Basement Impact Assessment

J1879, 51-53 Agar Grove

Ref: J1879-Doc-03
Revision: X4

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GENERAL NOTES

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REVISION HISTORY

Revisions indicated with line in margin.

Revision status: P = Preliminary, T = Tender, C = Construction, X = For Information

Revision	Date	Author	Reviewer	Description
X1	24.03.14	EA	RN	Draft Issue
X2	16.04.14	EA	RN	Planning Issue
X3	22.04.14	EA	RN	Planning Issue
X4	23.05.14	EA	RN	Non-Technical Summary Added

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1 INTRODUCTION

Webb Yates Engineers Limited (WYE) has been appointed by the client to undertake the structural engineering and below ground drainage design services at 51-53 Agar Grove, London.

51-53 Agar Road is in the Borough of Camden.

Camden council has developed its Local Development Framework (LDF), which requires that significant subterranean developments undertake a Basement Impact Assessment (BIA). This BIA has been commissioned to form part of the planning application submission.

2 BASEMENT IMPACT ASSESSMENT BACKGROUND

The London Borough (LB) of Camden will only permit basement and other underground developments that do not cause harm to the built and natural environment and local amenity. LB of Camden defines the range of harms that are controlled by the planning authority through a series of development policies that contribute to the LDF strategy for managing growth. Several development policies (DP) are relevant to the proposed development:

- **DP22: Sustainability** - requires developments to be resilient to climate change by ensuring schemes include appropriate climate change adaptation measures.
- **DP23: Water** - requires developments to reduce the risk of surface water flooding by reducing the pressure placed on the combined storm water and sewer network from foul water and surface water run-off and ensuring developments in the areas identified as being at risk of surface water flooding are designed to cope with the potential flooding.
- **DP24 - Securing High Quality Design** - requires all developments, including alterations and extensions to existing buildings, to be of the highest standard of design.
- **DP25: Conserving Camden's Heritage** - requires development in a conservation area not to cause harm to the character and appearance of that conservation area; particularly, where basements are concerned, the ponds on Hampstead Heath and other water features that are sensitive to hydrogeological interventions.
- **DP26: Managing the impact of development on occupiers and neighbours** – where basements are concerned, ensuring adjoining land or properties at a lower elevation are not subjected to an increased risk of surface water flooding.
- **DP27: Basements and Lightwells** - in determining proposals for basement and other underground development, LB Camden requires an assessment of the scheme's impact on drainage, flooding, groundwater conditions and structural stability, where appropriate.

A BIA investigates the potential impacts of basement developments on the above criteria.

As recommended by Camden Planning Guidance for Basements and Lightwells (CPG4) this BIA has been based around the following stages:

- **Stage 1 - Screening;** to identify any matters of concern which should be investigated further.
- **Stage 2 - Scoping;** to identify impacts shown by the screening process to need further investigation.
- **Stage 3 - Site investigation & study;** to develop an understanding of the site and its immediate surroundings.
- **Stage 4 - Impact assessment;** to evaluate the direct and indirect implications of the proposed project.

3 PROJECT INFORMATION

3.1 THE SITE

The site is located at 51-53 Agar Grove, London, NW1 5UE, on the corner of Agar Grove and St Paul's Crescent - refer to figure 1, below. The site incorporates an existing building that is partially demolished and potentially unsafe. Japanese knotweed has also been identified on site.

Figure 1: Site Location

3.2 THE PROJECT

The current proposal is to develop the site with a new 5-storey residential block and a new mews house to the St Paul's Crescent elevation. The mews house is 3 storeys in height. It is proposed that both the residential block and the mews house will have a one-story basement; this BIA is relevant to both basements.

4 STAGE 1 - SCREENING

4.1 SCREENING CHECKLISTS

The first stage in assessing the impact of a proposed basement development is to recognise what issues are relevant to the proposed site. This is done by using the screening flowchart and checklists found in the Planning Guidance [Ref 4]. The checklists dealing with surface flow and flooding, subterranean groundwater flow and slope stability are presented in the sections below.

Where an impact has been identified or the answer to the screening question is unknown the relevant screening question is presented in bold with the issue carried forward to the scoping stage.

4.1.1 SURFACE FLOW AND FLOODING SCREENING CHECKLIST

While nowhere in the borough is identified by the Environment Agency as being flood prone from rivers or the sea, there are still parts that are identified as being subject to localised flooding from surface water due to overwhelmed sewers and drainage systems and from inundation due to reservoir failure.

High precipitation events have been noted to cause deterioration in the water quality of the bathing ponds on Hampstead Heath with overland flows washing animal faeces and other organic matter into the ponds. For the bathing ponds, changes in quality would be of concern.

The surface water run-off will flow down-gradient away from the developed property and it is important to ensure that adjoining land or properties at a lower elevation are not subjected to an increased risk of surface water flooding. The following screening questions identify the issues that may contribute to flooding from surface flow:

No.	Screening Question	Impact	Source/Comment
1.	Is the site within the catchment of the pond chains on Hampstead Heath?	No	Approximately 2.5km north of the site at its closest lies Hampstead Heath. The site is located outside of the Hampstead Heath surface water catchment. [Ref 2: Figure 14]
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?**	**Yes**	**The new construction will cause the volume of surface runoff to increase because the new construction will increase the impermeable plan surface area of the site. Surface runoff from impermeable surfaces will be collected and transmitted to combined sewerage system via an attenuation tank, which will limit flow to 5L/s.**
3.	**Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?**	**Yes**	**The proposed basements and footprint of the properties will increase.**
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?	No	The impermeable area, including the building footprints and external areas will increase. The additional surface run-off will be transmitted to the mains sewerage system and will not contribute to surface flow.
5.	Will the proposed basement result in	No	No sources of contaminated groundwater are

	changes to the quality of surface water being received by adjacent properties or downstream watercourses?		expected nearby (mainly residential land-use) and hence groundwater quality for adjacent properties should not be adversely affected.
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	The site does not fall within the area known to be at flood risk and is it not located on one of the streets listed as being at risk of surface water flooding [Ref 2]. Indicative online flood map shows the site to fall within Flood Zone 1 [Appendix C]. Sites within Flood Zone 1 are considered to have less than a 1 in 1000 (0.1%) annual probability of flooding from rivers or the sea.

4.1.2 SUBTERRANEAN GROUNDWATER FLOW SCREENING CHECKLIST

Basement development may affect groundwater flows, and even though the displaced water will find a new course around the area of obstruction this may have other consequences for nearby properties, trees, etc. Basement development may have the potential to divert or displace groundwater which can cause a rise in groundwater, and cause flooding, upstream of the development, whilst immediately downstream the groundwater level may decline, which may affect wells, springs and ponds. The following screening questions identify the features that may cause significant changes to subterranean ground water flow:

No.	Screening Question	Impact	Source/Comment
1a.	Is the site located directly above an aquifer?	No	The site is underlain by unproductive strata comprising the London Clay [Appendix C/D]
1b.	Will the proposed basement extend beneath the water table surface?	No	The London Clay is up to 150m thick [Reference 13], with groundwater limited to pockets of perched water or localised lenses of water. The proposed basement is to extend to a maximum depth of 3.5m below ground level.
2.	Is the site within 100m of a watercourse, well (open/disused) or potential spring line?	No	The closest 'lost' river is the Fleet (which is in a similar location to Regents Canal) which is c. 500m away [Ref 3]. Regent's Canal is c. 500m from the site. There are no recorded wells within 100m of the site [Appendix C].
3.	Is the site within the catchment of the pond chains on Hampstead Heath?	No	The site is located approximately 2.5km south of Hampstead Heath and lies outside of the Hampstead Heath surface water catchment [Ref 2: Figure 14].
4.	**Will the proposed basement development result in a change in the proportion of hard-surfaced/paved areas?**	**Yes**	**The extent of impermeable surface area on the site will increase.**
5.	As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soak-away and/or SUDS)?	No	The new construction will intercept a larger proportion of the precipitation which will be discharged into the sewerage system leaving less surface run-off to be discharged into the ground.

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 or spring line?	No	The boating lake in Regent's Park is c. 2.5km to the west of the site; Highgate Pond in Hampstead Heath is also roughly 3km from the site to the north. Regent's Canal is roughly 500m to the south west of the site. The level of the site is c. 37m AOD but due to the London Clay beneath the site it is unlikely that the water level is in hydraulic continuity.

SLOPE STABILITY SCREENING CHECKLIST

Basement development applications may put the structural stability of adjoining or neighbouring buildings at risk or lead to slope instabilities. The following screening questions identify the features that may cause significant changes to slope stability:

No.	Screening Question	Impact	Source/Comment
1.	Does the existing site include slopes, natural or manmade, greater than 7°? (approximately 1 in 8)	No	None [Ref 2: Figure 16].
2.	Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7° degrees? (approximately 1 in 8)	No	None [Ref 2: Figure 16].
3.	Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°? (approximately 1 in 8)	No	None [Ref 2: Figure 16].
4.	Is the site within a wider hillside setting in which the general slope is greater than 7°? (approximately 1 in 8)	No	
5.	**Is the London Clay the shallowest strata at the site?**	**Yes**	**There is a 0.6m thick layer of made ground above the London Clay, but the London Clay is the effectively the shallowest strata on the site [Appendix D]**
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?**	**Yes**	**Refer to Arboriculturalist report.**

7.	Is there a history of seasonal shrink-swell subsidence in the local area (Claygate Beds), and/or evidence of such effects at the site?	No	No history of shrink-swell subsidence has been established. The effects of shrink swell subsidence are not evident at the site.
8.	Is the site within 100m of a watercourse or a potential spring line?	No	The site c. 500m from the Regents Canal. There are no recorded wells within 100m of the site [Appendix C].
9.	**Is the site within an area of previously worked ground?**	**Yes**	**There is an existing property on the site that is to be demolished and replaced.**
10.	Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No	The site lies within unproductive strata [Ref 2; Figure 8].
11.	Is the site within 50m of the Hampstead Heath ponds?	No	[Ref 2; Figure 14],
12.	**Is the site within 5m of a highway or pedestrian right of way?**	**Yes**	**Both the boundary of the site and the new basement retaining wall are adjacent to a minor access road; 'St Paul's Crescent'. The front of the property is also adjacent to Agar Grove.**
13.	**Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?**	**Unknown**	**The foundation configurations of the neighbouring properties are not known but the distance of the neighbouring properties to the basements is such that they are likely to be outside the zone of influence of the basement.**
14.	Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No	Appendix C

5 STAGE 2 - SCOPING

A number of potential impacts have been identified in the screening process which must be evaluated and assessed according to the Camden Development Policies to see whether they are impacts of concern.

5.1 SURFACE FLOW AND FLOODING

5.1.1 SCREENING SUMMARY

Question 2: Will surface water flows be materially changed?

The new construction will intercept a larger proportion of the precipitation than the previous scheme. This water will be captured and drained into the sewerage system. Therefore, a smaller proportion of the precipitation falling on the site will be transmitted as surface water or otherwise, the risk of flooding due to surface water flow will be reduced. Therefore there is no problematic impact on the surface water flows and flooding.

Question 3: Will the proposed basement result in a change in the proportion of impermeable surfaces?

The proposed construction will result in an increased plan area of impermeable surfaces and this will cause more surface runoff.

5.1.2 IMPACTS ON SURFACE FLOW AND FLOODING

The increased plan area of impermeable surfaces increases the peak volume flow rate of surface runoff. Precipitation landing on surfaces that have little capacity to store or attenuate the flow will rapidly transmit the flow away from the buildings. It is proposed that the new development will have a new attenuation tank to capture surface water runoff. It is proposed that the water would be pumped at a reduced flow rate from the tank into the combined sewerage system.

5.2 SUBTERRANEAN GROUNDWATER FLOW

5.2.1 SCREENING SUMMARY

Question 4: Will the proposed basement result in a change in the proportion of impermeable surfaces?

The proposed construction will result in an increased plan area of impermeable surfaces and this will cause more surface runoff. It is proposed that this runoff be collected from the site into an attenuation tank and released at a slower rate into the sewerage system.

Consideration has additionally been given to the potential presence of perched waters residing above the made ground/London Clay interface or in any fissured clay and to the potential presence of pockets for water bearing sand or claystone lenses that can occur in the London Clay.

5.2.2 IMPACTS ON SUBTERRANEAN GROUNDWATER FLOW

The increased plan area of impermeable surfaces in the new development means that surface water that would have in part contributed to the subterranean groundwater flow by infiltration, is now transmitted away from the site via the existing sewerage system. Reducing the subterranean base flow could undermine the vitality of surrounding water features or cause damage to structures through clay shrinkage or swelling.

Ground water could pass through the top stratum of made ground. If such a flow were blocked by the basement, it would be forced to find and alternative route. Research has shown [Ref 10] that when ground water flows around an obstruction, the volume flow rate is not significantly impacted, but the ground water level rises upstream of the obstruction and this could lead to local flooding or water logged ground.

5.3 SCOPING SLOPE STABILITY

5.3.1 SCREENING SUMMARY

Question 5: Is the London Clay the shallowest strata at the site?

London Clay is the shallowest strata on the site; the potential to impact slope stability will be investigated further.

Question 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?

Refer to Arboriculturalist report. This issue will not be investigated any further in this report.

Question 9: Is the site within an area of previously worked ground?

The site has an existing property that will be demolished to make way for the new development.

Question 12: Is the site within 5m of a highway or pedestrian right of way?

The site is adjacent to two roads; this issue will be investigated in the scoping stage.

Question 13: Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?

The foundation levels of the neighbouring properties are not known and therefore a worst-case scenario must be adopted in design. This will be investigated further.

5.3.2 IMPACTS ON SLOPE STABILITY

The site is located on the London clay formation, the long term effect of building on clay will be carefully considered during the design and construction phases.

One wall of one basement is adjacent to a minor access road. The basement will be designed to resist any additional loads from this access road and will ensure that movement is kept within acceptable limits. The stiffness of the retaining wall and any temporary propping will be checked to ensure that soil movements are within acceptable limits.

6 STAGE 3 – SITE INVESTIGATION AND STUDY

6.1 SITE INVESTIGATION

A Phase I desk study was undertaken by Constructive Evaluation Ltd in December 2013. This was followed by a Phase II investigation finalised in February 2014. The site investigation consisted of a 25m deep borehole; 2 window sample holes, a dynamic probe drilled to 6m depth, trial pits to determine foundation configurations and ground water monitoring with two monitoring rounds. The reports are included in Appendix C and D. A summary of the findings is as follows:

The investigation found made ground to a maximum depth of 0.6m with the London Clay formation below this. The clay layer was found to be soft to firm in consistency to 1.5m bgl and was found to be representative of the weathered London clay formation. The clay became very stiff at 3.8m bgl and to the end of the 25m deep borehole. The clay was fissured.

Groundwater was found in the window samples at 0.8m bgl; the borehole, which was cased to 2m recorded lower water levels of 7.26m bgl. It is considered that the higher water level in the top 2.5m of soil is a result of high rainfall during the time that the site investigation was undertaken. Preliminary design of the basement will take into consideration this high perched water level but further monitoring could be undertaken to see if the water levels reduce in the dryer months. Prior to constructing the basement the contractor will need to re-test and monitor the water levels on site. This will be discussed later in the report.

The clay was tested for shrink-swell potential and was found to be classed as clay of Very High Plasticity.

The results of soil sulphate tests indicate the ground has a class of DS-4. Testing of the soil was undertaken to cover a general range of contaminants; all results returned with values below relevant Soil Guideline Values. Refer to Appendix D for the full contamination results.

Safe bearing capacities have been calculated as being 70kPa at 1.2m bgl and 95kPa at 2.5m bgl.

6.2 SURFACE WATER RUNOFF

The London Borough of Camden requires details of sustainable design and construction measures showing how it is proposed that the development will reduce energy, water and materials used in design and construction. The prescribed sustainability assessment for all new build residential developments is based on the Code for Sustainable Homes and requires surface water drainage which avoids, reduces and delays the discharge of rainfall run-off to watercourses and public sewers using SUDS techniques [Ref 5]. The surface water runoff calculations in Appendix E describe how these requirements are met.

7 STAGE 4 – IMPACT ASSESSMENT

7.1 SURFACE FLOW AND FLOODING IMPACT ASSESSMENT

The proposed drainage system incorporates some key characteristics of SUDS with respect to surface flows. By storing rainfall and attenuating the discharge into the sewerage systems, natural drainage systems are replicated in a manner that smoothes peak flow of surface runoff that would otherwise contribute to the overloading of the existing sewerage and drainage systems following a high precipitation event.

As identified in the screening process, the site is not located in a flood risk zone. In comparison to the previous scheme, a larger proportion of the precipitation is transmitted to the sewerage system and so the risk of flooding is diminished both to the property and the neighbouring properties. The storage tank will be sized to account for the current precipitation load plus an additional margin to account for climate change [Appendix E]. Therefore, it is unnecessary to investigate the surface water flood risk of the proposed construction to either the drainage system or the neighbouring properties.

The site is not within the catchment area of the ponds. There are no areas of: outstanding beauty, environmental sensitivity, scientific interest, special conservation, special protection, nature reserves, forests or national parks within 500m of the site [Appendix C]. The nearest surface water feature or water abstraction is over 300m away [Appendix C]. Therefore, the site is located in an area of low ecological sensitivity, with no vulnerable local amenities. Given that the site is also located in impermeable unproductive ground, the works poses no significant threat to any heritage of Camden that might be vulnerable to a reduction in the volume of surface flow resulting from either the increased impermeable surfaces or adaptations to the transmission of the remaining surface flow.

7.2 SUBTERRANEAN GROUNDWATER FLOW IMPACT ASSESSMENT

Reducing the volume flow rate of subterranean base flow could undermine the vitality of surrounding water features. The site is located on London Clay with the upper 2.5m being water-bearing, thought to be as a result of recent heavy rainfall. The nearest surface water feature or water abstraction is over 300m away [Appendix C], so any reduction in subterranean flow will have a minor effect at such distance.

Research has shown [Ref 10] that when ground water flows around an obstruction, the volume flow rate is not significantly impacted, but the ground water level can rise upstream of the obstruction and this could lead to local flooding or water logged ground. On this site the top 2.5m layer of soil was found to be water-bearing. However, the proposed basements are relatively small and isolated on the site and the site itself is not on a slope; as a result it is deemed that any ground-flows that are diverted will be small. Furthermore, the water was found in clay medium meaning that it is unlikely to be flowing and is more likely to be perched locally.

Reasonable care should be taken to control ingress of water during construction; at this stage it is envisaged that this will be done using sheet piles. The basement will need to be waterproofed in the permanent condition, it is anticipated that this will be done using a cavity drain system.

The basement will be designed on piles which will act dually to take vertical load down to competent London Clay and to resist any uplift forces caused by high levels of perched water.

7.3 SLOPE STABILITY IMPACT ASSESSMENT

Although London clay is the shallowest strata on the site it is not situated in a hill-side setting, nor does it contain any significant slopes existing or proposed, nor does the neighbouring land. The design will take into account any shrink/ swelling of the clay with reinforcement or void formers where necessary and the basements will be adequately propped during construction to ensure stability.

7.4 RETAINING WALL

Given the levels of perched water found during the site investigation it is proposed that the basements will be formed using temporary sheet piles. During the works some local pumping of the perched water may be required.

The critical factors in controlling ground movement, and its effects on adjoining properties, are: the degree of horizontal propping during excavation and the transfer of loads from the temporary props to the permanent structure. Ground movement will be controlled in this case by propping the top of the sheet piles prior to excavating the basement. The permanent structure will be constructed with the props still in place and the props will be removed once the permanent structure has cured. The temporary props will be located at spacings which can be shown to limit lateral and vertical movements of the surrounding ground to acceptable levels.

Refer to appendix B showing an indicative construction sequence.

8 CONCLUSION

This Basement Impact Assessment has been carried out to justify that the basement construction at 51-53 Agar Grove meets the current planning rules related to basements in the Borough of Camden. This is in order to support a new planning application.

Following the stages of work set out, from screening through scoping, data collection and review to impact assessment it has been shown that the basement construction has no adverse effect on the surface and subterranean water regimes and has no impact on slope stability.

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