwork

Denotes concrete

Notes

1. All dimensions shown in millimetres
2. Disturbed samples taken from 0.30m and 0.55m depths
3. Pocket penetrometer testing:
   - P 0.2m - 42 (kN/m²)
   - P 0.3m - 46 (kN/m²)
   - P 0.4m - 63 (kN/m²)
   - P 0.5m - 63 (kN/m²)

Photographic record

Method of excavation
Hand tools
Dimensions
As shown
Groundwater observations
No groundwater encountered

Title
Trial pit record
Date of works
08.04.2015
Scale
1:5 at A3

Location reference
TP02
Location plan on drawing number
02
Appendix
D

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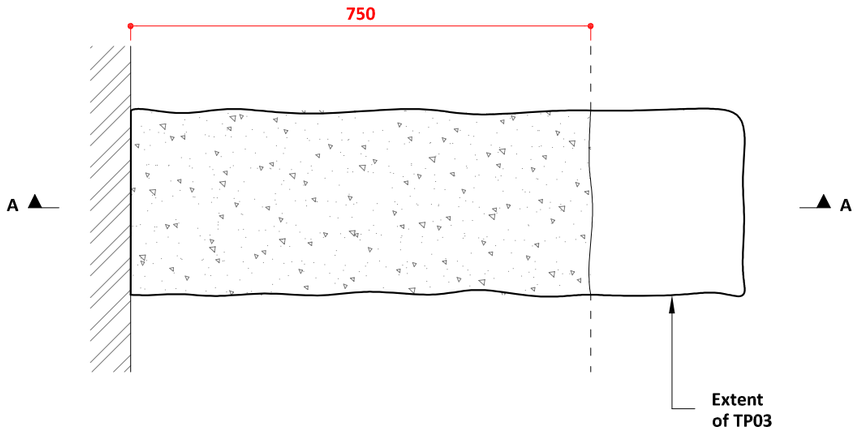
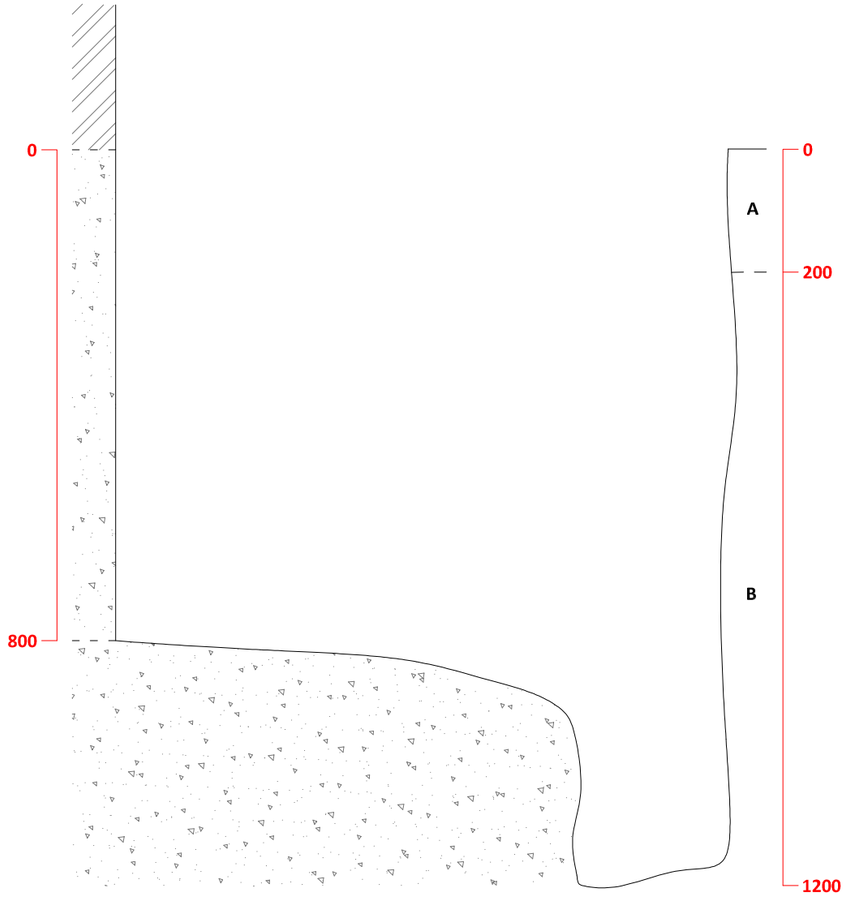
Plan



Section A-A



Photographic record

Key

A. Grey black CLAY with pocket of ash.
(MADE GROUND)

B. Medium strength brown sandy gravelly CLAY with cobbles of slag and brick.
(MADE GROUND)

Observed features
Assumed features

Denotes brickwork

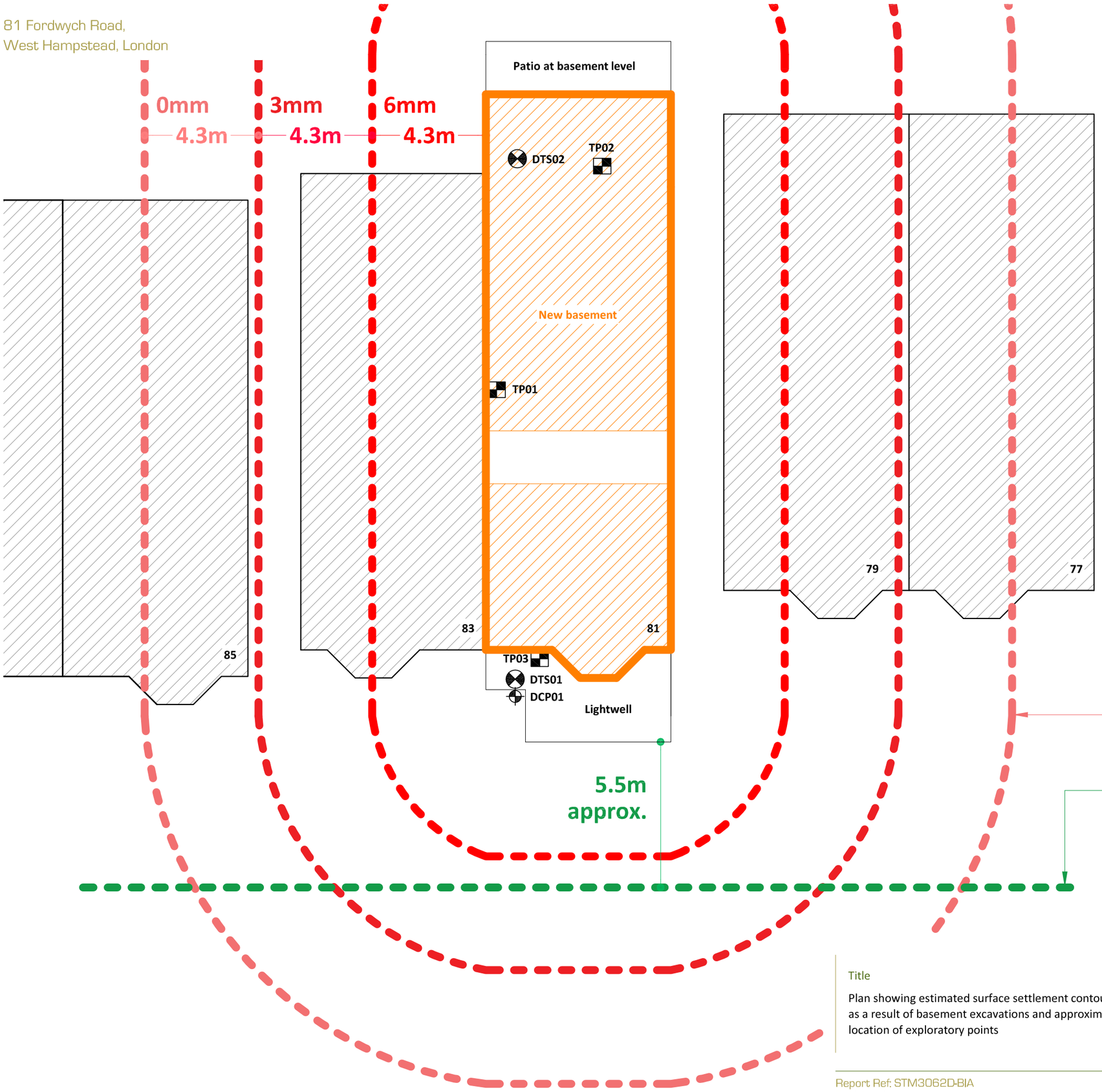
Denotes concrete

Notes

1. All dimensions shown in millimetres
2. Disturbed samples taken from 0.1m and 0.4m depths
3. Pocket penetrometer testing:
   - P 0.4m - 63 (kN/m²)
   - P 0.6m - 71 (kN/m²)

Method of excavation		Title	Location reference
Hand tools		Trial pit record	TP03
Dimensions		Date of works	Location plan on drawing number
As shown		08.04.2015	02
Groundwater observations		Scale	Appendix
No groundwater encountered		1:10 at A3	D

81 Fordwych Road,
West Hampstead, London



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Key

TP	Approximate location of trial pit excavation
DTS	Approximate location of borehole formed by Driven Tube Sampling techniques
DCP	Approximate location of Dynamic Cone Penetration testing

Revisions

A. Plan updated to architects drawing

Title	Scale	Drawing number
Plan showing estimated surface settlement contours as a result of basement excavations and approximate location of exploratory points	1:150 at A3	BIA01

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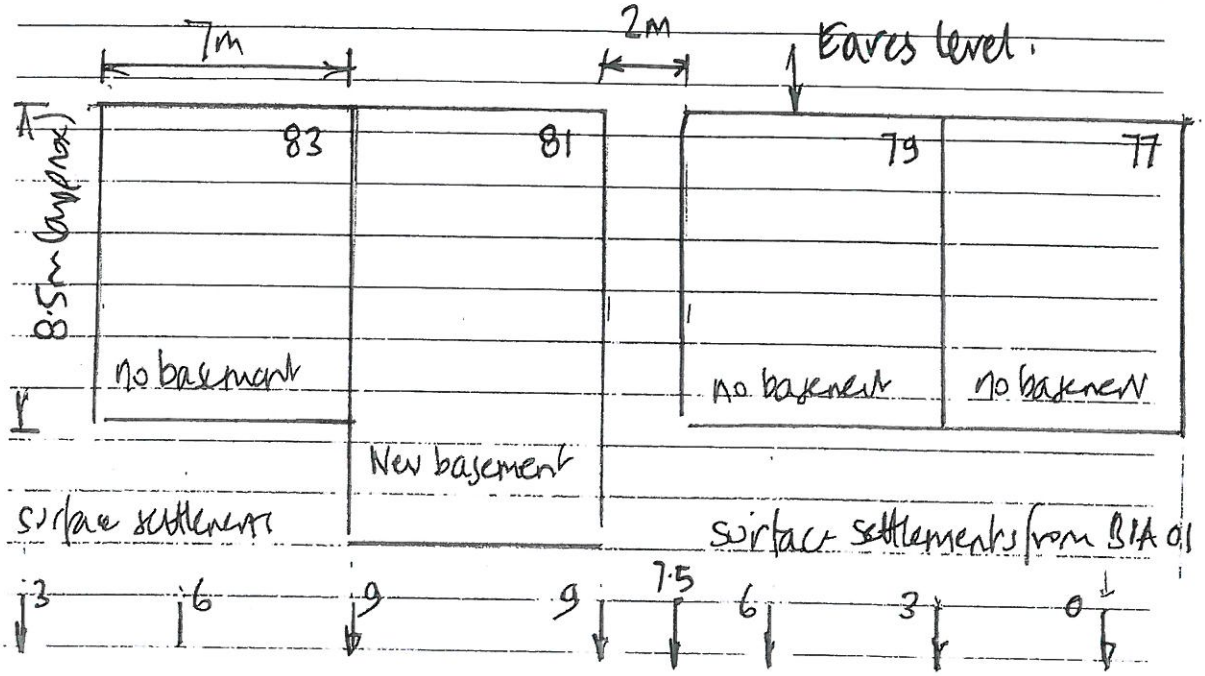
Consider front elevations of 77–83 (masonry panels)



front and rear elevations to 83 and 79 (neighboring properties) considered most vulnerable to movement damage due to excavation of basement to No 81
Refer drawing BIA 01 for predicted movement/settlement contours

Originator: NCT
Sheet number: 1 of 5

Title: 81 Fordwych Rd
Date: February 2016

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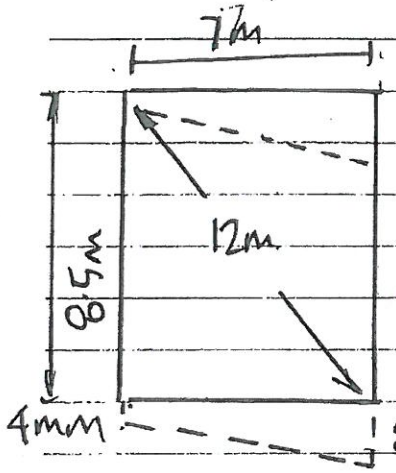
Consider front elevation of No 83 (considered most critical)

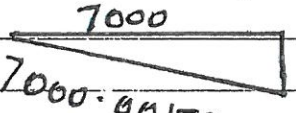


Deformation for vertical components only
Tensile strain on diagonal

$\frac{5}{12000} \times 100 = 0.042\%$

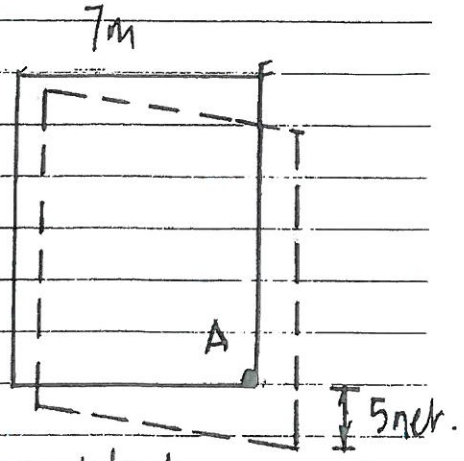
Borland category 0

Tensile strain on horizontal

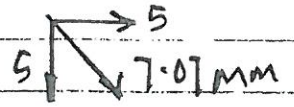


$\frac{0.00179}{7000} \times 100 = 0.0000255\%$

Borland category 0



Deformation for horizontal and vertical components at A,



Tensile strain on diagonal

$\frac{7.07}{12000} \times 100 = 0.059\%$

Borland category 1 (just!)

Tensile strain on horizontal

$\frac{(7.07 + 0.00179) \times 100}{7000} = 0.101\%$

Borland category 2.

Originator: NJT
Sheet number: 2 of 5

Title: 81 Fordwych Road
Date: February 2016

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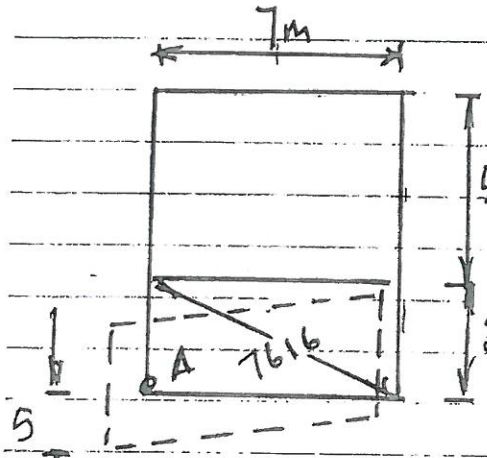
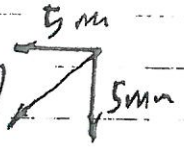
Consider rear elevation of Nº 83 - single storey projection building.



Consider worst case scenario of horizontal (inward yield) and vertical (settlement) movements.

← 5mm inward yielding (refer report text)

Arc A



Tensile strain on diagonal

$\frac{7.07}{7616} \times 100 = 0.0928\%$ Burland category 2.

Tensile strain on horizontal

$\frac{(7.07 + 0.0879)}{7000} \times 100 = 0.101\%$ Burland category 2.

Originator	Title
NCT	81 Fordwych Road
Sheet number	Date
30/5	February 2016

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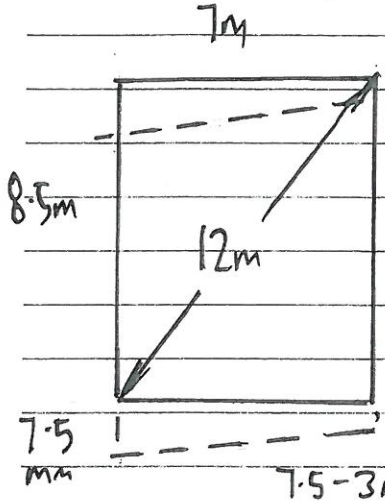
Consider front elevation of No 79 (to scrutiny CR & dit)



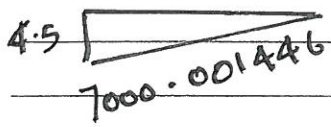
7.5 − 3mm = 4.5mm (net)

Deformation for vertical components only

Tensile strain on diagonal

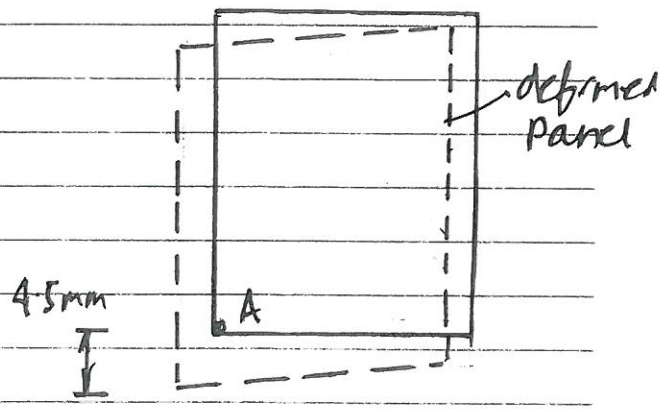
$= \frac{4.5}{12000} \times 100 = 0.0375\%$ Burland category 0

Tensile strain on horizontal



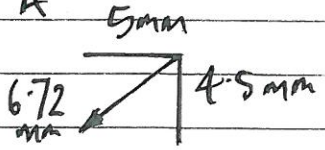
$\frac{0.001446}{7000} \times 100 = 0.00002\%$

Burland category 0



Refer report text.

Deformation for horizontal and vertical components at A



Tensile strain on diagonal

$\frac{6.72}{12000} \times 100 = 0.056\%$

Burland category 1 (just!)

Tensile strain on horizontal

$\frac{(6.72 + 0.001446)}{7000} \times 100 = 0.096\%$

Burland category 2

Originator: NLT	Title: 81 Fordwych Rd
Sheet number: 4 of 5	Date: February 2016

Tensile strains in masonry considering horizontal and vertical components of predicted movements exceed Burland category 1 damage (0.075% strain)

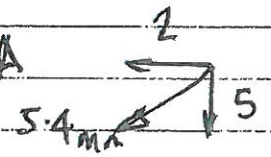
Determine amount of horizontal movement which would reduce damage to category 1

Horizontal (inward yielding) movement limit for Burland category 1 (xc = allowed movement in x)

$$\left[\sqrt{(5^2 + xc^2)} + 0.00179\right] \times \frac{100}{7000} = 0.075$$

$\sqrt{(5^2 + xc^2)} = 5.2482$, $x = 1.6\text{mm}$ say 2mm

Check tensile strain on diagonal movement.

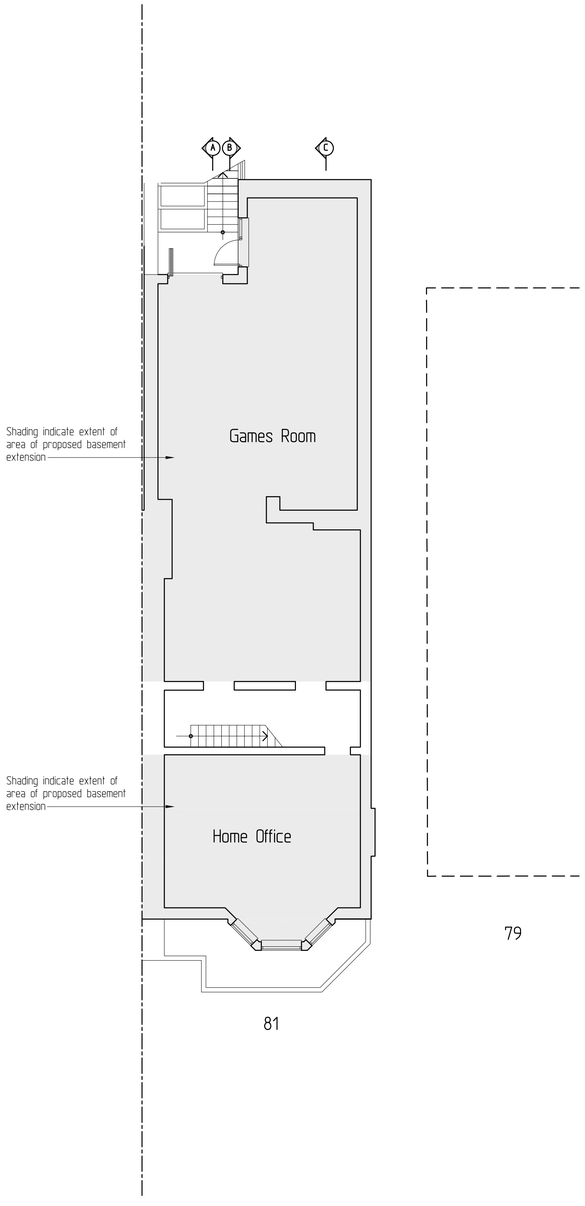


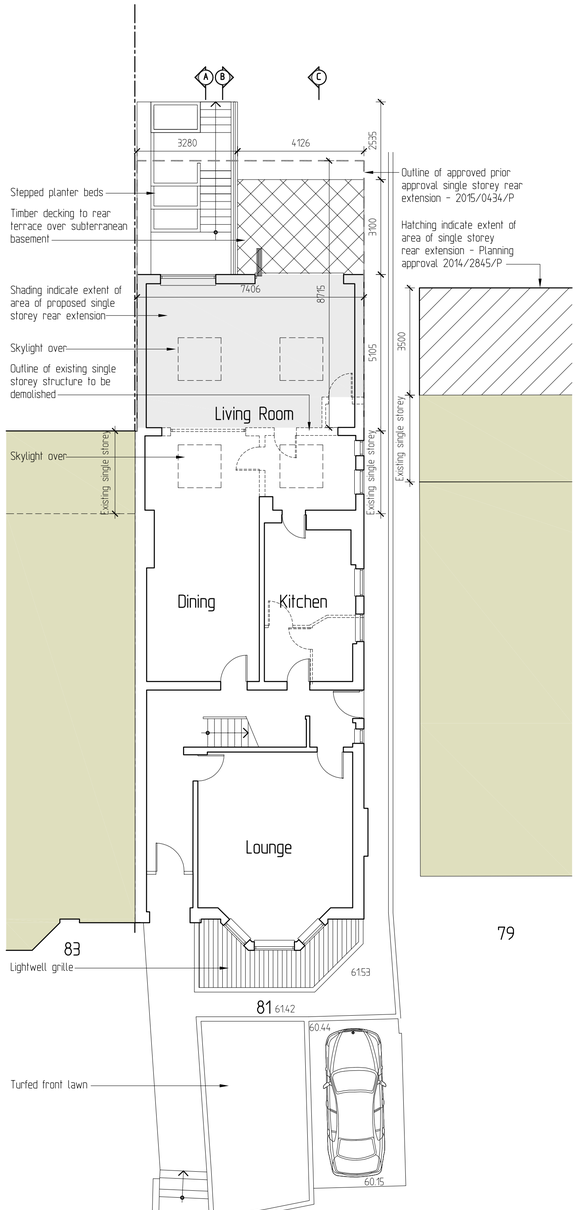
$\frac{5.4\text{mm}}{7617} \times 100 = 0.071\%$ Burland category 1.

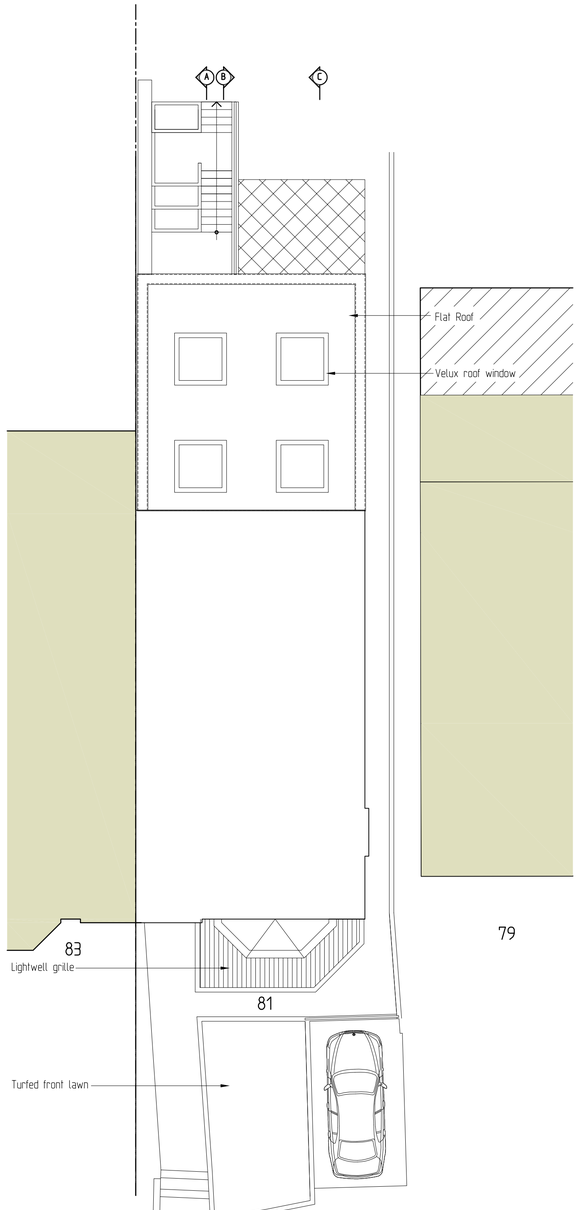
Ver limit of inward yielding = 2mm to limit damage to Burland category 1.

Originator: NT
Sheet number: 5 of 5

Title: 81 Fordwych Rd
Date: February 2016



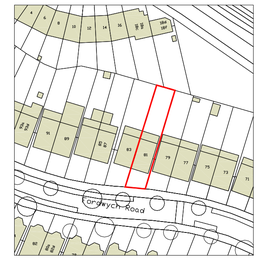




Check all dimensions and report all errors and omissions

0 5m 1m 2m 3m 4m 5m 6m

Scale 1:100



Site Plan 1:1250

Rev C Addition information indicated 05/02/16

Basement Extension to
81 Fordwych Road West Hampstead
London

Project :

Basement Extension
Scheme Proposal - FLOOR PLANS

Title :

Client :

Zyntax LIMITED
Chartered Architects
8 Arborfield Close, Slough
Berkshire SL1 2JW
Tel 01753 522944
reception @ zyntaxarchitects.com
ZYNTAX LIMITED TRADING AS ZYNTAX CHARTERED ARCHITECTS

Date :	Scale :	Drawing No. :	Revision :
Oct 2015	1:100	31-14-EX21	C

Sewer Flooding

History Enquiry

Soiltechnics Limited

White Lodge

Search address supplied

81
Fordwych Road
London
NW2 3TH

Your reference N/A

Our reference SFH/SFH Standard/2016_3262223

Received date **19 February 2016**

Search date **19 February 2016**

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Sewer Flooding

History Enquiry

Search address supplied: 81,Fordwych Road,London,NW2 3TH

This search is recommended to check for any sewer flooding in a specific address or area

TWUL, trading as Property Searches, are responsible in respect of the following:-

(i) any negligent or incorrect entry in the records searched;

(ii) any negligent or incorrect interpretation of the records searched;

(iii) and any negligent or incorrect recording of that interpretation in the search report

(iv) compensation payments

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Sewer Flooding

History Enquiry

History of Sewer Flooding

Is the requested address or area at risk of flooding due to overloaded public sewers?

The flooding records held by Thames Water indicate that there have been no incidents of flooding in the requested area as a result of surcharging public sewers.

For your guidance:

- A sewer is “overloaded” when the flow from a storm is unable to pass through it due to a permanent problem (e.g. flat gradient, small diameter). Flooding as a result of temporary problems such as blockages, siltation, collapses and equipment or operational failures are excluded.
- “Internal flooding” from public sewers is defined as flooding, which enters a building or passes below a suspended floor. For reporting purposes, buildings are restricted to those normally occupied and used for residential, public, commercial, business or industrial purposes.
- “At Risk” properties are those that the water company is required to include in the Regulatory Register that is presented annually to the Director General of Water Services. These are defined as properties that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system more frequently than the relevant reference period (either once or twice in ten years) as determined by the Company’s reporting procedure.
- Flooding as a result of storm events proven to be exceptional and beyond the reference period of one in ten years are not included on the At Risk Register.
- Properties may be at risk of flooding but not included on the Register where flooding incidents have not been reported to the Company.
- Public Sewers are defined as those for which the Company holds statutory responsibility under the Water Industry Act 1991.
- It should be noted that flooding can occur from private sewers and drains which are not the responsibility of the Company. This report excludes flooding from private sewers and drains and the Company makes no comment upon this matter.
- For further information please contact Thames Water on Tel: 0800 316 9800 or website www.thameswater.co.uk

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB