CampbellReith
consulting engineers

36 Redington Road, London, NW3 7RT

Basement Impact Assessment Audit

For

London Borough of Camden

Project Number: 12066-41
Revision: F1

April 2016

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D1	23/09/2015	Comment	EMBjw12066-41-230915-D1	E M Brown	E M Brown	S D Ash
D2	11/12/2015	Comment	EMBjw12066-41-111215-36 Redington Road-D2.doc	E M Brown	E M Brown	S D Ash
F1	08/04/2016	For planning	EMBjw12066-41-080416-36 Redington Road-F1.doc	E M Brown	E M Brown	S D Ash

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Project Number	12066-41
Project Name	36 Redington Road
Planning Reference	2015/3004/P

Contents

Appendix

1.0 NON-TECHNICAL SUMMARY

1.1. CampbellReith was instructed by London Borough of Camden, (LBC) to carry out an audit on the Basement Impact Assessment submitted as part of the Planning Submission documentation for 36 Redington Road, London, NW3 7RT (planning reference 2015/3004/P). The basement is considered to fall within Category C as defined by the Terms of Reference.

1.2. The Audit reviewed the Basement Impact Assessment for potential impact on land stability and local ground and surface water conditions arising from basement development in accordance with LBC's policies and technical procedures.

1.3. CampbellReith was able to access LBC's Planning Portal and gain access to the latest revision of submitted documentation and reviewed it against an agreed audit check list.

1.4. It has been confirmed that the BIA has been prepared by suitably qualified individuals. The geotechnical experience of the Structural Engineer has been confirmed.

1.5. The BIA has confirmed that the proposed basement will be founded within the Claygate Beds a short distance above the London Clay. The structure is to be supported on piled foundations with compressible material beneath the slab to accommodate heave.

1.6. The proposed basement will not undermine the adjacent property, No 38 Redington Road, as it has a two storey basement. It is reported that No 38 is structurally independent of No 36 and founded on piles in which case it will not be affected by the construction of the adjacent basement. No evidence of this has been seen by CampbellReith, however it is accepted that the increased basement depth to No 38 will reduce any impact.

1.7. Information is required to confirm that the structure of No 38 is able to accommodate the temporary loads from the RC wall until it cures, or a methodology provided to limit any such loads. It is accepted that a separation detail may be agreed with the party wall surveyor.

1.8. It is likely that the groundwater table will be encountered during basement construction. Proposals to prevent water ingress and avoid the loss of fine soils into the excavation are presented in the revised SER.

1.9. The original SER proposed a cantilever retaining wall whilst the ground movement and building damage assessment assumed a stiffly propped wall. The SER presented in December 2016 indicates temporary propping to remain in place until the slabs are cast. Details of the propping and temporary works may be agreed with the party wall surveyor.

1.10. It is accepted that there will be no significant adverse impact on the hydrogeology, even considering the consented basements at 25 and 26 Redington Gardens. It is possible that a former tributary of the River Westbourne crossed the site, however, there is no evidence of a significant body of water at the site and it is considered that the hydrogeological assessment is sufficiently robust.

1.11. It is accepted that in general the surrounding slopes are less than 7^{o} and that there will be no significant adverse impacts from or to the construction of the basement.

1.12. An FRA has confirmed the risk of flooding to be low and that the basement proposals will not alter the flood risk to the surrounding area. It has been confirmed that the sewer network can accommodate the flows off site.

1.13. A proposal for a condition survey of No 38 Redington Road is included in the SER. However, this should be extended to No 7 Redington Gardens. It is accepted that movements will be small, however, it is recommended that condition surveys and a monitoring regime are agreed with the party wall surveyor.

1.14. Queries and requirements for further information/clarification raised through the audit process are summarised in Appendix 2 and supporting information is presented in Appendix 3. It is accepted that subject to the provisions of the party wall act, the BIA and supporting documentation have adequately identified the potential impacts arising out of the basement proposals and propose suitable mitigation.

2.0 INTRODUCTION

2.1. CampbellReith was instructed by London Borough of Camden (LBC) on 11/08/2015 to carry out a Category B Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for 36 Redington Road, London, NW3 7RT.

2.2. The Audit was carried out in accordance with the Terms of Reference set by LBC. It reviewed the Basement Impact Assessment for potential impact on land stability and local ground and surface water conditions arising from basement development.

2.3. A BIA is required for all planning applications with basements in Camden in general accordance with policies and technical procedures contained within

- Guidance for Subterranean Development (GSD). Issue 01. November 2010. Ove Arup & Partners.
- Camden Planning Guidance (CPG) 4: Basements and Lightwells.
- Camden Development Policy (DP) 27: Basements and Lightwells.
- Camden Development Policy (DP) 23: Water.

2.4. The BIA should demonstrate that schemes:

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; and,

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

and evaluate the impacts of the proposed basement considering the issues of hydrology, hydrogeology and land stability via the process described by the GSD and to make recommendations for the detailed design.

2.5. LBC's Audit Instruction described the planning proposal as *"Erection of 3-storey plus basement 5-bed dwelling including car lift, front and rear lightwell and associated landscaping following demolition of existing dwelling."*

The Audit Instruction confirmed that the property is not listed, nor does it neighbour listed buildings.

2.6. CampbellReith accessed LBC's Planning Portal on 11/09/2015 and gained access to the following relevant documents for audit purposes:

- Basement Impact Assessment Report (BIA) – Stages 1 & 2
- Basement Impact Assessment Report (BIA) – Stages 3 & 4
- Structural Engineering Report/Method Statement (SER)
- Construction Method Statement (CMS)
- Planning Application Drawings consisting of
- Location Plan
- Existing Plans
- Proposed Plans and Sections
- Planning Consultation Responses

2.7. Subsequent to the issue of the initial audit, further information was submitted on behalf of the applicant on 27 October 2015. This comprised a letter and revised ground movement/building damage assessment by Southern Testing and a revised Structural Engineering Report/Method Statement prepared by Zussman Bear.

2.8. Further information was also provided to CampbellReith by a neighbour to 36 Redington Road. This comprised their original objection letter, dated 3 August 2015, with reviews of the BIA by esi and Key Geosolutions Ltd.

2.9. An instruction to update the audit report in light of the revised information was received on 5 November 2015.

2.10. Following the issue of the revised audit report, additional and updated information was provided by the architect and engineer comprising a revised SER, letter and email responses and a Flood Risk Assessment. These are presented in Appendix 3. Further information was also received from the occupant of 7 Redington Gardens as noted in Appendix 1. This final audit report considers additional information.

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Yes	Chartered Geologist and Chartered Engineer identified in preparation of BIA. SER prepared by Chartered Structural Engineer – confirmation of experience in engineering geology provided.
Is data required by Cl.233 of the GSD presented?	Yes	
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	Yes	BIA Stages 3 & 4
Are suitable plan/maps included?	Yes	
Do the plans/maps show the whole of the relevant area of study and do they show it in sufficient detail?	Yes	
Land Stability Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	BIA Stages 1 & 2
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	BIA Stages 1 & 2
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	BIA Stages 1 & 2
Is a conceptual model presented?	Yes	BIA Stages 3 & 4

Item	Yes/No/NA	Comment
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	Yes	Refer to BIA audit section 4.7
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	Yes	Refer to BIA audit section 4.7
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	Yes	Assessment required of increased flows off site required and potential surface water flooding.
Is factual ground investigation data provided?	Yes	BIA Stages 3 & 4
Is monitoring data presented?	Yes	BIA Stages 3 & 4
Is the ground investigation informed by a desk study?	Yes	BIA Stages 1 & 2
Has a site walkover been undertaken?	Yes	
Is the presence/absence of adjacent or nearby basements confirmed?	Yes	
Is a geotechnical interpretation presented?	Yes	
Does the geotechnical interpretation include information on retaining wall design?	Yes	Limited generic interpretation
Are reports on other investigations required by screening and scoping presented?	Yes	Flood Risk Assessment and confirmation of the capacity of the sewer network presented in March 2016.
Are baseline conditions described, based on the GSD?	Yes	
Do the base line conditions consider adjacent or nearby basements?	Yes	

Item	Yes/No/NA	Comment
Is an Impact Assessment provided?	Yes	
Are estimates of ground movement and structural impact presented?	Yes	Supplementary GMA provided for cantilever retaining walls.
Is the Impact Assessment appropriate to the matters identified by screen and scoping?	Yes	
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	No	No allowance made for monitoring.
Has the need for monitoring during construction been considered?	No	
Have the residual (after mitigation) impacts been clearly identified?	Yes	
Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure will be maintained?	Yes	Clarification provided with respect to propping and construction of RC wall against No 38 Redington Road.
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	Yes	
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	Yes	
Does report state that damage to surrounding buildings will be no worse than Burland Category 2?	Yes	Revised SER refers to temporary propping to restrict ground movements, for which GMA suggests Category 0 damage.
Are non-technical summaries provided?	Yes	

4.0 DISCUSSION

4.1. The Basement Impact Assessment (BIA) has been carried out by a well-known firm of geotechnical consultants, ST Consult. Supplementary information confirmed that both a Chartered Geologist and a Chartered Engineer were involved in the preparation of the report.

4.2. The Structural Engineering Report (SER) has been prepared by Zussman Bear. The author is a Chartered Structural Engineer. Confirmation of proof of expertise in engineering geology was confirmed in an email dated 18 December 2015 (refer to Appendix 3).

4.3. The LBC Instruction to proceed with the audit identified that neither the property, not any surrounding properties, was a listed building. It is understood that No 36 Redington Road is part of a former semi-detached property and that its neighbour, No 38 Redington Road, was recently redeveloped. It is further understood that No 38 is structurally independent of No 36, that it has a two storey basement, and has piled foundations and basement retaining walls. Whilst it was possible to verify the basement depth by reference to LBC's website, it was not possible to confirm the nature of the foundations and retaining walls. The next closest property is 7 Redington Gardens which is approximately 5m from the site. The occupants have confirmed that a small basement exists beneath the property.

4.4. The proposed basement consists of a single storey construction, approximately 3.50m deep, with three sides formed by a contiguous piled retaining wall. The fourth side, adjacent to No 38, is to comprise a reinforced concrete wall supported on a piled slab. The structural loads from the superstructure will be supported on a piled slab with a compressible medium beneath to accommodate heave. Details were requested of how the transfer of load from the RC wall on to No 38 Redington Gardens until the concrete has cured will be avoided, or confirmation that the structure of No 38 is capable of accommodating those loads. Additionally details of the proposed separator/slip membrane between the two properties were requested. A letter dated 17 December 2015 with an accompanying revised SER confirms that a separation detail will be determined once the wall to No 38 has been exposed. It is considered that this may be agreed with the party wall surveyor.

4.5. The BIA has identified that the sequence of strata at the site comprises Made Ground to approximately 0.70m depth, underlain by the Claygate Beds to approximately 4.50m depth, in turn underlain by the London Clay. Standing groundwater levels were recorded at approximately 1m below ground level.

4.6. The BIA (Stages 1 & 2) identified five areas that required further investigation, namely:

- The presence of a secondary aquifer beneath the site and the possibility that the proposed and neighbouring basements could have a damming effect.

- The potential for ground movements to affect 38 Redington Road and 7 Redington Gardens.
- The potential for ground movements in relation to the highway.
- The potential for an increase in surface water flows off site.
- The potential for surface water flooding from the neighbouring highway.

4.7. Concerns raised by neighbours have included questions on the screening exercise with respect to slopes in the surrounding area and the course of a tributary of the former River Westbourne. Reference to the figures in the Over Arup Guidance on Subterranean Development and other relevant sources of information, such as *Lost Rivers of London* by N J Barton, support ST's conclusion that whilst two former tributaries of the Westbourne lie close to the site, neither is shown to cross the site. A larger scale map provided by the occupant of 7 Redington Gardens suggests that a tributary may have run through the site historically.

4.8. Similarly, although there are small localised areas where slope angles exceed 7^{o}, by reference to the Arup data, it is accepted that slopes in the main are less than 7^{o}.

4.9. The presence of the aquifer and shallow groundwater table are considered in Stages 3 and 4 of the BIA and modelling has been carried out to determine the possible damming effect of the basements at 36 and 38 Redington Road. It is accepted that due to the low hydraulic gradient and the low permeability of the Claygate Beds, the change to groundwater levels will be negligible. The hydrogeological assessment considered groundwater flow in both a southerly direction, which might be the case if the tributary crossed the site, and a south westerly direction, which would occur if the tributary ran to the west of the site; in both cases the impact of the basement is negligible. It is considered that the impact assessment is adequate to cover the possibility of the tributary existing at either location.

4.10. It is understood that planning permission has been granted for basements at 25 and 26 Redington Gardens. However, due to their distance from the site, they do not constitute a continuous barrier to groundwater flow as described in the Arup Geological, Hydrogeological and Hydrological Study. It is not considered therefore that there will be any cumulative impacts to groundwater flow.

4.11. Stages 3 and 4 of the BIA also consider likely ground movements at 7 Redington Gardens arising from the construction of the basement. The approach, which follows CIRIA C580 and also includes a consideration of heave, was accepted, as were the conclusions (Burland Category 0 damage). However, it was noted that the assumed construction methodology comprised a stiff retaining wall with stiff high level props. The original SER referred to the retaining wall being designed as a cantilever; this would result in greater ground movements. Southern Testing submitted a revised GMA in which they considered a cantilever retaining wall. The predicted ground movements suggest damage in Categories 2 and 3 (slight and moderate)

for 7 Redington Gardens. CPG4 requires mitigation measures where predicted damage exceeds Category 1 (very slight). It is noted that No 7 Redington Gardens is reported to contain a small area of basement and that the GMA predicts ground movements at the ground surface. However, it is considered that this is conservative as deeper foundations are generally less affected by ground movement.

4.12. A revised Zussman Bear SER provided in December 2015 makes reference to propping in the temporary case to control ground movements and restrict damage. There was confusion in the document over raking and flying shores and temporary props were referred to only in Stage 2 of the construction sequence. This has been amended in the December version which shows temporary props in place until the slabs are cast. Details of the propping and temporary works should be agreed with the party wall surveyor.

4.13. The BIA does not consider No 38 Redington Road, or the adjacent highway. The SER reports that No 38 is structurally independent of No 36 and indicates that it is supported on piled foundations. The SER states that a condition survey will be undertaken. In light of the deep basement to No 38, if it can be confirmed that No 38 does not rely on No 36 for stability and it is on piled foundations, it is accepted that it is unlikely to be adversely affected by the construction of a basement to No 36. Despite being recommended in the BIA, no monitoring of either 38 Redington Road or 7 Redington Gardens is proposed and it is recommended that this is undertaken together with a condition survey of the Redington Gardens property. These may be agreed with the party wall surveyors.

4.14. The SER states that the works will have no effect on any roadway. The revised ground movement assessment confirmed the likely need for remedial works to the highway if a cantilever retaining wall is adopted. However, it has since been confirmed that the excavation will be propped.

4.15. The SER describes the basement being formed inside a contiguous retaining wall and states that the site investigation confirms "the presence of groundwater will not be very significant". Whilst the BIA concurs that pumping from sumps will be sufficient to deal with water ingress, it also warns that, due to the high water table, this method carries the risk of the migration of sandy materials into the excavation. Should that happen, there is the risk of significant settlement outside the excavation. The BIA recommends a secant wall, or mitigation measures such as sprayed concrete should a contiguous piled wall be adopted. The SER received in December and its covering letter both describe measures to exclude water from the basement excavation.

4.16. A site specific flood risk assessment, provided in March 2016, found the risk from all forms of flooding to be low and confirmed that the basement proposals would not change the potential for other sites to be affected by flooding. It confirmed that there was sufficient capacity in the

network for anticipated flows off site. Although the FRA did not consider the possibility of a former tributary to the Westbourne river to cross the site, as described above, this is covered by the hydrogeological assessment presented in the original BIA.

4.17. The CMS prepared by Archtype Ltd deals mainly with minimising the impact of construction in terms of nuisance. It is noted that it is prepared for Abbey Properties Ltd whilst the BIA was prepared for Mill Hill Properties Ltd. It is also noted that the CMS incorrectly refers to the site being located on Stuart Avenue. Archtype's drawings, together with the SER, incorrectly give the postcode as N4 2ED. It is clear that the documents submitted in December 2015 and March 2016 are specific to the proposals for 36 Redington Road.

4.18. As noted above, queries on the BIA and the development have been raised by two neighbours and these are detailed and addressed in Appendix 1.

5.0 CONCLUSIONS

5.1. It has been confirmed that the BIA has been prepared by suitably qualified individuals. The geotechnical experience of the Structural Engineer has been confirmed.

5.2. The BIA has confirmed that the proposed basement will be founded within the Claygate Beds a short distance above the London Clay. The structure is to be supported on piled foundations with compressible material beneath the slab to accommodate heave.

5.3. The proposed basement will not undermine the adjacent property, No 38 Redington Road, as it has a two storey basement. It is reported that No 38 is structurally independent of No 36 and founded on piles in which case it will not be affected by the construction of the adjacent basement. No evidence of this has been seen by CampbellReith, however it is accepted that the increased basement depth to No 38 will reduce any impact.

5.4. Information is required to confirm that the structure of No 38 is able to accommodate the temporary loads from the RC wall until it cures, or a methodology provided to limit any such loads. It is accepted that a separation detail may be agreed with the party wall surveyor.

5.5. It is likely that the groundwater table will be encountered during basement construction. Proposals to prevent water ingress and avoid the loss of fine soils into the excavation are presented in the revised SER.

5.6. The original SER proposed a cantilever retaining wall whilst the ground movement and building damage assessment assumed a stiffly propped wall. The SER presented in December 2016 indicates temporary propping to remain in place until the slabs are cast. Details of the propping and temporary works may be agreed with the party wall surveyor.

5.7. It is accepted that there will be no significant adverse impact on the hydrogeology, even considering the consented basements at 25 and 26 Redington Gardens. It is possible that a former tributary of the River Westbourne crossed the site, however, there is no evidence of a significant body of water at the site and it is considered that the hydrogeological assessment is sufficiently robust.

5.8. It is accepted that in general the surrounding slopes are less than 7^{o} and that there will be no significant adverse impacts from or to the construction of the basement.

5.9. An FRA has confirmed the risk of flooding to be low and that the basement proposals will not alter the flood risk to the surrounding area. It has been confirmed that the sewer network can accommodate the flows off site.

5.10. A proposal for a condition survey of No 38 Redington Road is included in the SER. However, this should be extended to No 7 Redington Gardens. It is accepted that movements will be small, however, it is recommended that condition surveys and a monitoring regime are agreed with the party wall surveyor.

5.11. It is accepted that subject to the provisions of the party wall act, the BIA and supporting documentation have adequately identified the potential impacts arising out of the basement proposals and propose suitable mitigation.

Appendix 1: Residents' Consultation Comments

Residents' Consultation Comments

Surname	Address	Date	Issue raised	Response
Heath & Hampstead Society	PO Box 38214, London NW3 1XD	18/07/2015	BIA not complete. Anticipated ground movements could damage neighbouring structure	See sections 4.9 and 4.10
Beckman	7 Redington Gardens, London NW3 7RU	03/08/2015	Slope stability and hydrogeology incorrectly assessed. Risk of flooding not addressed.	See sections 4.7 – 4.11, 4.13 and 4.14 Report by esi suggests that further groundwater monitoring is required. However, presence of shallow water (c1m below ground level) is acknowledged in temporary and permanent condition. Further clarification required with respect to loss of fines into basement excavation.
Beckman	7 Redington Gardens, London NW3 7RU	23/12/2015 06/01/2016 14/03/2016	Risk of Category 3 – 3 damage Former river tributary Consented basements at 25 and 26 Redington Gardens	See sections 4.7 – 4.12 and 4.16

Appendix 2: Audit Query Tracker

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Audit Query Tracker

Query No	Subject	Query	Status	Date closed out
1	Qualifications	No evidence of experience in engineering geology of structural engineer.	Closed	08/04/2016
2	Stability	Structural form of No 38 Redington Road, including foundations, to be confirmed.	Closed	08/04/2016
3	Stability	Ground movement assessment for 7 Redington Gardens to be revised for proposed construction methodology. Need to GMAs for 38 Redington Gardens and highway to be reviewed.	Closed	08/04/2016
4	Stability	Construction methodology for RC wall adjacent to No 38 Redington Road required.	Closed	08/04/2016
5	Stability	Confirmation of movement monitoring proposals and condition surveys for potentially affected structures required.	Closed	08/04/2016
6	Stability	Confirmation of measures to prevent soil and water ingress into excavation.	Closed	08/04/2016
7	Surface water	Risk of flooding identified in BIA – not addressed	Closed	08/04/2016
8	Surface water	Potential for increased surface water flows off site – not addressed.	Closed	08/04/2016

Appendix 3: Supplementary Supporting Documents

zussmanbear

STRUCTURAL ENGINNERING REPORT

METHOD STATEMENT

FOR SUBTERANIAN DEVELOPMENT

36 Reddington Road
London N4 2ED

May 2015

395 St Margarets Road
Richmond
TW7 7BZ
T: 0208 332 1199
T: 0208 744 3988
www.zussmanbear.com

Construction Method Statement for Proposed Subterranean Development
Planning Report

ZUSSMAN BEAR PARTNERSHIP
APRIL 2015

CONTENTS PAGE

1.00 Introduction & Location

1.1 At Present 36 Reddington Road is a two storey self-contained semi-detached house with a single storey extension and garage to the side. A planning application is being lodged to demolish the existing building and construct a larger house with a single storey basmenjt. The building is surrounded on all three sides by other properties with number 38 Reddington Road on the left, which already has been redeveloped including a double basement construction.

2.0 Structural Description

2.1 The existing building, photographed below is number 36 Reddington Road which is a traditional loadbearing brickwork and timber floor construction. This building will be demolished to allow for the construction of the new house.

2.2 The new house will be constructed as a steel frame with external brick cladding. The lower ground floor construction is as follows;

- Contiguous bored piles.
- Capping beam.
- RC retaining wall.
- Bearing piles supporting slab, lift shaft & steel columns.
- Suspended pile raft slab over compressible material.

2.3 The ground floor construction is as follows;

- Steel frame.
- Precast floor planks spanning between steel frame
- Internal non loadbearing walls.
- Framed lift shaft.

2.4 The first floor construction is as follows;

- Steel frame.
- Precast floor planks spanning between steel frame
- Internal non loadbearing walls.
- Framed lift shaft.

2.5 The loft floor construction is as follows;

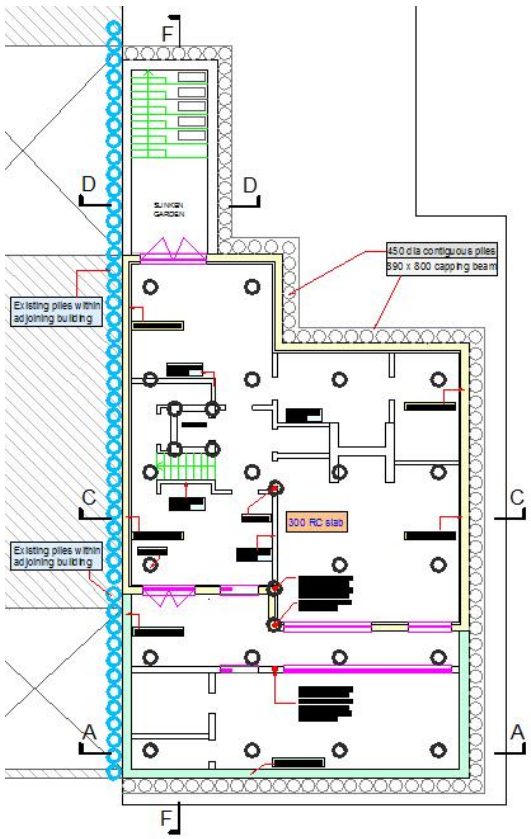
- Steel frame.
- Precast floor planks spanning between steel frame
- Internal loadbearing stud walls.
- Framed lift shaft.

2.6 The roof construction is as follows;

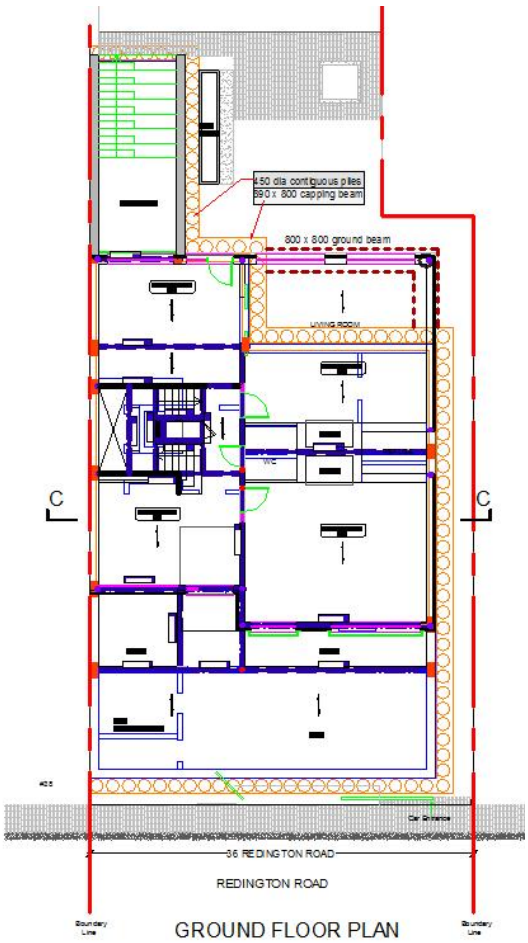
- Timber rafters.
- Loadbearing stud walls supporting rafters and purlins.
- Bracing and ply for stiffness

3.0 Proposed drawings

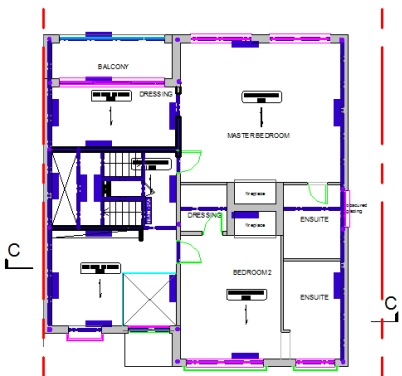
Proposed Floor Plans



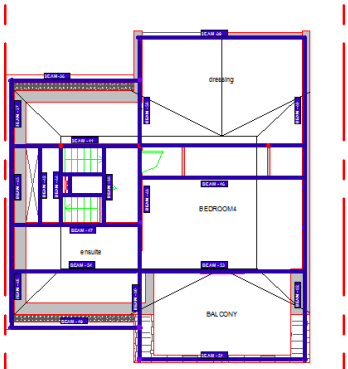
BASEMENT PLAN



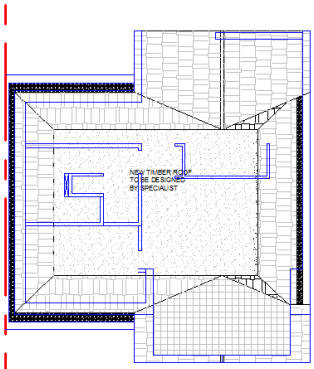
GROUND FLOOR PLAN



FIRST FLOOR PLAN



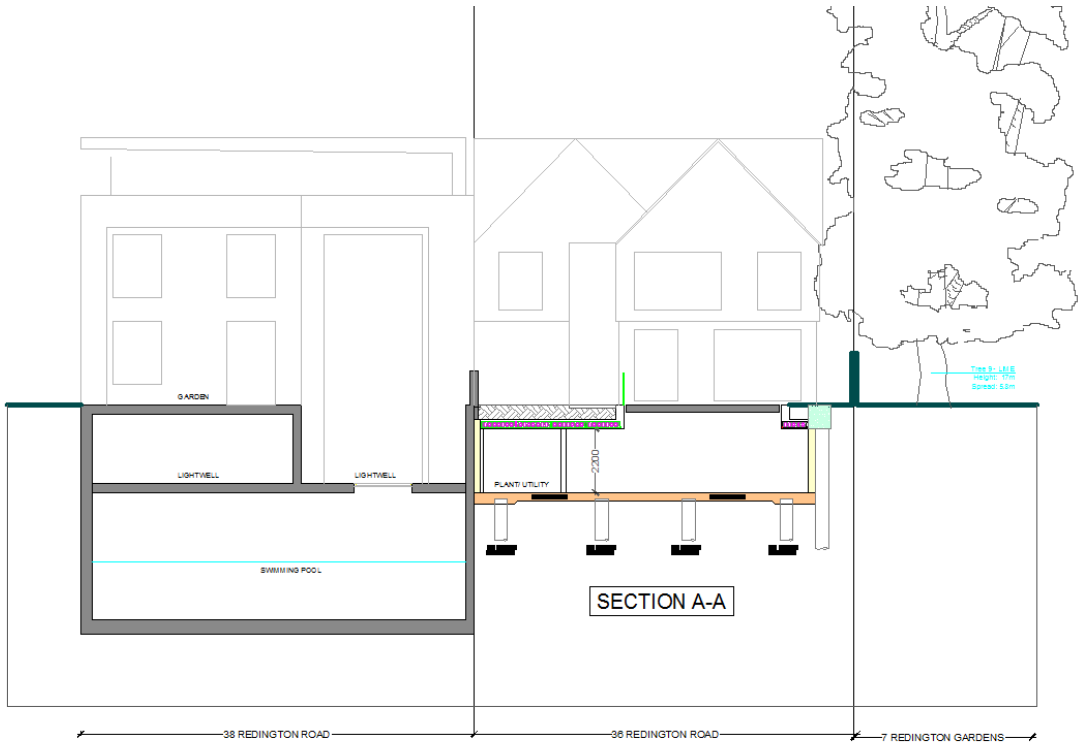
LOFT PLAN

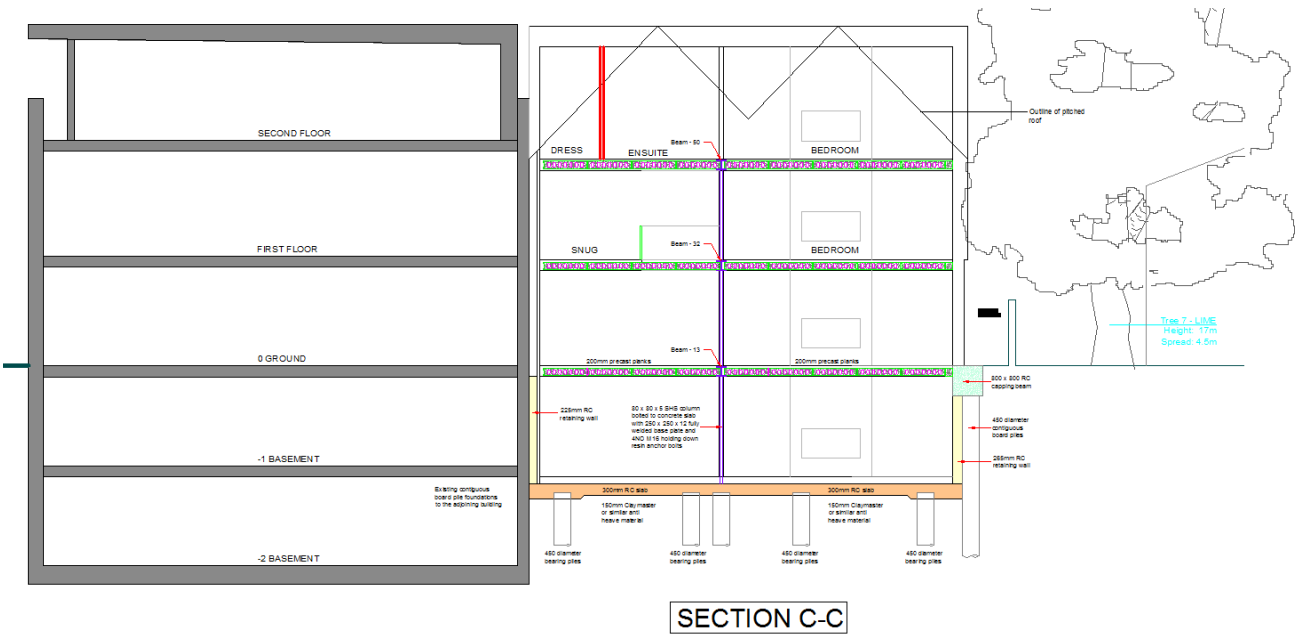


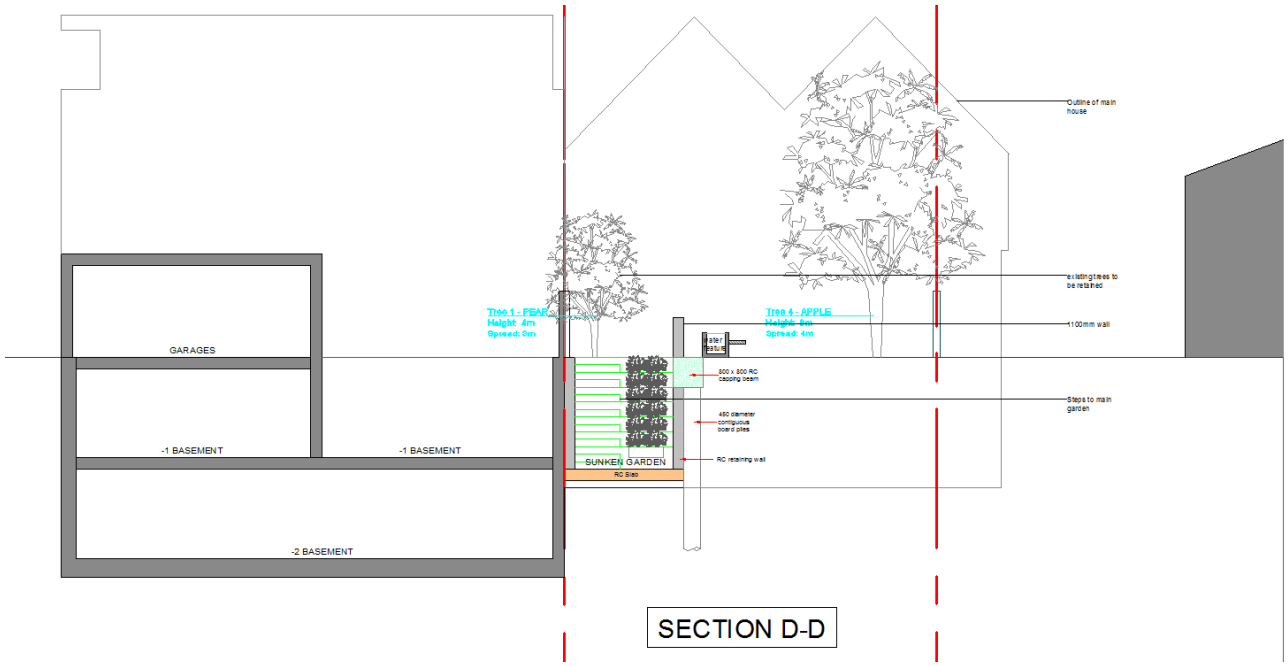
ROOF PLAN

4.0 Proposed drawings

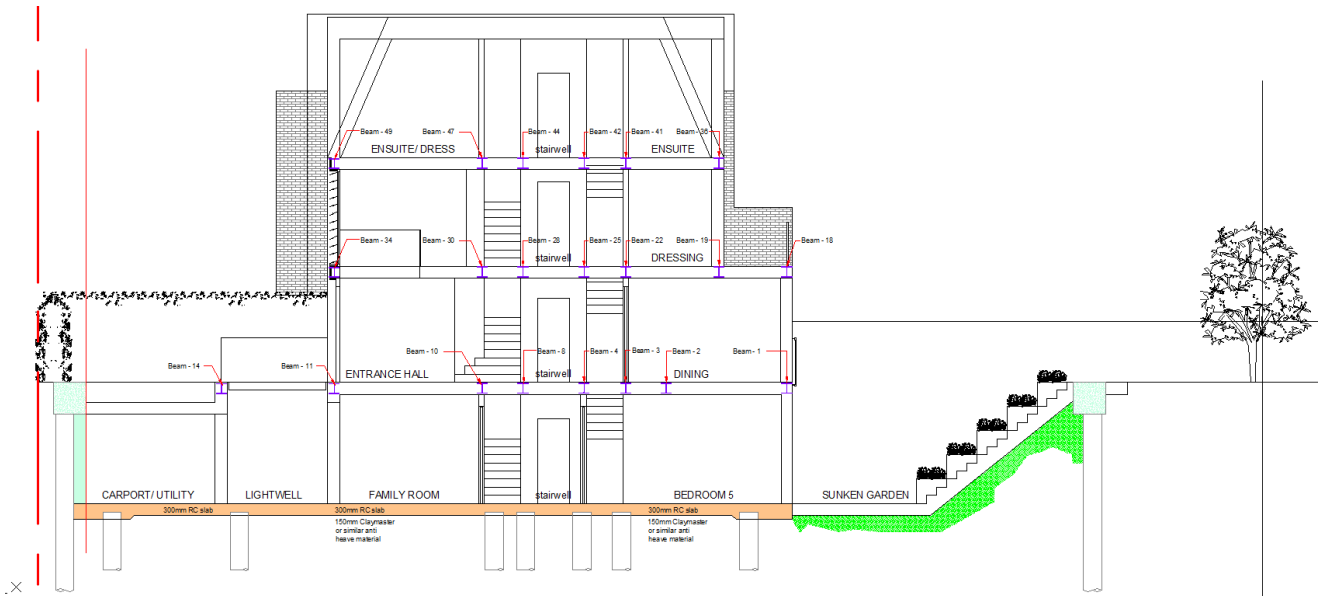
Proposed Sections






Outline of main house
existing trees to be retained
1100mm wall
Steps to main garden
Tree 1 - PEAR
Height: 4m
Spread: 3m
Tree 4 - APPLE
Height: 6m
Spread: 4m
GARAGES
-1 BASEMENT
-1 BASEMENT
-2 BASEMENT
SUNKEN GARDEN
RC Piles
800 x 800 RC capping beam
450 diameter contiguous board piles
RC retaining wall

SECTION D-D


ENSUITE/ DRESS
stairwell
ENSUITE
DRESSING
ENTRANCE HALL
DINING
CARPORT/ UTILITY
LIGHTWELL
FAMILY ROOM
BEDROOM 5
SUNKEN GARDEN
300mm RC slab
150mm Claymaster or similar anti heave material

5.0 Ground Conditions

5.1 In order to determine and evaluate the design of this construction ground investigation was carried out by Southern Testing Environmental & Geotechnical investigations and the details of this report are attached. The works were carried out between 15 – 23 2014 and the weather conditions during this period was reasonably dry.

5.2 The scope of the investigations comprised excavation of trial pits to examine the presence of tree roots as it was requested by the arboriculturalist and sinking of two 20m deep boreholes using a light percussion 150mm diameter shell and auger boring rig. The ground conditions according to the geology of the area mainly consist of Claygate overlaying London Clay as indeed much of West London.

5.3 Depth of excavation for the basement slab, underpinning and foundation will be around 4.0 m and at these depths the material encountered will consist mainly of silty and sandy clays and ground water will be present as this was struck at around 1.1 m. The results of the Atterberg Limit determination of the spoils confirm high shrink ability factor and there will be swelling of the soil after under the excavation as the overburden weight of the material has been excavated added by the close presence of mature high water demand trees.

Table from Southern testing – Page 6 (Site Investigation report)

13 Soils as Found

The soils encountered are described in detail in the attached exploratory hole logs (Appendix A), but in general comprised a thin covering of made ground over sandy clays (assumed to represent the Claygate Member) over London Clay. A summary is given below.

Depth	Thickness	Soil Type	Description
GL to 0.7m	0.7m	Made Ground	Dark brown to brown silty sandy CLAY with occasional to frequent brick, ash and concrete fragments.
0.7 to 5.1/5.2m	4.5/4.6m	Claygate Member	Variable firm pale brown to brown and bluish grey silty sometimes slightly sandy CLAY. Some more gravelly or sandy clays present.
5.1/5.2 to 20m+	Thickness unproven	London Clay	Firm to stiff/high strength dark brown to grey silty CLAY.

13.1 Visual and Olfactory Evidence of Contamination

No obvious evidence of possible contamination was recorded during the fieldwork other than the presence of superficial made ground; which can contain elevated levels of some contaminants.

14 Groundwater Strikes

Water was struck in the exploratory holes as follows:

BH	Water Strikes
BH1	Groundwater strike at 2.7m depth.
BH2	No groundwater strikes were made.

The shallow trenches were dry.

6.0 Substructure design

6.1 The ground condition seen here generally consists of London Clay with high shrink ability factor and this requires for the substructure to transfer the loads to deeper mediums and for this piling solution will be adopted. The results of the ground investigation has confirmed swelling potential of the London Clay and for this reason the foundations of this building will be designed as a pile raft that will transfer all the vertical loads to a suitable depth beyond the shrinkable zone.

6.2 The Loading from the external elevation cladding and the frame is transferred onto the capping beam which is supported by the contiguous board piles and the retaining walls. The vertical loading is shared by the two elements with the contiguous pile transferring a portion of the load to the ground with the aid of side friction plus end bearing and the retaining wall transfers the other portion of the vertical load directly to the bearing piles placed below the pile raft.

6.3 The Loading from the internal frame system is transferred onto the pile raft. Within the areas of concentrated load individual piles are positioned to minimise eccentric load transfer.

6.4 The reinforced pile raft is designed as a stiff plate sufficiently reinforced to transfer any eccentricity and midspan load directly onto the bearing piles. The underside of the raft has no contact with the ground and compressible material is placed below the raft to allow for ay heave and hydraulic pressure build up.

7.0 Superstructure design

7.1 The superstructure of the building will be a steel frame construction that will be designed to support precast floor planks and the external cladding.

7.2 Steel columns externally will be supported directly over the capping beam and the internal steel columns will be supported directly over the pile raft.

7.3 Steel beams will connect the columns to form a suitable frame and a grillage for each floor. The external beams will support the cavity wall cladding and the internal beams will support the floor structure.

7.4 The advantage of a steel frame design is that the skeleton and the support of the building is constructed with speed and is not reliant upon different trades such as brick and block subcontractors or precast floor manufacturers.

8.0 Construction sequence

The construction sequence has been illustrated in the following drawings.

8.01 Demolition of the existing building

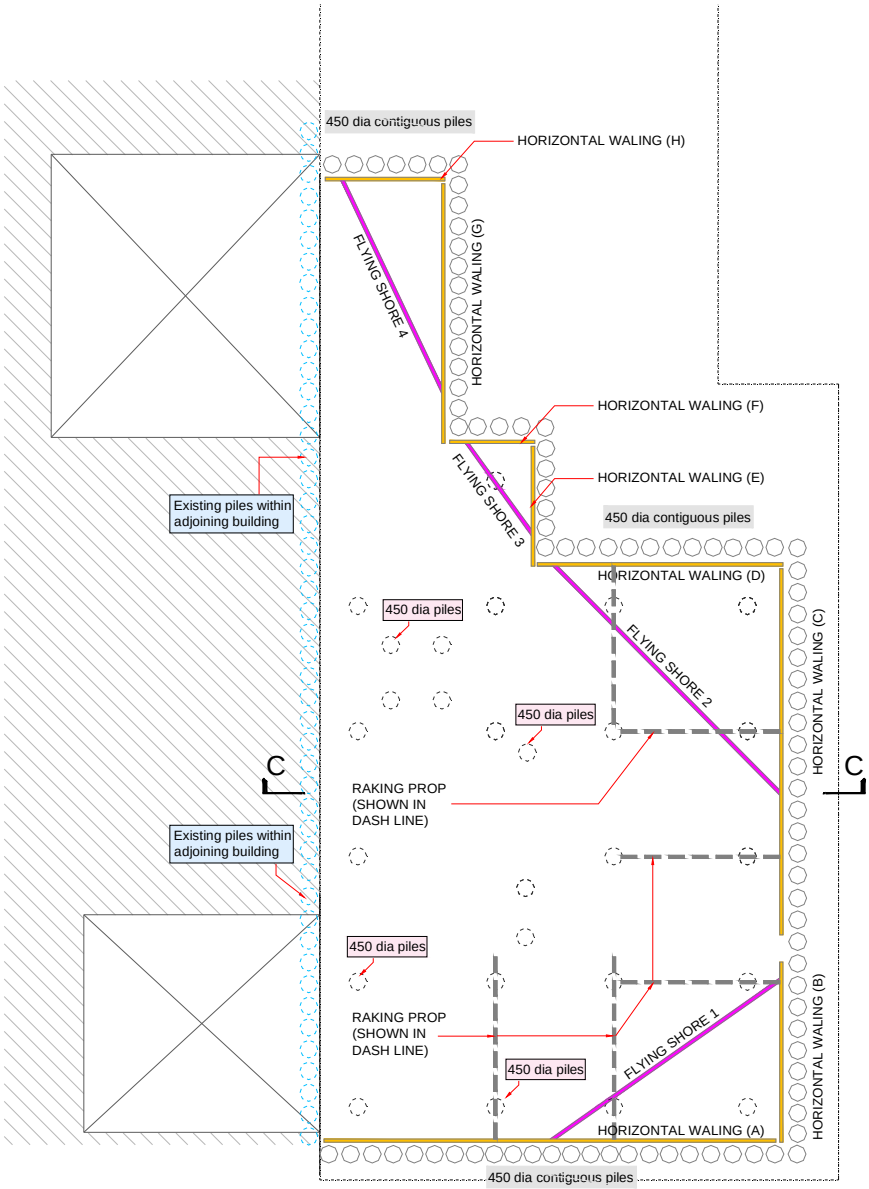
Number 38 Reddington Road was constructed recently as a totally independent structure and does not rely on number 36 for any lateral stability. Therefore with the removal of number 36 there will be no issues with having to prop or restrain number 38. However a comprehensive schedule of conditions will be prepared by the Party wall surveyors.

The demolition of number 36 will commence with careful stripping out of the roof and removal of all the fixture and fittings and any elements attached to number 38 will be removed carefully to ensure no damage is caused to any of the finishes.

After the removal of the roof, the floors will be gradually taken out followed by the internal and external walls. The contractor will ensure that the stability of he building is maintained at all times and the removal of debris is carried out in a orderly and sequential manner o minimise any noise and disturbance to the adjoining owners.

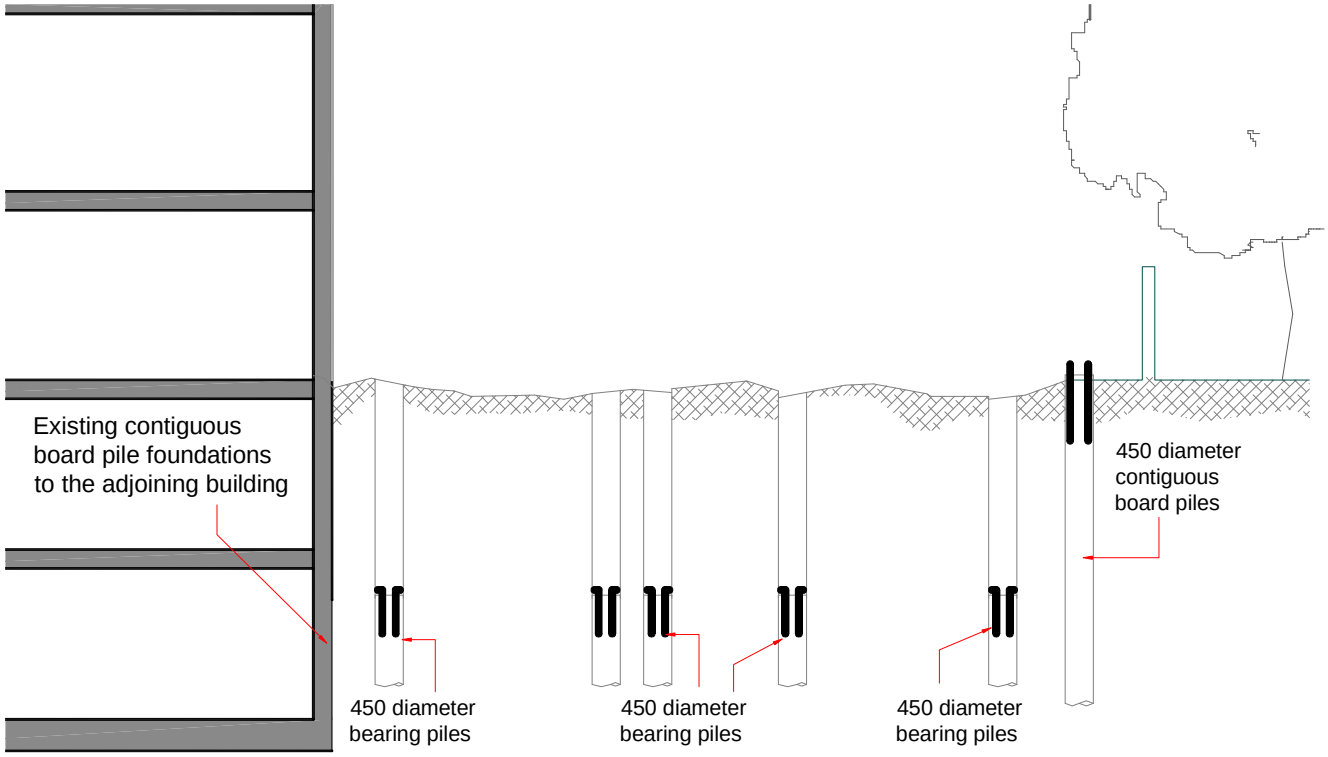
8.20 STAGE -1 PILING

After demolition of the existing building and construction of all the necessary protective elements around the perimeter of the site the piling mat will be provided and the piling contractor will commence installation of both the bearing and contiguous piles. The bearing piles will be poured down to their required cut off level which will be approximately 2.5m below the ground level. In order to reduce deflection in temporary condition at the head of the piles, temporary propping will be introduced and designed by specialist contractor as shown using either raking props or flying shores.



STAGE -1 PILING & PROPPING

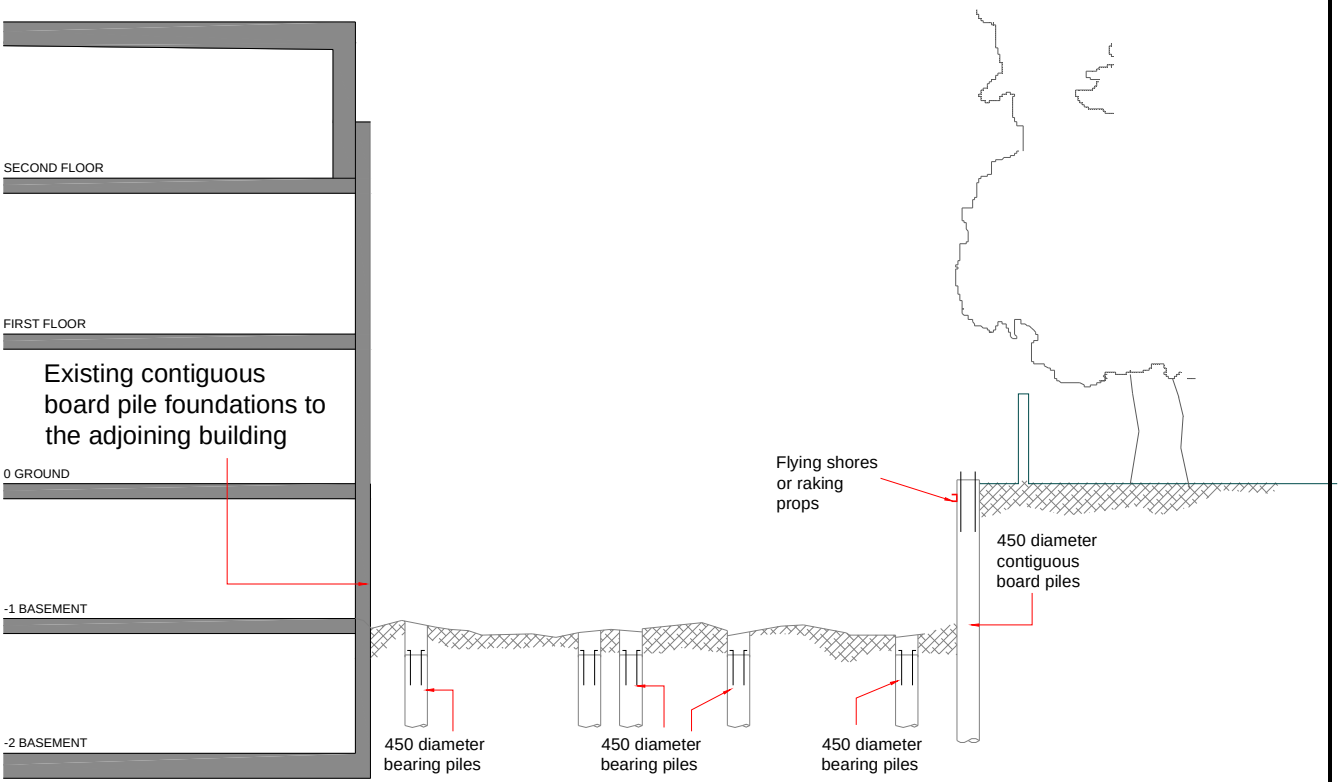
8.10 STAGE-1 Piling



STAGE 1- Piling Section C-C

8.20 STAGE -2 Excavations & Propping

After the installation of the piles has been completed, excavation of the ground can commence. The contractor will ensure all the necessary provisions for dewatering have been made and as it has been recommended in the site investigations report any ingress of water can be pumped from a pre-constructed sump. The site investigation also confirms that the presence of ground water will not be very significant. Raking props or flying shores will be installed in accordance with recommendations made on floor plan. (Page 12)



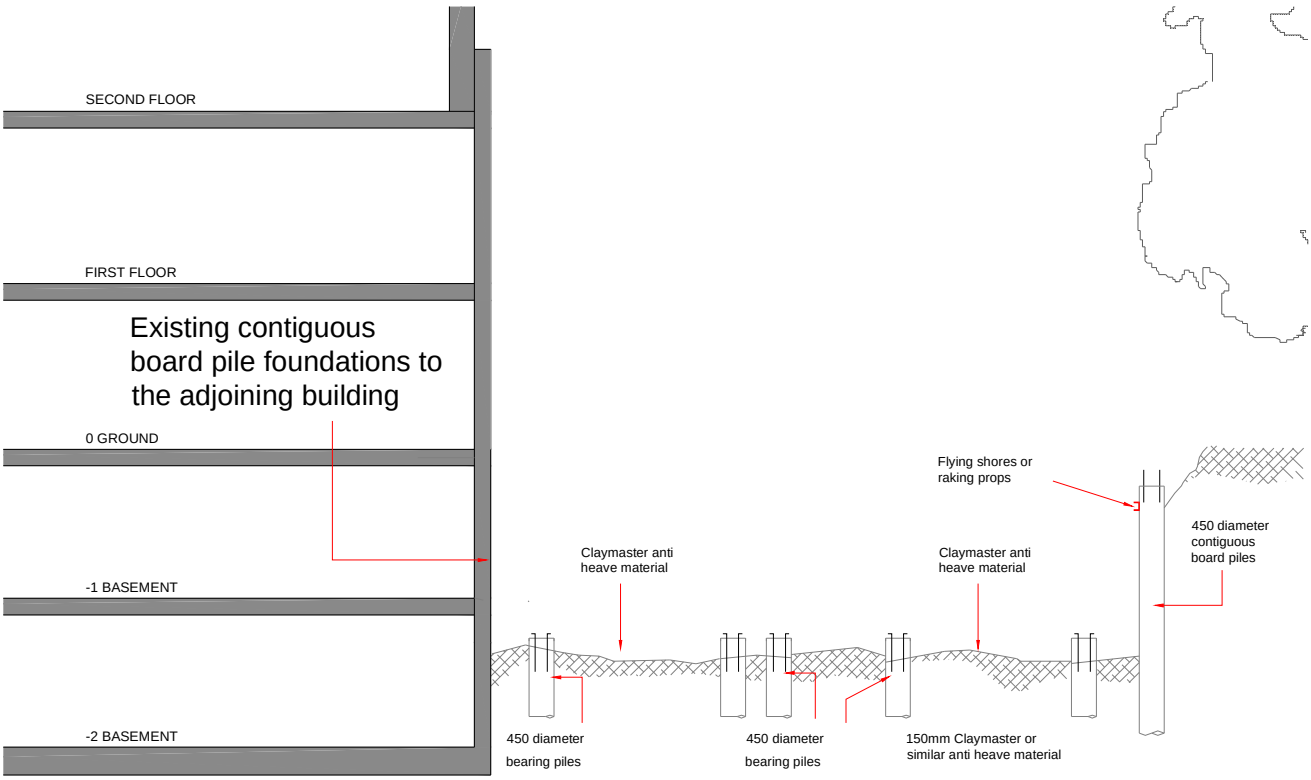
STAGE 2 - Excavation & PROPPING

8.20 STAGE -2 Excavation initial stages.

STAGE -2a Installation of props

8.30 STAGE -3 Excavation

The Excavation of the ground will continue down to the required formation level of the basement pile raft. The ground will be levelled and the starter bars from the bearing piles will be prepared to be linked to the basement pile raft. The clay master compressible material will be laid and ground will be ready to receive concrete for the pile raft.

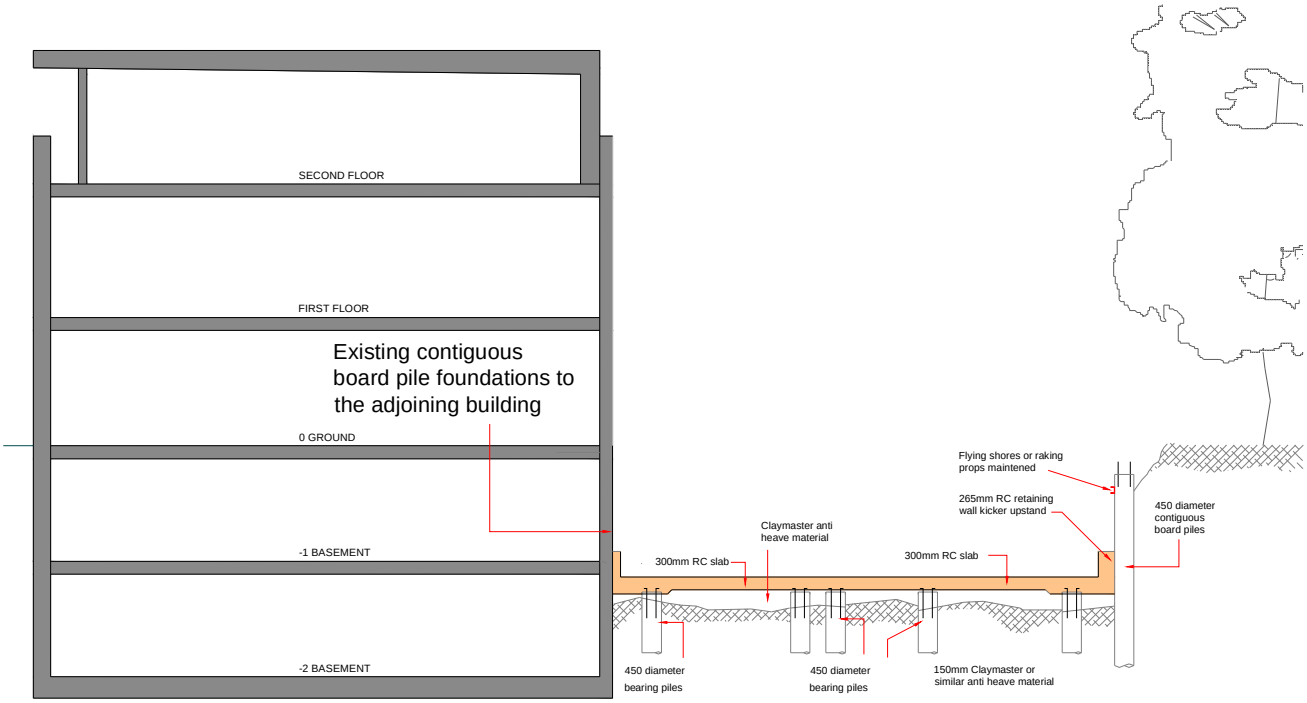


STAGE 3 - Excavation

STAGE-3 Excavation exposing bearing piles

8.40 STAGE -4 Slab Construction

All necessary formwork will be cut and prepared and the reinforcing bars will be laid and tied to the bearing pile starter bars. A kicker will be formed around the perimeter of the slab for the attachment of formwork for the retaining walls. Sufficient preparations and excavations will be made at ground level for the casting of the capping beam that will be constructed over the contiguous piles.



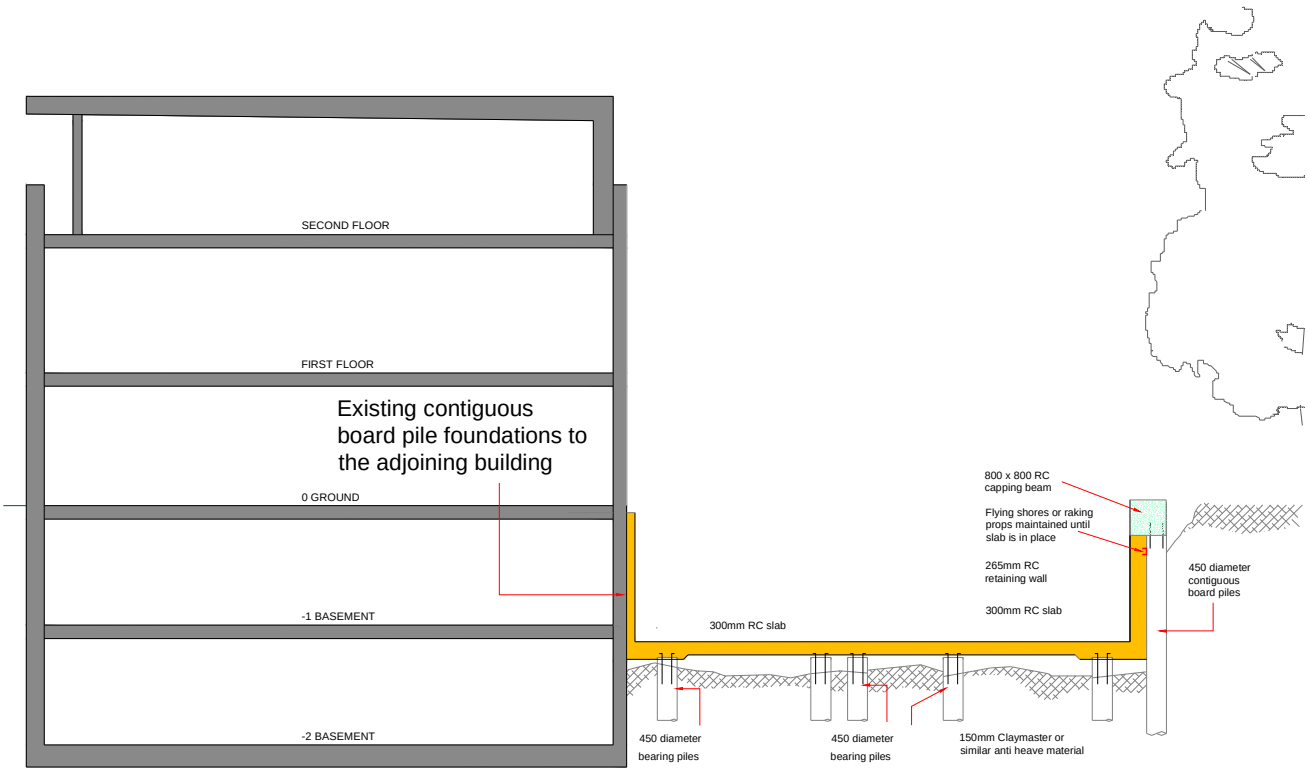
STAGE 4 - Slab construction

STAGE-4 Slab construction reinforcement fixed

STAGE-4 Slab construction concrete poured

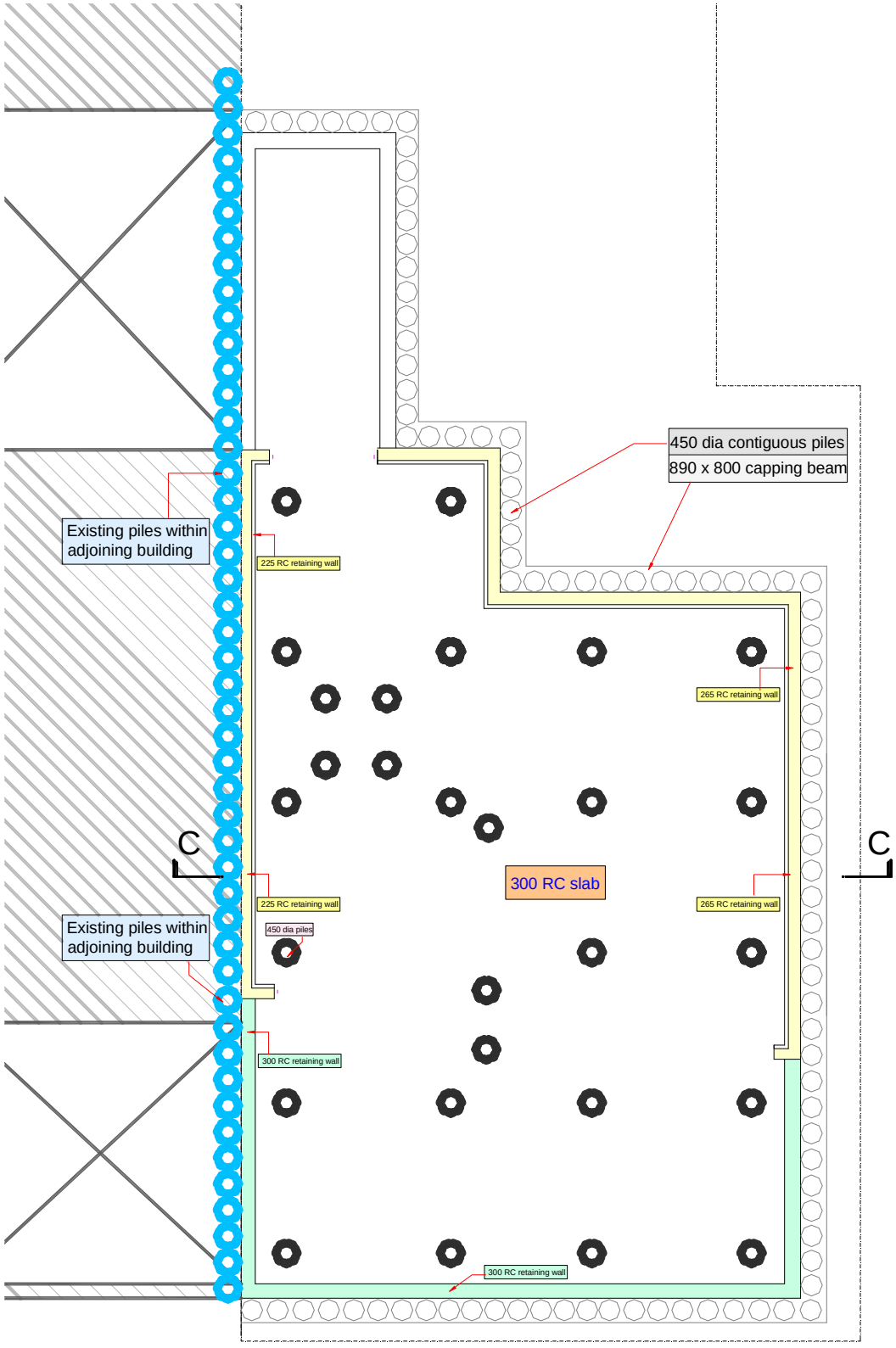
8.40 STAGE -5 Retaining wall and capping beam construction.

Reinforcement will be fixed for both the retaining wall and the capping beam and concrete will be poured to complete the substructure construction.



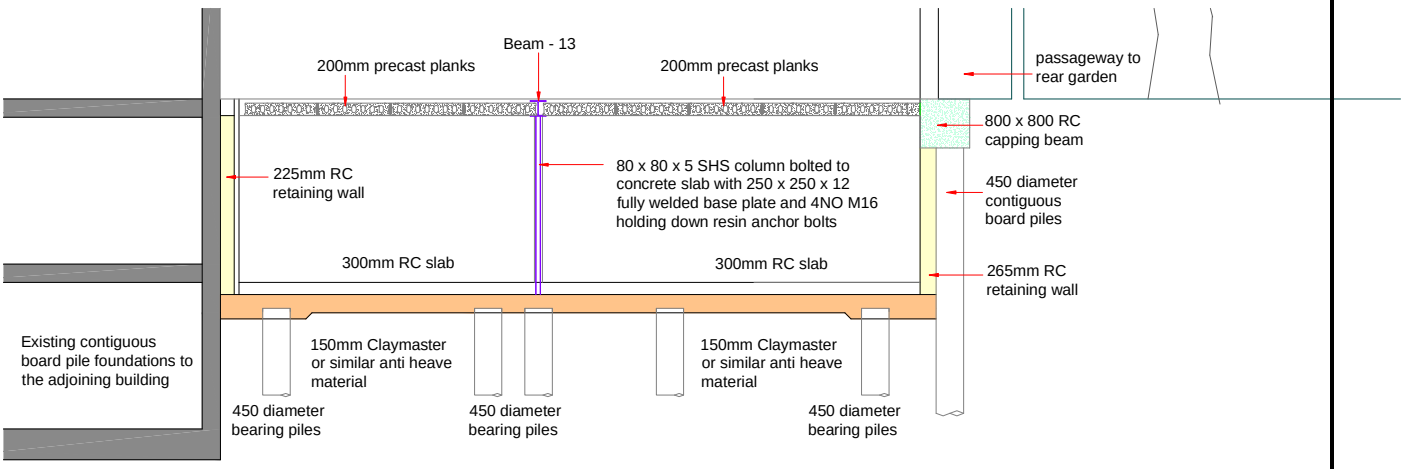
STAGE 5 - Retaining wall & capping beam

8.50 STAGE-5 Retaining wall and capping beam construction.

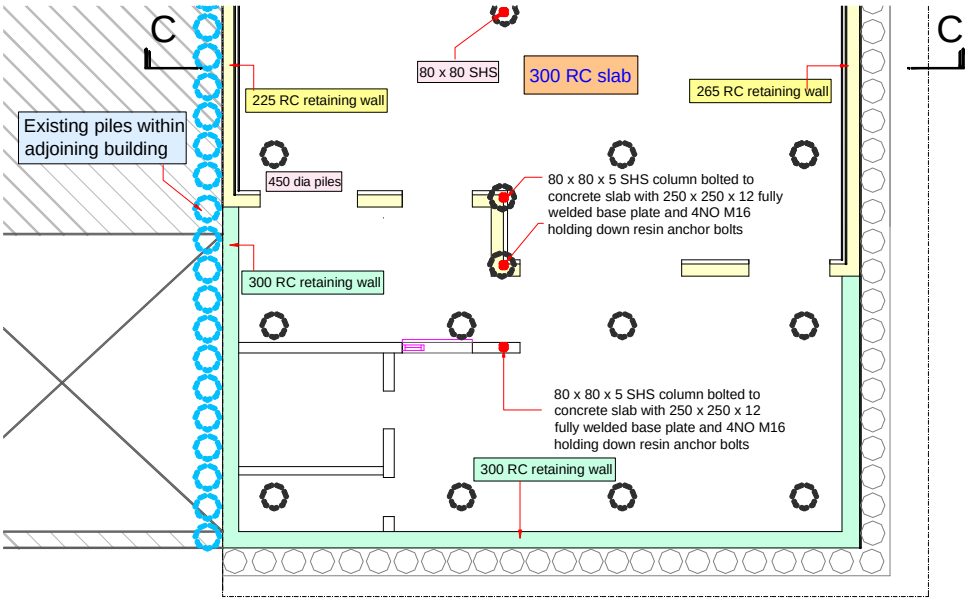


8.60 STAGE-6 Retaining wall and capping beam construction.

Reinforcement will be fixed for both the retaining wall and the capping beam and concrete will be poured to complete the substructure construction. No internal propping will be necessary because as pointed out in clause 8.30 the contiguous piles will be designed as cantilevers in order to allow free and open space within the newly formed basement.

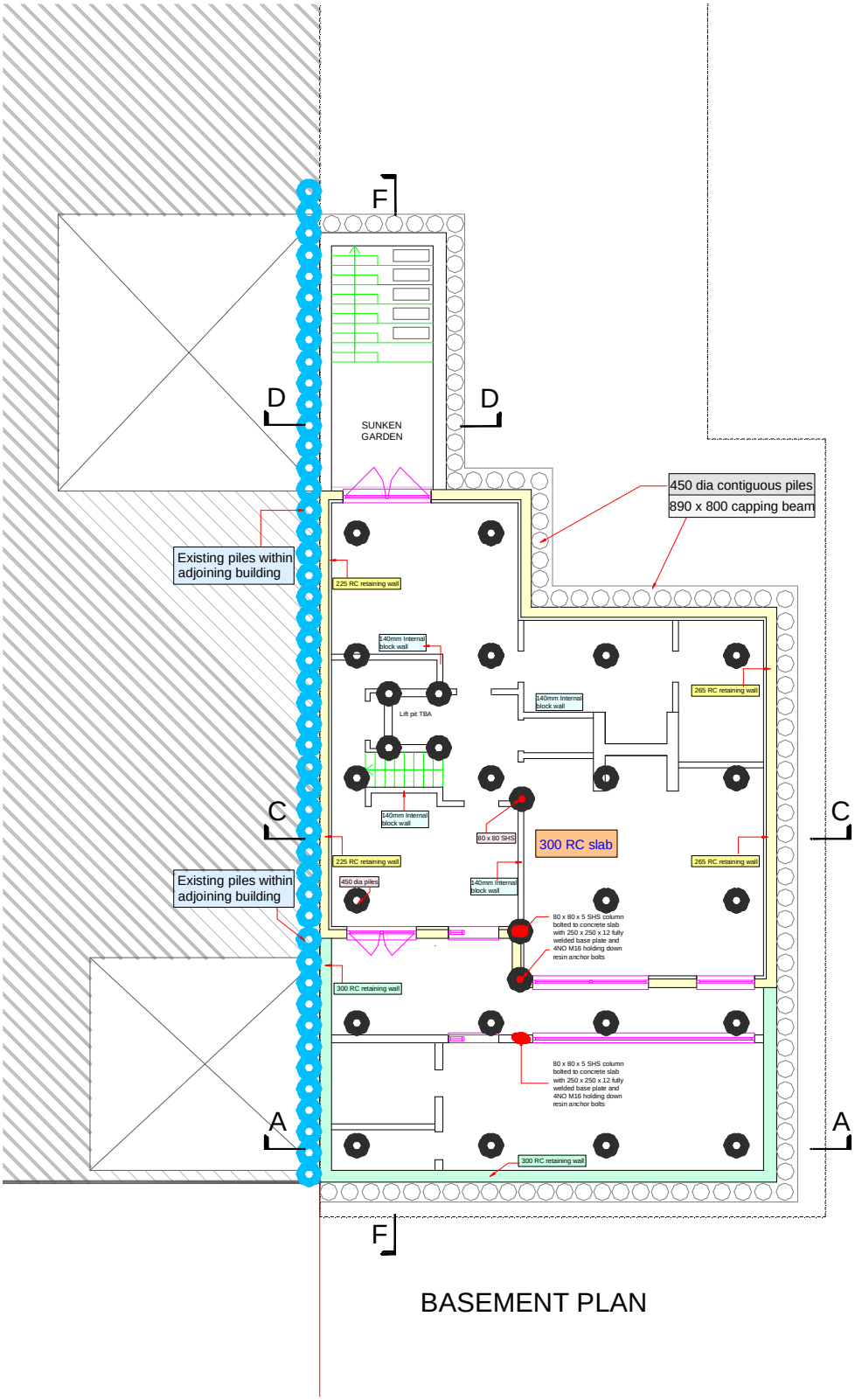


STAGE 6 - Steel
Frame & construction



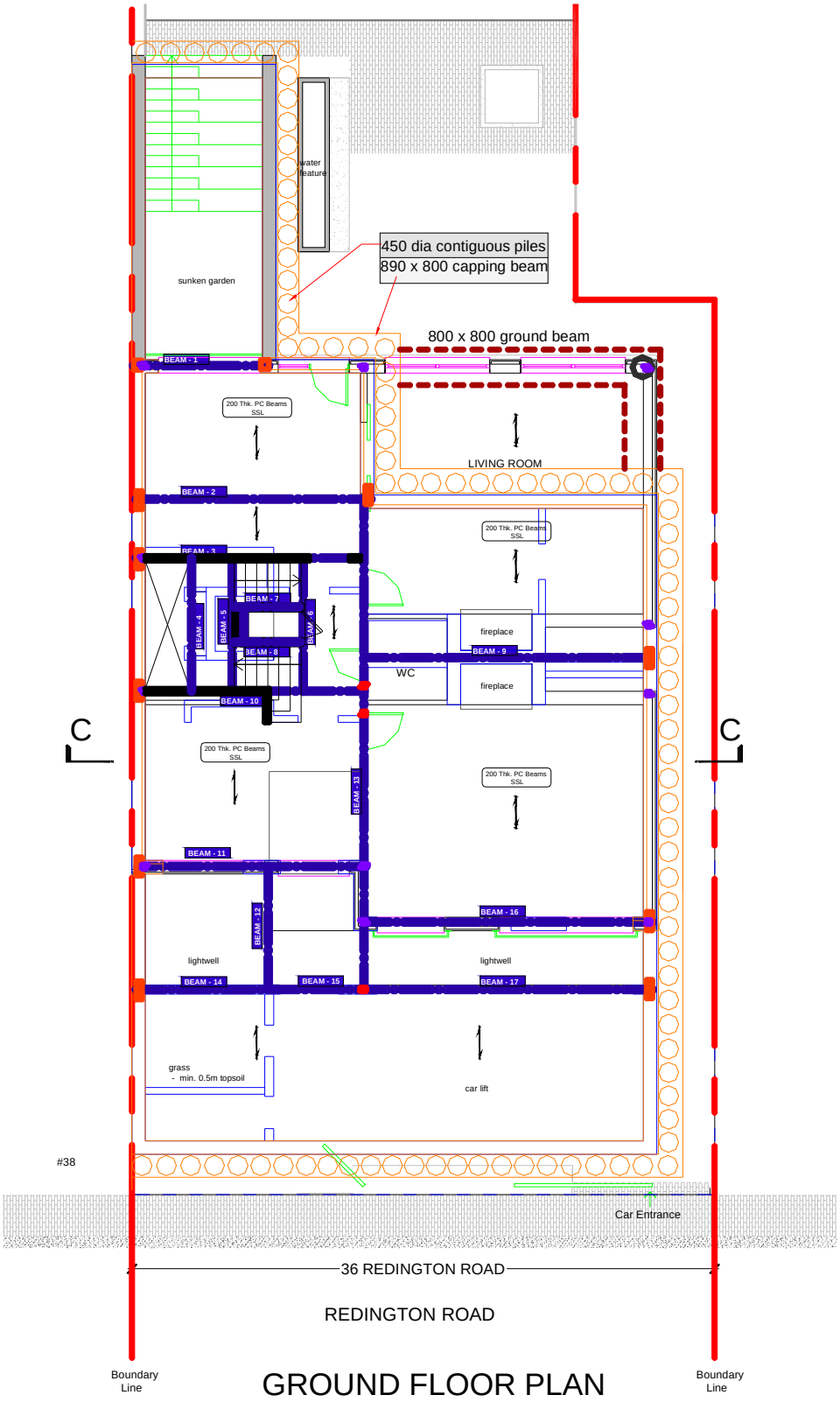
STAGE 6 - Steel
Frame & construction

8.70 STAGE-7 Basement structure completed



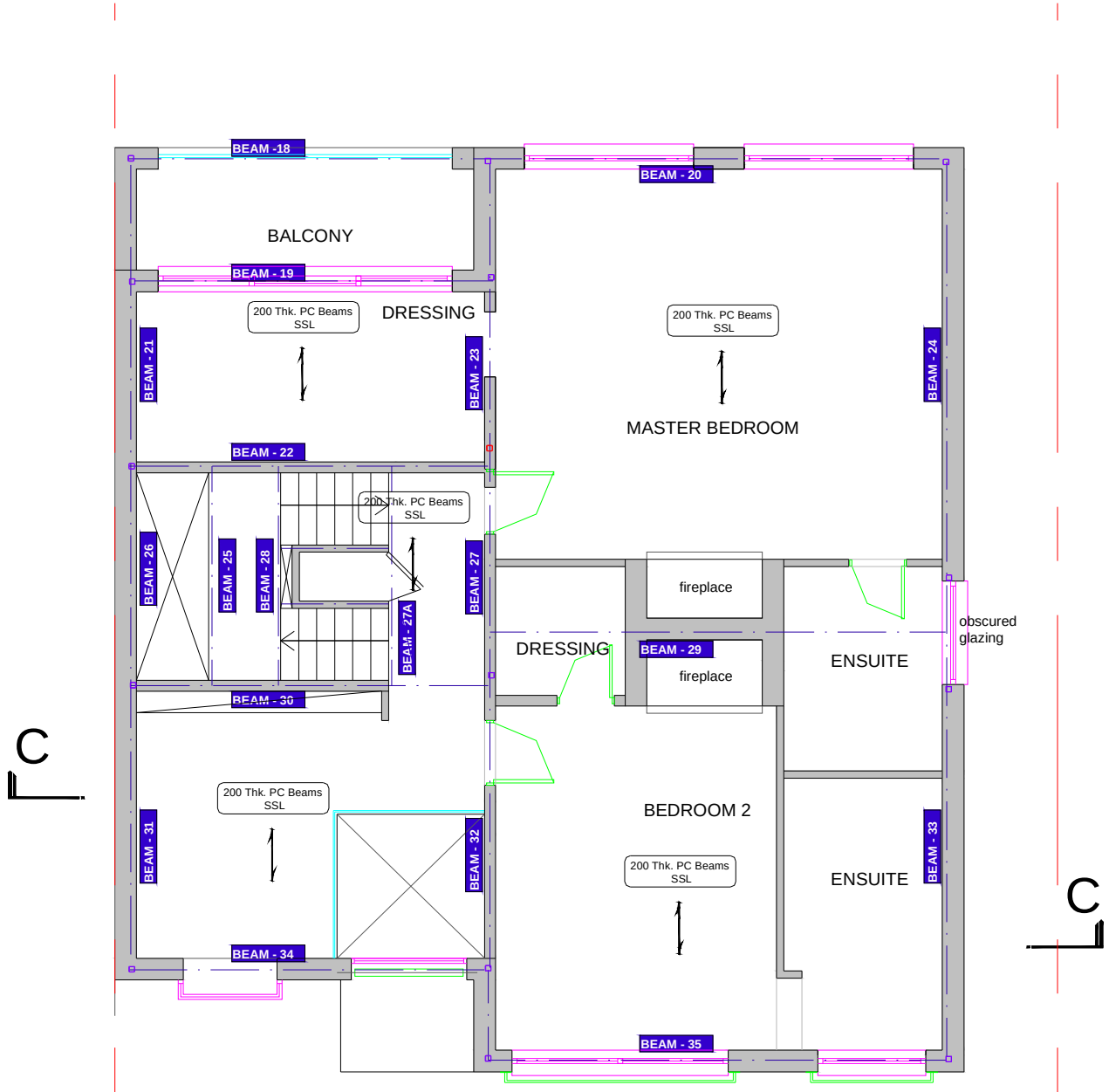
BASEMENT PLAN

8.80 STAGE -8 Ground Floor Structure Completed



8.80 STAGE-8 Ground floor precast floor on capping beam

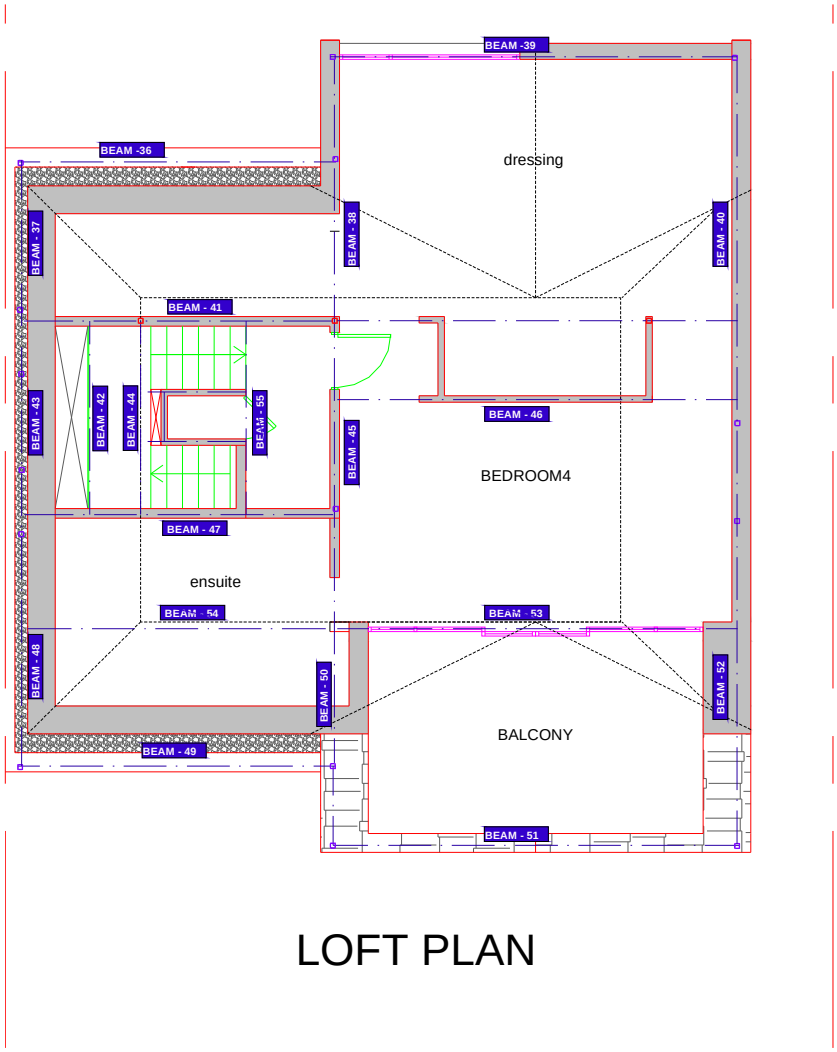
8.90 STAGE -9 First Floor Structure Completed



FIRST FLOOR PLAN

8.90 STAGE-9 First floor precast floor over steel frame

8.90 STAGE -9 Second Floor, Loft and Roof Completed



LOFT PLAN

9.00 Structural Calculations

The following design codes will be adopted for the structural design

BS8002 Earth Retaining Structures
BS8110 Structural Use of Concrete
BS648 Weight of Building Materials
BS6399 Loadings for Buildings
BS8004 Foundations

Underpinning party walls, worst case will be in temporary condition

Loading

Total area internally to be supported

12 x 12 = 144m2

DL1 = 0.86 x 144 = 120 kN
LL1 = 0.75 x 144 = 108 kN

DL = 0.25 x 24 x 144 x 3 = 2592 kN
LL = 1.5 x 144 x 3 = 684 kN

Total Load = 120+108+2592+684 = 3600kN

Number of internal piles = 22

Loading per pile = 163 kN + basement slab = 10 x 9 = 90 kN
Total per bearing pile = 253 kN

External piles Loading :

DL = 0.86 + 0.75 + 18 + 4.5 = 25 kN per/m x 4 = 100 kN/m + 4.8 x 10 = 148 kN/m

Each pile supporting 148/3 = 50 kN

Contiguous piles each support = 50 kN
Internal bearing piles = 253 kN

Design for internal bearing pile 8m deep

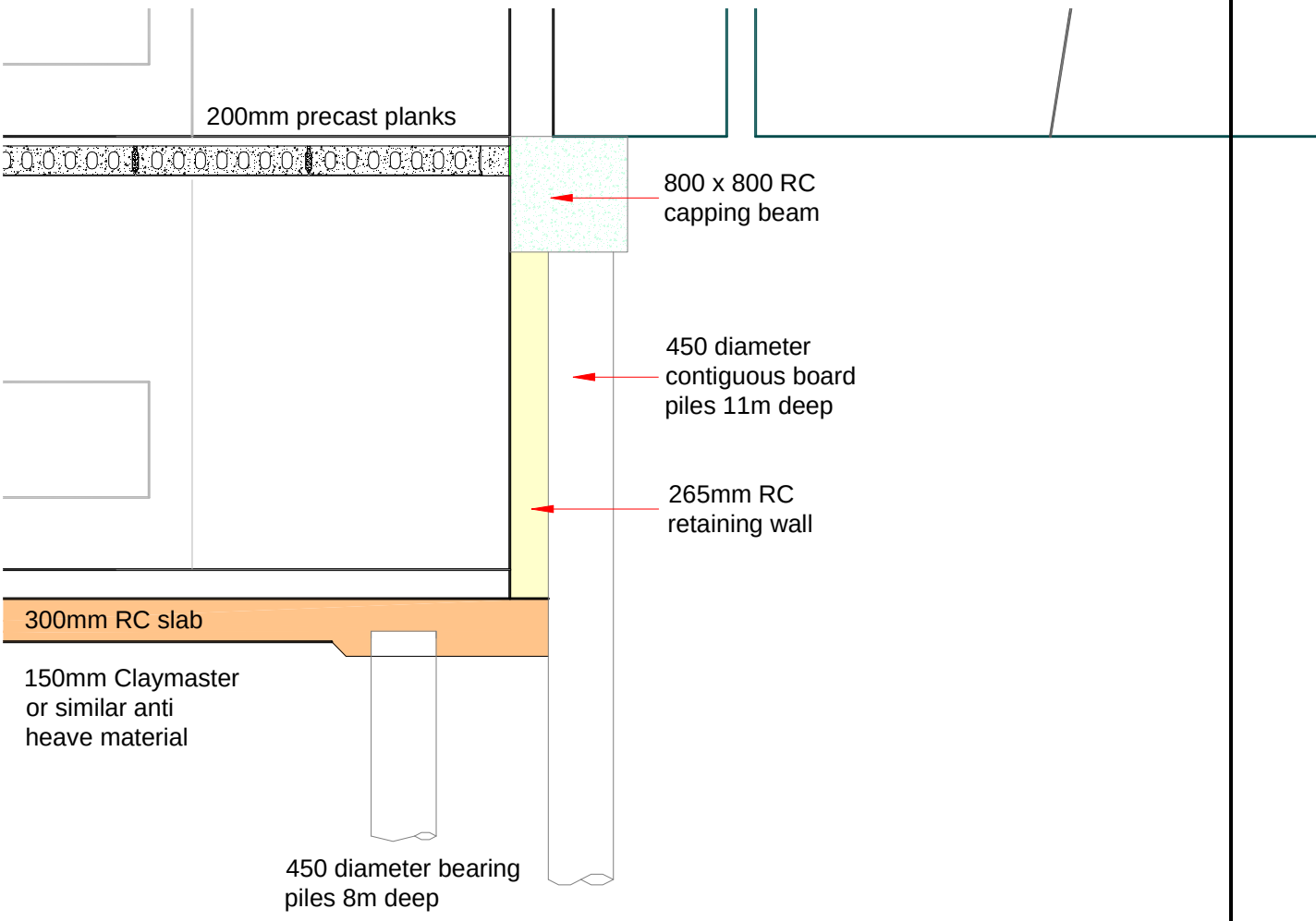
Pile capacity QS Friction = 0.45 x 80 x 11 = 396 kN
Qb end bearing = 80 x 0.15 = 12 kN

Pile resistance = 396 + 12 = 408 kN

Actual load = 140 kN

Factor of safety 408/140 = 3

Bearing pile specification will be 8m deep 450mm diameter
Contiguous pile specification will be 11m deep 450mm diameter



Suspended slab design

DL = 0.35 x 24 = 8.4 kN/m2
LL = 1.50 1.5 kN/m2

Factored bending moment

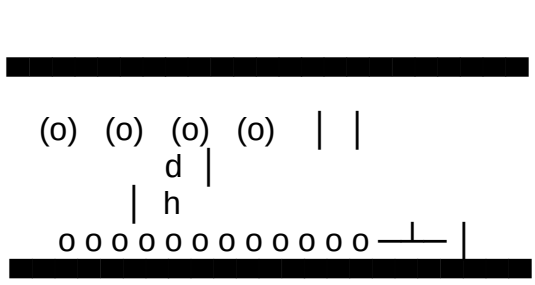
8.4 x 1.4 + 1.5 x 1.6 = 21 x 3.5 x 3.5 /8 = 32 kNm

300 slab

Location: Continuous slab

Bending in solid slabs (with comp.steel if reqd.), designed per metre width, with checks on minimum steel and span/effective-depth ratio

Calculations are based on EN1992-1 2004 Eurocode 2:Design of concrete structures and assume the use of a simplified rectangular concrete stress-block, and that the depth to the neutral axis is restricted to 0.45d



Design moment - (i.e. factored moment)

Design BM before redistribution Mbef=32 kNm
Section being analysed is considered as continuous.
Section considered has a sagging moment

Materials

Char cylinder compress strength fck=35 N/mm¬2 (concrete)
Char yield strength of reinft fyk=460 N/mm¬2
Max.aggregate size (for bar spc.) hagg=20 mm
Diameter of tension bars dia=12 mm

Diameter of distribution bars diad=10 mm

Durability and cover to reinforcement

Life of structure 50 years
Exposure class XC1
Designed concrete C 35 /45
Minimum cover covern=50 mm
Fixing tolerance tol=10 mm
Nominal cover (Cl. 4.4.1.1(2)) cover=60 mm

Section properties

Overall depth of section h=300 mm
Effective depth of section d=300 mm
Breadth of section b=1000 mm

Main reinforcement

Partial safety factor for steel gams=1.15
Char yield strength of reinft. fyk=fy=460 N/mm¬2
Partial safety factor for conc. gamc=1.5
Char cylinder compress strength fck=35 N/mm¬2 (concrete)
Design yield strength of reinft. fyd=fyk/gams=460/1.15=400 N/mm¬2
It is usual practice in the UK to restrict x/d to 0.45
Limit on factor delta=0.85
Factor K'=0.597*delta-0.18*delta^2-0.209
=0.597*0.85-0.18*0.85^2-0.209
=0.1684
Factor K=M*1E6/(b*d^2*fck)
=32*1E6/(1000*300^2*35)
=0.0102
No compression reinforcement required.
Lever arm z=d/2*(1+SQR(1-3.529*K))
=300/2*(1+SQR(1-3.529*0.0102))
=297.3 mm
Reduce lever arm to z=0.95*d=0.95*300=285 mm
Depth to neutral axis x=2.5*(d-z)=2.5*(300-285)
=37.5 mm
Tension reinforcement required As=M*1E6/(fyd*z)=32*1E6/(400*285)
=280.7 mm¬2
Mean width of the tension zone bt=bw=1000 mm
Mean value axial tensile strength fctm=0.3*fck^(2/3)=0.3*35^(2/3)
=3.21 N/mm¬2
Minimum reinforcement required Asmin=0.26*fctm*bt*d/fyk
=0.26*3.21*1000*300/460
=544.3 mm¬2
Area of tension reinforcement As=Asmin=544.3 mm¬2
Breadth of section bw=1000 mm

Maximum reinforcement permitted Asmax=0.04*bw*h=0.04*1000*300
=12000 mm¬2
Percentage area steel required rho=100*As/(bw*d)
=100*544.3/(1000*300)
=0.1814 %
Distribution steel Asmpr=Asmin=544.3 mm¬2

DESIGN SUMMARY FLEXURE

Overall depth 300 mm
Effective depth 300 mm
Parameter K 0.0102
Parameter K' 0.1684
Lever arm ratio z/d 0.95
Steel area (tension) 544.3 mm2/m
Steel percentage req. 0.1814 %
Minimum area of steel 544.3 mm2/m
Maximum area of steel 12000 mm2/m
Distribution steel 544.3 mm2/m

Use B1131 Mesh

British Standard reference	Longitudinal wires size mm	pitch mm	area mm² /m	Cross wires size mm	pitch mm	area mm² /m
Square Mesh Fabric						
A 393	10	200	393	10	200	393
A 252	8	200	252	8	200	252
A 193	7	200	193	7	200	193
A 142	6	200	142	6	200	142
A 98	5	200	98	5	200	98
Structural Fabric						
B1131	12	100	1131	8	200	252
B 785	10	100	785	8	200	252
B 503	8	100	503	8	200	252
B 385	7	100	385	7	200	193
B 283	6	100	283	7	200	193
B 196	5	100	196	7	200	193

Spacing of bars - Tension reinforcement

Minimum pitch (sagging moment) pchmn=50 mm
Maximum pitch of bars (<3h) pchmx=400 mm
Calculated pitch of bars pitch=1000*PI*dia^2/(4*As)
=1000*3.142*12^2/(4*544.3)
=207.8 mm
Round spacing (c.to c.of bars) to 200 mm (rounded).
Chosen spacing of tension bars pch=100 mm
Area of tension steel provided Aspr=1000/pch*PI*dia^2/4
=1000/100*3.142*12^2/4
=1131 mm2/m

TENSION (AND DISTRIBUTION) Diameter of bars 12 mm
REINFORCEMENT Spacing of bars 100 mm
Area of steel required 544.3 mm2/m
Area of steel provided 1130 mm2/m

Deflection

Effective span of slab L=3.5 m
Actual span to depth ratio l'd=L*1000/d=3.5*1000/300
=11.67
Reference reinforcement ratio rho0=(fck^0.5)/10=(35^0.5)/10
=0.5916 %
Basic span effective depth ratio terms (Clause 7.4.2)
N1=1.5*(fck^0.5)*rho0/rho
=1.5*(35^0.5)*0.5916/0.1814
=28.94
N2=3.2*(fck^0.5)*(rho0/rho-1)^1.5
=3.2*(35^0.5)*(0.5916/0.1814-1)^1.5
=64.35
N=11+N1+N2=11+28.94+64.35
=104.3
Factor for simply supported spans k=1.0
Flange beam factor F1=1
Factor for long spans F2=1.0
Tensile steel stress factor F3=500/(fyk*As/Aspr)
=500/(460*544.3/1130)
=2.257 (conservative)
Long spans factor F2 1
Steel stress factor F3 1.5
Allowable l/d ratio 40

10.00 Impact on Roadway and adjoining Buildings

10.10 The construction of this relatively small basement is confined within the boundaries of the main footprint of the house. The depth of excavation and the works is relatively low-level.

10.20 The works will have no effect to any roadway with the exception of skips and hoardings. The works will be carried out in accordance with an approved construction traffic management plan.

10.30 The surrounding buildings are classified as standard residential and there are no listed or historic buildings in the area that requires any special or particular attention. There will be minimal vibration as a result of installation of the piles and these are very unlikely to be felt within the surrounding area.

10.40 The new construction will not be deeper than the adjoining building at number 38 Reddington Road which has a double basement . The next neighbouring property at 7 Reddington Gardens will 5m away from the line of the excavation and with a single basement not being deeper than 3.8m the foundations of this building will not be undermined and no additional surcharge will be required to be taken for the design of the contiguous piles other than ground plus hydraulic pressure from standing water at a depth of 1m.

10.50 The ground which consists of London Clay will provide ample bearing and friction resistance to the piles and settlements expected from this relatively light weight construction will be minimal.

11.00 Conclusion

11.10 This construction is considered to be a simple and standard way of achieving a basement without affecting the surrounding areas.

11.20 A significant amount of data has been gathered including ground investigations borehole results and details of the adjoining building. Standard construction methods and techniques will be used together with traditional materials.

11.30 The construction techniques together with the presence of the contiguous board piles reduce the amount of temporary works and the nature of the underlying geology minimises the risk of ground slip and movement.

11.40 The new construction will be beneath the prevailing groundwater level and a suitable dewatering system will be designed involving sumps and pumps to discharge the water from the excavations. The construction method is controlled and will be undertaken in pre-determined sequences and without the need for large open excavations that could potentially be unstable.

12.50 On the basis of the above we can conclude that the construction of the proposed subterranean works will not affect the structural stability of the surrounding buildings and infrastructure.

12.60 There will be no disturbance to the geology and flow of natural water and there will be no disturbance to any critical utilities.

12.70 The works will not significantly increase the flow of storm water and the existing system will not be placed under any strain as a result of this work.

Peter Zussman BSc CEng MIStructE

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PZ/jc

17 December 2015

Massoud Parvardin
Archetype Associates Ltd
121 Gloucester place
London W1U 6JY

Dear Massoud

Re; 36 Redington Road, London NW3

I refer to latest correspondence received from Camden Councils engineers and respond to the queries which was mainly covered in our previous correspondence.

5.1 We have undertaken over 3500 projects in London including several hundred basements. In order to design the foundations for these a comprehensive knowledge of geotechnical engineering will be required. Therefore our experience is self evident.

5.3 The proposed single storey basement at number 36 will not undermine the double story basement at number 38 because the double storey is deeper than the single storey. This is common knowledge and it is not necessary to undertake intrusive investigations to verify the obvious.

5.4 The drawings clearly show that the existing structure at number 38 does not t provide any temporary support for the construction of the RC wall in number 36. The RC wall in number 36 is constructed independently and does not rely on number 38 for any kind of support in temporary or permanent condition. The separation detail will be determined after ground has been removed from the face of the contiguous pile at number 38 and the overspill evaluated.

5.5 This question was answered in the previous correspondence and we reiterate again that concrete grouting or spraying will be adopted in order to prevent loss of fine soils into the excavation. This is a method commonly used by all piling contractors.

5.6 The revised proposal clearly confirmed propping will be carried out at the temporary stage and this will be part of the temporary works design which will be fully detailed and implemented by the contractor. Both raking props and flying shores can be used in this scheme and the best option will be adopted by the contractor at construction stage. The intention of this document is to make it clear that propping will be carried out and this is sufficient for planning permission purposes.

5.10 The issue of movement monitoring for this proposal was fully addressed in the previous correspondence.

Yours sincerely

Peter Zussman
Bsc CEng MIStructE

MARGARET'S COTTAGE SANDHURST GLOUCESTER GL2 9NP TEL/01452 730818 email: david@three-counties-flood-risk-assessment.co.uk

Flood Risk Assessment

36 Redington Road, Hampstead, London NW3 7RT

March 2016

Dr Paul Garrad
Consultant Hydrologist
66 Charlock Way
Guildford
Surrey
GU1 1XZ

Flood Risk Assessment

36 Redington Road, Hampstead, London NW3 7RT

Contents

Figures

1 INTRODUCTION

1.1 The Existing Site

The proposed development site is located at 36 Redington Road in Hampstead, north west London (Figure 1.1). The rectangular site covers approximately 500m^2 and contains a two storey semi-detached house with a single storey extension and garage to the side (Figure 1.2). The front garden is lawn with a concrete path and driveway and the rear garden is mainly lawn with established hedges and trees along the boundaries and as shown on an aerial photograph of the site (Figure 1.3). The adjacent semi-detached property (No 38) has been recently redeveloped to provide a large three storey building (Figure 1.3) with a double basement.

A DTM topographical survey (Figure 1.4) shows the site is relatively flat and between 94.5m and 94.7m OD with a slight slope towards to a low point to the north east corner of the rear garden at 94.28m. The area around the dwelling at 94.75m OD and front garden fall towards Redington Road at 94.10m OD. The survey also shows that the land to the east of the site, along Redington Gardens and Heath Road, forms a shallow valley of a former watercourse and this is described in more detail in Section 2.

1.2 The Proposed Development

The proposals are to demolish the existing dwelling and to construct a new three storey residential property with a single level basement (Figure 1.5). The ground level footprint of the new building will be slightly larger than the existing building and will also extend below part of the existing front and rear gardens (Figure 1.6).

1.3 Requirements for a Flood Risk Assessment

Under the National Planning Policy Framework (NPPF) and the National Planning Policy Guidance (NPPG) a Flood Risk Assessment (FRA) is often required as part of a planning application depending on the nature of a development, its size and the anticipated flood risk as defined by the Environment Agency's flood risk zones. In England flood risk is divided into three zones:

- Zone 1 areas have low or no risk with an annual probability of tidal and fluvial flooding of less than 0.1% per year, above the 1000 year flood level.
- Zone 2 areas have a fluvial risk of flooding of between 0.1 and 1% a year, between the 100 year (the 200 year in tidal areas) and 1000 year, and
- Zone 3 areas are at high risk with a fluvial risk of greater than 1% a year, inside the 100 year flood extent or the 200 year in tidal areas.

The Environment Agency's flood map (Figure 1.7) shows the site is located in Flood Zone 1 with a low risk of fluvial and tidal flooding and there are no visible surface watercourses within 500m of the site. As the site is less than 1ha and in Flood Zone 1 under NPPF, NPPG, the EAs Guidance and the local Strategic Flood Risk Assessment (SFRA) a FRA is not required with the planning application.

However the Basement Impact Assessment (BIA) undertaken in May 2015 indicates that nearby areas have historically been at risk from pluvial flooding and hence Camden Council's engineers have requested that a FRA is provided. The main issue is to consider the risk of surface water flooding but flooding from all other potential sources, including the former watercourse, are considered in this FRA.

1.4 Report Structure

For this FRA the potential sources of fluvial, tidal and other sources of flooding are given in Section 2 and the implications of these sources on the proposed development considered in Section 3. The conclusions are given in Section 4.

2 FLOOD RISK

NPPF emphasises the need to consider all potential sources of flooding, not just rivers and the sea, when planning a development as these could be important considerations for managing flood risk. For this site these sources of flooding are considered below.

2.1 Fluvial Flooding

The site is located in Flood Zone 1 (Figure 1.7) and there are no visible surface watercourses within 500m of the site and no historical records of any fluvial or tidal flooding in the local area. The nearest surface watercourse or water body is the Leg of Mutton pond 750m to the north of the site but this drains through Golders Green to the River Brent catchment to the west. The ponds on the east side of Hampstead Heath are 1.5km east of the site and form part of The Fleet catchment which drains to the south east through Kentish Town and Holbourn. Flooding from these water bodies would therefore not affect this site.

The BIA identified that the River Westbourne, one of the Lost Rivers of London, flows close to the site (Figure 2.1). Whilst detailed layout maps, plans and dimensions of this culverted watercourse are not available the "London's Lost Rivers" (Tim Boltons, 2014) suggests this watercourse runs along the west side of Redington Gardens and Heath Road although other maps (Figure 2.1) suggest it is located on the east side of the road. It is understood this underground watercourse can be heard at Oak Tree House at the north end of Redington Gardens under a square drain cover which suggests that when it was culverted in Victorian times the obvious location would have been under the road rather than adjacent gardens or properties. It is therefore assumed that the River Westbourne follows the line of Redington Gardens and Heath Road to the south.

The basement will therefore not intercept this culverted stream and provided measures to ensure this basement would not be affected by this overflowing watercourse then the risk of flooding from this source is low. Whether the Westbourne is a likely source of flooding will depend on its course, elevation, it capacity and the likelihood of blockage compared to the level of the basement and ground levels on the site. The estimated flood flows and likely flow route if this culvert capacity is exceeded or it becomes blocked are considered below.

2.1.1 Flood Flows

The Flood Estimation Handbook (FEH) catchment descriptors have been derived from the FEH CD ROM version 3 for the River Westbourne assuming the FEH catchment delineation and watercourse flow paths are correct. This catchment delineation (Figure 2.2) confirms this watercourse does not drain the ponds on Hampstead Heath but the nearest location for which a catchment can be defined is at the A41 Finchley Road further downstream.

These FEH descriptors (Table 2.1) indicate that the catchment at this location is small (0.56km^2), with no lakes or reservoirs (FARL = 1.0), with a high percentage runoff (SPRHOST = 44.9%) and is very heavily urbanised with URBEXT1990 of greater than 0.5. A full definition of the parameters in Table 2.1 is given in the FEH volume 5 but the catchment descriptors suggest no obvious reasons for not using FEH methods apart from the small catchment area and high level of urbanisation.

Table 2.1 FEH Catchment Descriptors for the Westbourne at Hampstead

Parameter	Westbourne at Hampstead
Grid Ref	TQ 25400 85200
AREA	0.56
FARL	1.000
PROPWET	0.29
ALTBAR	96.0
BFIHOST	0.302
DPLBAR	0.80
DPSBAR	71.60
SAAR	658
SPRHOST	44.9
URBEXT1990	0.520

These catchment descriptors are used to define the median annual flood (QMED) with no adjustment from a donor gauging station based on the FEH Revised Statistical Method[1]. The EAs FEH guidelines recommend the use of urban adjusted Revised Method QMED which is 0.372 m^3/s. (Table 2.2).

Table 2.2 QMED from Catchment Descriptors at Subject Sites

Site	AREA (km^2)	Revised Method QMED (m^3/s)	Revised Method QMED URBAN (m^3/s)
Westbourne	0.56	0.222	0.372

The calculation of a flood frequency curve and more extreme flood flows requires the construction of a pooling group and the fitting of an extreme value distribution to the pooled group data using WINFAP. Two extreme value distributions are often used on the pooled group data (i) the Generalised Logistic (GL), and (ii) the General Extreme Value (GEV) distribution both fitted to the annual maximum data by the method of L-Moments. FEH indicates that the GL distribution can often provide the best fit to extreme value flood series and in this case WINFAP confirms that the GL provides the most acceptable distribution for this site.

The results of the frequency analyses (Table 2.3) are based on the QMED donor ratio of 1.0, with URBEXT1990 adjusted to 2016 according to methods detailed in the FEH and using the GL distribution as recommended by WINFAP. Recent research (Kjeldsen, 2010) has led to a revision of the urban adjustment factor (UAF) which is used only for the adjustment of QMED and unlike earlier methods the growth curve does not include the UAF. This suggests the 100 year flow is 1.21 m^3/s (Table 2.3) which is based on a larger catchment area downstream rather than the site at Redington Gardens and hence this will be an overestimate of flood flows but these are adopted as a conservative estimate.

Table 2.3 Westbourne Flood Flows (m^3/s)

Site	Return Period (Years)					
	2	5	10	20	50	100
Westbourne	0.37	0.54	0.66	0.80	1.01	1.21

[1] Improving the FEH statistical procedures for flood frequency estimation. CEH Science Report SC050050, July 2008

2.1.2 Flood Levels

The conversion of flood flows to flood levels is based on Manning's equaton which is applied to the road along Redington Gardens, assuming the Westbourne culvert is 100% blocked and that all flood water will flow along this road, which is a worst case assumption. The topographical survey (Figure 1.4) shows the road falls from 97.51m OD at its north end adjacent to Oak Tree Cottage to 93.25m OD at the junction with Heath Road over a distance of 105m. Assuming the road is 8m wide and adopting a relatively high Manning's roughness of 0.03 this suggests the 100 year flood flow of 1.21m^3/s would have a depth of 104mm and flood to 93.354m OD (Table 2.4). This compares to the ground level at the entrance to the site of 94.21m OD and the front garden level of 94.70m OD which is 1.35m above the estimated flood level. It is therefore unlikley that the site would flood from the Westboune culvert on Redington Gardens even if this was 100% blocked.

Table 2.4 Estimated Flood Levels and Depths at Remington Gardens

Return Period (yrs)	Flow (m^3/s)	Flood Depth (m)	Flood Level (m OD)
2	0.37	0.051	93.301
5	0.54	0.064	93.314
10	0.66	0.072	93.322
20	0.80	0.081	93.331
50	1.01	0.093	93.343
100	1.21	0.104	93.354

2.2 Storm Water Runoff

This can occur when excess water runs off the surface of a site particularly during short but intense storms. Flooding occurs because the ground is unable to absorb the high volume of rain water or because the amount of water is greater than the capacity of the drainage system or soils to take it away. This can particularly occur on developed impermeable sites such as concrete, tarmac or buildings or where the soils are impermeable.

The BIA indicates that the increase in the hard surface area may change the volume and peak flow of site runoff and the basement will extend into the garden area to the front and back and this too will increase site runoff. The proposals are to connect the new site drainage network to the existing storm water sewer on Redington Road as existing which has adequate capacity to handle these flows.

There are no records of the existing site, the local area or nearby properties having suffered from storm water flooding and with the new drainage system designed to handle extreme storm events the risk of flooding from this source will be managed. The EAs pluvial flood risk map shows the site is at high risk (Figure 2.3) but this relates to the area of lower ground located to the north of the garden (Figure 1.4) at 94.10m OD which is below the rear garden adjacent to the property at 94.55m OD and flood water from this lower area would drain towards and along Redington Gardens rather than across the site. To prevent any storm water ponding on the garden from entering the new building the entrances to the basement including all windows, doors and services, should be protected by a raised ramp, rim or ground levels to reduce the risk to the property.

2.3 Roads

Flooding on roads can occur when the amount of water arriving on the road is greater than the capacity of the local drainage network to take it away resulting in ponding. Exceptional rainfall, a road being in a low lying area, changes in runoff from adjacent land can all lead to road flooding even when the drainage system is in a good working order particularly if drains become blocked with silt or leaves. The EAs pluvial flood risk map shows local roads are at low or very low risk (Figure 2.3). The BIA identified that road flooding occurred in 2002 from the Arup report (Figure 2.4) and this may have been due to inadequate road drainage during this very intense storm but Redington Road and Redington Gardens were not affected. This type of flooding is difficult to predict at any location but the raised ground levels in the front garden, which is above the local road level, will reduce the risk of flooding from this source which is considered to be low.

2.4 Sewers

Sewer flooding can occur when a storm sewer or combined sewer network becomes overwhelmed and its maximum capacity is exceeded. Higher flows are likely to occur during periods of prolonged rainfall, the autumn and winter months, when the capacity of the sewer system is most likely to be reached. During summer periods sewers can become susceptible to blockage as the low flows are unable to transport solids which leads to the gradual build up of solid debris. The Water Companies maintain a register of properties/areas which are at risk of flooding from the public sewerage system, shown on the DG5 Flood Register. There are no records of sewer flooding in this area although this type of flooding is difficult to predict with any certainty. However the raised ground level on the site will provide protection and the risk of flooding from this source is considered to be low.

2.5 Impounded Water Bodies

The potential risk associated with artificial sources of flooding has been investigated by the EA. Their mapping indicates there are no reservoirs and/or water storage facilities near the site that may potentially pose a potential risk of flooding either directly or in case of failure (Figure 2.5) and the risk of flooding from this source is considered to be low.

2.6 Tidal Flooding

The site is far inland and at 92m OD and above hence the impact of rising sea levels and tidal flooding is very low.

2.7 Groundwater

Groundwater flooding is most likely in low-lying areas underlain by permeable rocks (e.g. Chalk or Sandstone) and occurs as water rises up through the underlying rocks or from water flowing from abnormal springs after long periods of sustained high rainfall. This can cause the water table to rise above normal levels and the risk will depend on local ground conditions.

BGS records show the site is underlain by the Claygate Member over London Clay (Figure 2.6) with no drift deposits in the area (Figure 2.7) and this has been confirmed by the Site Investigation undertaken as part of the BIA. This showed that the site is comprised of made ground over 5m of sandy clay with the London Clay at around 5m depth. Groundwater levels were shallow influenced by the permeability of the Claygate soils which are prevented from infiltrating vertically by the impermeable London Clay below. Groundwater monitoring on the site has provided levels of 1.04m to 1.11m bgl in BH1 in the front garden and 0.97m to 8.82m

bgl in BH2 in the rear garden and these reflect the perched water table in the Claygate Member. Although restricted vertical drainage and water logging may be a issue there are no recorded incidents of groundwater flooding in the area or on the site and it is likely that if groundwater levels reach the ground surface this would drain via the surface water drainage network.

The BIA assessed the impact of the proposed basement in relation to groundwater movement and indicated a very small change is likely and this would have little effect on neighbouring properties. The basement will extend to below the water table within the Claygate member and it is proposed to provide piled walls around the basement cut into the London Clay and this will prevent groundwater ingress to the new basement.

In summary the risk of flooding to the site from various sources is considered to be low due to the limited pathways to which water from these various identified sources could reach the site. The risk of flooding is therefore considered to be low subject to certain provisions which are detailed in Section 3.

3 IMPLICATIONS FOR THE PROPOSED DEVELOPMENT

3.1 Ground Floor Levels and Thresholds

The new dwelling and basement will be located on slightly raised ground above the local road and garden levels. However to avoid accumulation of surface water from an extreme rainfall event on the adjacent garden area from draining into the basement, it is usual to specify raising ground levels, a rim or ramp at the entrances to the basement, including all windows, doors and services.

3.2 Safe Escape

As the site is in Zone 1 there will always be a dry safe route to allow escape from the site to Redington Road and this leads to an area wholly outside of the flood plain where services and facilities exist.

3.3 Flood Resistance and Resilience Measures

In Flood Zone 1 the raising of floor levels or basement entrances will provide protection against pluvial and storm water flooding and is recommended at this site. There is no requirement to consider any other flood resistant or resilient measures. As a precaution the basement could include raised sockets, switches, circuits and services which are wired down from the ceiling rather than up from the floor.

3.4 Flood Storage Compensation

As the site is in Zone 1 there will be no displaced water and no change in the flooding potential for adjacent sites and hence there is no requirement for flood storage compensation.

3.5 Sump and a Pump

It is a often recommended that any new basements are fitted with a positive pumped device to ensure it can deal with any unforeseen drainage, groundwater or sewer flooding problems. A sump and a pump will be installed in the lowest part of the basement and fitted with a non-return valve to deal with any unforeseen internal or external sources of flood water.

4 CONCLUSIONS

- The proposals are to demolish the existing dwelling at 36 Redington Road, Hampstead and to construct a new three storey residential property with a single level basement. The middle part of the site lies between 94.5m and 94.7m OD with a slope down to the north east corner of the rear garden at 94.28m OD and to Redington Road at 94.10m OD.

- The site is located in Flood Zone 1 with a low risk of fluvial and tidal flooding and as the site area is less than 1ha a FRA is not required with the planning application under NPPF and NPPG. However the Basement Impact Assessment (BIA) in May 2015 indicated that nearby areas have historically suffered from pluvial flooding and hence Camden Council's engineers have requested a FRA. The main issue is to consider the risk of surface water but flooding from all other potential sources are considered in this FRA.

- There are no visible surface watercourses within 500m of the site and no historical records of any fluvial flooding in the local area. The nearest surface watercourse or water bodies on Hampstead Heath drain to the east and south east and do not flow near the site. However the River Westbourne flows close to the site in a culvert presumably under Redington Gardens and as such the basement will not intercept this culverted stream.

- There are no plans or details of the dimensions of this culvert but the risk of flooding from this watercourse has been assessed assuming the culvert is 100% blocked and that all water would flow down Redington Gardens. The 100 year flood flow of 1.21m^3/s would reach a depth of 104mm and a level of 93.35m OD at the junction with Heath Road which compares to the site entrance at 94.21m OD and the front garden at 94.70m OD, well above the estimated flood level. It is therefore unlikley that the site would flood from the Westbourne culvert even if this was 100% blocked.

- Storm runoff may cause flooding on site during short but intense storms when the ground is unable to absorb the high volume of rain water or because the amount of water is greater than the capacity of the drainage system or soils to take it away. There are no records of the existing site having suffered from storm water flooding and with the new drainage system the risk of flooding from this source will be managed. Mitigation measures may be appropriate to reduce any risk.

- The local roads to the north flooded in 2002 presumably due to inadequate road drainage during this very intense storm but Redington Road and Redington Gardens were not affected. The raised ground levels in the front garden, which is above the local road level, will reduce the risk of flooding from this source which is considered to be low.

- There are no records of sewer flooding in this area although this type of flooding is difficult to predict with any certainty. However the raised ground level on the site will provide protection and the risk of flooding from this source is considered to be low. The potential risk associated with failure of reservoirs and rising sea levels is considered to be low.

- Although restricted vertical drainage may be a issue there are no recorded incidents of groundwater flooding in the area and it is likely that if groundwater levels reach the ground surface this would drain via the surface water drainage network. The BIA indicated the proposed basement would have little effect on neighbouring properties.

The basement will extend to below the water table within the Claygate member and it is proposed to provide piled walls around the basement cut into the London Clay and this will prevent groundwater ingress to the new basement.

- The new dwelling and basement will be located on slightly raised ground above the local road and garden levels. However to avoid accumulation of surface water from an extreme rainfall event on the adjacent garden area from draining into the basement, it is usual to specify raised floor at ground floor level, a rim or ramp at the entrances to the basement, including all windows, doors and services.

- There is no requirement to consider any other flood resistant or resilient measures but as a precaution the basement could include raised sockets, switches, circuits and services which are wired down from the ceiling rather than up from the floor.

- There will always be a dry safe escape from the site to Redington Road and this leads to an area wholly outside of the flood plain where services and facilities exist. As the site is in Zone 1 there will be no displaced water and no change in the flooding potential for adjacent sites and hence there is no requirement for flood storage compensation.

- It is a often recommended that new basements are fitted with a positive pumped device to ensure it can deal with any unforeseen drainage, groundwater or sewer flooding problems. A sump and a pump will be installed in the lowest part of the basement and fitted with a non-return valve to deal with any unforeseen internal or external sources of flood water.

Figures

Figure 1.1 Site Location

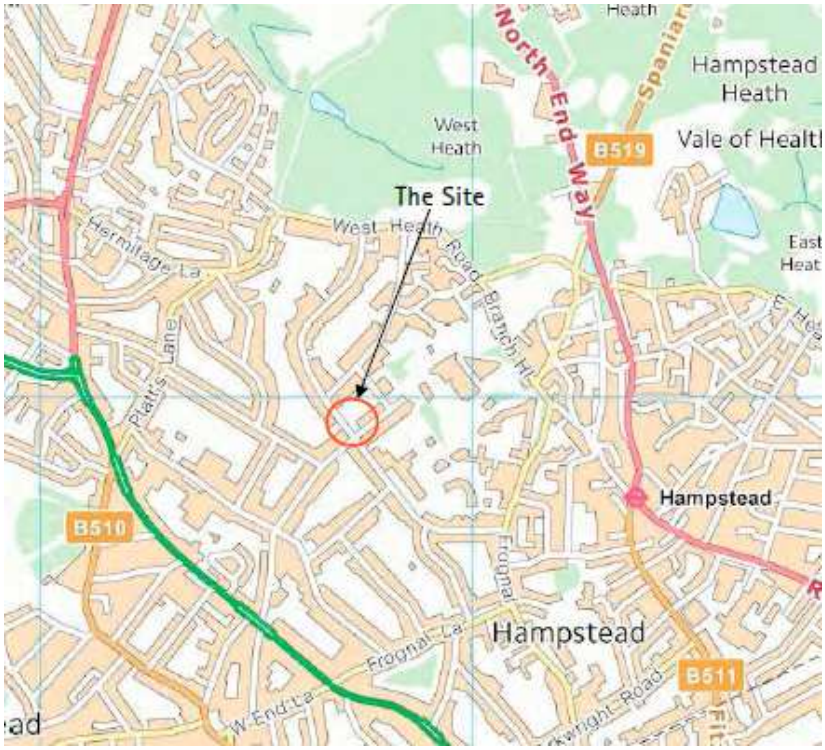


Figure 1.2 Existing Site Layout

Figure 1.3 Aerial Photograph

Figure 1.4 DTM Topographical Survey

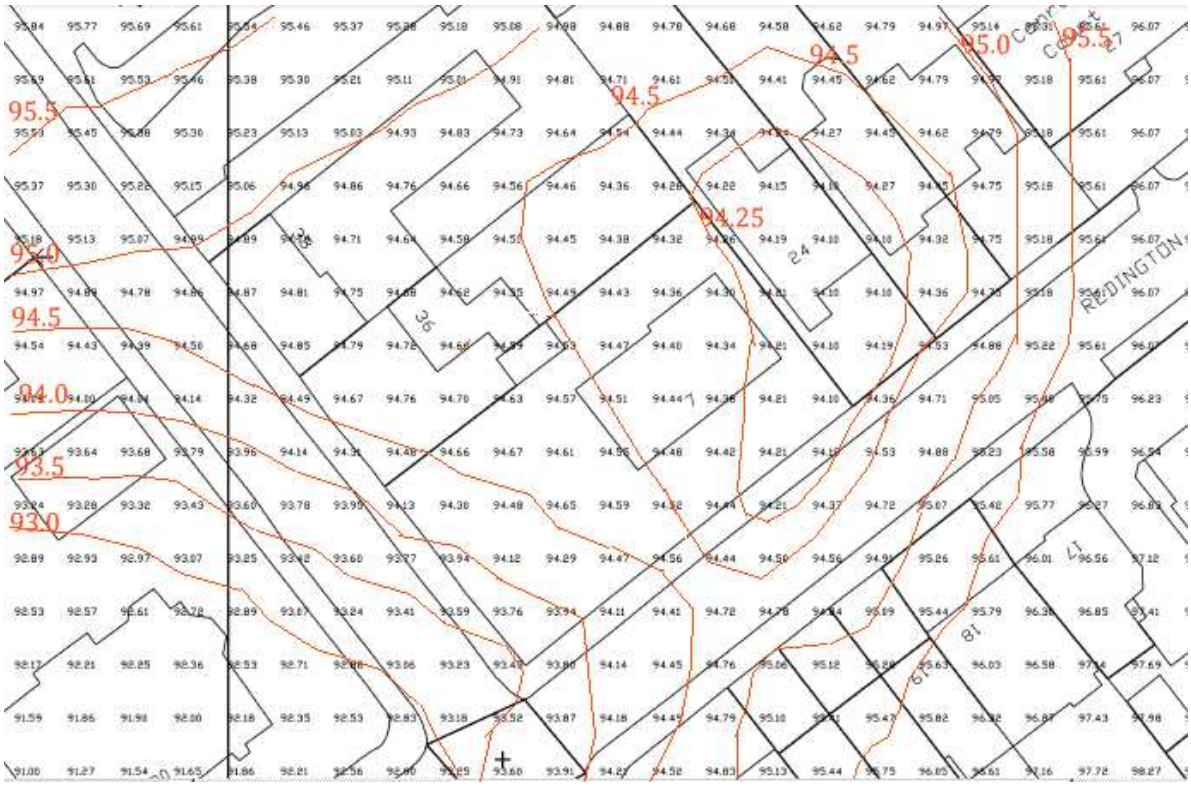


Figure 1.5 Proposed Development Section East to West

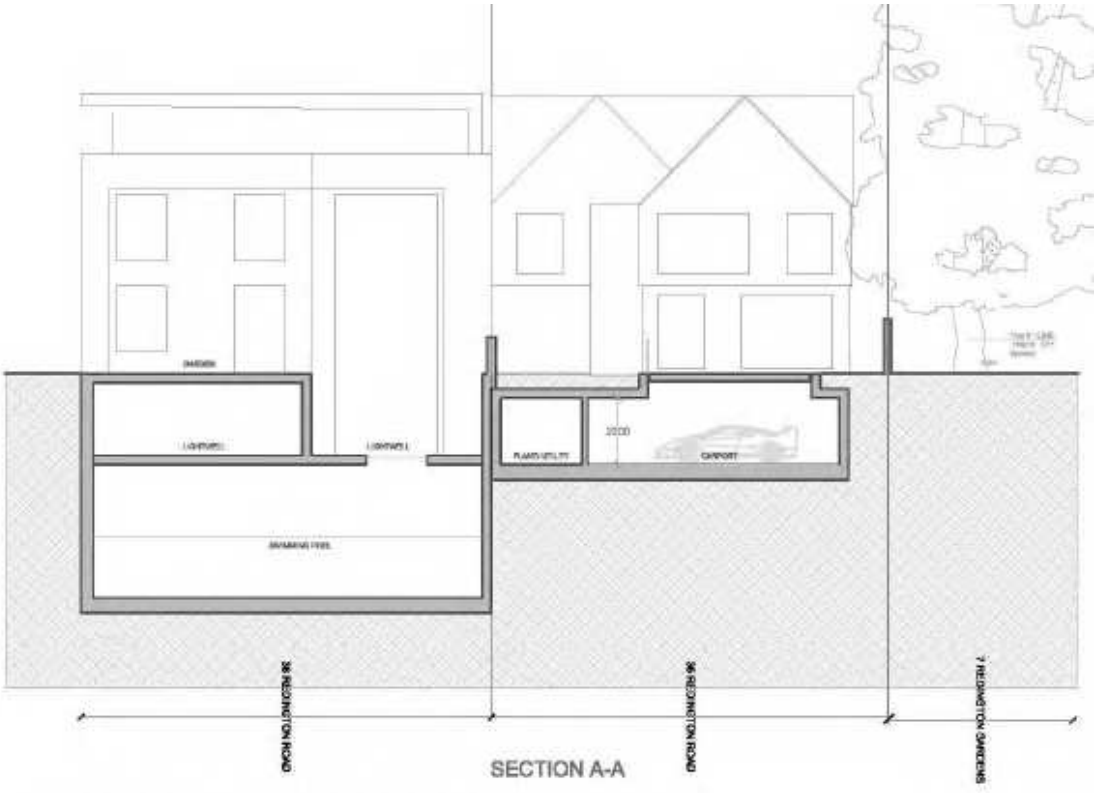


Figure 1.6 Proposed Development Section North to South

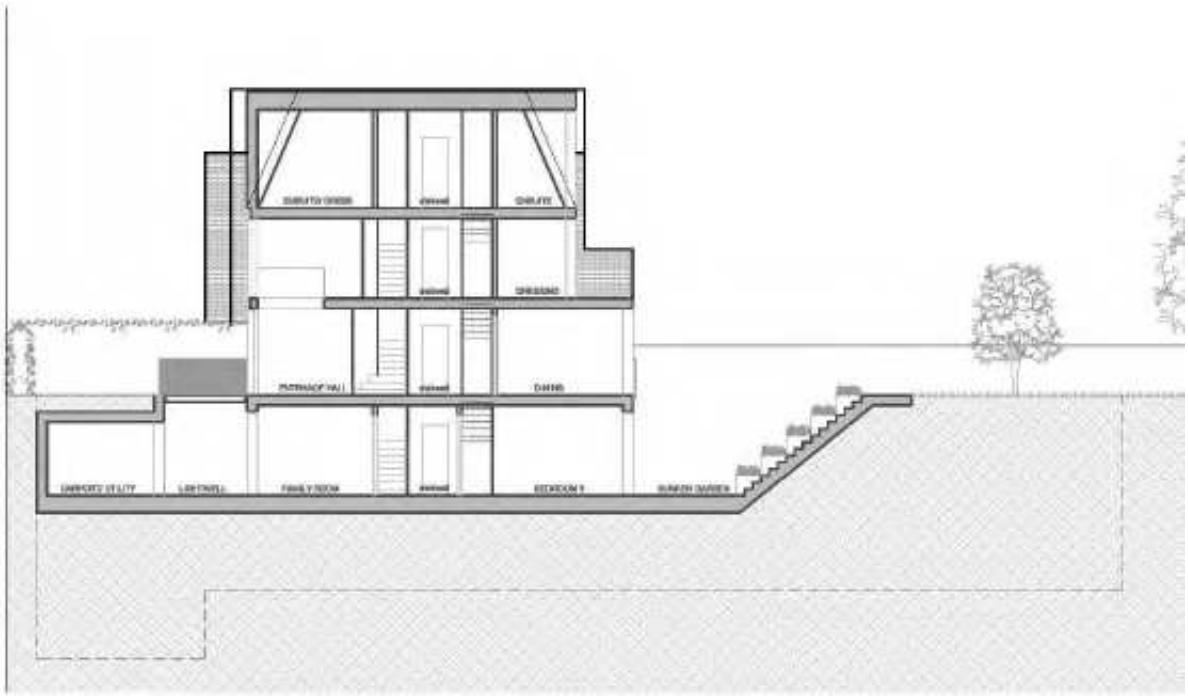


Figure 1.7 Environment Agency's Flood Map

Figure 2.1 River Westbourne Location

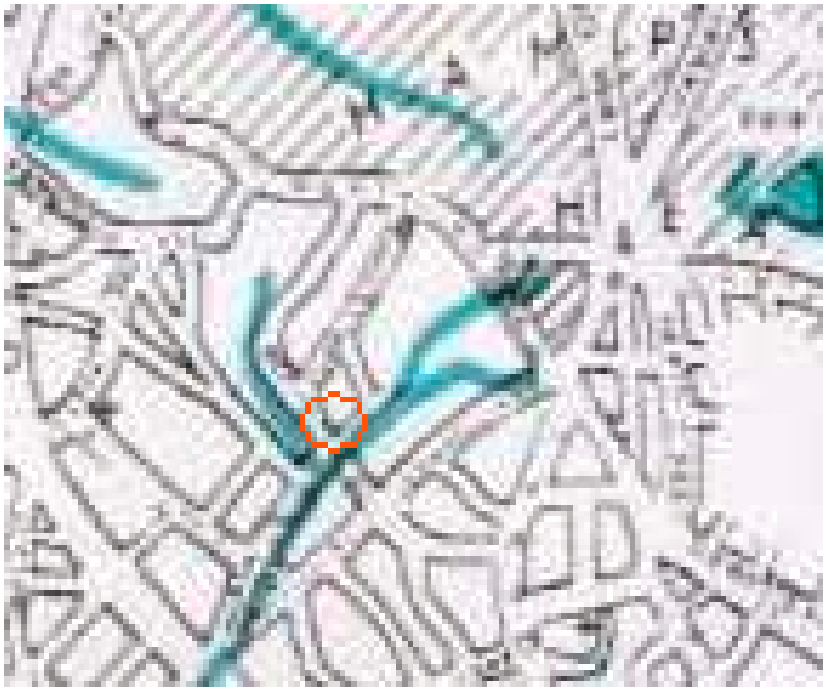


Figure 2.2 FEH Catchment Map

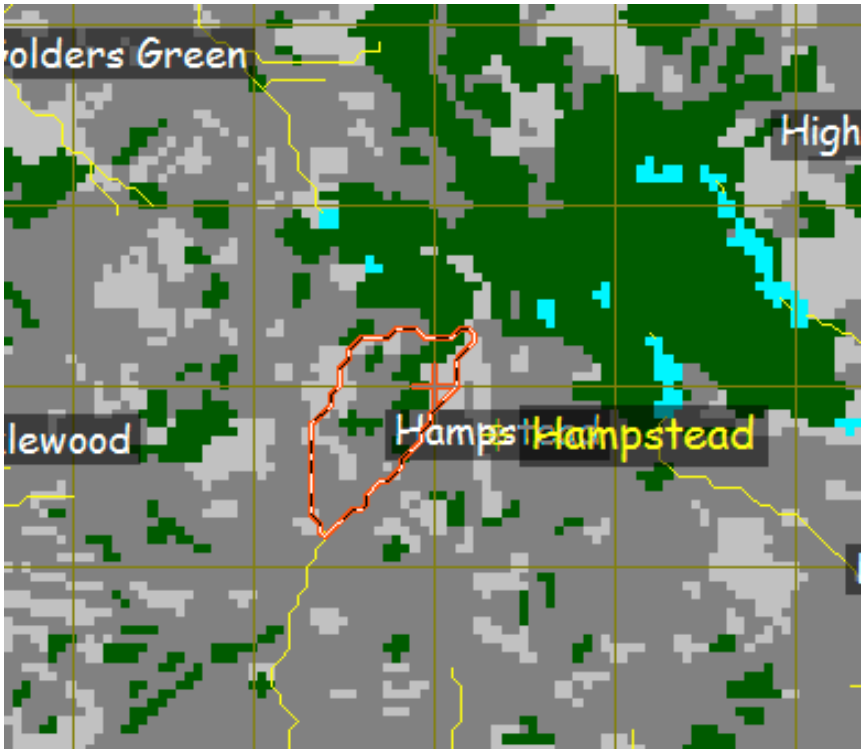


Figure 2.3 EA Pluvial Flood Risk Map

Figure 2.4 Historical Incidents of Road Flooding

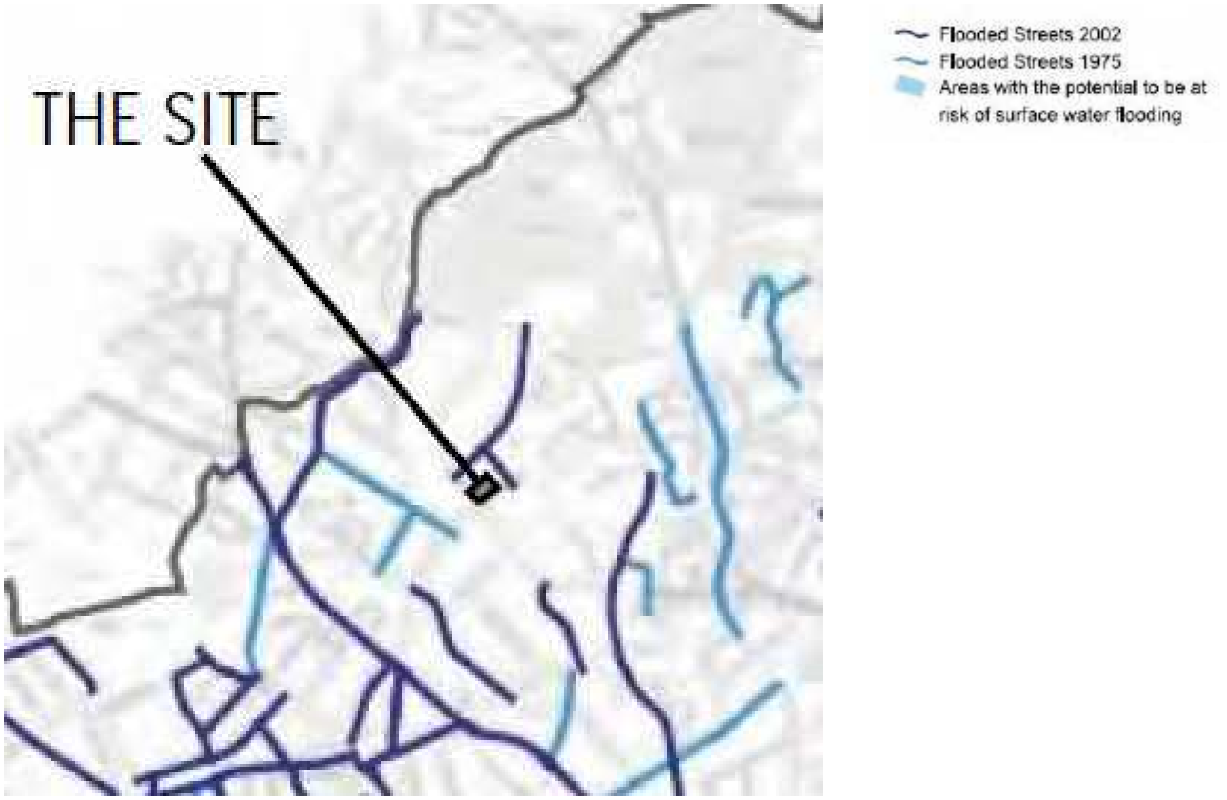


Figure 2.5 EA Reservoir Failure Flood Risk Map

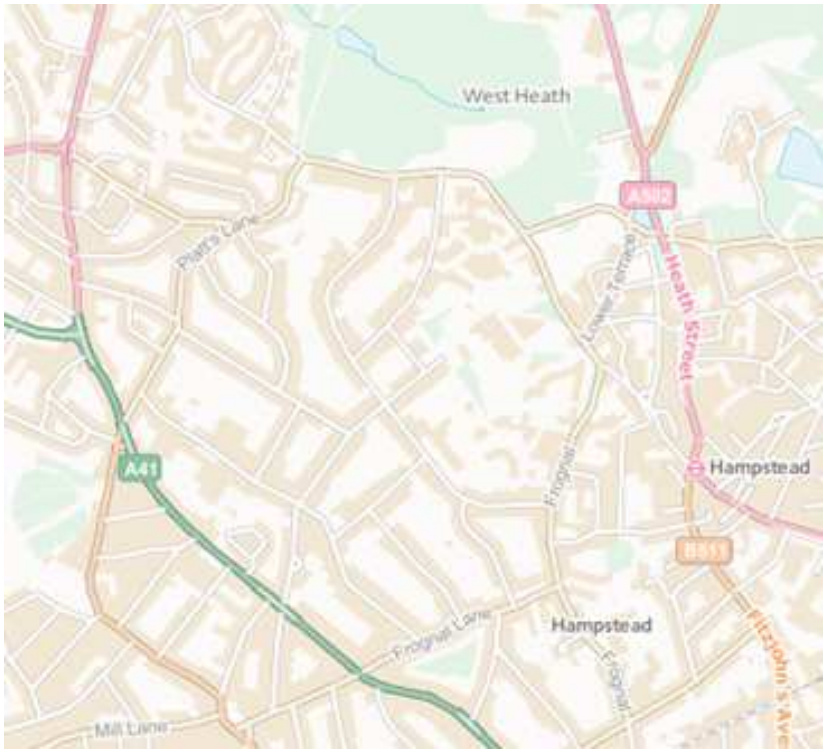


Figure 2.6 Bed Rock Geology

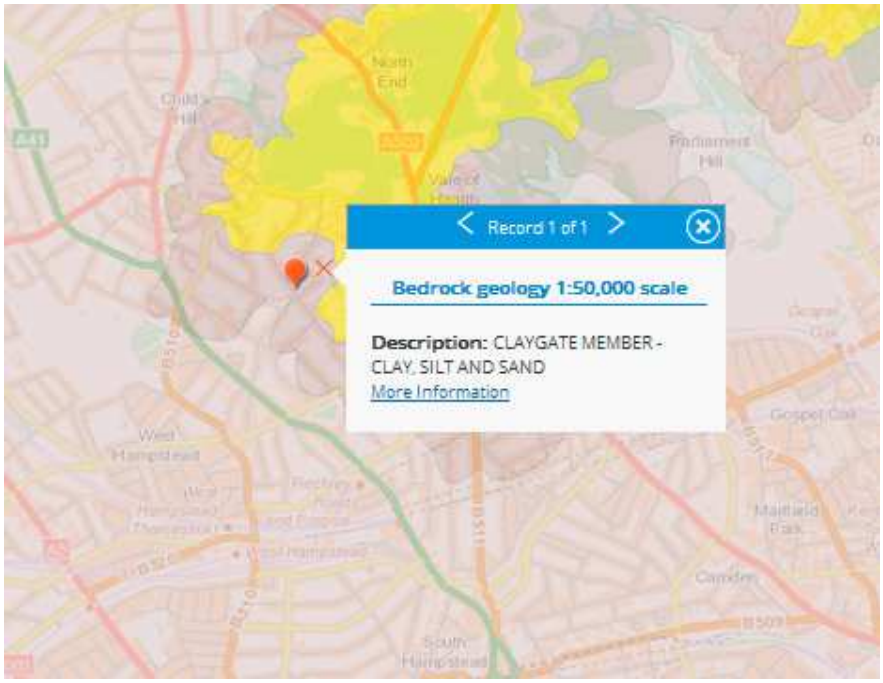
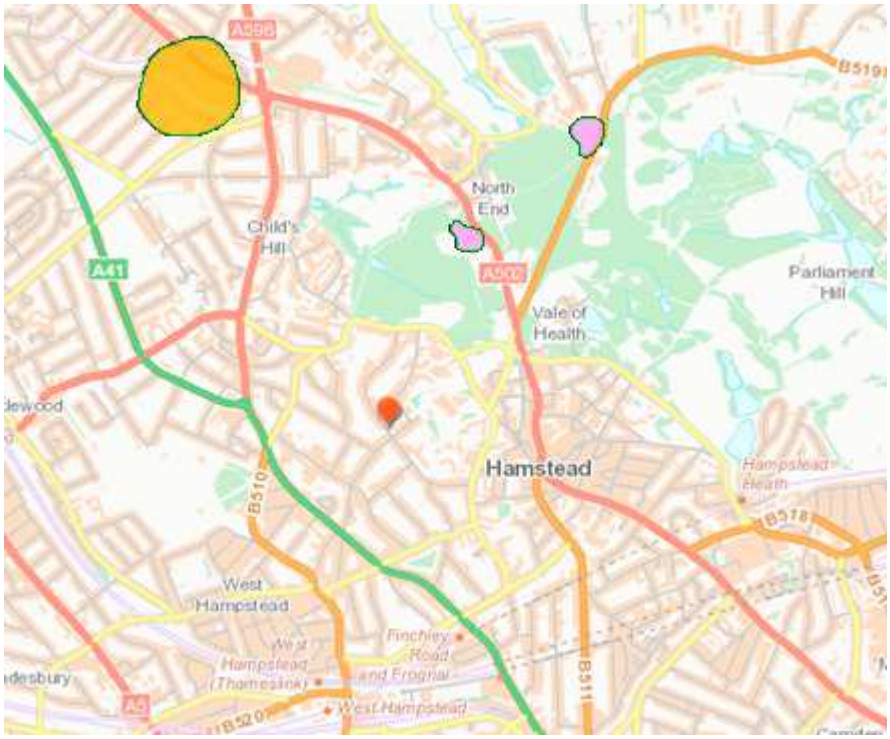


Figure 2.7 Drift Geology



{In Archive} FW: 36 Redington Road - 2015/3004/P

Peres Da Costa, David to: LizBrown@campbellreith.com 21/12/2015 09:22

History: This message has been replied to.

Archive: This message is being viewed in an archive.

3 attachments

07-12=15.jpg 36 Reddington Road, comments -2 .pdf 2. ZB - IMPACT ASESSMENT - 17-12-15.pdf

Dear Liz,

The agent for the above application has provided additional information in response to your audit (see attached and email below).

The agent has queried the need for a flood risk assessment (see email attached). I realise that the applicant's screening suggested that the site is in an area known to be at risk from surface water flooding. However, I have checked Camden's 'Critical Drainage Areas' map and Redington Road does not fall within a local flood risk zone. In this case would a flood risk assessment be required?

Kind regards

David

David Peres da Costa
Senior Planning Officer

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Visit camden.gov.uk for the latest council information and news

From: Masoud Parvardin [mailto:Masoud@archetype.org.uk]
Sent: 18 December 2015 12:07
To: Peres Da Costa, David
Cc: Peter Zussman; David Vooght
Subject: RE: 36 Redington Road - 2015/3004/P
Importance: High

Dear David,

I now have our engineers formal response and their amended report attached for your attention.

I find some of the queries raised by the auditing engineers rather academic and disdainful. My comments are as follows:

- Our Structure Engineer, Peter Zussman of Zussman Bear, have over 30 years experience in design and implementation of construction work in London and are suitably qualified with sufficient geotechnical knowledge for the purpose intended.
- I am currently engages in construction of basement structure within 3 meter of Main line railway, working under strict conditions with Network rail without any of the fuss raised by your auditors. For your information I herewith attach a picture of the work, which clearly shows the complications of the site. The disruption of the line will shut Paddington station and the overhead cables are 20,000 V, which I think you agree is much more serious than the above site. So you can rest assured that we have serious engineers on board.
- The Auditors should refer to the public documents on your website to satisfy themselves that No 38 has a two storey RC basement, piles and retaining wall, which will not be affected by the proposed work at the above site.
- Temporary work and construction method statement will need to be agreed by the appointing surveyors under Party wall Act as a civil matter before any approved works can be carried out on site.
- I believe that our application should be dealt with under planning law and local planning policies and not to be prejudiced by political issues.

Thank you for your attention and I trust the amended BIA and our engineers report should be satisfactory and enable you to recommend the application for approval as we have waited long enough for your decision.

Wish you a Happy Christmas

regards

Masoud Parvardin Mphil RIBA

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From: Peres Da Costa, David [mailto:David.PeresDaCosta@Camden.gov.uk]
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