BASEMENT IMPACT ASSESSMENT

1A PRIMROSE GARDENS, LONDON NW3

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Introduction

1a Primrose Gardens is an existing four storey dwelling to the southern end of Primrose Gardens close to Elizabeth Mews. The existing ground floor entrance is six steps up from pavement level with an existing Lower ground/basement level consistent with most of the other properties in Primrose Gardens (formerly Stanley Gardens circa 1870-1939) in the vicinity. The presence of pavement light to retail premises along England's Lane is consistent with basements and/or part basements to a fair proportion of properties in the area including to Belsize Park Gardens and Eton Avenue.

Camden Planning Guidance: Basements and Lightwells (CPG4)

Camden have produced guidance to supplement their Local Development Framework (LDF) to ensure that advice is provided at planning stage so that site specific information is prepared and submitted so that the application can be assessed for its impact on the natural and built environment; flooding risk and ground instability risk.

Site Location

Site location is TQ275846 with postal address 1A Primrose Gardens, London NW3 4UJ. The property is about 12m from the junction of Primrose Gardens and Elizabeth Mews, 500m due north of Primrose Hill Park and about 500m south-south east of Belsize Park (Northern Line) underground station in Haverstock Hill on the A502. The site altitude is about 61m with a fall from the north end of Primrose Gardens (alt. circa 65m) to England's Lane (alt. 60m approx.). There is also a general slope from the west (Belsize Park Gardens alt. circa 63m) to the east (Chalcot Gardens alt. approx. 58m.).

Site relationship to underground rail line.

Belsize Park tube station was opened in 1907 with platforms located about 33m below road level. The Northern line underground service is categorised as a "deep-level" rail line for most of its length. There is an air raid shelter associated with the Belsize Park station which indicates that the underground generally follows Haverstock Hill with the air raid shelter to the east (reference Subterranea Britannica). Although all references appear to indicate adequate separation between the site and the underground rail network, a specific request has been made to London Underground Limited for details of any other sub-surface structures which may be close to the property.

Site Geology

The British Geological Survey 1:50 000 scale geology for the site and environs indicates bedrock is London Clay formation, comprising clay, silt and sand. Boreholes closest to the site have been reproduced in the Appendix and indicate London Clay Formation below made ground at Haverstock Hill to the east of the site and to Adelaide Road to the south viz about 250m from the site location in both cases.

The logs for Adelaide Road indicate local fissures associated with rootlets and this may be anticipated at the site with one tree requiring removal for the formation of the new basement and ground floor extension. Both the reports for Haverstock Hill and Adelaide Road indicate dry conditions during boring.

Hydrogeology

London Clay is classified as an "unproductive stratum" and it is possible therefore that water may be encountered in the made ground overlying the London Clay at the horizon between the soil types. Reference to the boreholes in Adelaide Road indicate the variations that may be encountered over relatively short distances in the depth of made ground. The site does not appear to have been hit by bombs during the blitz but it is possible that variations in the depth of made ground and level at which London Clay is encountered may vary significantly and local pockets of water may be encountered.

It is assumed therefore that conservatively water pressures will be taken into account when designing the basement structures in the absence of detailed water monitoring. In accordance with current good practice, water level should be assumed to be at ground level for a "worst credible" design solution.

Trees and vegetation - affect on foundations

The recorded trees are an Acacia (possibly a false Acacia or Frisia); Laburnum; Apple; Birch; London Plane. The largest tree and that considered to have the highest water demand is the London Plane to the rear boundary of the garden. The lighter golden coloured Acacia appears to have attained a height of perhaps 8m (above the ridge line of properties in Elizabeth Mews). Reference was made to a comparative study "The relative water use levels of a London Plane compared to a False Acacia (Frisia) and a climbing plant (Wisteria) published in 2007.

The proposed plans indicate a separation between the new construction and the London Plane of about 12m. The publication "Does it really matter if there is a tree near a building" by Chris Overbeke, cites a maximum "tree-to-damage" distance of 12m for a London Plane; 10m for Birch and Apple and 7m for Laburnum. All of the trees found at the site are categorised as medium water demand except for the Birch which is low water demand. Both the Apple and the Birch will be circa 6m from the new construction.

The proposed new construction is shown to be some 4m below existing finished garden level which should be more than adequate to counteract the effects of tree roots (reference NHBC & BRE guidance). Assuming a " worst credible" approach the footing depth for a 30m high mature broadleaf tree with high water demand in highly shrinkable clay at a distance of 12m would be 2.75m. In terms of the moderate water demand Apple and Birch at 6m distance from the new construction indicates a need for foundations at less than 2.0m depth.

BASEMENT IMPACT ASSESSMENT

Stage 1 - Screening of groundwater

Item	Consideration	Response
a	Is the site over an aquifer?	No - predominant soil type is London Clay
b	Will new construction be below water table?	**No - but basement design to allow for water presssures to cater for future changes**
c	Is the site within 100m of watercourse or water feature?	No.
d	Is the site within catchment of pond chains on Hampstead Heath?	No.
e	Will the development increase the hard surfacing at the site?	**Yes - building over existing garden hard surfaces but increased area of about 14%. (drawing 383-1-C refers)**
f	Will there be an increased in surface water drainage?	**Yes - anticipate new soakaway or SUDS feeding existing trees and vegetation or rainwater harvesting if appropriate.**
g	Is the new construction below mean water level?	No - evidence from borehole history indicates dry conditions

Stage 1 - Screening of slope stability

Item	Consideration	Response
aa	Does the ground slope greater than 7degrees?	No - refer Arup report Figure 16
bb	Does the work include reprofiling ground levels above 7 degrees?	No. Land not reprofiled and trees retained
cc	Does land off site slope greater than 7 degrees?	No - refer Arup report
dd	Does the site lie in a hillside setting?	No. General slope 1 in 50
ee	Is the London clay the shallowest strata at the site?	**Yes. Historic boreholes in vicinity indicate London Clay.**
ff	What is the relationship between the development in respect of tree root zones and tree removal?	**Acacia or Frisia to be removed - remaining trees about 6m or more from new basement and retained.**
gg	Is there a history of seasonal ground movement in the area?	**Unknown - no apparent defects on site or in adjacent roads**
hh	Is the site within 100m of water course or feature?	No.
ii	Is the site within an area of previously worked ground?	No - records indicate the Belsize estate was agricultural land
jj	Is the site within an aquifer?	No.
kk	Is the site within 50m of Hampstead Heath ponds?	No.
ll	Is the site within 5m of a highway or a pedestrian right of way	No. Development in existing private garden
mm	Will the development significantly increase the differential footing depths in relation to neighbouring properties.?	**Possibly - although remote from 3 Primrose Gardens (more than 6m away) relative cross sections required to assess impact on properties in Elizabeth Mews**
nn	Is the site within any exclusion zone for underground services e.g. rail lines	**No. Deep level Northern Line circa 30m to crown of tunnel. Checks required to assess if other structures may be encountered**.

Stage 1 - Screening of flooding and surface water

Item	Consideration	Response
a1	Is the site within Hampstead heath ponds catchment?	No.
a2	Will surface water run-off from the site be materially increased?	No. Anticipate circa an extra 1cu.m peak additional flow which could be controlled in drainage design.
a3	Will the proposed development result in an increased hard surface?	**Yes. Nett 14% increase in total hard surfacing/buildings.**
a4	Will the development result in an increase in long-term and instantaneous surface water downstream of development site?	Not necessarily - drainage design can accommodate temporary storage; SUDS or rainwater harvesting. Existing trees and mature gardens retained wherever practicable.
a5	Will the development result in changes to the quality of surface water received downstream of site.	No. Anticipate status quo.

Stage 2 - Scoping

Issue	Consideration	Risks & actions
b	Will the basement extend below water table?	**Potential:** Disruption of ground water flow through made ground or within permeable horizons in London Clay
e	Will hard surfacing be increased at the site?	**Potential:** Increased surface water run-off affects water collection downstream of site. **Actions:** Drainage design to incorporate attenuation; SUDS; rainwater harvesting to mitigate position
f	Will there be an increase in surface water run-off?	**Potential:** Increase flood risk downstream of site. **Actions**: Drainage design to included measures to mitigate increase in surface water run-off.
ee	Is the London clay the shallowest strata at the site?	**Potential:** Heave due to tree removal and overburden loss from basement excavation **Actions:** Party Wall award Condition Surveys required of adjacent structures; use of anti-heave compressible materials; design piled footing with sleeved piles
ff	What is the relationship between the development in respect of tree root zones and tree removal?	**Potential:** Tree removal causes heave affecting construction and adjacent properties **Actions**: Retained trees (4 No.) with intact root zone(s) accommodate loss of tree(1 No.); Monitoring of adjacent structures and Party Wall Condition Surveys required to protect interests of others.
gg	Is there a history of seasonal ground movement in the area?	**Potential:** Tree loss and new development cause heave to adjacent structures **Actions**:Check root zone effects and Condition Survey adjacent structures.
mm	Will the development significantly increase the differential footing depths in relation to neighbouring properties.?	**Potential**: Instability of adjacent buildings in Elizabeth Mews **Actions:** Investigate as part of Party Wall works
nn	Is the site within any exclusion zone for underground services e.g. rail lines	**Potential**: Stress changes in tunnel lining due to soil excavation **Actions:** Designer to liaise with London Transport and London Underground
a3	Will the proposed development result in an increased hard surface?	**Potential:** Increased surface water run-off causes flooding downstream **Actions:** Designer to consider mitigation of additional hard surfacing by attentuation; SUDS; rainwater harvesting.

Stage 3 - Site Investigation

Based on the results of the screening and scoping, it is anticipated that the site will comprise London Clay below made ground from historic records which will be sufficient for preliminary design work. However, it cannot be discounted that ground conditions may vary from the anticipated conditions and it is recommended that further investigations including trial pits be formed early in the process to confirm design assumptions, depth of made ground, tree roots and relative levels of adjacent structures. Indeed, it be useful to make further enquiries or tests on ground water levels for the basement and drainage design. The drainage design may need to be increased to include consideration of SUDS; attenuation or rainwater harvesting consequent upon loss of the tree and increased hard surfacing due to the proposed extension.

Stage 4 - Impact Assessment

The site is not within 100m of a watercourse. The site would appear to be mainly on London Clay and relevant historic borehole records indicate that there is no water table close to the proposed footing depth. The historic boreholes are of small diameter and may not have remained open for sufficient time to determine the presence of groundwater. However, the depth of made ground overlying London Clay and the potential for water running on the horizon at the clay interface with the made ground cannot be discounted at this stage. It is also possible that perched water may collect in depressions in the upper surface of the London clay. It is noted , however, that the rear boundaries of properties in Primrose Gardens and comprises a line of mature trees and shrubs. The proposed extension will extend below the existing house footings and will probably extend below those of neighbouring properties in Elizabeth Mews.

Although records do not indicate groundwater, it is anticipated that local fissures created by tree roots and depressions in the upper weathered clay surface may retain water run-off. The existing surface water run-off is restricted by existing basements to Primrose Gardens and properties in England's Lane from the general topographical fall from the north and west to the south and east. It is therefore considered highly likely that the proposed development will have little impact on the ground hydrology and that a large proportion of surface water run-off feeds the trees and shrubs forming the boundary at the rear of properties in Primrose Gardens and Belsize Park Gardens.

Flood risk is considered minimal in that the site and environs are not one of the streets prone to flooding recorded in 1975 or 2002.

The site does not have a significant slope and is therefore categorised as outside the slope angle zone at which slope instability may occur. The close proximity of properties in Elizabeth Mews to the proposed development suggests that particular care may be needed to retain soil and monitor these buildings under Party Wall procedures.

Clay shrinkage and or swelling is potentially likely to occur due to removal of overburden to excavate for a new basement and tree removal. The basement design details should consider heave precautions to the new basement. Investigation of properties in the area revealed general cracking to parapets and around openings but no characteristic pattern cracking wider and base or top indicative of ground movements. The records from Haverstock Hill and Adelaide Road suggest that the structure will be founded in Brown London clay. It is probable that the shrinkage potential will be moderate or moderate to high. In order to mitigate heave recovery at the site and locally, additional planting or reduction in pollarding of trees and monitoring of vegetation may be appropriate for a period. Given the proliferation of trees in the "enclosed" zone formed by buildings in Primrose Gardens, Belsize Grove, Belsize Park Hardens and Elizabeth Mews/England's Lane, the existing trees and shrubs in mature gardens will accommodate the minimal change anticipated from the development and loss of one medium water demand tree. The shrinkage potential or compressibility is likely to have been reduced due to presence of many trees and buildings.

It would appear that the nearest underground tunnel is on the Northern Line between Belsize park and Chalk Farm approximately following the line of Haverstock Hill. It is a deep tunnel and it is anticipated that some 30m of overburden rests over the tunnels and the small shallow development proposed should not affect these. As a precaution, it is considered appropriate that the designer contacts London Underground and other statutory providers to ascertain if their in any equipment at shallow depth (within the zone of influence of the new basement.)

Local considerations: The proposed development is within 2m of the rear boundary to properties in Elizabeth Mews. The section drawings indicate the boundary with no. 3 Primrose Gardens and there is sufficient separation for the construction to be "open-dug" but further details are considered appropriate to indicate the relationship between properties along Elizabeth Mews. It is considered likely that these will have shallower footings, typically being of just two-storey construction, and built upto the boundary. London Clay is typically a heavily fissured material and fissures are recorded in the historic boreholes. As a result, the unsupported sides of trenches are unlikely to stand if left open for any appreciable period. The designer of the basement may need to consider the relationship between the properties on Elizabeth Mews carefully and it is anticipated that further site investigation is required for detailed design and to satisfy party wall matters along this boundary.

Although the trees may account for a fair proportion of the groundwater control, any hardsurfacing and disturbed ground comprising clay will affect run-off and therefore temporary works will need to consider control of surface water run-off and potential localised water pockets “perched water”. The designer may need to consider further site investigation and groundwater monitoring with particular consideration regarding the effects of the works to properties in close proximity ion Elizabeth Mews. It is anticipated that some sump pumping may be necessary and a suitable discharge point should be identified before works proceed.

Waterproofing of the new basement will be in accordance with Building Regulations and British Standards and further comment here is outside the scope of this report.

Preliminary Conclusions:

The proposed construction of a basement is considered acceptable in respect of **groundwater flow** at and below the site. Site control measures are anticipated to include temporary sump pumping to control local surface water run-off and groundwater based on the historic borehole records. In the absence of detailed relevant local water table readings, the provisional design of the basement should include buoyant uplift pressures.

The presence of numerous basements and part basements and with only slight slopes at the site and environs, the development is considered acceptable for **slope stability**. Further investigation is required to determine the relationship between the proposed works and existing foundations along the boundary with properties in Elizabeth Mews and to the rear of the property to be extended (it is assumed that the Architects drawings show an assumed arrangement). In particular, the new construction will be close to the boundary and upto 4m below garden level. It is anticipated that the design of temporary works and/or a combination of temporary permanent works and or sequencing will be appropriate and subject to party wall agreement(s).

It is anticipated that the small additional **surface water run-off** from the new construction can be retained on site by careful design of the drainage systems which may include SUDS; rainwater harvesting or trenching and soakaway nearer the trees and shrubs which form a feature of the rear boundary subject to suitable separation and root protection.

Adequate temporary support and/or permanent works design, using best practice, should ensure that ground movement during construction are within acceptable tolerances for the adjacent structures and their footings in relation to the works.

Further investigation of statutory providers equipment and relationship between existing foundations to off-site properties, perhaps together with establishing site groundwater table, is considered necessary at some juncture to verify the detailed design assumptions.

Appendix A

BOREHOLE RECORDS
(*courtesy British Geological Survey website*)