RIDGE

PROPERTY & CONSTRUCTION CONSULTANTS

Camden

BASEMENT IMPACT ASSESSMENT

October 2018

Property Details:

1A St Johns Wood Park
Camden
London
NW8 6NE

Prepared for

London Borough of Camden
Engineering Structures
Civic Centre
4W/06
High Street
Uxbridge

Prepared by

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VERSION CONTROL

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CONTENTS

1. NON-TECHNICAL SUMMARY

1.1 Introduction

Ridge and Partners has been commissioned by Almax Group to carry out a desk study and ground investigation at the land adjacent to 1 St John's Wood Park, London, NW8 6QS. This report forms the main part of a Basement Impact Assessment (BIA) which has been carried out in accordance with the London Borough of Camden (LBC) Basement Impact Assessment Pro Forma 1v0 in support of a planning application.

1.2 Site Location

The site location is the land adjacent to 1 St John's Wood Park, Camden, London, NW8 6QS.

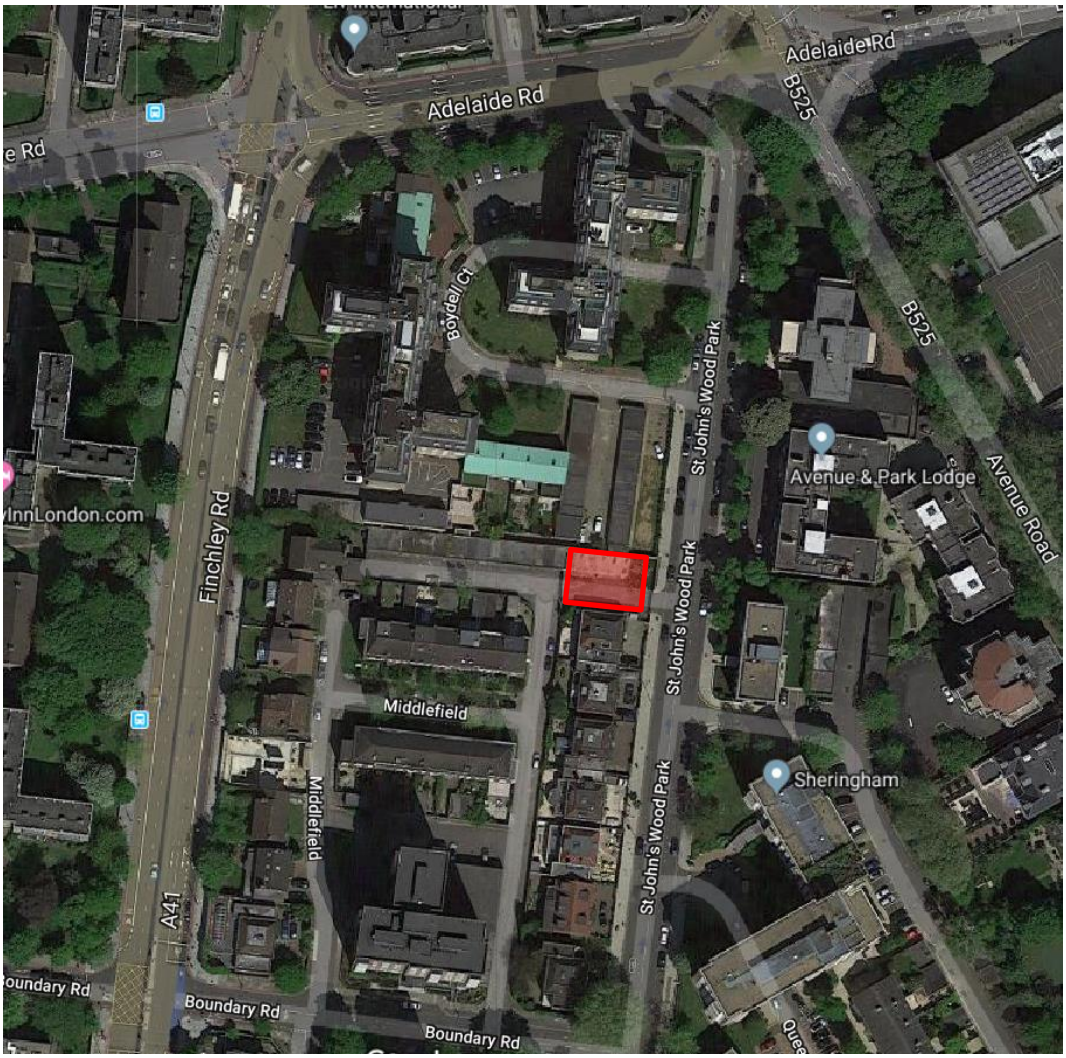

Figure 1 – Aerial view with approx. site area indicatively shown.

1.3 Existing Site

The land was previously a gated access road that leads to St Johns Wood Park to the east and Middlefield to the south-west. A row of garages occupied the land along the length of this access road. The garages that were previously located on the proposed site have since been demolished, the garages outside of the proposed site remain.

1.4 Proposed Development

The proposed development comprises the construction of a residential 6-storey reinforced concrete frame block of flats with a single storey basement.

1.5 Assessments

The following assessments are presented:

- Desk Study
- Screening
- Scoping
- Additional evidence/assessments
    - Ground investigation
    - Hydrogeology and land stability assessment
    - Ground movement assessment
    - Consultation with adjacent infrastructure/asset owners
    - Flood risk assessments
    - Surface water drainage strategy/SUDS assessment
- Impact Assessment

1.6 Authors

The following have been involved in the production of the BIA:

- Structural Design Review – Rob Leland BEng MSc CEng MICE
- Drainage Design Review – Rob Leland BEng MSc CEng MICE
- Hydrogeology Report – Julian Maund BSc PhD CEng MIMMM CGeol FGS
- Land Stability Report – Julian Maund BSc PhD CEng MIMMM CGeol FGS
- Report Compilation – Matt Linney MEng

1.7 Ground and Groundwater Conditions

The ground conditions beneath the site 0.5m of made ground underlaid by London Clay Formation.

The ground investigation report did not find the water table within their 12.5m borehole. However, a subsequent monitored well dug for the hydrogeology report a perched water table was found at 0.5m bgl.

Further information can be seen in Appendix B

1.8 Construction Methods

The construction methods proposed are as follows:

1. Place a contiguous piled wall and capping beam around the perimeter of the new basement.
2. Excavate soil to 1.5m depth within the piled perimeter, propping the walls.
3. Construct reinforced concrete inner walls around the building perimeter, within the contiguous piled wall.
4. Continue with the construction of the basement structure.
5. Waterproof the internal space using walls with two types of waterproofing to comply with NHBC Chapter 5.4 for habitable spaces.
6. Proceed with the construction of the above ground structure.

1.9 Structural Monitoring Strategy

A structural monitoring strategy to control the works and impacts to neighbouring structures will comprise of:

- Visual inspection and production of condition survey by Party wall surveyors at the beginning of the works and also at the end of the works.
- Visual inspection of existing party wall during the works.
- Vertical & lateral monitoring movement by theodolite at specific times during the projects.

Further information can be seen in Appendix H.

1.10 Basement Impact Assessment (BIA)

The BIA has assessed land stability and the impacts of the proposed development on neighbouring structures. A ground movement analysis was carried out for the surrounding properties to determine the ground movements from the installation of the piled walls and the excavation of the basement. The analysis has shown that No 1 St Johns Wood Park will experience Damage Category 2 'Slight' on the Burland Scale if the piles are propped at the top. It is noted that this damage category is not permitted by Policy A5 Basements and as such it is proposed to install a secondary row of propping at mid-height of the total excavation depth to decrease the deflection of the wall, and subsequently the surface ground movements, to bring the strain within the acceptable limits. All other buildings were analysed to be within Damage Category 1 'Very Slight' which is acceptable according to Policy A5 Basements. Residual impacts of Damage Category 1 according to the Burland Scale are 'Fine cracks that can easily be treated during normal decoration. Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection'. Other measures will also be implemented to control the ground movement, which can be seen in Section 7.4.

The hydrogeological, hydrological and slope stability impacts have been assessed in the Hydrogeology and Land Stability report by Maund Geo-Consulting. The report highlighted the following impacts and mitigation:

- Shrink Swell of the soil and ground movements
  - Basement to be assessed for heave, use of void former under slab.
- The basement formation level is below the perched water table
  - Groundwater to be pumped during construction, waterproofing to be used for final condition and retaining walls in permanent condition to be designed with water table at surface.
- The basement extent is 5m from the highway
  - Monitoring before, during and after construction
- Significant increase in foundation depth in relation to neighbouring properties
  - Monitoring before, during and after construction and by using basement method statement.

Refer to Appendix A for further information.

The BIA has concluded that the site is at no significant risk of flooding, except from the failure of infrastructure, which is an inherent risk with the construction of any subterranean structure. The proposed mitigation measures are to design the proposed surface water storage systems for the lightwell and the foul water storage for the basement to have 24hr capacity and fit an alarm to prevent overflowing in the event of a mechanical fault in the pump. The residual flood risk is from the existing infrastructure in the vicinity. However, this is an inherent risk with the construction of all subterranean structures.

2. INTRODUCTION

The purpose of this assessment is to consider the effects of a proposed basement as part of the development of the land adjacent to 1 St John's Wood Park, London, NW8 6QS on the local hydrology, geology and hydrogeology and potential impacts to neighbours and the wider environment. The site location is presented in Figure 2.

The BIA approach follows current planning procedure for basements and lightwells adopted by LB Camden and comprises the following elements (CPG Basements):

- Desk Study;
- Screening;
- Scoping;
- Site Investigation, monitoring, interpretation and ground movement assessment;
- Impact Assessment

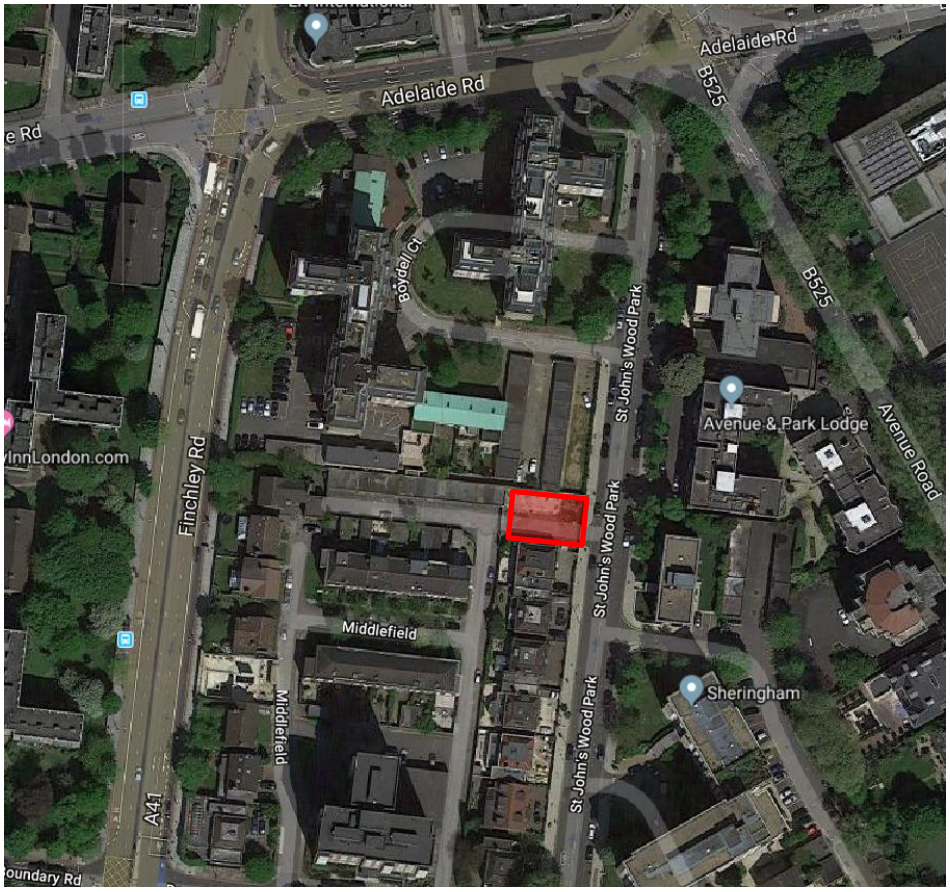

Figure 2 – Aerial view with approx. site area indicatively shown.

2.1 Authors

The following have been involved in the production of the BIA:

- Structural Design Review – Rob Leland BEng MSc CEng MICE
- Drainage Design Review – Rob Leland BEng MSc CEng MICE
- Hydrogeology Report – Julian Maund BSc PhD CEng MIMMM CGeol FGS
- Land Stability Report – Julian Maund BSc PhD CEng MIMMM CGeol FGS
- Report Compilation – Matt Linney MEng

2.2 Sources of Information

The following baseline data have been referenced to complete the BIA in relation to the proposed development:

- Site walkover
- Current/historical mapping from sources including Historic England, Aggregate Night Time Bomb Census and a Utilities Search, see Appendix J.
- Geological mapping carried out within the Hydrogeology and Land Stability Report, see Appendix A;
- Hydrogeological data within the Hydrogeology and Land Stability Report, see Appendix A;
- Current/historical within the Hydrogeology and Land Stability Report, see Appendix A;
- EA Interactive Flood Map for Planning, see Appendix C;
- LB Camden, Strategic Flood Risk Assessment (produced by URS, 2014);
- LB Camden, Floods in Camden, Report of the Floods Scrutiny Panel (2013);
- LB Camden, Planning Guidance (CPG) – Basements (March 2018);
- LB Camden, Camden Geological, Hydrogeological and Hydrological Study – Guidance for Subterranean Development (produced by Arup, 2010);
- LB Camden, Local Plan Policy A5 Basements (2017);
- LB Camden's Audit Process Terms of Reference;

2.3 Existing and Proposed Development

The application site is located on the land adjacent to 1 St John's Wood Park, London, NW8 6QS. The site is not within a wider hillside setting. The site is on level ground at approximately 52.0m AOD.

The land was previously a gated access road that leads to St Johns Wood Park to the east and Middlefield to the south-west. A row of garages occupied the land along the length of this access road. The garages that were previously located on the proposed site have since been demolished, the garages outside of the proposed site currently remain. However, the land upon which the remaining garages are located is registered to be developed with the inclusion of basements below new residential buildings. Co-ordination with the developers of this land will be maintained during the detailed design and construction stages to ensure that any combined impacts on the neighbouring properties are adequately controlled and kept to an acceptable minimum.

1 St John's Wood Park, south of the proposed site, is a three-storey residential property. A visual inspection of the property appears to show the structure is in an adequate condition. There are no records of any planning applications on the Camden Council's website to indicate that there is a basement present below this property.

The land immediately to the north of the site is occupied by 2 rows of garages, a structure which appears to be a UK Power Network substation and an access road. There are no records of any planning applications on the Camden Council's website to indicate that there are basements present below these structures, nor do any of the structures appear to be occupied for continual habitable use.

Also to the north of the proposed site are Nos 2-7 Court Close (terraced houses circa 17m from the site) and No 5 Boydell Court (a high rise apartment block circa 50m from the site). Nos 2-7 Court Close are likely constructed on strip footings, whilst No 5 Boydell Court is likely piled (to a depth greater than the proposed basement). A visual inspection of the properties appears to show the structure is in an reasonable condition. Searches of the planning applications on Camden Council's website show that no basements are present below any of these structures.

A row of terraced residential houses are located to the south-west of the proposed site. From visual inspection, these appear to be in a reasonable condition. Searches of the planning applications on Camden Council's website show that no basements are present below any of these structures.

Data from Historic England shows that there are no listed buildings close to the site.

Trees, shrubs and soft landscaping are present to the east and north-east of the site. These will be protected in accordance with Policy A5 Basements (Local Plan 2017). Existing boundary walls constructed from brickwork separate these from the proposed site.

Nearby infrastructure includes a public highway (>5m from the proposed structure) and footpath (>2m from the proposed structure) immediately to the east of the property. Asset owners will be consulted prior to the commencement of the construction stage to provide notice of the works and to obtain an Approval in Principal (AIP)

The nearest national train line is approximately 60m to the north of the site through the Primrose Hill Tunnels. It is unlikely the proposed single-storey basement will have a significant effect on this asset.

A utilities search was carried out by Groundsure to determine which services are located near the site, see Appendix J. The following were identified as being in close proximity:

- Jubilee Line tunnels – the indicative tunnel lines shows that the proposed basement lies outside of the 3m easement zone required by LUL. However, LUL have stated that a survey will be required to confirm the actual location of the tunnels. This shall be carried out in the detailed design phase.
- Thames Water combined sewer – sewer passes through the proposed site. Sewer is to be re-routed as per the route proposed in the previous approved development scheme, see Appendix L.
- Thames Water combined trunk sewer – sewer runs along the front of the site less than one meter from the extent of the basement. A survey will be undertaken at detailed design stage to determine the accurate position and diameter of this pipe, and correspondence made with Thames Water.
- Thames Water distribution main – circa 4m from the extent of proposed basement.
- UK Power Network sub-station with associated electric cables.
- Cadent LP gas main – the information provided indicates the gas main lies in excess of 3m from the piled basement wall. Cadent require a "scheduled works" enquiry to be completed prior to the commencement of works.
- Vodaphone underground route – circa 8m from the extent of proposed basement. Vodaphone to be contacted to notify them of the proposed works
- Verizon 3rd part duct – circa 8m from the extent of proposed basement.
- Virgin duct – circa 2m from the extent of proposed basement.
- BT duct – circa 2m from the extent of proposed basement.

All requirement set out by the affected asset owners within the utilities search shall be complied with within the detailed design and construction stage.

Based on the information obtained through this search two drawings were created to compile the information of the identified utilities, see Appendix K.

The Historic site surveys are presented in Appendix D and the proposed development drawings are presented in Appendix E.

The proposed development will utilise the following construction techniques:

1. Boring of contiguous piles to form the retaining wall around the proposed basement. This shall be carried out in several stages to allow the re-rerouting of the existing Thames Water combined sewer which currently runs through the site.
2. Construct the capping beam at the head of the piled wall.
3. Excavate the soil to a depth of 1.5m and introduce propping beams.
4. Excavate further to the required depth of basement.
5. Construct basement slab and reinforced concrete inner walls around the perimeter of the basement, and waterproof with 2no waterproofing methods as per NHBC standards. It is envisioned that this will comprise a membrane and waterproof concrete.
6. Proceed with the construction of the above ground structure.

The outline construction method statement for the proposed development is shown in Appendix I.

3. DESK STUDY

3.1 Site History

With reference to the land adjacent to 1 St John's Wood Park, London NW8 6QS the site is primarily hard surfaced, with some soft landscaping, trees and shrubs to the east and north-east. An existing masonry boundary wall separates the soft landscaped areas from the proposed site.

Historically, the land had been an access road leading from St John's Wood Park to Middlefield, with a row of garages occupying the north of the site. The six garages within the site boundary have since been demolished in preparation for the new development.

The Ground Investigation report GWPR1319/GIR/DEC2015 for the site states that there are no areas of Made Ground or Worked Ground noted within a 250m radius of the site.

Several historic survey drawings of the area have been collated by Groundsure, see Appendix D. The surveys are dated: 1871, 1896, 1915, 1935, 1953, 1960-62, 1965-69, 1973-78, 1984, 1991 and 1992-95. The surveys show that the site was residential, with two semi-detached houses built upon the land prior to 1871. The 1953 survey denotes the two properties, as well as several others in the area, as 'Ruin' which may indicate that the structure was compromised due to the WW2 bomb damage. In the 1960-62 survey the two properties, and several other in the area, appear to have been demolished. Significant re-development of the land has occurred including the construction of the access road, garages and the properties on Middlefield and Court Close. In the 1965-69 survey the properties to the south of the site, including 1 St John's Wood Park were constructed.

The Aggregate Night Time Bomb Census was reviewed using the online Bomb Sight Map. Several highly explosive bombs were recorded to have been dropped near the site between 7th October and 6th June 1941. None were recorded to have fallen within the site boundary. Excavation is to proceed with caution regardless.

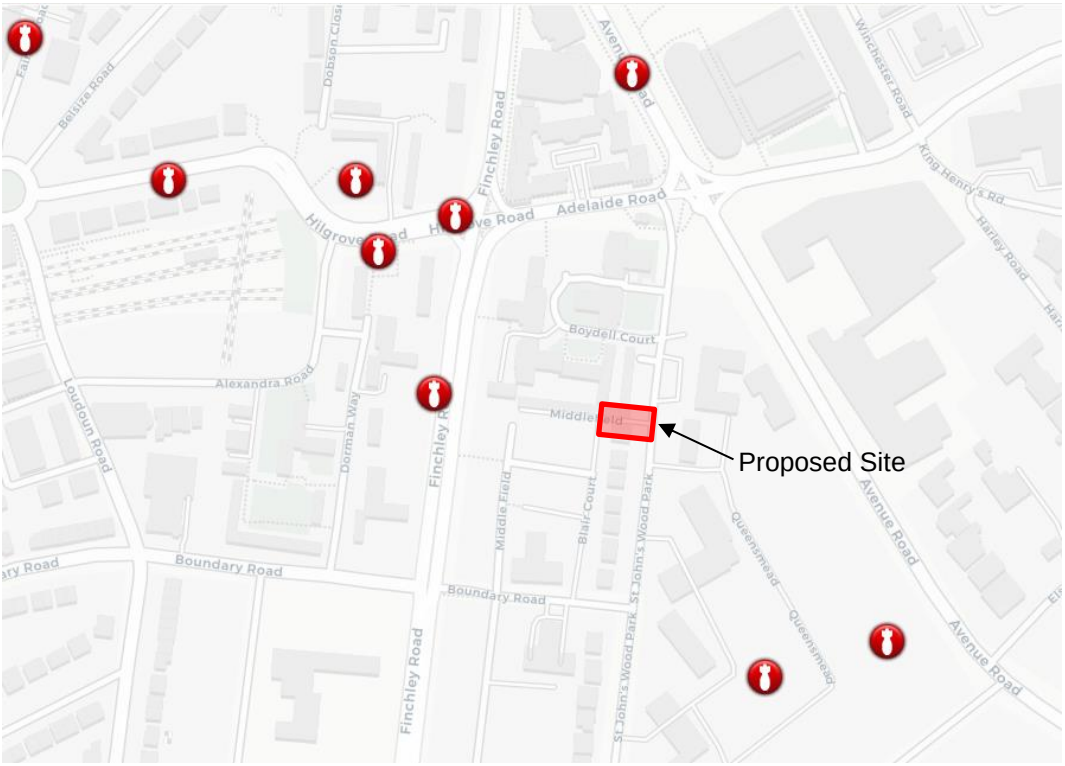

Figure 3 – Extract from Bomb Sight WW2 Map (Bomb Sight, 2018)

A utilities search was carried out by Groundsure to determine whether any tunnels or services ran through or near to the site. The most significant underground feature nearby the site is the Jubilee line which is believed to run approximately 6m from the extent of the piled walls forming the basement. The information provided by LUL regarding the position of the running lines has been caveated as indicative. A survey of the line in relation to the proposed structure shall be carried out at detailed design phase to confirm this position. The full report can be seen in Appendix J. Two drawings have subsequently been created to collate the relevant information to highlight the risks, see Appendix K.

3.2 Geology

The following was stated within the Ground Investigation Report GWRP1319/GIR/DEC2015:

"BGS Geological Map (Solid and Drift) for the North London area (Sheet No. 256), and Figures 3 and 4 of the Camden Geological, Hydrogeological and Hydrological Study, revealed that the site was underlain by the London Clay Formation.

London Clay Formation
The London Clay Formation comprises stiff grey fissured clay, weathering to brown near surface. Concretions of argillaceous limestone in nodular form (Claystones) occur throughout the formation. Crystals of Gypsum (Selenite) are often found within the weathered part of the London Clay Formation, and precautions against sulphate attack to concrete are sometimes required. The lowest part of the formation is a sandy bed with black rounded gravel and occasional layers of sandstone and is known as the Basement Bed.

A BGS borehole ~60m north of the site, drilled to 11.12m bgl, revealed ~0.50m of Made Ground to overlie firm to stiff brown, becoming grey with depth, silty clays. Claystone bands and selenite crystals were noted at depth."

Refer to the Ground Investigation report GWRP1319/GIR/DEC2015 (Appendix B) and the Hydrogeological and Land Stability Assessment (Appendix A) for further details.

3.3 Hydrogeology

The property is located on the London Clay Formation. London Clay is classified as 'unproductive strata'. The Camden Aquifer designation map (Figure 8 of the GSD) confirms the property is located on unproductive strata.

The site lies within the outer source protection zone of Barrow Hill Pumping Station. The Barrow Hill Pumping Station is located 939 m to the east of the site.

Refer to the Ground Investigation report GWRP1319/GIR/DEC2015 (Appendix B) and the Hydrogeological and Land Stability Assessment (Appendix A) for further details.

3.4 Hydrology, Drainage and Flood Risk

There are no discernible geomorphological features in the vicinity of the site. There are no open watercourses within at least 100 m of the site.

The site is not within the catchment of the Hampstead Heath Pond Chain, which is 1800m to the north of the site.

The historic use of the site was an access road. As such, the surfacing of the site is an impermeable tarmacadam road construction. A site walk over survey showed that the garages, now demolished, had rainwater pipes which discharged below ground level. A Thames Water combined foul and surface sewer which passes through the site serves the surrounding area. The sewer is proposed to be re-routed as shown in Appendix L.

The proposed surface area will be primarily impermeable, with a small permeable area in the garden to the rear of the building. The proposed scheme will not increase the percentage of impermeable surface on the site. The surface water will be drained using rainwater pipes and sewer runs which connect into the existing combined Thames Water sewer. The surface water in the lightwell will be drained using gullies and run into a storage tank designed for a 1:100 year storm, which will then be pumped into a demarcation manhole and then into the existing combined sewer. The storage tank will be designed for 24hr storage capacity and fitted with an alarm to prevent mechanical breakdown of the pump causing flooding. The lightwell will also be constructed with an upstand to prevent surface water from ground level draining into the lightwell.

The Environment Agency's Interaction Floor Map for Planning states that the site is in flood zone 1, an area with a low probability of river and sea flooding. They state that a flood risk assessment for a development less than 1 hectare, such as the proposed scheme, does not need to be carried out if the site is not affected by other sources of flooding. The Hydrogeological and Land Stability Assessment (Appendix A) states that a GroundSure report carried out for the site did not identify any flooding issues within 250m of the site. The only flood risk would be from failed infrastructure near the sight.

4. SCREENING

A screening process has been undertaken and the findings are described below.

4.1 Hydrogeology and Groundwater Flooding

The below table is an extract from the Hydrogeology and Land Stability report (ref: 150607) produced for the site by Maund Geo-Consulting in August 2015.

QUESTION	RESPONSE	DETAILS
1a. Is the site located directly above an aquifer?	No	The site is located in the London Clay, a non-aquifer. The London Clay extends to a depth of 84.2 m at a borehole at Swiss Cottage 300 m north (BGS ref. TQ28SE1769) and 87 m at a borehole at Waverley Place 500 m to the south (BGS ref. TQ28SE 1566).
1b. Will the proposed basement extend beneath the water table surface?	Yes	The borehole drilled on 1 /7/2015 at the site indicated that no groundwater was encountered to a depth of 12.50 m bgl. Borehole TQ28SE1769 at Swiss Cottage indicated a rest water level of 90m bgl. Subsequent monitoring from a well installed to 5.40 m bgl indicated water at 0.49 m to 1.63 m bgl. This was considered to represent perched water level as it was not consistent with regional groundwater records, however any design of the basement will allow for groundwater to surface level.
2. Is the site within 100mof a watercourse, well (used / disused) or potential spring line?	None	There are no known wells or spring-lines within 100 m of the site[b,c.]
3. Is the site within the catchment of the pond chains on Hampstead Heath?	No	The site is not within the catchment of the ponds[b]
4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	No	The existing area has pavement cover and buildings. The proposed development will have a building over the entire site.
5. As part of site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?	No	The London Clay is relatively impermeable and is unlikely to be suitable for soakaway or SUDS drainage.

QUESTION	RESPONSE	DETAILS
6. Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath) or spring line?	No	There are no recorded local ponds or spring lines within 250 m of the site
a. Camden Geological, Hydrogeological, and Hydrological Study, Arup, 2010. (Fig. 8) *b. Camden Geological, Hydrogeological, and Hydrological Study, Arup, 2010. (Fig. 11)* *c. Camden Geological, Hydrogeological, and Hydrological Study, Arup, 2010. (Fig. 14)*		

Table 1 – Responses to Hydrogeology and Groundwater Flooding questionnaire – Extract from Maund Geo-Consulting Hydrogeology and Land Stability Report

4.2 Slope Stability

The below table is an extract from the Hydrogeology and Land Stability report produced for the site by Maund Geo-Consulting in August 2015.

QUESTION	RESPONSE	DETAILS
1. Does the existing site include slopes, natural or man-made greater than 7 degrees (approximately 1 in 8)?	No	The site is on level ground at approximately 52.0m AOD.
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.	N/A
3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately 1 in 8)?	No.	N/A
4. Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately1 in 8)?	No.	N/A
5. Is the London Clay the shallowest strata at the site?	No.	London Clay is overlain by 0.5m of made ground and/or approximately 1.5m of head deposits (possibly made ground).
6. Will any trees be felled as part of the development and/or are any works proposed within any	No.	A tree survey was carried out for the site in 2013 which showed two Ash and one Beech tree on/near the north-east corner of the site. These

QUESTION	RESPONSE	DETAILS
tree protection zones where trees are to be retained?		were removed at some point between November 2015 and June 2017 (based on Google street view imaging of the site). ***Response amended by Ridge and Partners to reflect current site conditions.
7. Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?`	No records.	The London Clay is susceptible to seasonal shrink/swell movements and it is likely that these will occur, which is normal. The BGS define the risk of shrink/swell as 'moderate'. There is no evidence or records of subsidence in the vicinity of the site. The foundations will be below the influence of shrink/swell from seasonal fluctuations.
8. Is the site within 100m of a watercourse or a potential spring line?	No.[a, b]	None.
9. Is the site within an area of previously worked ground?	No.	Borehole and trial pit records for the site show made ground extends to 1.5m bgl. It is assumed this relates to a sub base for the access road and foundations associated with the garages present on the site and potentially earlier houses which were present on the site from before 1871 to when they were demolished between 1953 and 1960. There is no historical evidence of any working of the ground.
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.[a, b]	None.
11. Is the site within 50m of the Hampstead Heath Ponds?	No.	None
12. Is the site within 5m of a highway or pedestrian right of way?	Yes.	The site is immediately adjacent to St John's Wood Park road at a distance of approximately 4 m. Impact assessment will be carried out including the monitoring of movements before, during and after construction.
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes.	New foundations will be significantly deeper than those of neighbouring properties which do not have basements. This risk will be mitigated by outline design shown in the basement construction method statement.

QUESTION	RESPONSE	DETAILS
14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No.	The site is reported as more than the 3 m exclusion zone from the London Underground tunnel from the data obtained from LUL in the utilities search. Tunnels will be surveyed prior to detailed design phase to confirm accurate location of running tunnels.
a. Camden Geological, Hydrogeological, and Hydrological Study, Arup, 2010. (Fig. 8). b. Camden Geological, Hydrogeological, and Hydrological Study, Arup, 2010. (Fig. 11). c. Camden Geological, Hydrogeological, and Hydrological Study, Arup, 2010. (Fig. 14). d. Groundsure Report July 2015		

Table 2 – Responses to Slope Stability questionnaire – Extract from Maund Geo-Consulting Hydrogeology and Land Stability Report

4.3 Surface Water and Flooding

QUESTION	RESPONSE	DETAILS
1. Is the site within the catchment of the ponds chains on Hampstead Heath?	No	The site lies outside of the catchment areas denoted in the Camden Geological, Hydrogeological and Hydrological Study (Arup, 2010). See Figure 4.
2. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No	The surface water that flows from the proposed development will be routed the same way as before; water is and will be collected from hard surfaced areas and enter the existing drainage system.
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No	Prior to their demolition, the site was occupied by a row of garages and hard-surfaced areas. The area of hard-standing will not increase with the proposed scheme.
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 site will remain fully occupied by buildings and hard-surfaced areas so the inflows will remain unchanged.
5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	Collected surface water will be from building roofs and paving, as before. The quality of the water received downstream will therefore not change.

QUESTION	RESPONSE	DETAILS
6. Is the site in an area identified to have surface water flood risk according to either the Local Flood Risk Management Strategy or the Strategic Flood Risk Assessment or is it at risk from flooding, for example because the proposed basement is below the static water level of nearby surface water feature.	At risk of flooding from infrastructure failure only	See Table 4 for discussion of potential sources of flooding. Based on Table 4 a flood risk assessment is shown to be unnecessary as the risk of flooding is no greater than that associated to all subterranean structures. Flooding from infrastructure will be investigated further at detailed design stage.

Table 3 – Responses to Surface Water and Flooding questionnaire

POTENTIAL SOURCE	POTENTIAL FLOOD RISK AT SITE?	JUSTIFICATION
Fluvial Flooding	No	EA Flood Mapping shows Flood Zone 1 (See Appendix C). Distance from nearest surface watercourse >1km.
Tidal Flooding	No	Site location in 'inland' and topography >50m AOD.
Flooding from rising / high groundwater	No	Site is located on low permeability London Clay.
Surface water (pluvial) flooding	No	The development is not on the list of streets that flooded in 1975 and/or 2002, see Figure 5.
Flooding from infrastructure failure	Yes	Drainage at / near the site could potentially become blocked or ruptured. Drainage of the basement areas may rely on pumping.
Flooding from reservoirs, canals and other artificial sources	No	There are no reservoirs, canals or other artificial sources in the vicinity of the site that could give rise to a flood risk.

Table 4 – Potential Sources of Flooding

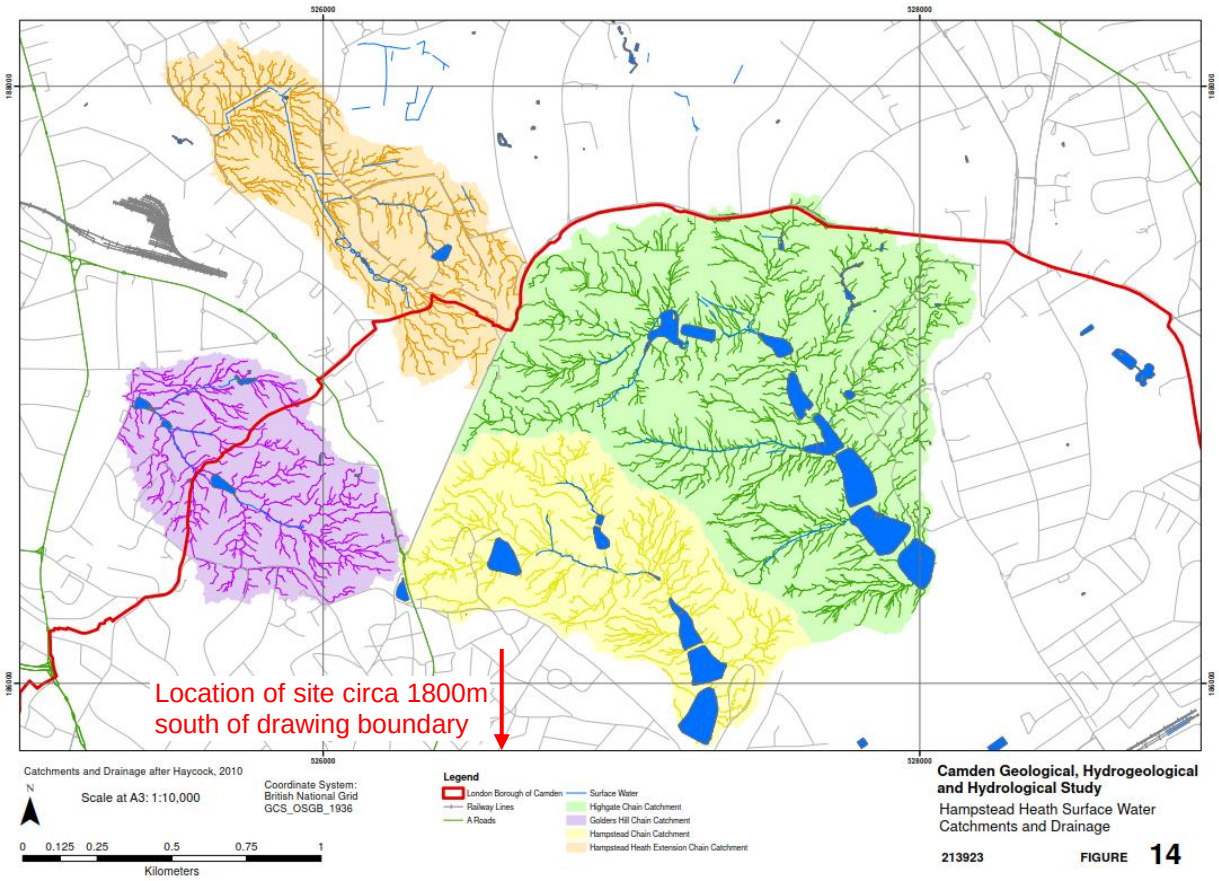

Figure 4 – Marked-up extract from the Camden Geological, Hydrogeological and Hydrological Study (Arup, 2010)

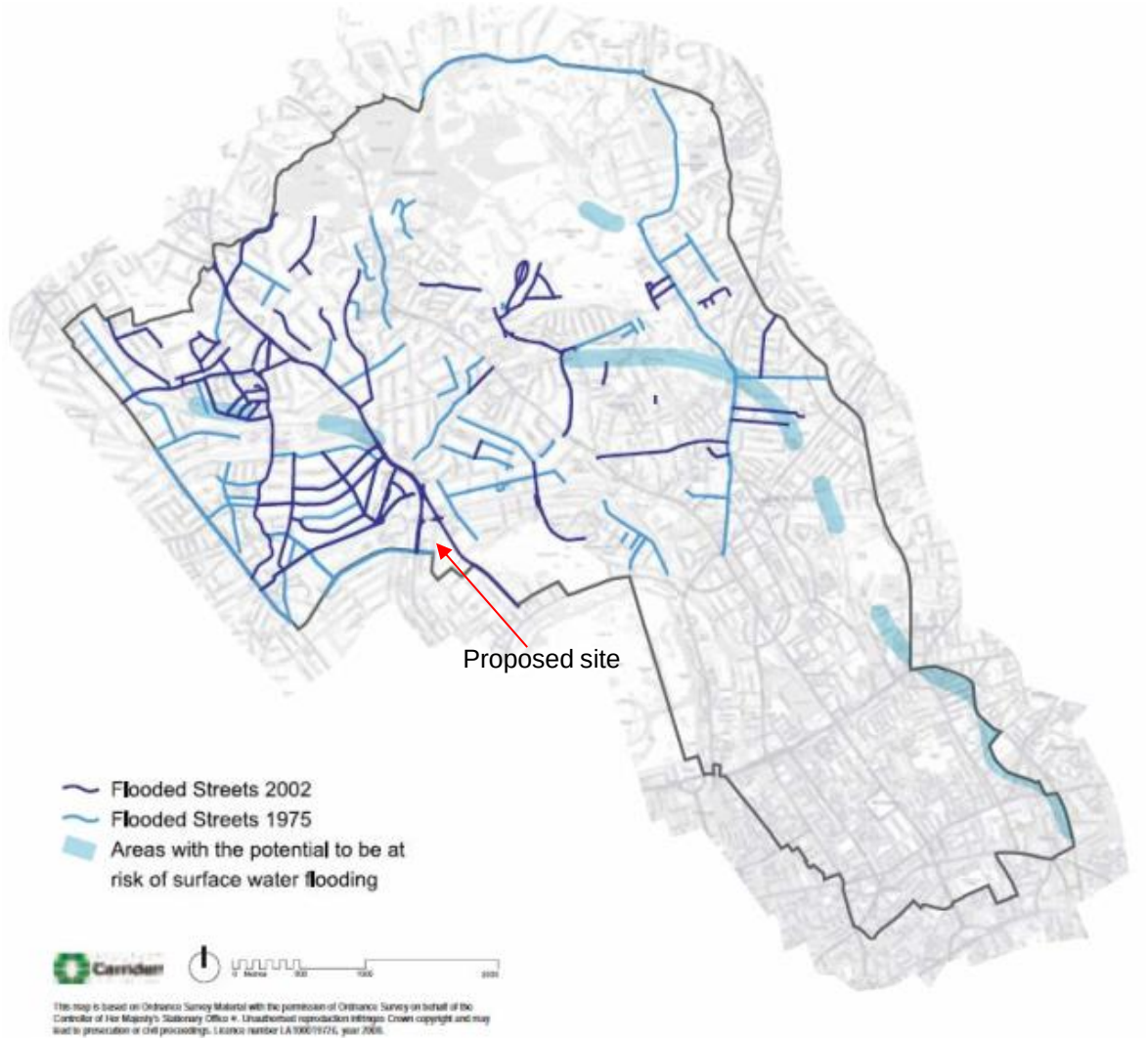

Figure 5 – Marked-up extract from the Camden Geological, Hydrogeological and Hydrological Study (Arup, 2010)

4.4 Non-Technical Summary of Screening Process

1.1.1. The screening process identifies the following issues to be carried forward to scoping for further assessment:

- The proposed basement formation level is below groundwater level
- Seasonal shrink-swell of the ground
- The proposed site is within 5m of a highway / pedestrian right of way
- The proposed basement significantly increases the differential depth of foundations relative to neighbouring properties
- The proposed site is close to the Jubilee line, although shown to be outside the easement zone based on the information provided by LUL.
- The location of other services in the vicinity.
- The site is at risk of flooding from infrastructure failure (not at significant risk from any other flooding)

5. SCOPING

The following issues have been brought forward from the Screening process for further assessment:

5.1 Proposed Basement Formation Level Below Groundwater Level

A perched groundwater level was found to be at a depth of approximately 0.5m bgl. The underlying strata is London Clay which is a non-aquifer. Therefore, the proposed basement will not impact groundwater flow.

The design of the basement structure will be analysed to allow for a groundwater table to surface level.

The perched groundwater level will be mitigated by pumping during construction and by waterproofing for long term mitigation.

5.2 Seasonal Shrink-Swell of the Ground

Seasonal Shrink-Swell of the ground may cause settlement or heave of the structure.

The depth of the basement is considered below the seasonal shrink-swell depth, therefore shrink/swell will not affect the development.

Assessment of heave and mitigation by suitable basement slab construction with void former to mitigate a potential heave of 31mm.

5.3 The Proposed Site is within 5m of a Highway / Pedestrian Right of Way

The stability of the adjacent highway is at risk of disturbance from the construction of the proposed basement due to ground movement.

To mitigate the risk of damage to the site it is proposed that the road is monitored before, during and after construction. An Approval in Principal (AIP) application will be submitted to the Camden Council (Asset Owner) during the detailed design stage.

5.4 The Proposed Basement is Significantly Deeper than Foundations of Neighbouring Properties

The proposed development will increase the differential foundation depth with neighbours. Construction and excavation activities will cause ground movements that have the potential to damage existing, neighbouring structures.

It is considered that the development proposals can be suitably designed to maintain stability. In order to demonstrate this, a site specific ground investigation is presented in Section 6, with structural information and a ground movement assessment presented in Section 7. Conclusions of the impact assessment are provided in Section 8.

5.5 The Proposed Site is Close to the Jubilee Line

The information provided by LUL shows that the proposed basement does not encroach upon the required 3m easement around the tunnel. A full survey will be conducted during the detailed design stage to accurately confirm the position of these tunnels in relation to the site, as per instruction from LUL.

5.6 The Location of Other Services in the Vicinity.

The utilities search carried out highlighted several other services in the area which have been compiled in 2 drawings to show how these relate to the proposed site.

A full survey will be carried out using GPR and other methods as advised by the asset owners to determine the accurate location of these services in relation to the site in the detailed design stage.

5.7 The Site is at Risk of Flooding from Infrastructure Failure

Infrastructure failure was the only source of flooding risk applicable to the site. The utilities search highlighted combined sewer runs and water mains in the vicinity of the site. These will be subject to further investigation in the detailed design stage.

6. SITE INVESTIGATION / ADDITIONAL ASSESSMENTS

6.1 Site Investigation

A Ground Investigation report was issued for the proposed site by Ground & Water in December 2015. The report, GWPR1319/GIR/DEC2015, can be seen in Appendix B for reference.

It should be noted that whilst the superstructure design has changed since the issue of this document the basement has remained relatively similar. As such the results of the site investigation will remain applicable to the current proposal.

6.2 Additional Assessments

A Hydrogeology and Land Stability report was issued for the proposed by Maund Geo-Consulting in December 2015. The report can be seen in Appendix A for reference.

A site walk over survey was also carried out which confirmed that there are no surface water features near the site. The site is covered with hard surfacing, and the existing garages which ran along the north elevation of the site have been demolished. Rain water collected on the site appears to flow to the south east of the site, towards St Johns Wood Park, due to the site gradients. It is believed the water is then drained through road gullies into the existing sewer network.

An SUDS Strategy has been completed for the site, see Appendix M.

A utility search of the area has been carried out to highlight the services running in the vicinity, see Appendix J.

7. CONSTRUCTION METHODOLOGY / ENGINEERING STATEMENTS

7.1 Outline Geotechnical Design Parameters

The following outline, reasonably conservative geotechnical parameters have been determined, based on the site investigation data presented Appendix B and relevant technical guidance (as referenced in Section 2.2).

Atterberg Limit Tests Results Summary

Stratum/Trial Hole/Depth (m bgl)	Moisture Content (%)	Passing 425 µm sieve (%)	Modified PI (%)	Soil Class	Consistency Index (Ic)	Volume Change Potential	
						BRE	NHBC
London Clay Formation BH1/1.00	33	99	60.39	CV	0.88 (Stiff)	Very High	High
London Clay Formation BH1/3.00	29	100	53.00	CV	0.45 (Soft)	High	High
London Clay Formation BH1/5.50	25	100	42.00	CH	0.79 (Stiff)	High	High
London Clay Formation BH1/10.00	25	100	50.00	CV	0.46 (Soft)	High	High

Liquidity Index Calculations Summary

Stratum/Trial Hole/Depth	Moisture Content (%)	Plastic Limit (%)	Modified Plasticity Index (%)	Liquidity Index	Result
London Clay Formation BH1/1.00m bgl (Brown and grey silty CLAY with rare fine gravel and traces of fine rootlets)	33	25	60.39	0.13	Heavily Overconsolidated
London Clay Formation BH1/3.00m bgl (Brown, grey and occasional orange brown silty CLAY with traces of selenite crystals)	29	23	53.00	0.11	Heavily Overconsolidated
London Clay Formation BH1/5.50m bgl (Brown silty CLAY with traces of selenite crystals)	25	25	42.00	0.00	Heavily Overconsolidated
London Clay Formation BH1/10.00m bgl (Brown silty CLAY with traces of selenite crystals)	25	27	50.00	-0.04	**Potential Moisture Deficit**

Moisture Content vs. Liquid Limit

Strata/Trial Hole/Depth/Soil Description	Moisture Content (MC) (%)	Liquid Limit (LL) (%)	40% Liquid Limit (LL)	Result
London Clay Formation BH1/1.00m bgl (Brown and grey silty CLAY with rare fine gravel and traces of fine rootlets)	33	86	34.4	**MC < 0.4 x LL (Potential Significant Moisture Deficit)**
London Clay Formation BH1/3.00m bgl (Brown, grey and occasional orange brown silty CLAY with traces of selenite crystals)	29	76	30.4	**MC < 0.4 x LL (Potential Significant Moisture Deficit)**
London Clay Formation BH1/5.50m bgl (Brown silty CLAY with traces of selenite crystals)	25	67	26.8	**MC < 0.4 x LL (Potential Significant Moisture Deficit)**
London Clay Formation BH1/10.00m bgl (Brown silty CLAY with traces of selenite crystals)	25	77	30.8	**MC < 0.4 x LL (Potential Significant Moisture Deficit)**

Summary of Undrained Triaxial Compression Testing Results

Borehole/ Depth (m bgl)	Moisture Content (%)	Bulk Density (Mg/m^3)	Dry Density (Mg/m^3)	Mode of Failure	Shear Strength (kPa)	Classification
London Clay Formation BH1 at 4.00-4.45m (Brown and blue grey mottled CLAY)	30	2.01	1.55	Brittle	110	High

Figure 6 - Tabular extracts from Ground Investigation Report

7.2 Outline Temporary and Permanent Works Proposals

The works proposals include:

- Foundations
- Retaining walls
- Temporary works (including dewatering, propping etc)
- Permanent structure

An initial method statement can be seen in Appendix I.

The drainage strategy can be seen in Appendix M.

7.3 Ground Movement and Damage Impact Assessment

A Ground Movement Assessment (GMA) has been carried out in accordance with CIRIA C760 and takes into account the construction methodology and site-specific ground and groundwater conditions.

All structures / properties within the zone of influence have been assessed, and foundation depths have been confirmed as 13.25m below ground level.

The following reasonably conservative assumptions have been made within the GMA:

- The design assumes that the piled wall acts as a propped cantilever beams and the deflections, and associated ground movements, have been calculated based on this assumption.

The ground movements resulting from the works are movements due to installation of the retaining wall and excavation.

The following structures were assessed, having been identified as potentially within that zone of influence:

- The analysis has shown that No 1 St Johns Wood Park will experience Damage Category 2 'Slight' on the Burland Scale if the piles are propped at the top.
    - It is noted that this damage category is not permitted by Policy A5 Basements and as such it is proposed to install a secondary row of propping at mid-height of the total excavation depth to decrease the deflection of the wall, and subsequently the surface ground movements, to bring the strain within the acceptable limits.
- All other buildings were analysed to be within Damage Category 1 'Very Slight' which is acceptable according to Policy A5 Basements.

Residual impacts of Damage Category 1 according to the Burland Scale are 'Fine cracks that can easily be treated during normal decoration. Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection'.

Other measures will also be implemented to control the ground movement, which can be seen in Section 7.4.

7.4 Control of Construction Works

The construction works will be closely controlled in accordance with the Party Wall Act. Method Statements, suitable to satisfy the requirements of the Party Wall Act, will be kept up-to-date throughout the design and construction phases to manage the works. An initial Method Statement can be seen in Appendix I. Condition surveys will also be carried out before and after the works.

The construction works will be controlled as follows:

- By appointing a contractor with proven experience in the construction of basement structures
- The basement shall be designed by a suitably qualified consultant; Ridge and Partners has extensive experience in the design of subterranean structure
- Provide Method Statements to the Contractor to follow
- Design the structure from the information provided within the Ground Investigation and Hydrogeology & Land Stability reports.
- Carry out condition surveys before and after the construction phase
- Monitor ground movements before, during and after the construction phase, see Appendix H

Ground movement during the installation of the piles and the excavation of the basement will be controlled as follows:

- By appointing a contractor with proven experience in the construction of basement structures who will conduct the works with good execution. Props are to be installed tight to the wall and will not rely on friction/adhesion between the prop end and the waling to hold it in place.
- The wall is to be designed to have sufficient embedment in competent strata to maintain stability.
- The first-stage excavation depth will be minimised, and the support propping installed as early as possible.
- Digs will be minimised beyond the proposed support levels.
- Delays to the construction of the wall and support systems to be minimised.
- Unplanned over-excavation will be avoided.
- The removal of fines during dewatering will be minimised.
- Drawdown outside excavation will be minimised.

A structural monitoring strategy has been developed to control construction works and maintain movements/damage impacts within the predicted limits. The structural monitoring strategy includes the following:

- A structural monitoring layout plan of instrumentation/survey points/critical sections;
- Programme/frequency of monitoring;
- Trigger values derived for each of the structures within the zone of influence;
- Contingency actions

See Appendix H for further details.

8. BASEMENT IMPACT ASSESSMENT

8.1 Introduction

The Conceptual Site Model (CSM) is described below and is presented in Figure 7.

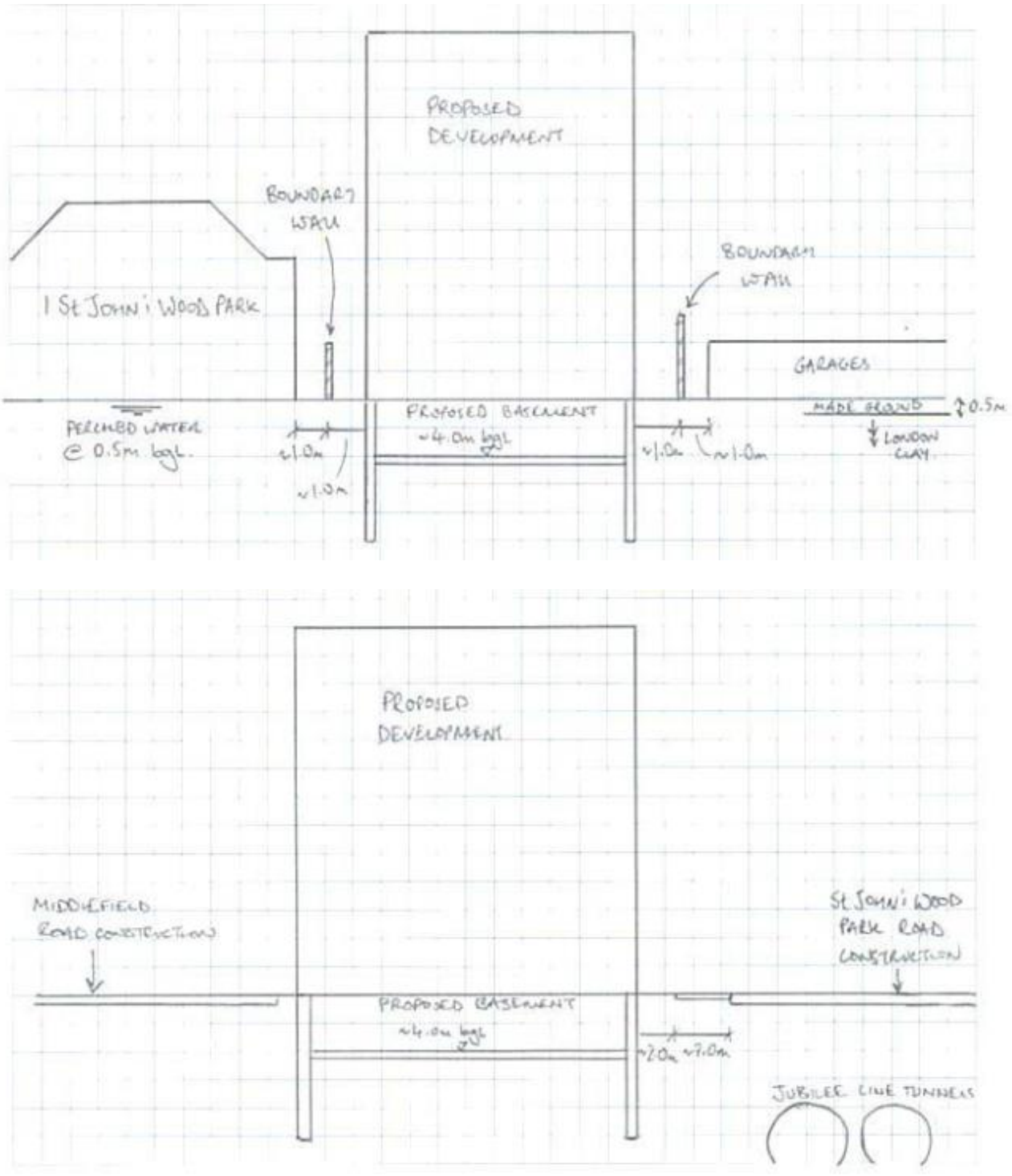

Figure 7 – Conceptual Site Model (CSM)

- The proven ground conditions are approximately 0.5m of made ground underlaid by London Clay formation.
- A borehole carried out in the site did not encounter the water tables, thus suggesting the groundwater level was below 12.5m (the depth of the borehole). However, a later monitored well dug to a depth of 5.8m showed that the water table was at a level approximately 0.5m bgl. This was believed to be a perched water table, but the design has conservatively allowed for a groundwater table at surface level for the permanent case (during construction groundwater pumping is to be implemented).
- The site has a slight fall from the north-west to the south-east.
- The proposed structure is to be constructed upon land historically used as an access road and a row of garages. The structure below is therefore tarmacadam road construction and hardstanding slab below the now demolished garages.
- The proposed development will be a piled scheme with basement level approximately 4.0m below ground level. The piles supporting the columns will be bored to a depth of 26m bgl.
- The depths of neighbouring foundations/basements are assumed to be significantly higher, except for No5 Boydell Court which is assumed to also be piled due to the height of the block. Based on the construction of the other properties it is likely they have strip footings. Further investigation into the foundations of the adjacent properties will be undertaken in the detailed design phase.
- The distance to the highway is approximately 5m, with the footpath approximately 2m from the extent of the basement piled walls.
- Adjacent tunnels/utilities are shown in Appendix J and are compiled onto two drawings in Appendix K. The most significant to the development are the Jubilee Line which passes approximately 5m from the site boundary, and Thames Water combined sewers, one of which passes under the site and will be re-routed.

8.2 Land Stability / Slope Stability

Refer to the Hydrogeology and Land Stability report in Appendix A.

8.3 Hydrogeology and Groundwater Flooding

Refer to the Hydrogeology and Land Stability report in Appendix A.

8.4 Hydrology, Surface Water Flooding and Sewer Flooding

The BIA has concluded that the site is at no significant risk of flooding, except from the failure of infrastructure, which is an inherent risk with the construction of any subterranean structure.

To mitigate the risk of flooding on the site the following measures are proposed:

- The surface water in the lightwell will be drained using gullies and run into a storage tank designed for a 1:100 year storm, which will then be pumped into a demarcation manhole and then into the existing combined sewer. The storage tank will be designed for 24hr storage capacity and fitted with an alarm to prevent mechanical breakdown of the pump causing flooding.
- The lightwell will also be constructed with an upstand to prevent surface water from ground level draining into the lightwell.

- The foul water for the basement will also be drained into a storage tank designed for 24hr storage capacity and fitted with a non-return valve and an alarm to prevent mechanical breakdown of the pump causing flooding from the backed-up drainage.

The percentage of hardstanding area on the site will not be increased by the proposed scheme. A SUDS Strategy has also been created, whereas the original site relied on the falls on site to drain the surface water to the road gullies on St John's Wood Park, improving the drainage of the site. Flooding from surface water is therefore not considered to be a significant risk.

The BIA has concluded the proposed basement scheme has no impacts on the wider hydrological environment.

9. REFERENCES

Arup. (2010). *Camden Geological, Hydrogeological and Hydrological Study .*

Bomb Sight. (2018, October 02). *Bomb Sight Map*. Retrieved from http://bombsight.org/#17/51.54063/-0.17357

APPENDIX A – HYDROGEOLOGY AND LAND STABILITY REPORT

APPENDIX B – GROUND INVESTIGATION REPORT

APPENDIX C – EA FLOOD MAP FOR PLANNING REPORT

APPENDIX D – EXISTING SURVEY DRAWINGS

APPENDIX E – PROPOSED DEVELOPMENT DRAWINGS

APPENDIX F – STRUCTURAL ENGINEER'S STATEMENT AND CALCULATIONS

APPENDIX G – GROUND MOVEMENT AND DAMAGE IMPACT ASSESSMENT

APPENDIX H – GROUND MOVEMENT MONITORING

APPENDIX I – CONSTRUCTION METHOD STATEMENT

APPENDIX J – UTILITY AND INFRASTRUCTURE CONSULTATIONS

APPENDIX K – UTILITY SEARCH COLLATED DRAWINGS

APPENDIX L – THAMES WATER SEWER PROPOSED DIVERSION

APPENDIX M – DRAINAGE STRATEGY