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51 CALTHORPE STREET, LONDON WC1X 0HH

Basement Impact Assessment – Volume 1 of 4

51 CALTHORPE STREET
LONDON WC1X 0HH
Basement Impact Assessment

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Revision	Amendment Details	Revision Prepared By	Revision Approved By

1.0 INTRODUCTION

Brief

1.1 Create Consulting Engineers Ltd has been appointed to provide a Basement Impact Assessment, to support the forthcoming planning application for the proposed mixed-use development at 51 Calthorpe Street, London, WC1X 0HH (the Site) in the London Borough of Camden. The scheme consists of the refurbishment of the existing building and a change of its use from offices to residential. The scheme will lead to the creation of 17 flats over six floors.

Current Site Use

1.2 The Site is located at 51 Calthorpe Street, London, WC1X 0HH, and comprises an existing three storey Victorian-era building that is currently used as offices and storage. The building's eastern side is located adjacent to the Holiday Inn Hotel and the western side abuts other residential buildings on Calthorpe Street. The front of the existing development faces south-east over Calthorpe Street and is opposite the Mount Pleasant Royal Mail sorting centre. The rear north-west elevation of the development faces the Cubitt Street play centre. The Site is accessed solely via Calthorpe Street.

Figure 1.1: Site Location Plan

Proposed Development

1.3 The development proposals include the partial demolition and removal of some existing structures (including the roof) with the retention of the external walls and some floors followed by the construction of 17 new flats over six storeys. This includes a new basement level below the footprint of the building and the excavation of the forecourt to extend the existing lower ground floor.

Project Context

1.4 This report has been prepared in accordance with the London Borough of Camden's (LBC) Planning Guidance document 'Basements and Lightwells' CPG4 Sept 2013 and 'Guidance for subterranean development document' (LBC, 2010).

Constraints and Limitations

1.5 Create Consulting disclaims any responsibility to the Client and others in respect of any matters outside the scope of this report.

1.6 The copyright of this report is vested in Create Consulting Engineers Ltd and the client. The Client, or his appointed representatives, may copy the report for purposes in connection with the development described herein. It shall not be copied by any other party or used for any other purposes without the written consent of Create Consulting Engineers Ltd or the client.

1.7 Create Consulting Engineers Ltd accepts no responsibility whatsoever to other parties to whom this report, or any part thereof, is made known. Any such other parties rely upon the report at their own risk.

2.0 SOURCES OF INFORMATION

2.1 The information contained in this report is based on a review of readily available information pertinent to the site, a ground investigation, and consultation with interested parties.

Records Review

2.2 Key reports, drawings and websites pertinent to this assessment are detailed below in Table 2.1.

Document/Website	Author/Publisher	Date
Fluvial/Tidal Flood Maps, Surface Water Flood Maps, Groundwater Mapping, Reservoir Flood Map – www.environment-agency.gov.uk	Environment Agency	Accessed May 2015
BGS GeoIndex – Geology and borehole records - www.bgs.ac.uk/geoindex	British Geological Survey	Accessed May 2015
North London Strategic Flood Risk Assessment	Mouchel	2008
London Borough of Camden Strategic Flood Risk Assessment	URS	2014
London Borough of Camden Preliminary Flood Risk Assessment	London Borough of Camden/Drain London	2011
London Borough of Camden Surface Water Management Plan	Drain London/Halcrow	2011
The Lost Rivers of London	Nicholas Barton	1992
Existing Site Layout Plans (Drawings 939-P1-008, 939-P1-010, 939-P1-011, 939-P1-012) (Appendix A)	Centre Line Surveys	2012
Topographic Survey (Appendix F)	Centre Line	2012
Proposed Site Layout Plans (Drawings 939-108 to 939-114)	Brooks/Murray Architects	April/May 2015
Thames Water asset plans (Appendix B)	Thames Water	2012
51 Calthorpe Street Flood Risk Assessment	Create Consulting Engineers	May 2015
Camden Geological, Hydrogeological and Hydrological Study Guidance for Subterranean Development	Arup	2010
Thames Water Sewer Flooding History Enquiry (Appendix C)	Thames Water	April 2015
Camden Planning Guidance – Basements and Lightwells CPG4	London Borough of Camden	Sept. 2013
GroundSure EnviroInsight, GeoInsight reports and historic mapping (Report ref FIND-23078)	Find Maps	November 2012
Camden Flood Risk Management Strategy	London Borough of Camden	2013
Borehole log, water level monitoring and lab testing records(Appendix C)	Harrison Group	December 2012
Report on Ground Investigation (Appendix I)	A F Howland Associates	May 2015

Table 2.1: Key Information Sources

Consultation

2.3 The parties consulted as part of this Basement Impact Assessment are detailed in Table 2.2.

Consultee	Form of Consultation	Topics Discussed and Actions Agreed
Nick Humphrey, Sustainability Officer, London Borough of Camden (18 April 2013)	Telephone/email correspondence	Latest surface water flood maps reviewed (Figure 2.1) and it was confirmed Camden Council do not consider the vicinity of Calthorpe Street and Mount Pleasant as an area of significant surface water flood risk and have no records of flooding there (Appendix A).
Amy Farthing, Sustainability officer, London Borough of Camden (23 April 2015)	Email correspondence	Updated surface water flood maps were requested. It was confirmed that these can now be found in the 2014 Strategic Flood Risk Assessment. It was also confirmed that Camden Council do not hold records of any particular properties being flooded in the area.
Thames Water	Sewer Flooding History Enquiry	Requested standard search for historic sewer flooding at and in the locality of the Site

Table 2.2. List of Parties consulted

Ground Investigation

2.4 An intrusive site investigation borehole was undertaken in December 2012 and a further borehole investigation in April/ May 2015. The works and findings are summarized in Sections 3 and 5 of this report with borehole log, location plan and test results included as Appendix C and Appendix I.

3.0 SITE SETTING

Site Location

3.1 The Site is located on the northern side of Calthorpe Street in the London borough of Camden. The Site lies at grid reference 530931E 182471N at Postcode WC1X 0HH. The area of the Site is approximately 640 m^2.

Description of Site and Surroundings

3.2 The Site comprises an existing three storey Victorian-era building that is currently used as offices and storage. The building's eastern side is located adjacent to the Holiday Inn Hotel and the western side abuts other residential buildings on Calthorpe Street. The front of the existing development faces south-east over Calthorpe Street and is opposite the Mount Pleasant Royal Mail sorting centre. The rear north-west elevation of the development faces the Cubitt Street play centre. The Site is accessed solely via Calthorpe Street.

3.3 Relative to ordnance datum the Site lies at approximately 20.0 mAOD. Calthorpe Street is generally flat; however the surrounding area generally falls towards the south west.

Adjacent Property

3.4 Immediately to the west of the Site is a terrace of three four-storey Victorian-era residential properties; the nearest of which (No.49) abuts the site. To the east of the Site is a hotel; while the Royal Mail's Mount Pleasant Sorting Office site is across Calthorpe Street.

3.5 The hotel is understood to have a basement, the depth of which is greater than that proposed for this site. No.49 is understood to have a lower ground floor level, as do the rest of the terrace; which is of comparable depth to the existing lower ground floor of the Site.

3.6 There are no trees or shrubs within the Site. The front gardens of the terrace of houses to the west are mainly grass, with some smaller shrubs to the front of their plots and larger planting along the Pakenham Street boundary. To the rear of the Site, the adjacent external part of the play centre is hard landscaped.

3.7 There are manhole covers along Calthorpe Street and adjacent streets, which indicate a range of below ground utilities, all taken to be active, with the drainage utility records showing the sewer runs to be within Pakenham Street.

Geology

3.8 The following general assessment of the geology of the site and ground conditions has been inferred from the 1:50,000 BGS Sheet 256 "North London" Solid and Drift Edition, BGS records (Appendix E), the FIND Report Reference 23078 and the 2012 borehole record (Appendix I).

Stratum		Depth to Base (mbgl)	Thickness (m)	Description / Comment
Group	Formation			
Made Ground		>5m at front of site	Unproven	Concrete overlying soils of mixed gradings and composition. Expected to be present over entire site.
Gravels		-	Typically 6m to 10m	Deposits generally consist of sand and gravel of flint or chert commonly in a matrix of silt and clay. Sometimes includes an upper finer grained alluvial material. Expected to be present over entire site.
Thames Group	London Clay	-	Typically 3-14 m	The London Clay Formation comprises stiff grey fissured clay, weathering to brown near surface. Concretions of argillaceous limestone in nodular form (Claystones) occur throughout the formation. Expected to be present over entire site.
Reading Beds		-	Typically 10-20 m	A variety of strata including mottled clay, pebbles and sand and green sand.
Thanet Sand		-	Typically 15-19	Grey sands of varying compactness including bands of flint.
Chalk		-	Unproven	The white chalk subgroup.

Table 3.3: Summary of Expected Geology

Ground Workings

3.9 None are indicated within 1000m of the Site.

Mining, Extraction and Natural Cavities

3.10 No mining activities are recorded on or in the near vicinity of the Site.

Ground Subsidence

3.11 The Site is indicated as being at negligible risk from shrinkage heave, ground dissolution or compressible deposits. The Site is also indicated as being at negligible risk from landslides.

Borehole Records

3.12 Examination of online BGS borehole records (Appendix E) reveal two boreholes in close proximity, i.e. <50m to the Site; which were drilled as part of the historic Mount Pleasant post sorting office development (referenced TQ38SW3091). A deeper borehole (referenced TQ38SW512) was located some 200 m to the east.

3.13 Although not logged in detail the shallower holes show made ground of between 13' and 16' (approximately 5m) with drift deposits (assumed to be Terrace Gravel) over London Clay at depth. The deep borehole found made ground to 5.5m over gravel to 7.3 m, with London Clay between 7.3 and 21 m, Reading Beds (Lambeth Group) and then Chalk at 35 m depth.

3.14 The investigation in 2012 took a borehole to 5m depth, at the front of the Site. Made Ground of varying composition, but essentially granular, was encountered throughout.

Slope Stability and Subterranean Developments

3.15 The Site is not situated within an area where a natural or man-made slope of greater than 7° is present.

3.16 The Site is known to be in part underlain by an existing basement (subterranean development) the extension to which forms part of the redevelopment of the site. We also understand that the adjoining property and the nearby hotel both have basements although the extent of these is unknown. It appears, from observations made during the site visit, that the lower ground floor of the adjoining terrace property is at a similar level to the existing lower ground floor and rear yard of the Site. However its hard landscaped rear yard is raised by approximately a metre.

3.17 A tunnel, understood to be the Metropolitan Tube Line, is indicated as running approximately 76m to the north east of the Site. There are not believed to be any Post Office Tunnels proximate to the Site.

Hydrology and Hydrogeology

3.18 The Site is not located in a groundwater Source Protection Zone (SPZ). No surface water features were recorded on the Site itself or in the immediate vicinity.

3.19 A study of the aquifer maps on the Environment Agency website revealed the Site to be located within a Secondary "A" Aquifer comprising the superficial drift deposits of the Terrace Gravels. The underlying London Clay Formation is described as Unproductive Strata.

3.20 Secondary aquifers include a wide range of drift and bedrock deposits with an equally wide range of water permeability and storage capacities. Secondary "A" Aquifers are permeable

layers capable of supporting water supplies at a local rather than strategic scale, and in some cases form an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

3.21 The 2012 investigation indicates that a small perched water table is present within the made ground beneath the site. Ground water is anticipated in the Terrace Gravels, above the London Clay. Groundwater flow in the gravels is likely to be to the south but may be locally influenced by the adjacent "lost river" channel to the west of the Site.

3.22 The Site was not recorded as being at risk from flooding from rivers or the sea. The Council's Sustainability Team has confirmed that the Site is not at potential risk from surface water flooding.

Flood Risk

3.23 The Site is located in Flood Zone 1 of the Environment Agency's indicative flood map, indicating that the Site has a less than 1:1000 probability of fluvial flooding (the lowest level indicated on their mapping).

3.24 The Site lies within the Environment Agency's (EA) Flood Zone 1, as shown in Figure 3.1, which is described within the NPPF Technical Guidance as having less than a 1 in 1000 (<0.1%) annual probability of river or sea flooding in any one year. This zone is the lowest risk area.

3.25 The Camden SFRA (2014) and SWMP (2013) show the Site lies within a Critical Drainage Area whilst the SWMP shows the Site does not lie within a Local Flood Risk Zone.

3.26 The Site is not located in an area at risk of reservoir flooding according to the EA flood maps.

3.27 The Site is located within an 'area with potential to be at risk of surface water flooding' according to Camden Geological, hydrogeological and hydrological study (Arup, 2010). It is understood that this outline broadly follows the route of the 'lost' River Fleet which runs to the west of the Site. The Site is not shown to have flooded in 1975 or 2002 according to this map.

3.28 Consultation with Camden Council has provided more up to date and accurate surface water flood modelling (dated July 2012), which is summarised in full in the Flood Risk Assessment. This shows the predicted extent of flooding for a 1 in 75 year event. It shows that the Site is not at risk of flooding during this event. The EA Surface Water Flood Maps (accessed online, May 2015) and updated Camden SFRA (2014) suggest the Site is at a 'very low' risk of surface water flooding (Figure 3.1). The Site is therefore classified as being at a less than 1 in 1000 (<0.1%) risk of flooding from extreme rainfall in any one year.

Figure 3.1: SW flood map from EA website (accessed May 2014)

Radon

3.29 From an inspection of the GroundSure report and the relevant radon map, as published by the BRE, the Site does not fall within an area affected by radon. The area is not considered an affected area as fewer than 1% of homes are above the action level.

Trees

3.30 There are no trees or shrubs within the Site. The front gardens of the terrace of houses to the west are mainly grass, with some smaller shrubs to the front of their plots and larger planting along the Pakenham Street boundary. To the rear of the Site, the adjacent external part of the play centre is hard landscaped.

4.0 SCREENING

Screening Assessment

4.1 The London Borough of Camden guidance suggests that any development proposal that includes a subterranean basement should be screened to determine whether or not a full BIA is required.

4.2 A number of screening tools are included in the Guidance for Subterranean Development prepared by Arup and reference has been made to them. These consist of a series of questions with a screening flow chart relating to groundwater flow, land stability and surface water flow.

4.3 The following pages tabulate the findings of the initial screening assessment as follows:

- Slope Stability and Subterranean Developments;
- Stability Screening Assessment;
- Surface Flow and Flooding Screening Assessment.

Question	Response	Justification
1a: Is the site located directly above an aquifer?	**Yes**	• The Site is over a secondary "A" aquifer (the Terrace Gravels). • The EA aquifer mapping (accessed online) and Figure 8 of the Camden Geological, Hydrogeological and Hydrological Study also confirms this.
1b: Will the proposed basement extend beneath the water table surface?	**Yes**	• Based on published information, the Site is underlain by the Terrace Gravels; which are permeable in nature. Shallow/perched groundwater was encountered during the 2012 investigation.
2: Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	**No**	• Although the Site lies within 50m of the course the former River Fleet, this is now culverted and part of the Thames Water Sewer network running beneath Pakenham Street to the west of the Site. • Based on a review of historical maps (www.oldmaps.co.uk), EA website (Groundwater SPZs in 'what's in my backyard', BGS Geoindex map (accessed online), no watercourses, reservoirs or wells (used/disused) or springs were identified within 100m
3: Is the site within the catchment of the pond chains on Hampstead Heath?	**No**	• The Site is located approx 5.0 km south of the three ponds in this chain, according to Figure 14 of the Camden Geological, Hydrogeological & Hydrological study, placing it outside the catchment.
4: Will the proposed basement development result in a change in the proportion of hard surfaced /paved areas?	**Yes**	• The Site is currently covered by hardstanding. Some soft landscaped areas/raised planters will be included into the scheme
5: As part of the site drainage, will more surface water (e.g. rainfall / run-off) than at present be discharged to the ground (e.g. soakaways and/or SUDS)?	**No**	• Surface water will continue to be discharged via existing surface water sewers. Sewer flows are likely to decrease very slightly due to the introduction of some soft landscaping/raised planters.
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.	**No**	• There are no ponds in the locality of the Site. Given the scale of the proposed basement and the Site's distance from any local water bodies, we do not consider that the proposed development will significantly affect flow to any ponds and therefore do not consider any mitigation measures are required.

Table 4.1: Subterranean (Groundwater) Flow Screening Assessment - undertaken prior to 2015 site investigation.

Question	Response	Justification
1: Is the site within the catchment of the pond chains on Hampstead Heath?	**No**	• Figure 14 of the Camden Geological, Hydrogeological and Hydrological Study places the Site outside of the catchment for these ponds.
2: As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	**No**	• The majority of the Site currently discharges to the public sewer network in Pakenham Street via a spur in the public sewer which runs to the rear of the adjacent terraced properties. This outfall will be maintained following development.
3: Will the proposed basement development result in a change in the proportion of hard surfaced /paved external areas?	**Yes**	• The impermeable area of the Site will decrease following development due to the introduction of planting to the property and through introduction of planters.
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 watercourses?	**Yes**	• It is proposed to attenuate surface water run-off from the Site in accordance with the Mayors Plan.
5: Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	**No**	• All foul sewerage will be connected to the public sewer network.
6: Is the site in an area known to be at risk from surface water flooding, such as South Hampstead, West Hampstead, Gospel Oak and King's Cross, or is it at risk from flooding, for example because the proposed basement is below the static water level of a nearby surface water feature?	**No**	• Although the Site is located within an 'area with potential to be at risk of surface water flooding' according to the Camden Geological, Hydrogeological and Hydrological study (Arup, 2010). It is understood that this outline broadly follows the route of the 'lost' River Fleet which runs to the west of the Site. However EA Surface water maps (accessed online) indicate a "very low" risk of flooding in the vicinity of the Site (Figure 3.1). • The Site is not shown to have flooded in 1975 or 2002. • The 2013 Surface Water Management Plan indicates that the Site lies within the Critical Drainage Area CDA (3_003) associated with the former "lost river valley", but not within a Local Flood Risk Zone LFRZ . • No records of flooding in the vicinity of the Site has been identified.

Table 4.2: Surface Flow and Flooding Screening Assessment

Question	Response	Justification
1: Does the existing site include slopes, natural or manmade, greater than 7º? (approximately 1 in 8)	**Yes**	• Within the land of the proposed new property, there is a step down from the existing forecourt to the lower ground floor. The main footprint of the existing building is at this lower level.
2: Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7º? (approximately 1 in 8)	**Yes**	• The land within the Site boundary is currently generally flatter than 7°; other than between the forecourt and lower ground floor. The new basement level will extend up to the Site boundary on 3 sides and partially under the forecourt, with a resultant step change in levels on each side.
3: Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7º? (approximately 1 in 8)	**Yes**	• The adjoining land to the north-east is a hotel, which is understood to have a deeper basement than that proposed for the Site. • No.49 Calthorpe St, to the immediate south-west of the Site, also has a lower ground floor that is below the level of their front garden.
4: Is the site within a wider hillside setting in which the general slope is greater than 7% (approximately 1 in 8)	**No**	• The area falls gently, generally to the east and south, below the threshold of 7°.
5: Is the London Clay the shallowest strata at the site?	**No**	• Published BGS records and the 2012 borehole show the Site to be underlain by made ground over Terrace Gravels.
6: Will any tree/s 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? (Note that consent is required from LB Camden to undertake work to any tree/s protected by a Tree Protection Order or to tree/s in a Conservation Area if the tree is over certain dimensions).	**No**	• There are no trees within the Site.
7: Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	**Unknown**	• The 2012 borehole was taken to 5m and did not prove the base of the made ground. The adjacent property has previously reported movement related issues; however the cause is not known.
8: Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	**No**	• There is no known river, pond, reservoir, spring or well within 100 m of the Site. • Although the Site lies within 50m of the course the former River Fleet, this is now culverted and part of the Thames Water Sewer network running beneath Pakenham Street to the east of the Site. • Based on a review of historical maps (www.oldmaps.co.uk), EA website (Groundwater SPZs in 'what's in my backyard', BGS Geoindex map (accessed online), no watercourses, reservoirs or wells (used/disused) or springs were identified within 100m
9: Is the site within an area of previously worked ground?	**No**	• The only significant previous works were the construction of the existing premises. The 2012 borehole did identify Made Ground to its full depth of 5m.
10: Is the site within an aquifer? If so, will the proposed	**Yes**	• The BGS GeoIndex shows the Site lies above a secondary aquifer. The EA aquifer mapping (accessed online) and

Question	Response	Justification
basement extend beneath the water table such that dewatering may be required during construction?		Figure 8 of the Camden Geological, Hydrogeological and Hydrological Study also confirms this. The 2012 investigation recorded standing groundwater in the made ground which suggests shallow/perched water.
11: Is the site within 50m of the Hampstead Heath ponds?	**No**	• Based on OS mapping
12: Is the site within 5m of a highway or pedestrian right of way?	**Yes**	• The existing building is set back from the Site frontage. However the forecourt of the Site adjoins the back of pavement to the public highway. The lower ground floor is to be extended under the forecourt.
13: Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	**Yes**	• Along the boundary with No.49 Calthorpe St, the new basement will be deeper than the footings to the lower ground floor of No.49.
14: Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	**No**	• The Site lies outside of all exclusion zones.

Table 4.3: Slope Stability Screening Assessment

- **Scoping Study**

4.4 The following potential impacts and potential consequences were identified based on the initial desktop assessment.

Category	Question	Potential Impact	Possible Consequence
Subterranean (Groundwater) Flow	1a	The Site is over a secondary "A" aquifer (the Terrace Gravels)	• The basement might be at risk of water ingress from any shallow or perched groundwater and there is potential for localised impacts on the water table/water quality if a groundwater table is present.
	1b	There is a possibility of encountering shallow or perched groundwater during construction.	
	4	Some soft landscaped areas/raised planters will be included in the scheme, which will allow some infiltration of rainwater to occur.	• Increased recharge of the shallow groundwater may occur.
Surface flow and flooding	3	Peak surface water run-off will be reduced slightly due to the increase in soft landscaping,	• This has potential to slightly decrease surface water run-off (peak flows and volumes) to the sewer.
	4	The impermeable area of the Site will remain unchanged. However the effective area will be slightly reduced through the introduction of landscaped gardens.	
Slope Stability	1.	There is an existing step down from the existing forecourt to the lower ground floor.	• Without adequate temporary and permanent propping this would lead to slope stability issues.
	2.	The proposals will alter the ground profile and will require a step change in level with the adjacent highway.	
	3.	The house at No.49 to the SW has a lower ground floor that is below its front garden. The adjoining land to the north-east is a hotel, which is understood to have a deeper basement than that proposed for this Site.	• Without adequate temporary and permanent propping this would lead to slope stability issues.
	7.	The 2012 borehole did not prove the base of the made ground. The adjacent property has previously reported movement related issues; however the cause is not known.	• Nearby BGS borehole records show the area to be underlain by Terrace Gravels. • Further investigation is required to a depth sufficient to prove the natural strata beneath the Site.
	10.	The Site lies above a secondary aquifer.	• Further investigation is required to a depth sufficient to prove the natural strata beneath the Site and hence clarify the requirements for any dewatering. Dewatering may result in change of moisture content and settlement issues.
	12.	The lower ground floor will be extended closer to the Site boundary with and extend below the level of the pavement.	• Without adequate temporary and permanent propping this could lead to settlement or collapse of the pavement.
	13.	The new basement will be deeper than the footing to No.49 Calthorpe St.	• Without adequate temporary and permanent propping this could lead to settlement or collapse of the adjacent property.

Table 5.1: Potential Impacts

5.0 GROUND INVESTIGATION

Objective

5.1 In order to further inform the assessment of the potential impacts of the development and to assist with design of the sub-substructure, so that any impacts of the basement can be mitigated through the design of the temporary and permanent works, an intrusive investigation was scoped.

5.2 This was to build on the findings of the desktop assessment set out in previous sections of this report (which includes the 2012 borehole record and laboratory testing – Appendix C); so as to collect basic geotechnical, chemical and hydrogeological data to further develop the conceptual site model.

Site Work

5.3 The April 2015 Site Investigation was scoped to increase the depth of data available from the earlier investigation, to reflect the proposed basement depth. The factual report reflecting the 2015 is included in Appendix I.

5.4 The borehole position was chosen to investigate the ground conditions at the location of the proposed basement and to check for presence of groundwater within the standpipe.

5.5 The ground investigation fieldwork was carried out on 16th April 2015, at the position shown on the attached exploratory borehole location plan in Appendix I.

5.6 Prior to the intrusive site works, a services scan had been carried out at the proposed borehole location.

5.7 The site work consisted of a borehole, taken below an area of current concrete forecourt slab. The borehole was taken to a depth of 15m using conventional cable percussive techniques ('shell and auger') in 150 mm diameter casing.

5.8 Representative disturbed and bulk disturbed samples were taken from the boring tools at regular intervals throughout the depth of the borehole.

5.9 Undisturbed 100mm diameter samples (U100) were taken in the cohesive material, at regular intervals throughout the depth of the borehole.

5.10 In-situ Standard Penetration Tests (SPTs) were carried out at varying depths.

5.11 On completion of the borehole, a groundwater monitoring standpipe was installed to the base of the bore. This was sealed above the slotted bottom zone of the pipe, so that the

piezometric pressure could be recorded. A protective cover was installed flush with the ground surface.

5.12 Groundwater monitoring was carried out during a return site visit on 30th April 2015. The findings are set out in the Groundwater section below.

Laboratory Work

5.13 The samples were forwarded to a registered laboratory, where geotechnical tests were conducted and the results are presented in the Appendices.

5.14 The moisture content of selected soil samples was determined.

5.15 Liquid and plastic limits of selected samples at various depths were determined, as a guide to soil classification and behaviour.

5.16 A test specimen was prepared at full diameter from an undisturbed cohesive sample. Undrained triaxial compression testing was undertaken on the sample at a single confining cell pressure.

5.17 Selected samples of soil were analysed to determine the concentration of water soluble sulphate, using the BRE SD1 Pyrite Suite. The pH values were also determined.

5.18 The laboratory certificates are included in Appendix I and are summarised in Table 6.1.

Plasticity Index (NHBC modified)				
Borehole No.	**Sample depth, m**	**Index**	**Soil Class**	
BH01	8.00	25	CH	
BH01	8.40	21	CI	
BH01	9.45	21	CI	
BH01	10.50	17	CI	
Shear Strength (unconsolidated single stage triaxial)				
Borehole No.	**Sample depth, m**	**Dry density Mg/ m^3**	**Moisture content %**	**C_u kPa**
BH01	9.00	1.69	21	52
Chemical Tests				
Test – sample at 5.6-9.5m depth		**Range**		
Moisture Content %		See above		
pH		6.8-8.0		
Total Sulphate as SO_4 %		0.02-0.13		
W/S Sulphate as SO_3 (2:1) g/l		0.04-0.52		
Total Sulphur mg/kg		0.01-0.37		
Chemical contamination tests on the Made ground		Refer to AFHowland report (Appendix I) Did not exceed guideline values (Except lead at 280-770 mg/kg)		

Table 6.1: Summary of Geotechnical Testing

Ground Conditions

5.19 The encountered soil conditions are reported in the borehole log within Appendix I and summarised below.

Made Ground

5.20 At the borehole location, a 200mm thick concrete slab was Made Ground. The initial layers were very sandy very gravelly clay with some brick fragments and then varying layers of cohesive Made Ground, with fine brick, concrete and rare charcoal and chalk. This was a total of 8.0m depth of Made Ground.

Clay

5.21 Clay was encountered below the Made Ground. This was initially a soft to firm dark brown slightly sandy clay, with fine rootlets and a slight organic odour, and was underlain by firm greyish brown to grey sandy clay. These may represent alluvial deposits, associated with the material that often overlies the River Terraces, or may be related to a former channel of the Lost River Fleet

Gravels

5.22 From 10.9m to the base of the borehole at 15.0m, there was a medium dense fine to course gravelly sand (assumed to be the River Terrace).

Groundwater

5.23 Groundwater was recorded in the Made Ground during the drilling of BH1 at a depth of 6.85 m and rose to 5.6 m during the short term. This most probably represents a perched water body associated with locally sandier materials within otherwise cohesive soil. The principal water strike took place at the top of the gravelly sand at 10.9 m. The level rose rapidly to 8.2 m depth, which suggests relatively permeable ground.

5.24 The ground water level was recorded during a return site visit on 30th April 2015, as set out in Table 6.2.

Location	Ground level (mAOD)	Water Level (mbgl)	Water Level (mAOD)	Base of well (mbsl)
BH1	18.19	7.36	10.83	12.0

Table 6.2: Groundwater Monitoring – 30th April 2015

Interpretation of Geotechnical Testing results

5.25 The laboratory test results are consistent with and confirm the soil descriptions in the borehole log, namely that beneath the layer of concrete slab and Made Ground the Site is underlain by a 2.9 m thickness of medium strength grey and brown Clay of intermediate to high plasticity (alluvial–type deposits), overlying Terrace Gravels.

5.26 The NHBC modified Plasticity Index identifies the clay as being of low to medium volume change potential soil. In relation to the influence of nearby trees to the Site, the NHBC guidance Chapter 4.2 'Building Near Trees' sets out the minimum recommended depth to which new foundations should thus be taken.

5.27 The basement reinforced concrete walls and base will be designed using the Strength parameters noted in the Laboratory Tests and a concrete mix will be specified to address the raised sulphate readings, in accordance with BRE Special Digest 1.

6.0 IMPACT ASSESSMENT

6.1 Following completion of the site investigation, the potential impacts associated with the scheme have been reassessed in light of the findings. Table 6.1 summarises the assessment and provides appropriate mitigation measures.

Category	Question	Potential Impact	Possible Consequence	Work undertaken to investigate likelihood and significance of impact	Revised conceptual model following ground Investigation	Mitigation measures	Risk following mitigation	Justification
Subterranean (Groundwater) Flow	1a	There is the possibility of encountering shallow/perched groundwater during construction.	The basement may be at risk of flooding from any perched/shallow groundwater and there is potential for localised impacts on the water table if a groundwater table is present which may affect neighbouring foundations or result in flooding of below ground structures.	Site investigation is required to characterise the groundwater regime to the founding depth.	Monitoring of the site investigation recorded shallow/perched water which the design will need to consider.	Sump pumps for dewatering of the excavation itself may be required.	Low	As the basement will partly piled, any seepage from the Made Ground and underlying strata will be minimal though dewatering of the excavation itself may be required during the construction works. As only limited dewatering within the excavation may be required, any dewatering is unlikely to affect any shallow/perched groundwater levels in the Made Ground outside of the excavation.
						Basement will need to be appropriately waterproofed.	Low	This will protect the basement property from water ingress.
	1b		The foundation methods may create pathways for potential contamination between the made ground and any perched/shallow ground water to the underlying aquifer	Site investigation is required to characterise the chemical properties of the made ground and to characterise the groundwater regime to the founding depth.	Some elevated Lead concentrations are present in the Made Ground	A piling risk assessment should be undertaken to establish suitable mitigation measures for implementation to limit or remove this potential for contamination of the underlying aquifer.	Low	This will protect groundwater quality This will ensure no negative impacts on groundwater quality.
	4	Some soft landscaped areas will be included into the scheme, which will allow some infiltration of rainwater to occur.	Increased recharge of the shallow groundwater may occur.	Investigate permeability of made ground and ground quality	Some elevated Lead concentrations are present in the Made Ground	Add a thickness of clean topsoil to cover the made ground	Low	Lead is relatively insoluble, note the leachate value from WAC testing which was only slightly above drinking water standards.
Surface flow and flooding	3	Peak surface water runoff will be slightly reduced, due to the increase in soft landscaping,	This has potential to slightly decrease surface water runoff (peak flows and volumes) to the public sewer.	None required	Unchanged.	Include as much attenuation for surface water flows, to further reduce peak runoff rates in line with policy requirements of London Plan.	Low	Development will have a positive impact by reducing flows in to the public sewer, which will contribute to a reduced flood risk in the receiving public sewer.
	4	The impermeable area of the Site will remain largely unchanged. However the effective area will be slightly reduced through the introduction of landscaped gardens.						
Slope Stability	1 & 2	The proposals will alter the ground profile and will require a step	Without adequate temporary and permanent propping this would lead to slope stability issues.	Site investigation has tested ground conditions within the Site and has provided soil characteristics.	Unchanged.	A structural retaining wall will need to be included in the proposals. The design of this structure will be based on the Site investigation results (see Section 8 for	Low	This will enable safe construction and provide long term stability.

Category	Question	Potential Impact	Possible Consequence	Work undertaken to investigate likelihood and significance of impact	Revised conceptual model following ground Investigation	Mitigation measures	Risk following mitigation	Justification
		change in levels with adjacent highway.				concept design)		
	3	The house at No.49 has a lower ground floor that is below its front garden	Without adequate temporary and permanent propping this would lead to slope stability issues.	None	Unchanged.	Trial pit(s) to identify depth of the footings to No.49 Secant piled retaining wall, designed to provide lateral support to the footing of No.49.	Low	This will ensure the integrity of the adjacent property during and after construction; without creating a potentially 'hard' zone under its end wall.
	7	The Site is understood to be underlain by the Clay Formation, which is prone to shrink-swell.	Differential movement may occur in the structure and adjacent buildings, if not taken into account in the design of the temporary works and the permanent design of the substructure. Without adequate temporary and permanent propping this could lead to the collapse of the pavement.	The depth to and geotechnical properties of the Clay were established through site investigation.	The Clay was confirmed to be of High-Medium plasticity, however, given the depth of Made Ground at the Site, the Clay is at a depth that is below the zone where seasonal or tree influence will affect the clay.	The potential for shrink-swell to occur is low, but will be considered in the detailed design of the temporary works and the permanent design of the substructure (see Section 6 and also Section 8 for concept design). A structural condition survey of neighbouring properties, as part of the Party Wall award process, will be undertaken prior to commencement of works.	Low	The depth to Clay is below the zone where it is likely to be influenced. The basement will be adequately designed for the prevailing ground conditions. A baseline will be established, to demonstrate that there has been no impact to the neighbouring property, both during and after construction. This is a standard Party Wall award process.
	10	The Site lies above a secondary aquifer.	The foundation methods may extend below the water table and Dewatering may be required. Dewatering can result in a change of moisture content and settlement issues.	A site investigation is required to characterise the natural strata and establish the groundwater regime to the founding depth and hence clarify the requirements for any dewatering.	Monitoring of the site investigation recorded shallow/perched water which the design will need to consider.	Sump pumps for dewatering of the excavation itself may be required.	Low	As the basement will partly piled, any seepage from the Made Ground and underlying strata will be minimal though dewatering of the excavation itself may be required during the construction works. As only limited dewatering within the excavation may be required, any dewatering is unlikely to affect any shallow/perched groundwater levels in the Made Ground outside of the excavation.
	12	The lower ground floor will be extended closer to the Site boundary adjacent to the pavement.	Without adequate temporary and permanent propping this could lead to collapse of the pavement.	The geotechnical properties of the soils have been established through site investigation.	Unchanged.	Propping will be required as part of the detailed design of the temporary works and the permanent design of the substructure (see Section 8 for concept design). Agree proposals with Camden's Highways Department as part of the standard AIP process.	Low	This will ensure the integrity of the highway during and after construction.
	13	The new basement will be deeper than the footing to No.49 Calthorpe St.	Differential movement may occur in the structure and adjacent buildings, if not taken into account in the design of the temporary works and the permanent design of the substructure.	The geotechnical properties of the soils have been established through site investigation.	Unchanged.	Trial pit(s) will identify the depth of the footings to No.49 A secant piled retaining wall, will be constructed to provide lateral support to the footing of No.49.	Low	This will ensure the integrity of the adjacent property during and after construction; without creating a potentially 'hard' zone under its end wall.

Table 6.1: Assessment of Impacts

7.0 CONCEPTUAL DESIGN

7.1 Based on the assessment of potential impacts, initial concept design solutions are set out below, to demonstrate how the temporary and permanent works might be progressed as part of the detailed design process in accordance with Table 6.1.

7.2 Construction of the new basement is envisaged as a watertight reinforced concrete box up to the respective external ground level. This box will be generally formed as a sequence of underpins to the existing perimeter and internal structural walls. For the extension to the lower ground floor under the forecourt, a reinforced concrete retaining wall is envisaged, while alongside No.49 a concrete faced secant piled retaining wall is proposed. The latter should avoid the need to alter the existing foundations of that property. Based on the site investigation borehole, there is a zone of Made ground below the proposed basement level, before the natural soils strata is reached. Walls will be taken down to found within the competent natural strata, using mini-piles below the basement level (or underpins subject to the findings of the trial pits noted below). .

7.3 To minimise the loss of residential space within the basement, a waterproofing additive will be provided to the concrete mix for the concrete to the perimeter walls and base, together with reinforcement spacing and a concrete mix designed to make the concrete watertight.

Surveys & Consents

7.4 To inform both the permanent design and the temporary works, it is proposed that trial pits will be dug along the main structural walls; to identify the depth and any projection of their foundations. These will be alongside the walls of the property, adjacent to the building at No.49, and to the main internal and perimeter walls. As well as the depth of the footings to each of the walls, the depth to the natural strata should be also confirmed.

7.5 The hotel and No.49 are both less than 6m from the Site; so the work will be subject to Party Wall awards, both in relation to the basement works being within 3m and where it will be below a 45 degree line from the underside of a neighbour's foundations. As part of the Party Wall Award process, various safeguards that are applicable, and prior to excavation work commencing; a visual condition survey will be carried out of the site boundary and of the immediately adjacent properties. This record will enable a comparative assessment to be made, should it be considered that the works have resulted in any movement cracks to the building.

7.6 Although beyond the 6m zone defined by the Party Wall award process, it will be prudent for a visual condition survey of other nearby properties to be undertaken, such as the remainder of the terrace of which No.49 is the nearest house.

7.7 Agreement will be required with the Highway Authority, given that the extension of the lower ground floor below the forecourt will abut the area under the pavement and will thus uphold the integrity of the pavement. This would be through the Approval in Principle submission and approval process.

Temporary Works

7.8 The contractor will be required to provide a detailed method statement for the works. This will set out their proposed method for underpinning and constructing retaining walls, forming the excavation, maintaining the stability of the sides of the excavation until such time as the new concrete basement is sufficiently complete and for constructing the permanent basement and forecourt ground slab. The method statement will also set out how the Site will be secured by appropriate hoarding during the demolition and construction phase to ensure safety to the general public, including neighbours.

7.9 In outline, a sequence of underpinning of the existing structural walls to the property will precede excavation for basement construction. Removal of spoil will be accompanied by the installation of temporary props and wailing beams to the boundary of the opening; to secure the bottom and top of the underpinning panels. The temporary works design criteria will be set to limit potential movement of the soil behind the underpinning and to limit the risk of undue movement and hence damage to adjacent properties.

7.10 Alongside No.49, piles to the secant piled retaining wall will be installed using a small rig, from within the existing lower ground floor of the Site. These will be embedded at the bottom, but will require temporary props and a line of wailing beam to support the top until they are integrated into the lower ground floor construction.

7.11 Given that the basement is a single storey, it is expected that just a single horizontal wailer beam will be required to support the underpinning and other perimeter walls, placed just below the existing lower ground level. The underpins and other walls will be designed to cater for both the temporary and permanent load cases; these will support the applied ground and nominal groundwater loads and, where applicable, also those resulting from the spread of foundation loads from the neighbouring property and road. To inform this part of the design, the trial pits mentioned above would provide detail on the depth at which these loads are to be applied. To minimise horizontal deflection of the wailer beam, it would be propped at regular centres, with the props taken down at an incline to temporary footings within the excavation or horizontally across the excavation. Confirmation on the depth to the competent natural strata is subject to the findings of the trial pits. If the depth to the competent strata is shallow, then further underpinning would be used to extend the walls. Otherwise mini-piles will be installed close to the structural walls and ground beams cast across and tight to the bottom of the walls. These mini-piles and ground beams would be below the new basement level.

7.12 Given the variable nature of the made ground (granular at WS1 and cohive at BH01 and evidence of groundwater at this level at both positions, the contractor's method statement will need to include provision for sump pumps to address any seepages in to the basement excavation, or other means of groundwater control.

Permanent Works

7.13 Construction of the new basement is envisaged as a watertight reinforced concrete box up to external ground level; this will include the area of the private gardens and also the extension of the lower ground floor under the forecourt. For the latter area, the waterproof box will include the slab that forms the support of the forecourt.

7.14 To minimise the loss of residential space within the basement, a waterproofing additive will be provided to the concrete mix for the concrete to the perimeter walls and base, together with reinforcement spacing and a concrete mix designed to make the concrete watertight. As noted above, confirmation on the depth to the competent natural strata is subject to the findings of the trial pits. If the depth to the competent strata is shallow, then further underpinning would be used to extend the walls. Otherwise mini-piles will be installed close to the structural walls and ground beams cast across and tight to the bottom of the walls. These mini-piles and ground beams would be below the new basement level.

7.15 For the basement works, the perimeter walls would be designed to be propped by the basement slab and also by the lower ground floor slab, which will act as a plate across the building. Around the private sunken rear gardens, the walls will be freestanding. Given the sometimes granular nature of the Made Ground, and more pertinently the Terrace Gravel strata, together with the groundwater identified within the borehole, the walls and basement slab design will take account of the appropriate depth of hydrostatic water pressure, using the requirements of the British Standard for Basement construction (BS.8004).

7.16 The concrete mix for all concrete in the ground will be to suit the results of the site investigation chemical tests; that is up to 0.37 g/l sulphate (SO_3) in groundwater and up to 0.13% of soluble sulphate (SO_3). This will be in accordance with BRE Special Digest 1.

7.17 Construction of the reinforced concrete base and walls would be detailed around the temporary props, so that they could remain in place until sufficient of the concrete works have been completed. Except where the concrete wall is designed as a free standing cantilever, such as around the sunken garden, this will be once a sufficient length of the wall has been tied into the lower ground slab and so that this portion of the wall has been propped. The props and wailer beam will then be removed and the penetrations made good in waterproof concrete.

7.18 All new on site drainage will be separated until the point of connection to the public sewer in order to meet Thames Water requirements. To inform the detailed design of the drainage, a full CCTV drainage survey will be carried out to agree the existing points of connection to be reused as part of the development with Thames Water and to confirm any necessary diversions to existing private drainage.

7.19 An indicative foul and surface water drainage strategy is included on SK001 and SK002 (Appendix H). Detailed calculations and a summary of the drainage proposals are included in the FRA.

7.20 The proposed surface water drainage strategy can be summarized as follows:

- All roof drainage, and front lightwells/external areas including the forecourt will be designed to drain under gravity to an attenuation tank. This will be sized for the 1 in 100 year plus 30 % climate change event and will need to be accommodated in a 13.4 m^3 attenuation tank. It is considered that a structure of this size can be accommodated beneath the lower ground floor slab adjacent to the CHP plant room, as shown on SK001.

- A flow control device (hydrobrake) will restrict the outflow from the attenuation feature to 5.0 l/s (in line with best practice) as greenfield runoff rates have been estimated to be less than 5.0 l/s for the Site.

- The existing terminal manhole (assumed to be under the ownership of Thames Water based on the asset plans) will be relocated and incorporated as a raised structure within one of the basement gardens and a disconnecting manhole constructed next to it. Surface water will drain from the attenuation tank under gravity to the disconnecting manhole before leaving Site.

- The rear lightwells/courtyards will be drained by individual sump pumps outfalling direct to the disconnecting manhole.

- The surface water drainage system will incorporate pollution control measures in line with the SUDS Manual.

7.21 The proposed foul water drainage strategy can be summarized as follows:

- It is proposed that a foul drainage from all flats will drain under gravity to a sump beneath the store/plant room, where it will be pumped to the aforementioned raised disconnecting manhole via a backdrop connection, prior to a gravity outflow to the final manhole within the courtyard garden of flat 1, and then the Thames Water Sewer network in Pakenham Street.

Maintenance

7.22 Regular inspection and maintenance of highway drainage, public and private drainage (including pumped drainage) by Camden Council, Thames Water, residents and site management respectively, will minimise the residual risks associated with surface water/sewers.

8.0 CONCLUSIONS

8.1 A Basement Impact Assessment has been carried out in accordance with the guidance published by the London Borough of Camden.

8.2 Based on our current understanding of the Site setting and ground conditions, we do not envisage that the proposed development will result in material impacts on subterranean groundwater flow, surface water flow and flooding and slope stability, as long as the mitigation measures set out in Table 6.1 are incorporated into the detailed design of the temporary and permanent works. The detailed design should develop the concept design set out in Section 7.0 of this report.

8.3 In order to minimise any negative environmental impacts to neighbouring residents associated with the construction process, all demolition and construction should be undertaken in accordance with the Considerate Constructors Scheme standards and the ICE demolition Protocol (www.ice.org,uk) and should have regard to the Guide for Contractors Working in Camden Guidance (dated Feb 2008) and the GLA's best practice guidance document The Control of Dust and Emissions from Construction (www.London.gov.uk). An outline Construction Management Plan (CMP) has been prepared as part of the planning submission.

9.0 REFERENCES

i. Bakewell, I. (2008) *North London Strategic Flood Risk Assessment.* Mouchel.

ii. London Borough of Camden Planning Guidance CPG4 Basements and Lightwells (2013).

iii. Ove Arup & Partners (2010) Camden geological, hydrogeological and hydrological study. Guidance for Subterranean Development for London Borough of Camden, November 2010.

iv. Find GroundSure Report (23078).

v. BSI British Standard, BS5930:1999+A2:2010 "Code of Practice for Site Investigations".

vi. BS EN ISO 22475-1:2006 & 22475-2/3:2011 Geotechnical investigation and testing. Sampling methods and groundwater measurements.

vii. BS EN ISO 22476:2005+A1:2011 Geotechnical investigation and testing. Various.

viii. BS EN ISO 14688-2:2004 Geotechnical investigation and testing. Identification and classification of soil. Principles for a classification.

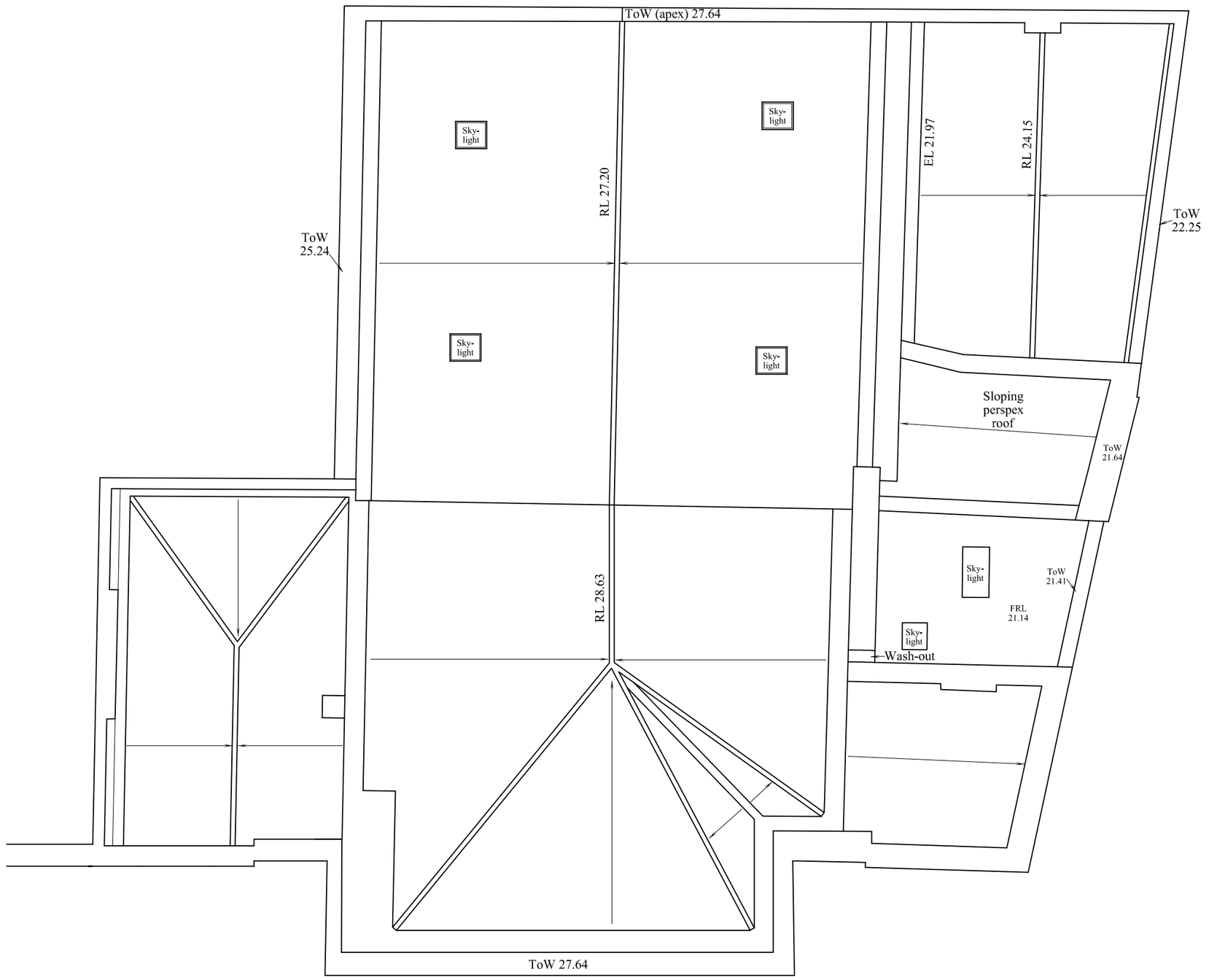
ix. BSI British Standard. 1990. BS1377:1990, "Methods of Test for Soils for Civil Engineering Purposes".

x. BS EN 1997-1 Eurocode 7 Part 1 "General Rules".

xi. BS EN 1997-2 Eurocode 7 Part 2 "Ground Investigation and Testing"

APPENDICES

APPENDIX A



Roof

Fit point

LEGEND

EL	Eaves level
FRL	Flat roof level
RL	Ridge level
ToW	Top of wall

NOTE:

Due to limited access some of the roof information has been obtained through photography.

Surveyed for

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Survey at

51 CALTHORPE STREET
LONDON
ROOF PLAN

File: BRM312	Sheet 4 of 4
Scale 1:100 (A2 Sheet)	

Date of survey: March 2012

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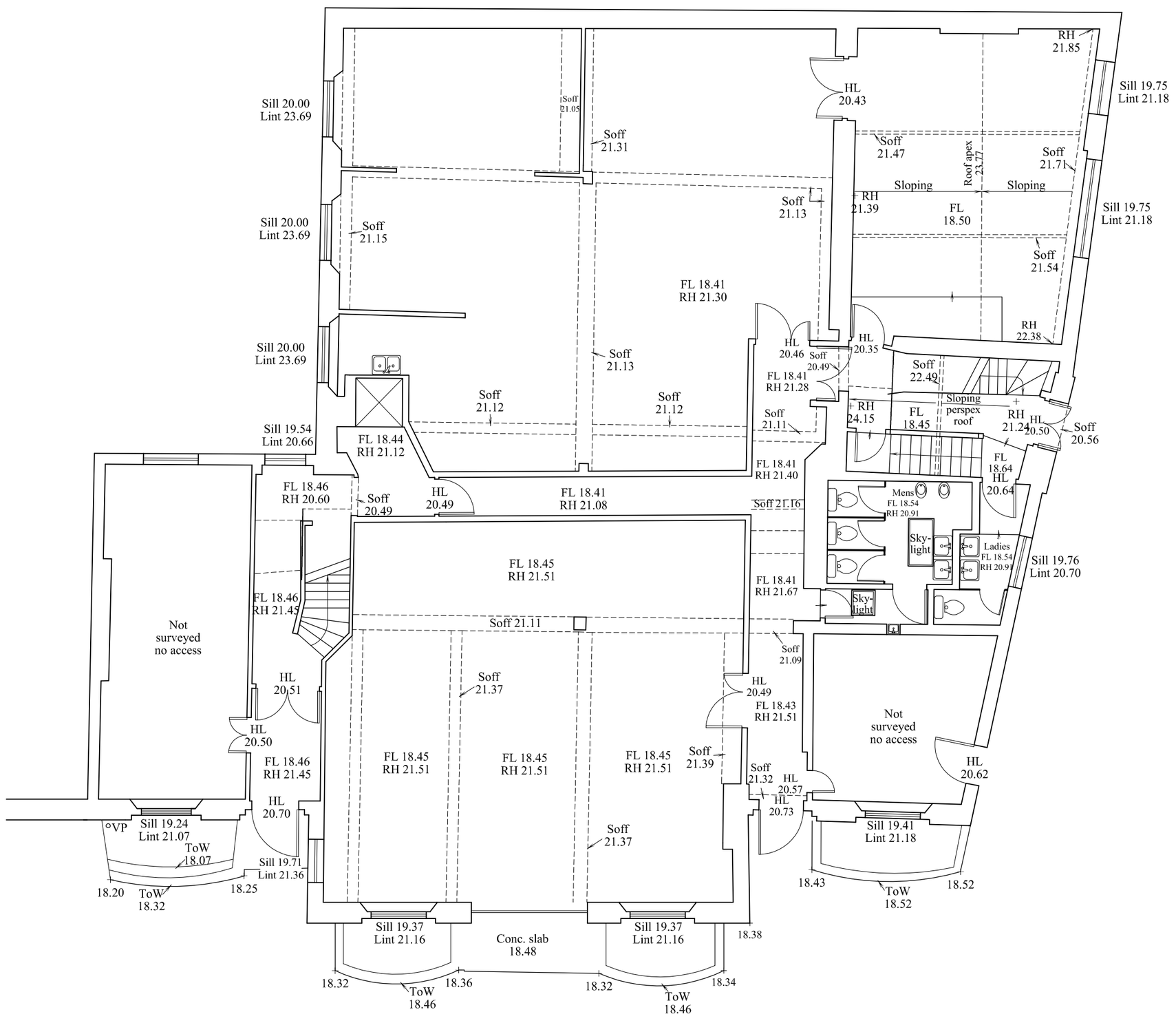

Ground floor

LEGEND

CBD	Cupboard
FL	Floor level
HL	Head level
Lint	Lintel level
RH	Room height
Sill	Sill level
Soff	Soffit level
ToW	Top of wall
VP	Vent pipe

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Survey at

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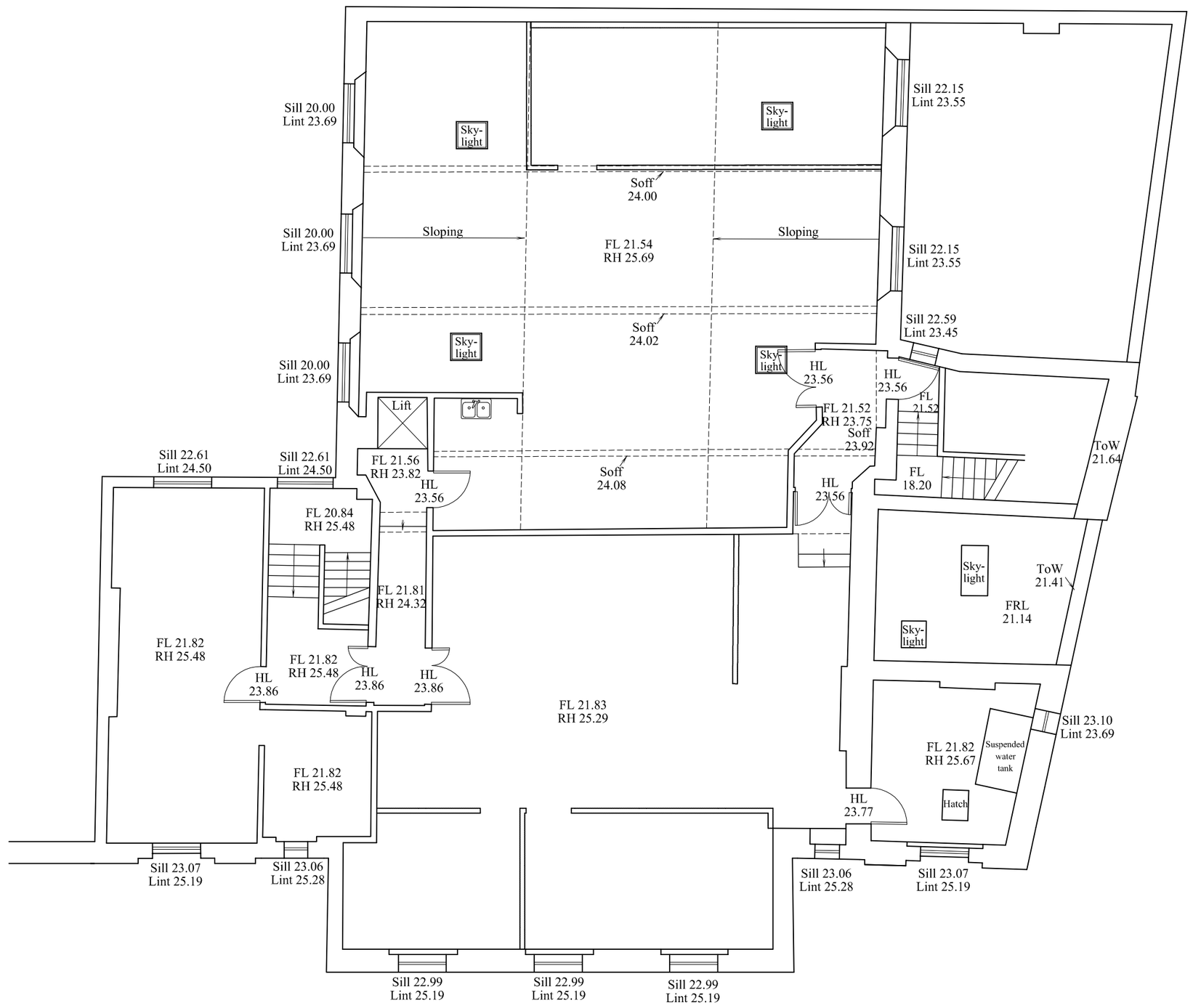

First floor

LEGEND

CBD	Cupboard
FL	Floor level
HL	Head level
Lint	Lintel level
RH	Room height
Sill	Sill level
Soff	Soffit level
ToW	Top of wall

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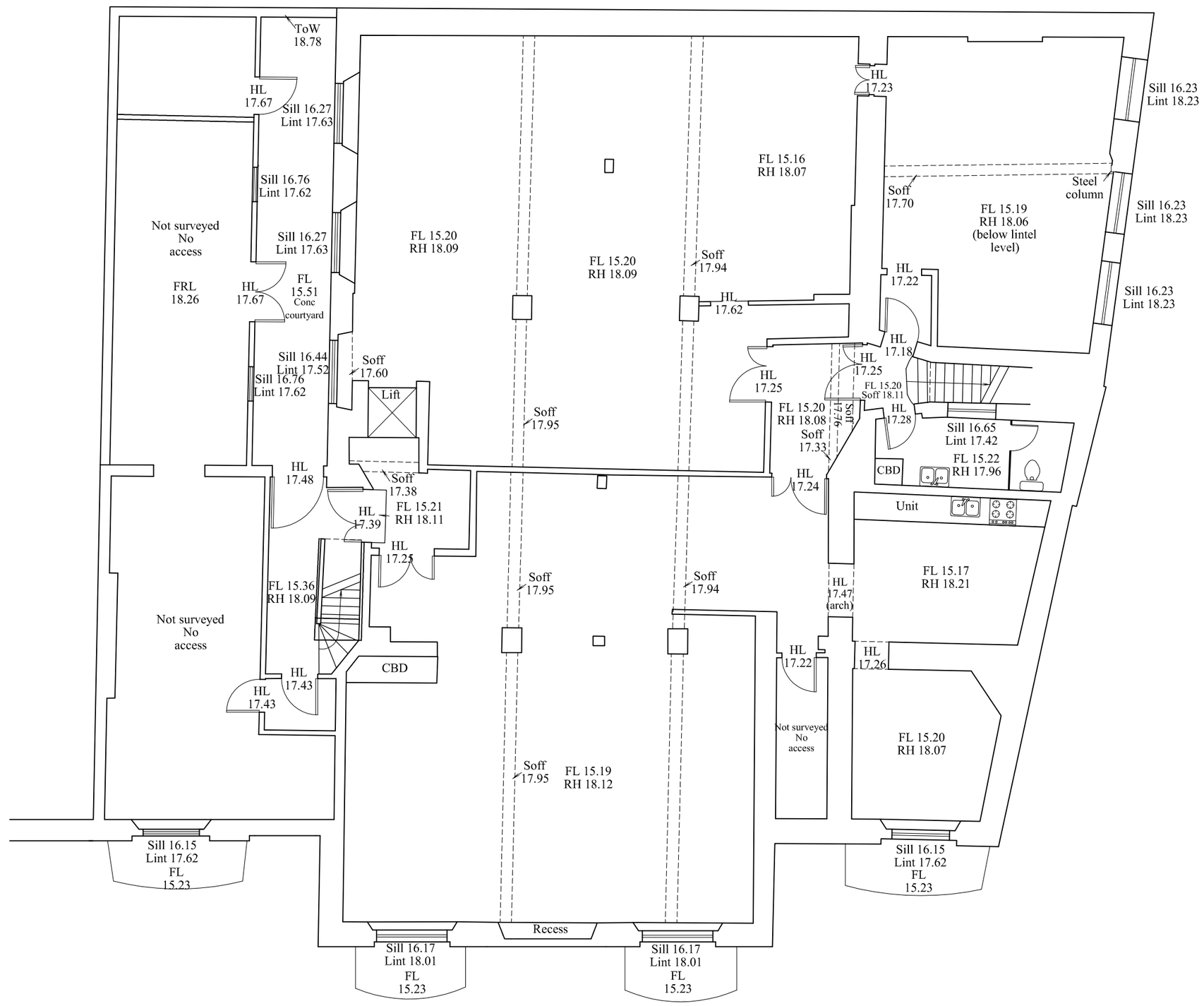

Basement

Fit point

LEGEND

CBD	Cupboard
FL	Floor level
FRL	Flat roof level
HL	Head level
Lint	Lintel level
RH	Room height
Sill	Sill level
Soff	Soffit level
ToW	Top of wall

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Survey at

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