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WEST END LANE
BASEMENT IMPACT ASSESSMENT
AG HOMES
June 2020

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Prepared for

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VERSION CONTROL

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-	23.06.2020	Initial Issue	Matt Linney Engineer MEng GMICE	Mathew Christie-Newman Associate BSc(Hons) CEng MIStructE	Robbie Bushfield Senior Engineer BEng(Hons)
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CONTENTS

1. NON-TECHNICAL SUMMARY

Ridge and Partners LLP (Ridge) has been commissioned by AG Homes to carry out a desk study and ground investigation at the land adjacent to West End Lane, London, NW6 4QJ. 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.

1.1. Site Location

The site location is the land adjacent to West End Lane, West Hampstead, London, NW6 4QJ.

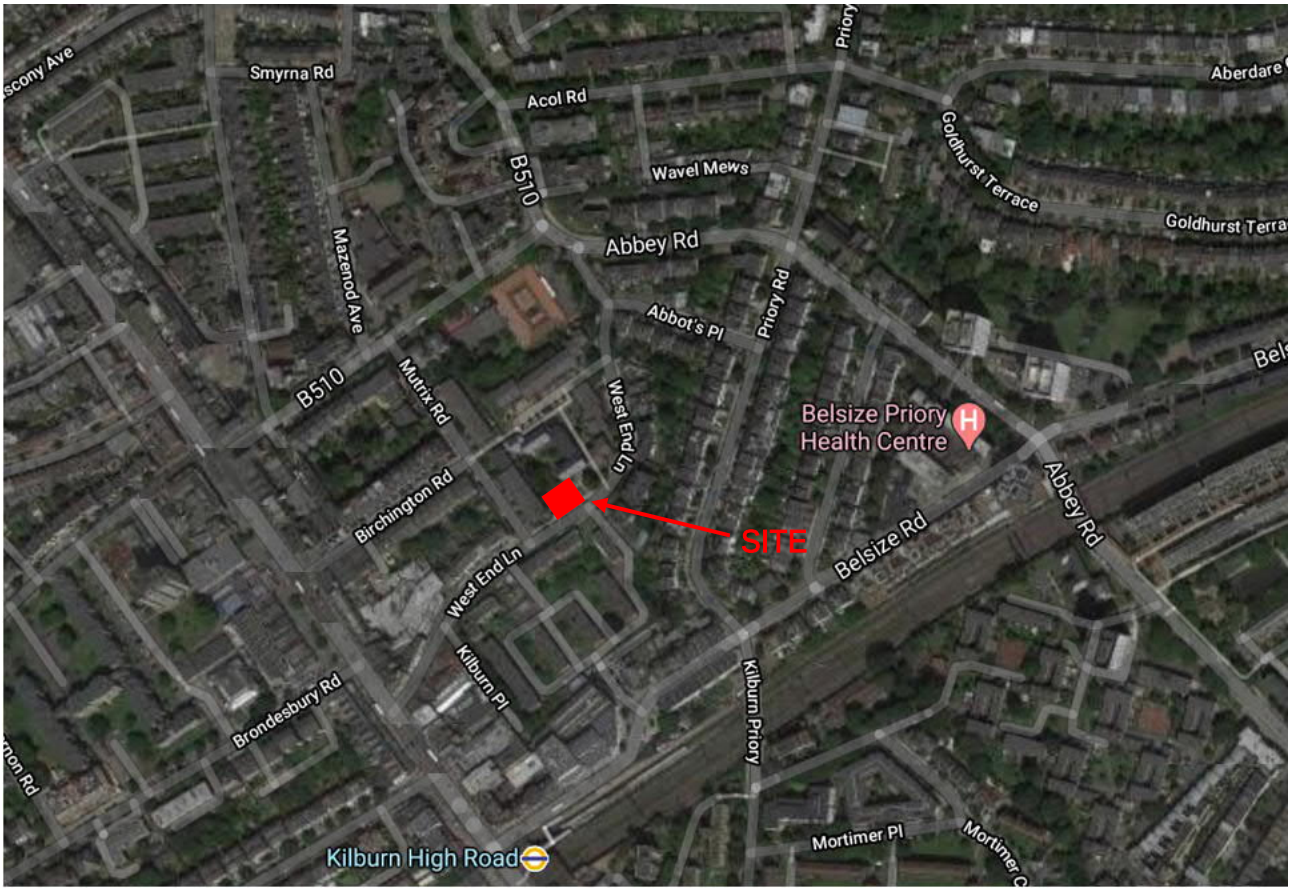


Figure 1 – Aerial view with approx. site indicatively shown.

1.2. Existing Site

The site is currently occupied by a vacant open area of concrete hardstanding car park with a row of 8 single-storey, lock up garages along the South East boundary.

The site boundary is marked on 3 sides by masonry brick boundary walls, up to 2.0 metre in height. Beyond the boundary walls, the site is bordered on all sides by existing residential properties, open air car park hardstanding and a road.

To the South West of the site there is a terraced row of 3 storey townhouses which run along Mutrix Road. To the North East of the site there is a large 3 storey multiple occupancy residential flat building known as Sycamore Court. To the East of the site there is a flat open area of car park hardstanding. To the South East of the site there is a 2-way traffic tarmac surfaced road known as West End Lane.

1.3. Proposed Development

To make way for the proposed development, the existing garages and the concrete hardstanding slab are to be demolished.

The proposed development comprises the construction of a new 3-storey block of residential dwellings with a single storey basement. The development will provide 8 individual flats comprising:

- 3No. 1 bed flats
- 3No. 2 bed flats
- 2No. 3 bed flats

The proposed superstructure is to be traditional loadbearing masonry with a reinforced concrete basement structure. Foundations generally are to be supported on continuous flight auger (CFA) type reinforced concrete piles and the basement retaining walls are to be constructed as embedded piled walls.

Figure 2 - Existing Site Footprint

Figure 3 - Proposed Site Footprint

Figure 4 - Proposed Front Elevation

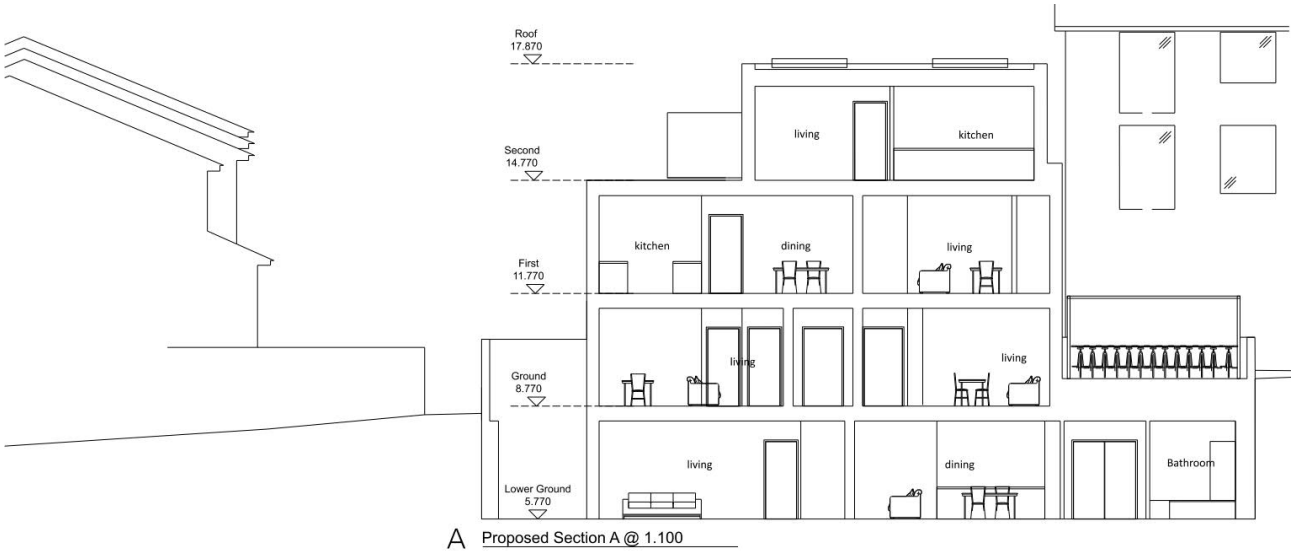


Figure 5 - Proposed Section with Basement

1.4. Assessments

The following assessments are presented:

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

1.5. Authors

This report has been written by Matthew Linney MEng GMICE (4 years' experience) and peer reviewed by Mathew Christie-Newman BSc(Hons) CEng MIStructE (12 years' experience)

1.6. Ground and Groundwater Conditions

Published BGS information indicates that the site is underlain by the London Clay with no superficial deposits present. Made ground of varying thickness has been recorded overlying the London Clay in nearby boreholes. The six-inch geological mapping for this part of London indicates that the site is within an area of pits, 2-3m deep, excavated within the London Clay [original geological mapping dated 1889; last revised 1980].

A site investigation report was prepared for the site by Soil Consultants Ltd in August 2017 [Ref 10120/MR/CB], see Appendix 2, which confirmed the sequence in the BGS logs. The following soil conditions were encountered:

Made Ground

The existing concrete slab varied in thickness between 150mm to 600mm and was noted to be reinforced within the garages. The underlying made ground extended to a maximum depth of 2.20m in the borehole. The made ground generally comprised silty sandy gravelly clay / clayey sandy gravel with variable amounts of flint, brick, concrete, ash, clinker, slate, chalk and glass.

London Clay

The London Clay was encountered only in the borehole. It comprised brown and orange brown fissured silty clay becoming dark grey at around 10.30mbgl. Laboratory / onsite testing indicate the London Clay to be of medium becoming high strength with depth. The testing showed the London Clay to be of Very High plasticity and High-Volume Change Potential [NHBC Standards]. No rootlets were observed within the London Clay at the borehole position.

Ground Water

Groundwater was not encountered in any of the exploratory holes during the investigation. Subsequent monitoring recorded water levels at 2.55m, rising to 0.58m on 10th August 2017. Ground-water levels vary seasonally and with prevailing weather conditions.

1.7. Construction Methods

The construction methods proposed for the single storey basement are as follows:

- Install piling mat.
- Place a piled wall around the perimeter of the new basement.
- Construct a concrete capping beam at ground level on top of the piles around the perimeter of the basement to tie the heads of the individual piles together.
- Excavate soil within the piled perimeter, installing temporary propping to restrain the capping beams to the perimeter piled retaining walls and the underpinning pits.
- Construct reinforced concrete inner walls around the building perimeter, within the contiguous piled wall.
- Continue with the construction of the basement structure. Construct the basement slab connected to the contiguous piled perimeter walls with stainless steel dowels.
- Waterproof the internal space with two types of waterproofing to comply with NHBC Chapter 5.4 for habitable spaces. Expected to include specialist waterproof membrane with a drained cavity wall.
- Proceed with the construction of the above ground structure. Construction of the ground floor slab which will be tied to the concrete capping beam at the head of the piles to provide a permanent restraint to the piles.
- Temporary props can then be removed once the ground floor is cast.

1.8. Structural Monitoring Strategy

A structural monitoring strategy has been created to control the works and the impacts they will have on neighbouring structures. This strategy comprises the following:

- Immediately prior to the start of the construction works, a visual inspection will be carried out by party wall surveyors of all neighbouring properties. Based on the findings of the survey a full condition survey report shall be produced.
- During the works vertical and lateral movement monitoring will be undertaken by theodolite at specific times during the projects. Written protocols using a colour-coded system will determine necessary actions based on the readings.
- Also, during the works, visual inspections will be carried out at specific times during the project to note any visible distress in the neighbouring properties that can be actioned in a timely manner.
- Following the completion of the construction works a further visual inspection will be carried out by party wall surveyors to compare the condition of the neighbouring properties, post-completion, to the prior condition.

1.9. Basement Impact Assessment (BIA)

This report has assessed the various impacts of the proposed subterranean development on the surrounding area, presenting suitable mitigation measures where appropriate.

These observations are summarised, as follows:

The BIA has identified the following potential slope stability impacts:

- London Clay is the shallowest strata
- History of Seasonal Shrink-Swell Subsidence in Local Area
- Site Located within 100m of Watercourse
- Site Located within an Area of Previously Worked Ground
- Site Located within 5m of Highway / Pedestrian Right of Way
- Basement Significantly Increases Differential Depth of Foundations Relative to Neighbouring Properties

The following mitigation measures are proposed:

- Proposed development to be constructed on piled foundations & heave protection to basement slab
- Ground movement monitoring to ensure no unacceptable movements to existing structures.
- Groundwater from watercourse unlikely to affect slope stability (slope <4 degrees)
- Foundations and basement slab constructed within London Clay strata to avoid made ground.
- Adequate planning design and movement monitoring, with competent contractor to limit damage to surrounding structures / assets

The residual impacts to slope stability are:

- None.

The BIA has identified the following potential hydrological / hydrogeological impacts:

- Proposed Basement Formation Level Below Groundwater Level
- Site Located within 100m of Watercourse
- Proposed Basement Formation Level Below Water Level of Local Watercourse

The following mitigation measures are proposed:

- Basement to be constructed with two forms of waterproofing, compliant with NHBC Standards

The residual impacts on the wider hydrological environment are:

- The BIA has concluded there will be minimal impacts to the wider hydrogeological environment. The proposed basement may alter the groundwater flow regime of the perched groundwater in the made ground. However, due to the size of the proposed basement (low water displacement) and the seasonal nature of this perched groundwater, it is anticipated that any effects on the surrounding existing structures will be minimal.

The BIA has identified the following flood risks for the proposed development:

- Fluvial / Tidal flooding – negligible risk
- Groundwater flooding – not anticipated
- Flooding from artificial water bodies – no significant sources identified in immediate vicinity
- Flooding from infrastructure failure – low risk (residual risk with any construction)
- Sewer flooding – high risk based on historic flooding
- Surface water flooding – very low risk (although located in Critical Drainage Area)

The proposed mitigation measures are:

- The basement will be constructed with two forms of waterproofing in compliance with NHBC requirements
- Surface water drainage to be constructed within lightwell areas.

The residual flood risk is:

- The BIA has concluded there are no impacts to the wider hydrological environment.

2. INTRODUCTION

The purpose of this assessment is to consider the effects of a proposed basement as part of the development at 27a West End Lane, West Hampstead, London NW6 4QJ on the local hydrology, geology and hydrogeology and potential impacts to neighbours and the wider environment.

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

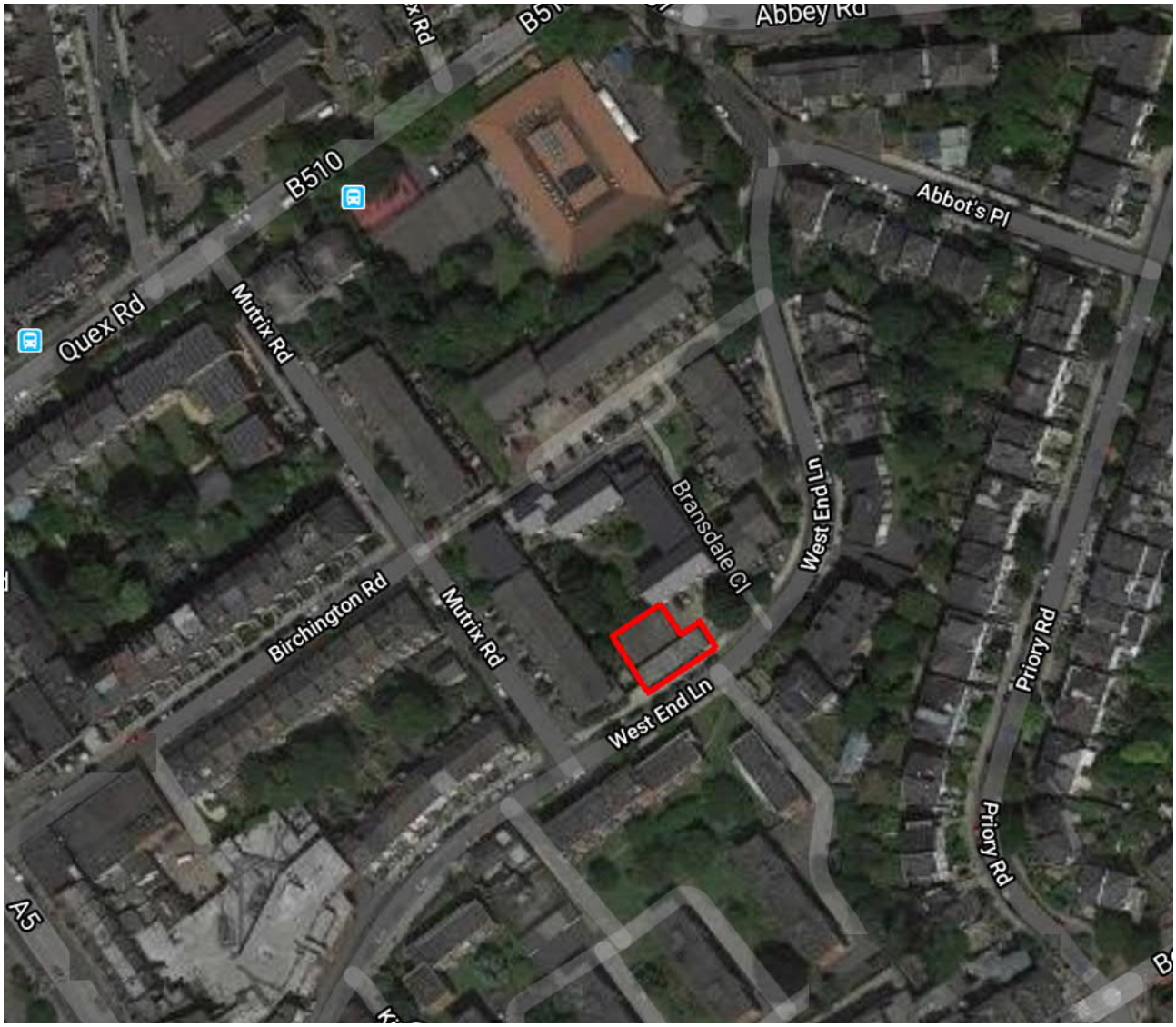


Figure 6 – Aerial view with approx. site area indicatively shown.

2.1. Authors

This report has been written by Matthew Linney MEng GMICE (4 years' experience) and peer reviewed by Mathew Christie-Newman BSc(Hons) CEng MIStructE (12 years' experience)

Land Stability & Hydrological Assessment Author – Rob Leland BEng MSc CEng MICE
Hydrogeological Assessment Author – Richard Holloway – BSc(Hons) MSc FGS CEnv MCIWEM C.WEM

2.2. Sources of Information

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

- Site walkover (14/03/2019)
- Current/historical mapping;
- Geological mapping (see Appendix 2);
- Hydrogeological data (see Appendix 2);
- Current/historical hydrological data (see Appendix 2);
- Flood risk mapping (see Appendix 5);
- 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;
- Other relevant technical references pertinent to the proposed development, construction methods, etc

2.3. Existing and Proposed Development

The Application site is located at the land adjacent to the junction at West End Lane and Bransdale Close, Hampstead, London NW6 4QJ. Slope angles are slight (0 - 7°), see grid reference 525500,183800 on Figure 7. The site is 38m above sea level.

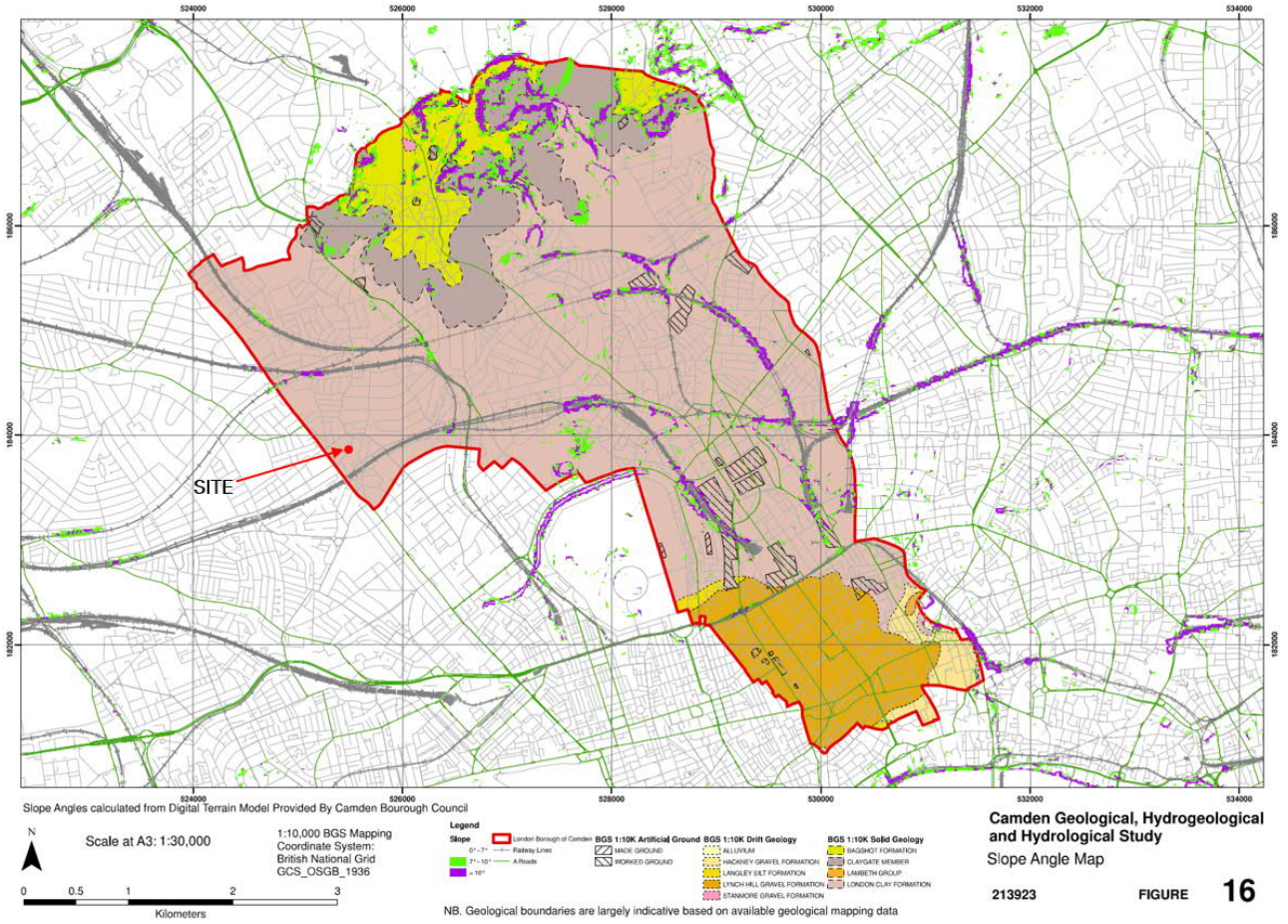


Figure 7 - Site Location on the Camden GHHS Slope Angle Map

The current site (adjacent to West End Lane) comprises a single storey block of 8 garages on the south side of the site. The garages are constructed from loadbearing masonry with a flat roof, reinforced concrete floor slab and assumed mass concrete strip footings. The North end of the site is comprised of a hard paved parking / driveway for access into the garages. The site is enclosed by boundary walls to the north and the west constructed from double skin masonry founded upon strip footings.

The existing garage block appeared to be in an adequate condition with no signs of deterioration or distress observed. The concrete paved area was noted to have cracked in some areas due to ground movement and depression in the slab could be seen in front of the garages where the level of the paved area was lower than the reinforced concrete slab of the garages. The boundary wall of the site was noted to be in poor condition with cracking and leaning of the panels (a timber A-frame has been erected behind the wall to maintain stability) observed.

Surrounding the proposed site are terraced houses to the west (accessed from Mutrix Road), and a 3-storey block of flats, Sycamore Court, to the north-east (accessed from Bransdale Close), both estimated to have been constructed circa 1970s. The terraced houses appear to be constructed from traditional loadbearing masonry with an assumed timber trussed pitched roof. Sycamore Court appears to be of a non-traditional loadbearing masonry construction with exposed concrete slabs at each level and a pitched roof, also assumed to be formed of timber trusses.

Due to the age and construction of these dwellings it is not believed that any of the structures would have been constructed with a basement. A search on the Camden Planning Portal also suggests that no planning permission has been granted for the surrounding properties for the construction of a basement.

As part of an onsite investigation a trial pit was carried out to determine the construction of the footings of Sycamore Court. The results from the trial pit were inconclusive due to the location of the site hoarding. A further trial pit was proposed and has been agreed in principle by Camden (who owns the land) but works were stopped due to COVID-19. It will therefore be conservatively assumed in this report that the foundations are strip footings, until proven otherwise.

A visual survey was undertaken by William Springthorpe MEng MSc GMICE (Ridge), which showed that the external fabric of the terraced houses along Mutrix Road and Sycamore Court were in an adequate condition with no visible signs of distress in the main structure. The visual inspection was limited to the externals of these properties as internal access had not been granted. The survey did, however, note that several garden / boundary walls were suffering damage. Some of the walls had full height cracks, some up to 30/40mm in width, and some were learning out of alignment and were being propped by timber A-frames that had been erected. The damage to these walls appears to have been caused by ground movement.

A site inspection report for Sycamore Court was generated based on the findings of the site walk over. A condition survey was also undertaken in 2018 by a party wall surveyor on Flats 9 and 21 in Sycamore Court and 2 Mutrix Road for the previous scheme proposed on this land.

There are no known listed buildings neighbouring the site.

The private gardens of the terraced houses along Mutrix Road flank the west of the site, separately by a walkway serving as access to the gardens, and the boundary wall on the proposed site. Some of these private gardens have trees within their boundaries. These trees will be protected in accordance with A5 Basements (Local Plan 2017).

The communal gardens belonging to Sycamore Court are immediately behind the wall along the northern boundary of the site. The gardens in Sycamore Court have several mature trees which will be protected during construction in accordance with A5 Basements (Local Plan).

Adjacent infrastructure includes West End Lane directly south, and London Overground tracks 180m south, including the platforms of Kilburn High Road Station. Data from TFL's Property Asset Register shows there are no known tunnels within close vicinity of the site.

Underground infrastructure present close to the site includes a combined public sewer [1143 x 762mm] and a distribution main [180mm diameter] running east to west under West End Lane. From Groundsure's investigation, an Electricity Transmission Cable has been found running North to South directly under the A5 170m West of the site. No high-pressure gas transmission pipelines were found within 500m of the site. All infrastructure is sufficient distance from the application site such that the proposed structure will have no impact on these assets.

Existing and Proposed development drawings are presented in Appendix 1.

The proposed development will demolish the existing block of garages and the paved car park area to facilitate the construction of a block of residential units, approximately 15m x 15m in area comprising a lower ground floor (basement) and 3 storeys of residential units. The superstructure will be constructed from loadbearing masonry. The substructure will be embedded piled walls with an in-situ reinforced concrete construction to the basement and ground floors, with appropriate waterproofing specification.

The outline construction programme for the proposed development is as follows:

- Install piling mat.
- Place a contiguous piled wall around the perimeter of the new basement.
- Construct a concrete capping beam at ground level on top of the piles around the perimeter of the basement to tie the heads of the individual piles together.
- Excavate soil within the piled perimeter, installing temporary propping to restrain the capping beams to the perimeter piled retaining walls and the underpinning pits.
- Construct reinforced concrete inner walls around the building perimeter, within the contiguous piled wall.
- Continue with the construction of the basement structure. Construct the basement slab connected to the contiguous piled perimeter walls with stainless steel dowels.
- Waterproof the internal space with two types of waterproofing to comply with NHBC Chapter 5.4 for habitable spaces. Expected to include specialist waterproof membrane with a drained cavity wall.
- Proceed with the construction of the above ground structure. Construction of the ground floor slab which will be tied to the concrete capping beam at the head of the piles to provide a permanent restraint to the piles.
- Temporary props can then be removed once the ground floor is cast.
- Loadbearing superstructure will then be built off the capping beam / ground floor slab.

3. DESK STUDY

3.1. Site History

The land at 27a West End Lane remained rural fields up until 1896, after which residential dwelling were founded on the site. This consisted of detached households with individual gardens. As London urbanised through the 20th century, the portion of paved areas around the site increased. By 1974, the original dwelling had been replaced by the terrace housed, the block of flats and the garages currently residing at the site. From the Groundsure investigation, there is no known industrial use at the site, with no tanks, energy features, infilled land or petrol stations recorded. Given the age and nature of the low-rise residential buildings surrounding the site, it is not expected that many basements or underground structures are present.

The Aggregate Night-time Bomb Census was reviewed using the online Bomb Sight Map. Several high explosive bombs were recorded to have been dropped in the areas around the site between 7th October 1940 to 6th June 1941. However, none is recorded to have fallen within the site boundary, with the closest recorded high-explosive bomb falling 200m away from the site on Belsize Road. Excavation is to proceed with caution regardless.

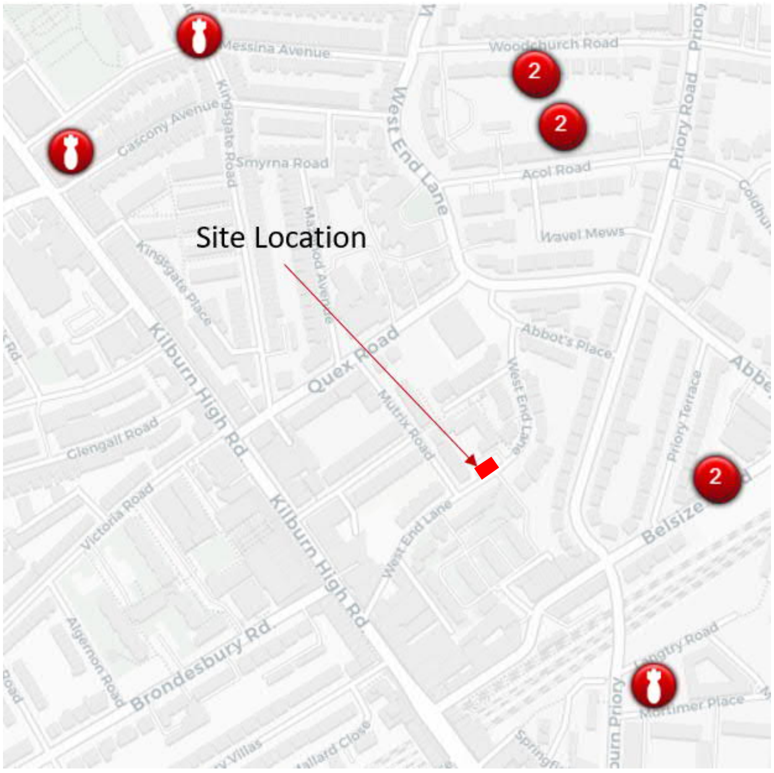


Figure 8 - Aggregate Night-time Bomb Census search of area surrounding the proposed site

A utilities search was carried out by GroundSure to determine whether any tunnels etc ran through or near to the site. No tunnels were found within 500m of the site, with the nearest rail infrastructure being the London Overground, circa 170 m south of the site.

3.2. Geology

Published BGS information indicates that the site is underlain by the London Clay with no superficial deposits present. Made ground of varying thickness has been recorded overlying the London Clay in nearby boreholes. The six-inch geological mapping for this part of London indicates that the site is within an area of pits, 2-3m deep, excavated within the London Clay [original geological mapping dated 1889; last revised 1980].

A site investigation report was prepared for the site by Soil Consultants Ltd in August 2017 [Ref 10120/MR/CB], see Appendix 2. The following soil conditions were encountered in the 15m deep borehole and the 1.6m deep trial pits carried out during the investigation works:

3.2.1. Made Ground

The existing concrete slab varied in thickness between 150mm to 600mm and was noted to be reinforced within the garages. The underlying made ground extended to a maximum depth of 2.20m in the borehole, confirming the . The made ground was heterogenous but generally comprised dark brown to grey silty sandy gravelly clay to clayey sandy gravel with variable amounts of flint, brick, concrete, ash, clinker, slate, chalk and glass. Live and decaying roots were observed to depth of between 0.60m and 1.30m in TP1 to TP4 inclusive with some evidence of partial desiccation in TP1 and TP2. It is likely that this made ground is a result of the historical excavations.

3.2.2. London Clay

The London Clay was encountered only in the borehole. It comprised brown and orange brown fissured silty clay becoming dark grey at around 10.30mbgl. The clay contained occasional partings of silt, rare manganese staining and occasional selenite crystals above 10.30mbgl. Below this, rare partings of silt were noted along with rare shell fragments. Laboratory triaxial testing and SPTs indicate the London Clay to be of medium becoming high strength with depth. The plasticity index testing has shown the London Clay to be of Very High plasticity [BS5930] and High-Volume Change Potential [NHBC Standards]. No rootlets were observed within the London Clay at the borehole position.

3.2.3. Ground Water

Groundwater was not encountered in any of the exploratory holes during the investigation. Subsequent monitoring of the standpipes recorded water levels at 2.55m, rising to 0.58m on 10th August 2017. This was attribute this to gradual inflow of water from the made ground. Ground-water levels can of course vary seasonally and with prevailing weather conditions. It was therefore recommended that continued monitoring is undertaken prior to design and construction to ascertain water levels in relation to the development / construction works.

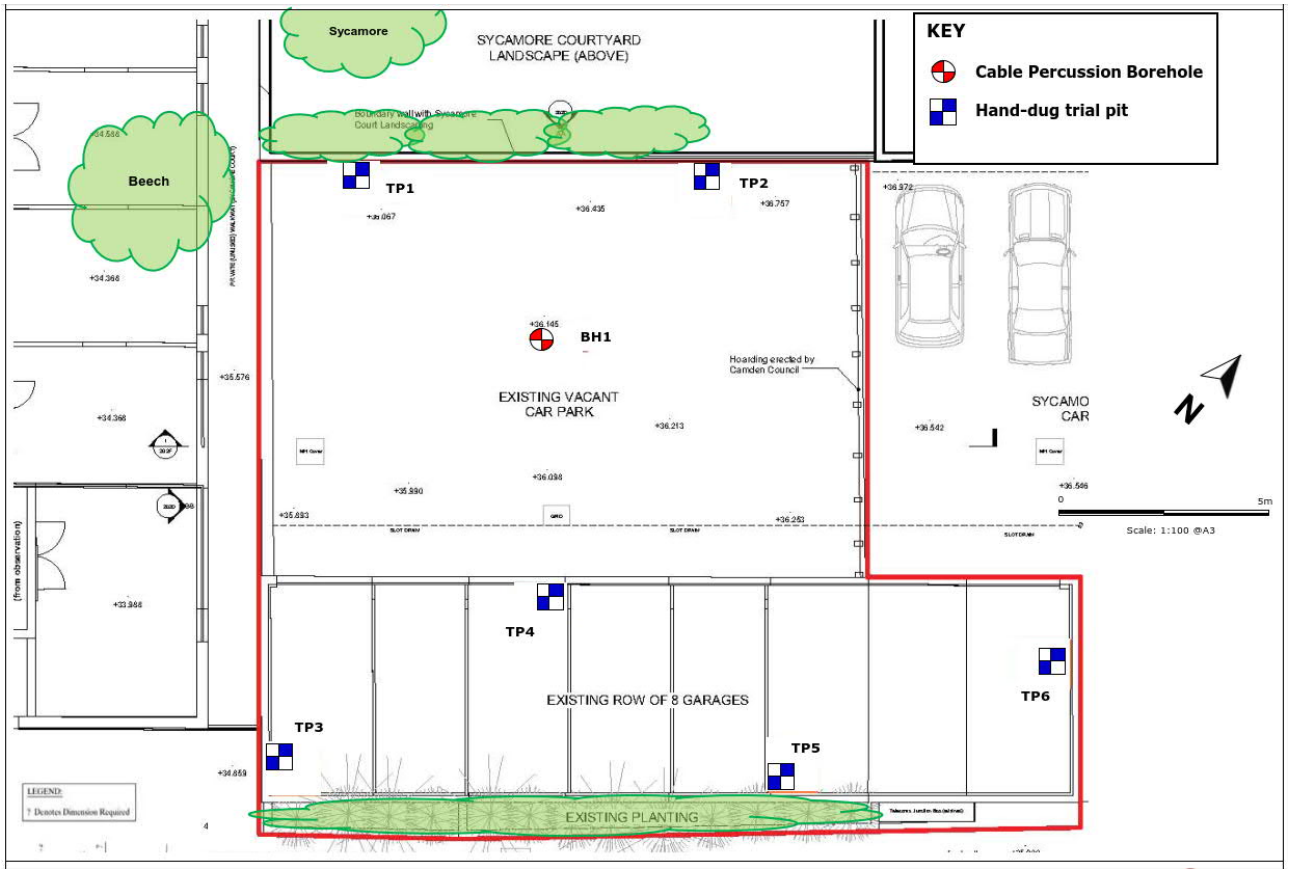


Figure 9 – Location of Borehole taken within the site boundary

Please refer to the Borehole Logs included within Appendix 2 for a more detailed description.

3.3. Hydrogeology

The following observations are taken from the British Geological Survey (BGS) Geology of Britain Viewer (2019). The Geology of Britain Viewer indicates that the site is underlain by the London Clay Formation with no superficial deposits present.

A borehole undertaken during the site investigation in 2017 by Soil Consultants Ltd described the London Clay as follows:
"The London Clay comprised brown and orange brown fissured silty clay becoming dark grey at around 10.30mbgl. The clay contained occasional partings of silt, rare manganese staining and occasional selenite crystals above 10.30mbgl. Below this, rare partings of silt were noted along with rare shell fragments. Laboratory triaxial testing and SPTs indicate the London Clay to be of medium becoming high strength with depth. The plasticity index testing has shown the London Clay to be of Very High plasticity [BS5930] and High Volume Change Potential [NHBC Standards]. No rootlets were observed within the London Clay at the borehole position." Further information can be seen in Appendix 2.

The Environment Agency's online mapping suggests the underlying soils are classified as "Unproductive".

The GroundSure report also confirmed that there are no source protection zones within 500m of the site.

3.4. Hydrology, Drainage and Flood Risk

Figure 12 of Arup's Camden Geological, Hydrogeological and Hydrological Study (GHHS) shows that the site is not located within the proximity of any surface water features. However, Figure 11 of Arup's GHHS shows that a watercourse is located approximately 30m from the site. This watercourse was not observed during the site walkover and is therefore believed to be subterranean. No further information is known about this watercourse and is not featured on British Geological Survey (BGS) maps. Should this watercourse cause water levels to rise or flood, then this may cause water ingress to the proposed basement. It is proposed that this would be mitigated by the installation of an appropriately specified waterproofing system.

BGS maps do not indicate that the site is in close proximity to any historic watercourses.

The site is not within the catchment of the Hampstead Heath Pond Chain, which is 3.6km to the North East.

The site surface area is currently 100% impermeable, constructed from concrete hardstanding and the garage construction. The proposed scheme will therefore see no increase in this area. The existing site is assumed to be connected to the existing combined public sewerage network operated by Thames Water.

The site is classified as low risk and is within a Local Flood Risk Zone 1.

The site is on the edge of a critical drainage area as shown on Camden's Surface Water Management Plan, due to sewer capacity issues. However, it should be noted that the local typography would likely allow flood water to flow past the site in a south westerly direction rather than ponding within the site.

3.5. Other Information

The site investigation identified elevated levels of lead within samples of made ground in conjunction with pockets of demolition rubble and ash, which are anticipated to be the likely source.

In addition, both Chrysotile and Amosite asbestos was located on the site as microscopic cement fragments.

The site investigation document has identified low oxygen levels in gas standpipes, recommending a Characteristic Situation 2 and therefore requiring the proposed construction to include some enhancement against ground gas.

There is no expected archaeological potential to be encountered on the site.

4. SCREENING

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

4.1. Hydrogeology and Groundwater Flooding

QUESTION	RESPONSE	DETAILS
1a. Is the site located directly above an aquifer?	No	Site is underlain by London Clay which has a Bedrock Aquifer Designation of 'Unproductive'
1b. Will the proposed basement extend beneath the water table surface?	No	The site is located within London Clays, a known unproductive stratum. Furthermore, groundwater was not encountered during detailed investigations dated July 2017. Subsequent standpipe monitoring visits confirmed water levels at 2.55 m, rising to 0.58 m in August 2017, which was attributed to gradual inflow of perched water within the made ground. Continued monitoring has been recommended and appropriate waterproofing construction will be adopted within the proposed basement.
2. Is the site within 100m of a watercourse, well (used / disused) or potential spring line?	Yes	British Geological Survey (BGS) maps do not note / indicate any watercourses within 100m of site. However, Figure 11 of Arup's GHHS shows a watercourse, supposedly subterranean, approximately 30m from the site.
3. Is the site within the catchment of the pond chains on Hampstead Heath?	No	No, catchment area shown in Figure 14 of Arup's GHHS – site not shown.
4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	No	No, existing site comprises an area of hard standing and garages. No increase in area from proposed construction.
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 impermeable nature of the underlying soils precludes the use of infiltration-based techniques.
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	Watercourse identified in Figure 11 of Arup's GHHS appears to be subterranean (not visible during site walk over). No details are known about this watercourse, however it is highly likely that if still functional, its depth would be greater than the proposed basement formation.

Table 1 – Hydrogeology and Groundwater Flooding Screening

4.2. Slope Stability

QUESTION	RESPONSE	DETAILS
1. Does the existing site include slopes, natural or man-made greater than 7 degrees (approximately 1 in 8)?	No	Site Investigation 10120/MR/CB confirms "slight fall from north east to south west" of approximately 1m across the 15m wide site. Therefore, fall of 4 degrees.
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	The majority of the application site will be part of the building and therefore installed level. Nominal areas of external works will generally maintain existing topography.
3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately 1 in 8)?	No	There are no significant changes in levels from adjacent land, none exceeding 7 degrees.
4. Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately 1 in 8)?	No	Site not within wider hillside setting
5. Is the London Clay the shallowest strata at the site?	Yes	Site Investigation 10120/MR/CB confirms London Clay is shallowest strata, overlaid by up to 2.2m of made ground.
6. Will any trees be felled as part of the development and/or are any works proposed within any tree protection zones where trees are to be retained?	No	There are no trees within the application site, however trees are present within the adjoining gardens. At this stage, these are assumed to be sufficiently far from the proposed development such as to mitigate influence however this will be confirmed by a qualified arborist in due course. Additionally, the depth of the proposed basement and distance to the nearest tree is such that any excavations and the proposed basement would be sufficiently deep to pass through any soils affected by water abstraction.
7. Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?	Yes	Site founded on London Clay with high volume change potential with several mature trees. The dwelling blocks and terraced houses adjacent to the site do not appear to be showing signs of distress from seasonal shrinkage. However, garden walls appear to be affected – with cracking up to 30mm in width and leaning out of alignment.

		The recorded damage however is commensurate with the anticipated age of the structures and likely shallow nature of existing foundations.
8. Is the site within 100m of a watercourse or a potential spring line?	Yes	British Geological Survey (BGS) maps do not note / indicate any watercourses within 100m of site. However, Figure 11 of Arup's GHHS shows a watercourse, supposedly subterranean, approximately 30m from the site.
9. Is the site within an area of previously worked ground?	Yes	There are no historical surface ground working features shown by the GroundSure databased within 250m of the site boundary. However, reference to the BGS 6'' geological mapping indicates that the site is within an area of pits, 2-3m deep, excavated within the London Clay.
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 is underlain by London Clay, confirmed to have a Bedrock Aquifer Designation of 'Unproductive'.
11. Is the site within 50m of the Hampstead Heath Ponds?	No	Site not within 50m of Hampstead Heath Ponds
12. Is the site within 5m of a highway or pedestrian right of way?	Yes	Pedestrian footpath immediately adjacent to site, with West End Lane circa 3.2m from site boundary.
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Unknown (assumed likely)	Trial pit carried out to determine foundations of existing buildings inconclusive. However, it is likely that the proposed foundations will be significantly deeper than those of neighbouring properties which do not have basements. This will be mitigated by appropriate design of the proposed basement walls and implementation of structural monitoring as outlined within this report.
14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No	Utilities Search carried out by GroundSure confirm there are no tunnels within 250m from the site. The nearest railway is the London Overground which is approximately 170m from site.

Table 2 – Slope Stability Screening

4.3. Surface Water and Flooding

QUESTION	RESPONSE	DETAILS
1. Is the site within the catchment of the ponds chains on Hampstead Heath?	No	No, catchment area shown in Figure 14 of Arup's GHHS – site not shown.
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	To satisfy planning requirements, the scheme will incorporate on-site SuDS attenuation to temporarily store surface water on-site such that the off-site flow can be restricted, demonstrating an overall betterment to the existing drainage network. This system will be appropriately designed in accordance with current requirements for the 1 in 100-year event plus a climate change allowance. Furthermore, it can be argued that the reduction in flow to the public sewer will decrease flood risk generally to the local area.
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No	The existing and proposed sites are 100 % impermeable owing to the unproductive nature of the underlying soils. The scheme does however propose the use of green roofs, which will not only provide biodiversity benefits, but also assist with retarding the time taken for surface water to enter the drainage system, as well as nominally reducing the overall surface water run-off via transpiration and evaporation.
4. Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	Yes	The proposed SuDS methods will reduce the inflow rate to the public sewer network, thus alleviating demand and reducing flood risk downstream.
5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	Yes	Surface water will be collected either by a green roof system or permeable tanked sub-base providing some filtration benefits in accordance with the SuDS Manual. The quality of run-off will therefore improve versus the current quality expected of a car parking area.
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.	Yes	The flood risk assessment submitted as part of the previous planning application outlines flood risk to the application site, which is summarised in Table 4, below. This concludes the site to be subject to be at negligible / low risk generally, however at high risk of flooding due to failure of on-site surface water drainage and public sewers.

	All new drainage infrastructure will be designed and installed to current rigorous standards and subject to an ongoing maintenance plan. Therefore the on-site risk can be safely mitigated. The overall reduction in surface water inflow to the public sewer resulting from the proposed SuDS systems will also mitigate flood risk to this site and downstream by alleviating demand to the network.

Table 3 – Surface Water and Flooding Screening

Potential Source	Pathway	Potential Linkage to Site	Justification
Fluvial/Tidal (River Thames)	Overtopping of banks and overland flow	No	The site is assessed as having a less than 1 in 1000 (<0.1%) probability of flooding from rivers and sea in any one year. Therefore the site is at a **negligible** risk of flooding from fluvial events and this source is not considered further in this report.
Groundwater (shallow)	Perched/shallow groundwater may be present	No	Groundwater is not anticipated to be shallow in the vicinity of the site.
Artificial water Bodies	Breach and overland flow	No	No significant sources identified in the immediate vicinity of the site therefore this source is not considered further within this report.
Infrastructure failure from water mains and internal water supply system	Failure of the Thames Water network and/or internal water supply and distribution system	Yes	Flood risk from this source is considered to be a residual risk with the main threat being from internal pipe work during any building works. Flooding from this source poses a **low** risk to the proposed development as a basement is not proposed however there are multiple water mains and hydrants located on Ewell Road.
Sewer flooding from Thames Water assets and private site drainage	Surcharge in site drainage and the public sewer network due to blockage or exceedance of capacity	Yes	Given records of historic flooding from this source reported in the vicinity of site the risk of sewer flooding is considered to be **high**. Sewer flooding from blockage of internal building drainage as well as the Thames Water network is also a residual risk managed by the design of the site drainage and regular inspection and maintenance of the public and private sewer network. The flood risk associated with this source may also increase over time due to the effects of climate change.
Surface water flooding as a result of extreme rainfall and runoff from overland flow	Flooding of the surrounding roads due to extreme rainfall	Yes	The site is located within Critical Drainage Area however the EA Surface Water Flood Maps show the site itself is at a **very low** risk from surface water flooding whilst part West End Lane adjacent to the property is at a **low** risk. Surface water flooding from this source is considered a residual flood risk and appropriate mitigation measures are discussed in Table 5.2

Table 4 – Potential Sources of Flooding

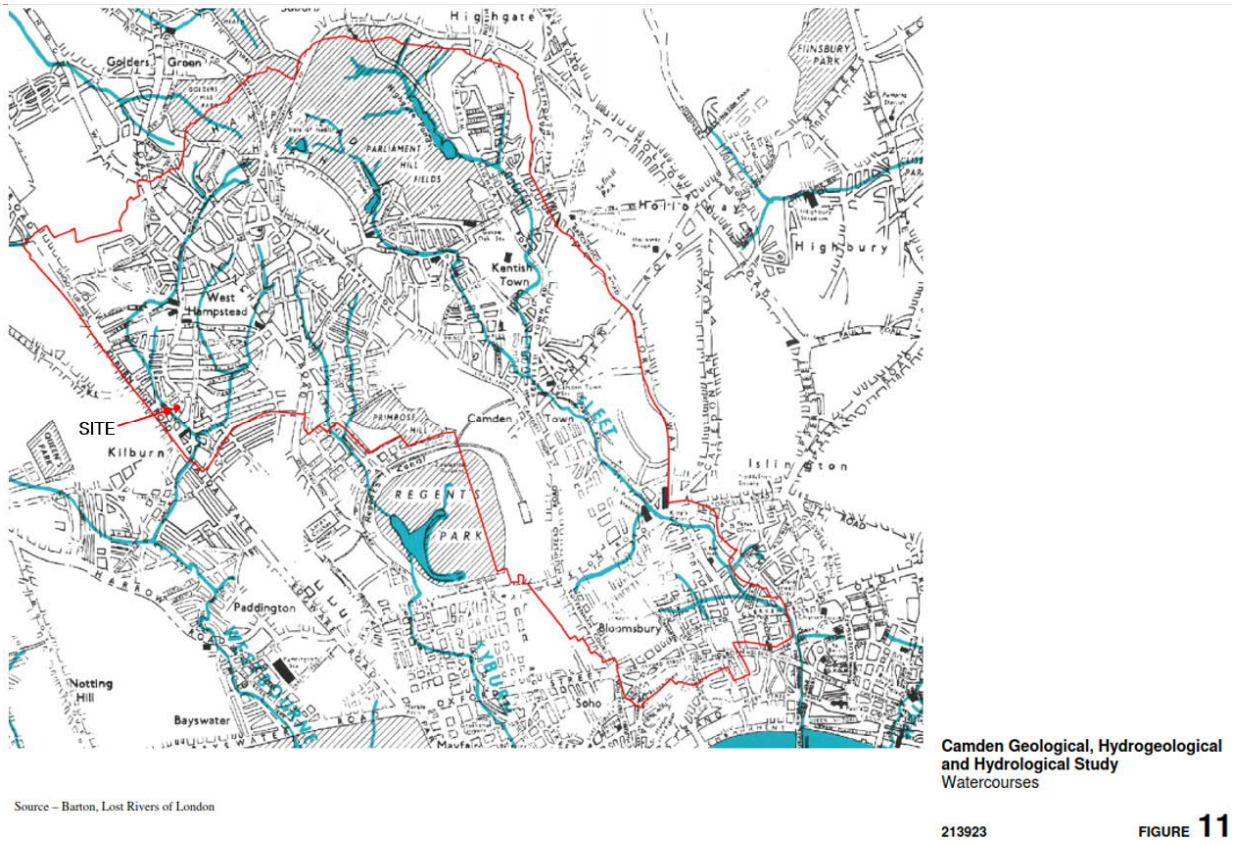


Figure 10 - Extract from the Camden Geological, Hydrogeological and Hydrological Study – Figure 11 (Arup, 2010)

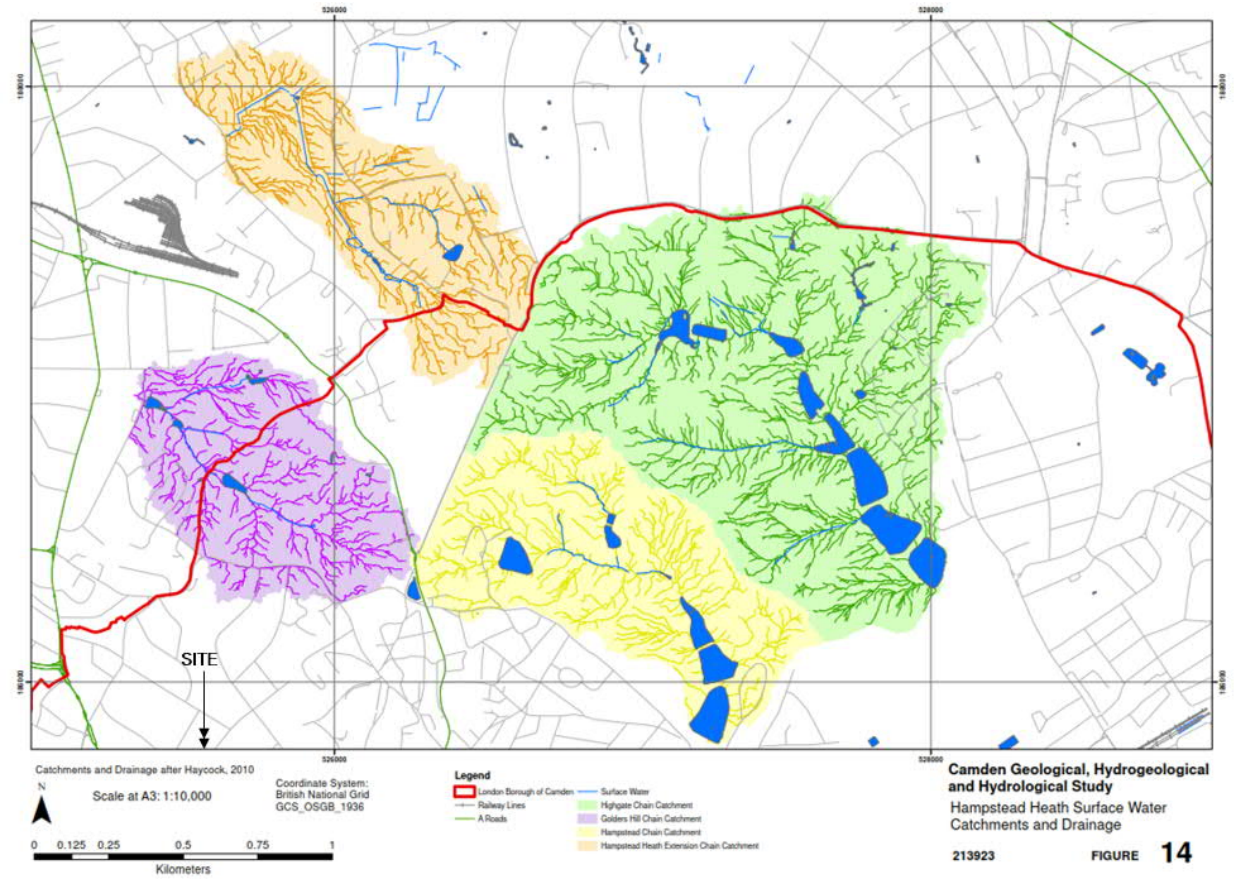


Figure 11 - Extract from the Camden Geological, Hydrogeological and Hydrological Study – Figure 14 (Arup, 2010)

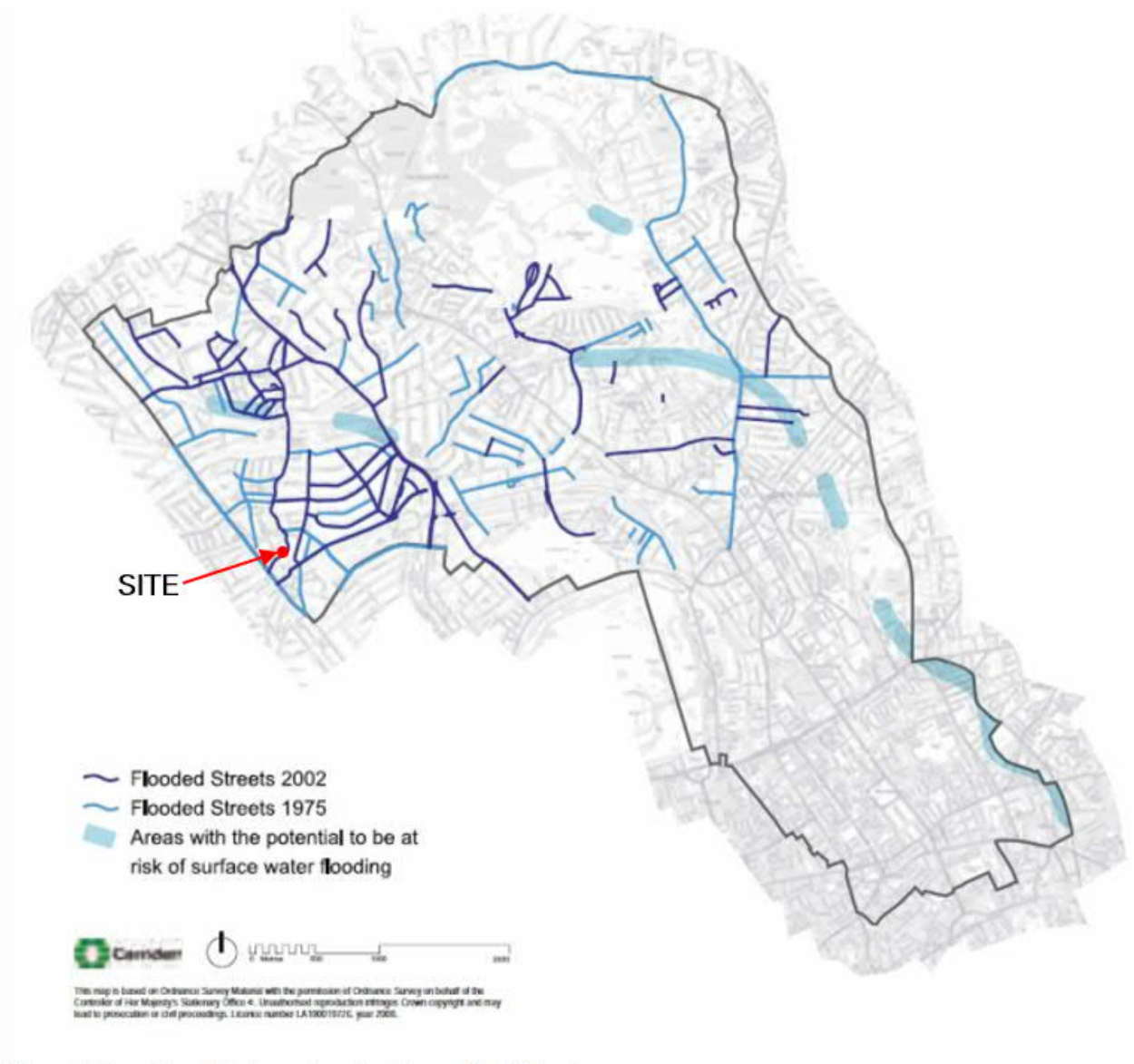


Figure 5 from Core Strategy, London Borough of Camden

Camden Geological, Hydrogeological and Hydrological Study
Flood Map

Figure 12 – Extract from the Camden Geological, Hydrogeological and Hydrological Study – Figure 15 (Arup, 2010)

4.4. Non-Technical Summary of Screening Process

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

Hydrogeology and Groundwater Flooding

- The presence of perched surface water within shallow made ground.
- Site located 30m from a subterranean watercourse.
- Lowest point of basement may be close / beneath mean water level of subterranean watercourse (details of watercourse unknown)

Slope Stability

- London Clay is the shallowest strata.
- History of seasonal shrink-swell subsidence in local area.
- Site located 30m from a subterranean watercourse.
- Site within an area of previously worked ground.
- Site within 5m of highway / pedestrian right of way.
- Basement construction may significantly increase differential depth of foundations relative to neighbouring properties.

Surface Water and Flooding

- Site is in an area identified to have flood risk from surface water and infrastructure failure.

The other potential concerns considered within the screening process have been demonstrated to be not applicable or not significant when applied to the proposed development.

5. SCOPING

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

5.1. Hydrogeology and Groundwater Flooding

Proposed Basement Formation Level Below Groundwater Level

Ground water was not encountered within any of the exploratory holes during the site investigation carried out in July 2017, nor was groundwater recorded in any of the BGS borehole records in the vicinity of the site.

However, subsequent monitoring of standpipes undertaken as a part of the site investigation in August 2017 did record water levels at 2.55m, rising to 0.58m. This was attributed to gradual inflow of water from the made ground and may be perched groundwater above the London Clay Strata, which is a known unproductive soil.

The proposed basement may therefore alter the flow regime of this perched water within the made ground, however as the site is bounded on all sides by existing wall structures, it is likely that this water infiltration would have occurred on / within and be contained within the application site itself.

The removal of the made ground as part of the proposed works will mitigate this localised risk and indeed, reduce any residual impact on surrounding structures.

Site Located within 100m of Watercourse

Little information is known as to the extent and type of the nearby subterranean watercourse, or indeed if it is still functional.

It should however be noted that the unproductive nature of the underlying London Clays is such that it would be extremely unlikely that any failure of this watercourse would impact significantly on the proposed development.

Furthermore, owing to the proposed habitable use of the basement, an active ‘2 method’ waterproofing system will be adopted and appropriately designed by an accredited specialist, thereby mitigating risk to the proposed development.

Proposed Basement Formation Level Below Water Level of Local Watercourse

As above, little information is known as to the nearby subterranean watercourse, however owing to the highly developed local area, it is unlikely that the proposed basement formation will exceed the water level.

Furthermore, it is likely that this watercourse will be culverted or piped and therefore water levels will not accurately represent the phreatic surface and therefore be shared with the application site.

Regardless of this, enhanced waterproofing measures will be adopted as above.

5.2. Slope Stability

Shallowest Strata – London Clay

Of the at-surface soil strata present in LB Camden, the London Clay is the most prone to seasonal shrink-swell (subsidence and heave).

The site investigation carried out on the site confirmed that the London Clay is of a 'High' volume change potential according to the NHBC Standards, and Very High plasticity [BS5930].

The proposed foundation and basement floor structures will incorporate void forming materials to accommodate any potential heave and/or further assessment made to determine heave pressures such that the structural elements can be designed to appropriately resist these forces.

No trees are proposed to be felled as part of the works, thus there will be no soil moisture deficit due to the proposed development. Seasonal shrink-swell rates for the site will therefore remain constant.

History of Seasonal Shrink-Swell Subsidence in Local Area

As stated above, the proposed construction will incorporate heave protection measures.

No trees are proposed to be felled as part of the works, thus there will be no soil moisture deficit due to the proposed development. Seasonal shrink-swell rates for the site will therefore remain constant.

The construction of the proposed development shall also be carefully controlled to ensure excessive ground movements do not occur during construction which may adversely affect the neighbouring properties / structures, especially those that have previously suffered subsidence damage.

Site Located within 100m of Watercourse

It is known that seasonal springlines and changes to groundwater regimes within slopes can affect slope stability.

Whilst the site is located within 100m of a watercourse, the site was found to be on a slight slope of less than 4 degrees. Slope stability is therefore unlikely to be impacted by the watercourse.

As the foregoing, it is also likely that the nearby watercourse would be within a man made culvert or piped structure and therefore unlikely to influence the stability of nearby soils.

Site Located within an Area of Previously Worked Ground

BGS 6'' geological mapping indicates that the site is within an area of pits, 2-3m deep, excavated within the London Clay. The results from the site investigation show that made ground was found to a depth of 2.2m. The made ground was heterogeneous but generally comprised dark brown to grey silty sandy gravelly clay to clayey sandy gravel with variable amounts of flint, brick, concrete, ash, clinker, slate, chalk and glass.

The design of the piled foundations will ignore the made ground when determining shaft adhesion, assuming no adhesion is generated until the pile enters the London Clay formation. The base of the piled foundation will be founded within the London Clay strata. The depth of the basement below ground level will also ensure that the concrete slab will be within the London Clay strata.

Site Located within 5m of Highway / Pedestrian Right of Way

The construction of the proposed basement may place the stability of the adjacent highway (West End Lane) or the buried services below the highway at risk of disturbance. However, with proper planning of the construction works and adequate monitoring throughout the construction phase, the effects on the adjacent highway can be controlled to be within acceptable limits as defined by Camden BC.

During the detailed design phase of the project an Approval in Principal (AIP) application will be submitted to the Camden Council (Asset Owner) detailing the proposed works.

To ensure the disturbance of these assets are controlled during construction the proposed development is to be carried out by an experienced and suitable qualified contractor. The construction works will be closely controlled in accordance with the Construction, Design & Management Regulations (CDM) 2015 to ensure safe construction methods are adopted. Condition surveys will also be carried out before and after the works, with monitoring for ground movements carried out throughout the construction phase. 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.

Basement Significantly Increases Differential Depth of Foundations Relative to Neighbouring Properties

The construction of the proposed basement may result in structural damage to neighbouring properties. However, with proper planning of the construction works and adequate monitoring throughout the construction phase, the effects on the adjacent highway can be controlled to be within acceptable limits as defined by Camden BC.

To ensure the disturbance of these assets are controlled during construction the proposed development is to be carried out by an experienced and suitable qualified contractor. The construction works will be closely controlled in accordance with the Construction, Design & Management Regulations (CDM) 2015 and the Party Wall Act to ensure safe construction methods are adopted. Condition surveys will also be carried out before and after the works, with monitoring for ground movements carried out throughout the construction phase. 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.

5.3. Surface Water and Flooding

Site in an Area Identified to have Flood Risk from Surface Water and Infrastructure Failure

The site has been noted to be within an area that is liable to flooding from surface water and infrastructure failure. See Table 4 in Section 4.3 for the scoping discussion of each of these sources.

It is however considered that on-site flood risk will be mitigated through appropriate design and construction of the new SuDS system and that flood risk from the public sewer would be mitigated by adoption of SuDS systems on the scheme, to effectively alleviating demand on the sewer and reducing flood risk within the local area and downstream.

6. SITE INVESTIGATION / ADDITIONAL ASSESSMENTS

6.1. Site Investigation

The site investigation undertaken by Soil Consultants Ltd in 2017 on the proposed site comprises several stages including:

- Desk study
- Field investigation, including intrusive investigation
- Monitoring
- Reporting
- Interpretation

The desk study stage has comprised the review and analysis of existing literature pertaining to the site (historical maps etc)

The field investigation stage has consisted of intrusive investigations within the boundary of the site including the excavation of trial pits and boreholes.

With the data from the ground investigation report, assessment can be made as to the potential impacts identified through the scoping exercise.

The site investigation, 10120/MR/CB, can be seen in Appendix 2.

6.2. Additional Assessments

Condition Survey

Condition Surveys were undertaken in 2018 by a party wall surveyor on Flats 9 and 21 in Sycamore Court and 2 Mutrix Road for the previous scheme proposed on this land.

The reports note some internal defects within the properties but the findings were largely hairline cracking, with no significant structural issue observed.

A visual site inspection carried out by William Springthorpe MEng MSc GMICE from Ridge showed that the external fabric of the terraced houses along Mutrix Road and Sycamore Court were in an adequate condition with no visible signs of distress in the main structure. The visual inspection was limited to the externals of these properties as internal access had not been granted. The inspection around did, however, note that several garden / boundary walls were suffering damage. Some of the walls had full height cracks, some up to 30/40mm in width, and some were learning out of alignment and were being propped by timber A-frames that had been erected. The damage to these walls appears to have been caused by ground movement.

Flood Risk Assessment

Given the desired development has a basement, planning policy dictates that a Flood Risk Assessment (FRA) be undertaken. An FRA was undertaken for the previous scheme on this site in October 2016. Whilst there have been alterations to the scheme, including the addition of the basement, the FRA for the site will not change and is therefore considered to remain valid.

The flood risk to site is summarised in the previous Table 4.

7. CONSTRUCTION METHODOLOGY / ENGINEERING STATEMENTS

7.1. Outline Geotechnical Design Parameters

An extract from the site investigation is produced below which shows a summary of the key Characteristic Geotechnical Parameters. The full site investigation report can be seen in Appendix 2.

Site & Location	**Garages to the south of 27A West End Lane, London NW6 4QJ**	Report No:	**10120/MR**

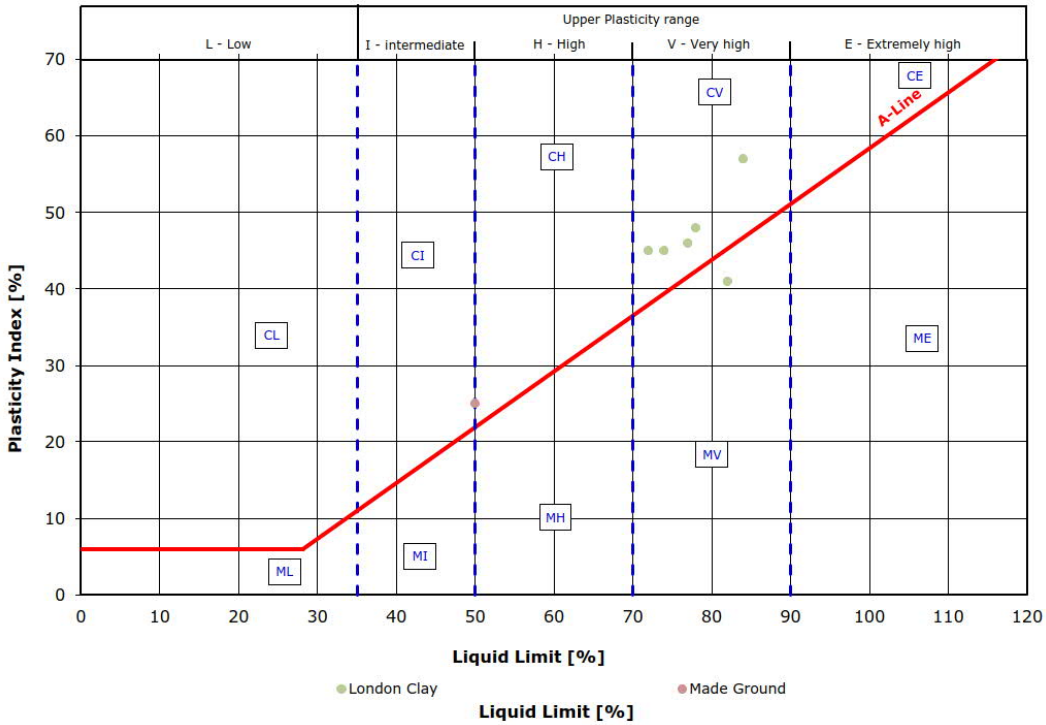
SUMMARY OF CLASSIFICATION TEST RESULTS

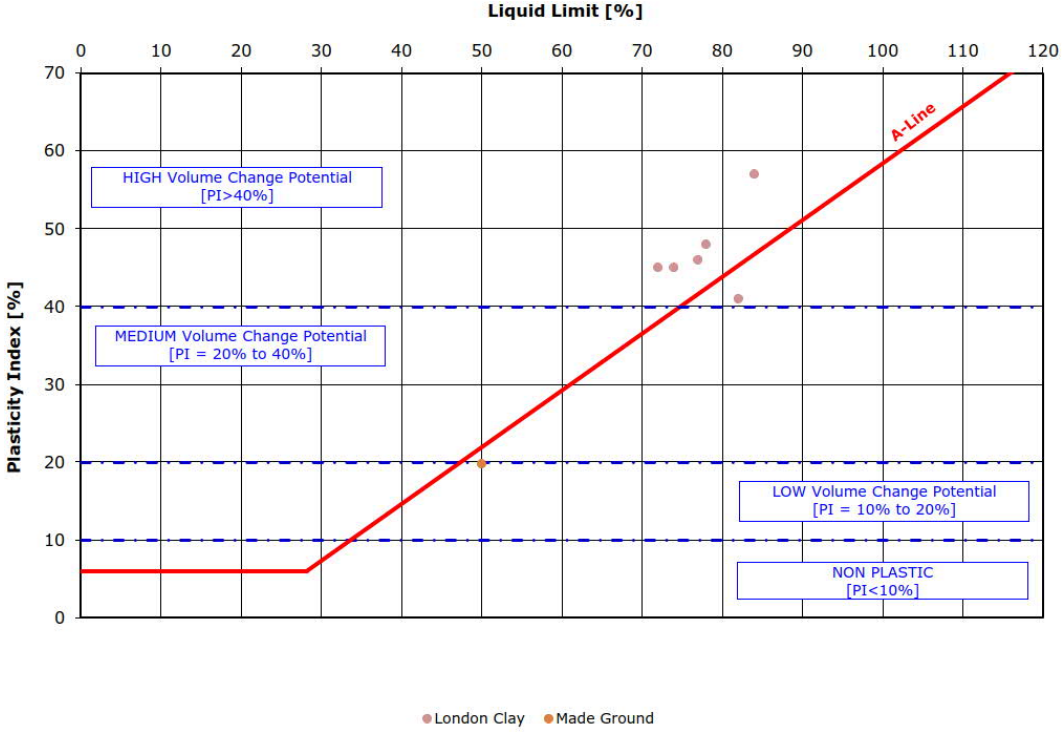
BH ID	Depth (m)	Type	w (%)	wL (%)	wP (%)	Pass 425 (%)	IP (%)	Mod IP (%)	IL (%)	LOI (%)	Description
BH1	1.25	U	35	50	25	79.1	25	20	0.40		MADE GROUND: Dark grey mottled black slightly sandy slightly gravelly clay
	3.25	U	29	72	27	>95	45		0.05		Fissured brown / orange brown mottled blue grey CLAY
	5.25	U	31	74	29	>95	45		0.05		Fissured brown to dark brown silty CLAY
	7.55	U	160	78	30	>95	48		2.71		Fissured brown to dark brown silty CLAY
	9.55	U	30	77	31	>95	46		-0.03		Fissured brown to dark brown silty CLAY
	11.55	U	29	82	41	>95	41		-0.30		Fissured dark grey silty CLAY
	13.55	U	27	84	27	>95	57		0.00		Fissured dark grey silty CLAY

Site Location	**Garages to the south of 27A West End Lane, London NW6 4QJ**	Report No:	**10120/MR**

SUMMARY OF UNDRAINED SHEAR STRENGTH TEST RESULTS

BH ID	Depth [m]	Moisture content [%]	Bulk density [Mg/m^3]	Dry density [Mg/m^3]	Cell pressure [kPa]	$(\sigma_1-\sigma_3)_f$ [kPa]	Failure strain [%]	Failure mode	Undrained cohesion [kPa]	Remarks
BH1	1.25	35	1.81	1.34	60	75	5.00	I	38	
	3.25	29	1.98	1.53	100	169	6.00	B	85	
	5.25	31	1.91	1.46	100	165	7.00	B	83	
	7.55	160	1.96	0.75	160	300	7.00	B	150	
	9.55	30	1.99	1.53	200	282	7.00	B	141	
	11.55	29	1.97	1.53	240	332	7.00	I	166	
	13.55	27	2.05	1.61	280	256	3.00	B	128	





M - SILT [plots below the A-Line]
C - CLAY [plots above the A-Line]

The site investigation report also provides tables which show the coefficients which may be used for the preliminary determination of the pile resistance, see below.

Shaft adhesion

Stratum	Depth (see note e)	Undrained cohesion (from strength profile)	Ultimate unit shaft adhesion 'q_s'
All soils above London Clay	Above say 2.2m depth	N/A	Ignore
London Clay	2.2m to 15m depth	Increases linearly from 60kN/m^2 at a rate of 7kN/m^2/m	Increases linearly from 30kN/m^2 at a rate of 3.5kN/m^2/m (incorporates α = 0.50)

Notes:

a) Unit shaft adhesion 'q_s' = α x c_u (where α = 0.50 and c_u is the undrained cohesion from the design line)
b) The α value of 0.5 is based upon 102mm diameter triaxial tests and this should not be varied
c) The average shaft adhesion over the pile length should be limited to 110kN/m^2
d) The maximum value for unit shaft adhesion should be limited to 140kN/m^2
e) Depth relates to current ground level at the borehole location – approx +36.15mOD

End bearing

Stratum	Depth (see note c)	Undrained cohesion (from strength profile)	Ultimate unit base resistance 'q_b'
London Clay	Below 10m depth	Increases linearly from 115kN/m^2 at a rate of 7kN/m^2/m	Increases linearly from 1035kN/m^2 at a rate of 60kN/m^2/m (incorporates Nc = 9)

Notes:

a) Unit base resistance 'q_b' = Nc x c_u (where Nc = 9 and c_u is the equivalent undrained cohesion from the design line)
b) Depth relates to current ground level at the borehole location – approx +36.15mOD

Table 5 – Characteristic Geotechnical Parameters.

7.2. Outline Temporary and Permanent Works Proposals

The works proposals include the construction of a single storey basement.

The most suitable construction method for forming the basement structure is bottom-up construction. In this approach, the soil within the enclosed pile sidewall is gradually excavated, and, as the excavation deepens, temporary support to the sidewalls using props and struts will be installed. Once the excavation has reached the depth of the basement base, the basement floor slab is cast in place and connected to the piled wall with stainless steel dowels. Once cured, this slab immediately starts to help support the sidewalls, and the slab augments the props. Being a single storey basement, the ground floor slab is subsequently cast, and any remaining props are removed.

With this construction method, the wall is designed for the worst-case excavation and propping (temporary/construction stage). Specifically, the wall embedment is designed to facilitate the fully excavated basement with a single prop resisting the top of the wall.

The following sequence provides an approach which will allow the basement design to be correctly considered during construction, and the temporary support to be provided during the works. The Main Contractor once appointed will be responsible for the works on site and the final temporary works methodology and design.

The approach followed in this design is:

- Demolish the existing structures on site.
- Grub out and remove existing footings to below the level of the proposed new basement slab.
- Install piling mat.
- Place a contiguous piled wall around the perimeter of the new basement.
- Construct a concrete capping beam to tie the heads of the individual piles together.
- Internal bearing piles (where required) for the superstructure frame to be also piled from the existing ground level at the same time. Concrete mix for the top of the bearing piles within the depth of the basement to be changed to a pea shingle mix to allow the piles to be easily broken down during the bulk dig to the required cut off levels for the basement.
- Excavate soil within the piled perimeter, installing temporary propping to restrain the capping beams to the perimeter piled retaining walls and the underpinning pits.
- Construct reinforced concrete inner walls around the building perimeter, within the contiguous piled wall.
- Continue with the construction of the basement structure. Construct the basement slab connected to the contiguous piles with stainless steel dowels.
- Waterproof the internal space with two types of waterproofing to comply with NHBC Chapter 5.4 for habitable spaces. Expected to include specialist waterproof membrane with a drained cavity wall.
- Construction of the ground floor slab which will be tied to the concrete capping beam at the head of the piles to provide a permanent restraint to the piles.
- Temporary props can then be removed once the ground floor is cast.
- Proceed with the construction of the above ground superstructure constructed from loadbearing masonry.

7.3. Ground Movement and Damage Impact Assessment

A Ground Movement Assessment (GMA) has been carried out in accordance with CIRIA C760 (C760, 2017). and considers the construction methodology and site-specific ground and groundwater conditions.

All structures / properties within the zone of influence have been assessed. This includes the original Branch Hill Manor House.

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

1. A zone of influence equal to 2 times the wall piled wall depth.
2. An excavation depth of 4m (basement depth + basement slab + over dig).
3. A total pile length of circa 11.0 m
4. The proposed pile will be of a contiguous type, with ‘high stiffness’ (i.e. propped in both the temporary and permanent conditions).
5. The foundations of the neighbouring properties are strip footings and higher than the proposed basement.

The total horizontal ground movements resulting from the works are estimated as:

- Installation stage = **4.40 mm**
- Excavation stage = **6.00 mm**

The vertical ground movements resulting from the works are estimated as:

- Installation stage = **4.40 mm**
- Excavation stage = **3.20 mm**

The following structures were identified as having been within the estimated zone of influence and most at risk of potential ground movements as a result of the construction of the basement:

- Sycamore Court
- Terraced houses along Mutrix Road
- West End Lane infrastructure

Of these, Sycamore Court is considered to be at most risk owing to its proximity to the proposed excavation works. The analysis has therefore been undertaken to determine the ground movements specifically at this location, as effects elsewhere would be much reduced.

The analysis has shown that ground supporting Sycamore Court would be subject to a tensile strain of circa **0.014 %** and therefore categorised as Category 0 (Negligible) in accordance with the Burland Scale.

It is noted that Policy A5 Basements dictates that only Category 1 (Very Slight) would be considered acceptable and therefore the policy is considered to be satisfied.

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 Construction, Design & Management Regulations (CDM) 2015 and the Party Wall Act to ensure safe construction methods are adopted. 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. Condition surveys will also be carried out before and after the works.

The demolition of the existing structures, site excavations and the substructure works for the proposed dwelling block up to finished ground slab stage have the potential to cause vibration and ground movements due to the following:

- Ground heave from removal of weight of existing building,
- Possible risk of accidental uncontrolled collapse of the existing garages during demolition,
- Removal of any existing redundant foundations/obstructions,
- Installation of piles for foundations and perimeter basement walls,
- Excavation of basement,

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.

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 will be developed to control construction works and maintain movements/damage impacts within the predicted limits. The structural monitoring strategy will include 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

8. BASEMENT IMPACT ASSESSMENT

8.1. Introduction

- A ground investigation was undertaken by Soil Consultants Ltd in July 2017. The Report and borehole logs are available in Appendix 2.

The site geology as found by the ground investigation may be summarized as:

Made Ground

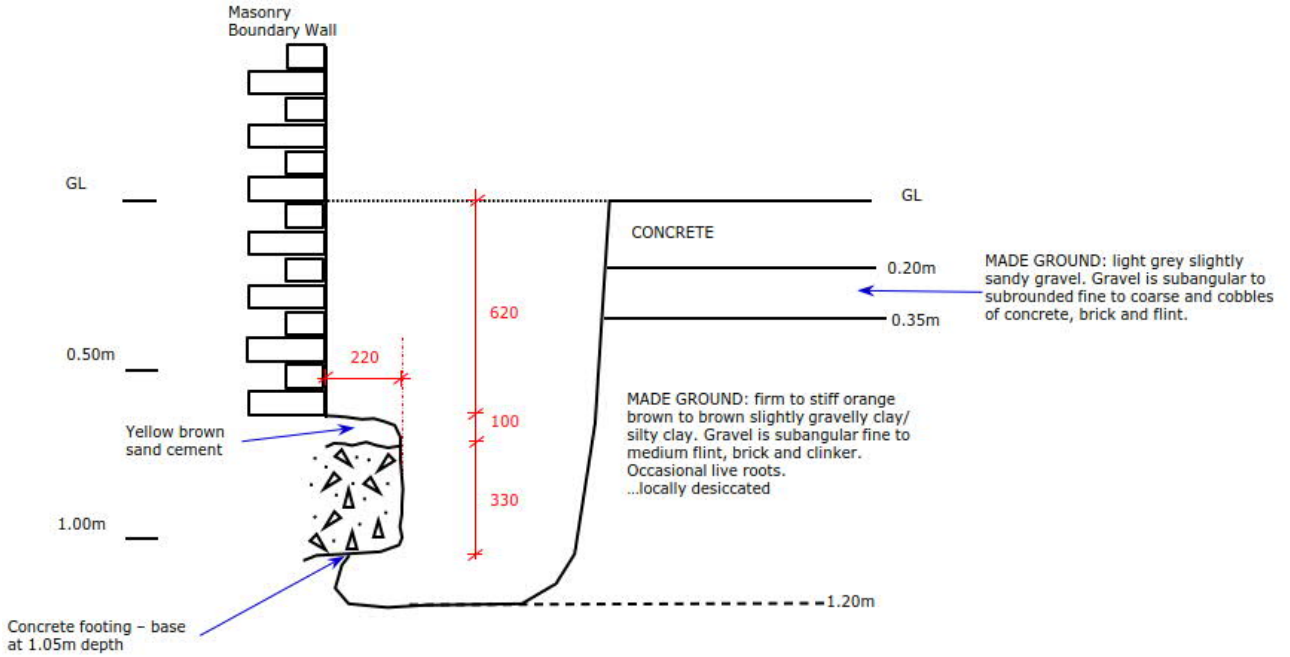
Existing concrete slab varied in thickness between 150mm to 600m and was noted to be reinforced within the existing garages.

Underlying made ground extended to a depth of 2.2m. The soil was found to be heterogeneous, comprising dark brown to grey silty sandy gravelly clay to clayey sandy gravel with variable amounts of flint, brick, concrete, ash, clinker, slate, chalk and glass.

London Clay

The London Clay comprised brown and orange brown fissured silty clay becoming dark grey at around 10.30mbgl. The clay contained occasional partings of silt, rare manganese staining and occasional selenite crystals above 10.30mbgl. Below this, rare partings of silt were noted along with rare shell fragments. Laboratory triaxial testing and SPTs indicate the London Clay to be of medium becoming high strength with depth. The plasticity index testing has shown the London Clay to be of Very High plasticity [BS5930] and High Volume Change Potential [NHBC Standards].

- Ground water was not encountered within any of the exploratory holes during the site investigation carried out in July 2017, nor was groundwater recorded in any of the BGS borehole records in the vicinity of the site.
- However, subsequent monitoring of standpipes undertaken as a part of the site investigation in August 2017 did record water levels at 2.55m, rising to 0.58m. This was attributed to gradual inflow of water from the made ground and may be perched groundwater above the London Clay Strata.
- Site Investigation 10120/MR/CB confirms “slight fall from north east to south west” of approximately 1m across the 15m wide site. Therefore, fall of 4 degrees.
- The existing site is comprised of a block of 8 garages, approximately 20m x 5.5m in plan, with an area of concrete hardstanding used as a car park / access into the garages. The site elevation is 38m AOD.
- The proposed development will be founded at 34.5m AOD, approximately 3.5 metres below ground level.
- Searches on the Camden Planning portal suggest that the surrounding properties do not have a basement.
- Trial pits excavated to determine the foundations of Sycamore Court were inconclusive. Further trial pits were due to be excavated. However, due to the current situation with COVID-19 and Sycamore Court being a sheltered housing the works have been postponed. The foundations have therefore been conservatively assumed to be strip footings, extending 750mm below ground level, as per the foundations of the masonry boundary wall between the car park area and the garden of Sycamore Court.



- The distance to the highway, West End Lane, is approximately 3.5m, with a pedestrian footpath separating the site from the highway.
- A utilities search was carried out by GroundSure to determine whether any tunnels or services ran through or near to the site.
- Adjacent infrastructure includes the London Overground tracks 180m south, including the platforms of Kilburn High Road Station. Data from TFL's Property Asset Register shows there are no known tunnels within close vicinity of the site.
- Underground infrastructure present close to the site includes a combined public sewer [1143 x 762mm] and a distribution main [180mm diameter] running east to west under West End Lane.
- An Electricity Transmission Cable has been found running North to South directly under the A5 170m West of the site. The cable is a sufficient distance from the site such that the construction of the proposed structure will have no impact on this asset.
- No high-pressure gas transmission pipelines were found within 500m of the site.
- Potential impacts are damage to the existing structures, highway and Thames Water assets.
- Damage to these structures/assets will be controlled by adequate planning and design to limit ground movements, and monitoring of ground movement on site to allow quick response should limits be exceeded.
- Residual impacts are none expected.

8.2. Land Stability / Slope Stability

The site investigation has identified a suitable founding stratum of London Clay which is suitable for piled foundations. The clay has been found to be of high shrinkage potential. The foundation design will take this shrinkability into account.

A Ground Movement Assessment has concluded that ground movements caused by the excavation and construction of the proposed development will be negligible. The Damage Impact to surrounding structures within the zone of influence has been assessed as Category 0 in accordance with the Burland Scale.

The BIA has concluded that there will not be risk(s) or stability impact(s) to the development and/or adjacent sites due to slopes.

8.3. Hydrogeology and Groundwater Flooding

The BIA has concluded there is a low risk of groundwater flooding. Ground water was not encountered within any of the exploratory holes during the site investigation carried out in July 2017, nor was groundwater recorded in any of the BGS borehole records in the vicinity of the site. However, subsequent monitoring of standpipes undertaken as a part of the site investigation in August 2017 did record water levels at 2.55m, rising to 0.58m. This was attributed to gradual inflow of water from the made ground and may be perched groundwater above the London Clay Strata.

It may also be possible that Groundwater may drain from the subterranean watercourse, found to be within 30m of the site, into the basemen/excavation space. However, as the groundwater is believed to be perched, and simply from flow in the made ground, it is unlikely groundwater from the watercourse would flow into the basement.

Regardless of this, the basement will be waterproofed using two systems as per the requirements of the NHBC.

The BIA has concluded there will be minimal impacts to the wider hydrogeological environment. The proposed basement may alter the groundwater flow regime of the perched groundwater in the made ground. However, due to the size of the proposed basement (low water displacement) and the seasonal nature of this perched groundwater, it is anticipated that any effects on the surrounding existing structures will be minimal.

8.4. Hydrology, Surface Water Flooding and Sewer Flooding

The BIA, based on the findings of the FRA carried out by Create Consulting Engineers, has concluded the below:

- Fluvial / Tidal flooding – negligible risk
- Groundwater flooding – not anticipated
- Flooding from artificial water bodies – no significant sources identified in immediate vicinity
- Flooding from infrastructure failure – low risk (residual risk with any construction)
- Sewer flooding – high risk based on historic flooding
- Surface water flooding – very low risk (although located in Critical Drainage Area)

The basement will be constructed with two forms of waterproofing in compliance with NHBC requirements and surface water drainage within lightwell areas.

The BIA has concluded there are no impacts to the wider hydrological environment.

9. REFERENCES

Arup. (2010). Camden Geological, Hydrogeological and Hydrological Study .
C760, C. (2017). Guidance on embedded retaining wall design.
Milieu Consult. (2019). Branch Hill House, Hampstead: Utilities Assessment for Planning.

APPENDIX 1
ARCHITECTURAL DRAWINGS

APPENDIX 2
SITE INVESTIGATION REPORTS

APPENDIX 3
GROUND MOVEMENT ASSESSMENT

APPENDIX 4
UTILITY RECORDS

APPENDIX 5
FLOOD RISK ASSESSMENT

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