The Milvum Group Ltd.
71-75 Shelton Street
London WC2H 9JQ

t: +44 7472 611560
e: contact@milvumgroup.com

www.milvumgroup.com

DESK STUDY & BASEMENT IMPACT ASSESSMENT

20 CREDITON HILL LONDON, NW6 1HP

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Approved By:	Phillip Lewis BSc MSc CGeol FGS
	Corrado Candian MEng CEng MICE
Contributors:	Phil Jones BSc CEng MICE
	Predrag Maric Dipl Eng Arch RIBA

Table of Contents

1.0 Non-Technical Summary

At the request of PM&A Architects, a Basement Impact Assessment (BIA) has been carried out at 20 Crediton Hill, London, NW6 1HP in support of a planning application for a proposed new development which includes:

a) Retention of existing single storey building;
b) Creation of a 1 storey lower ground floor by underpinning existing 2.2m deep mass concrete foundations;
c) Creation of new landscaped patio garden at lower ground floor level.
d) Removal of hard standing forecourt and replacement by permeable, drive-over patio.

A Desk Study, Site Investigation, Ground Movement Assessment, Damage Impact Assessment and Arboricultural Study have informed the BIA. *The assessments have been undertaken by appropriately qualified professionals in accordance with the criteria of CPG4.*

The British Geology Survey (BGS) map of the area (North London, Sheet 256) indicates that the site is underlain by the London Clay Formation. *This formation typically comprises firm to stiff clay of medium to high strength and is a suitable bearing stratum for the proposed development's foundations. This has been confirmed by the Site Investigation.*

The London Clay has potential to shrink and swell with moisture variation, which may cause movement and damage to structures bearing upon it. *The risk of movement and damage to this development or neighbouring structures is negligible*, considering the proposed depth of foundations, the proximity of neighbours, the lack of trees and the existing conditions on site, which show no evidence of historical movements or damage.

The London Clay is designated Unproductive Strata. *There is no risk of groundwater flooding or potential for impacting the wider hydrogeological environment. Groundwater monitoring confirms the underlying soils are dry to >4m below the proposed lower ground floor level.*

The site, the adjacent properties and Crediton Hill have not been affected by flooding. *There is no risk of flooding to the proposed development and the proposed development will not impact on the wider hydrological environment.*

The site is level and is not situated in a wider hillside environment of slopes of 7° or more. There is change in level downward to the adjacent cricket field of 2.5m, which is currently retained by the existing studio building's foundations. This retaining structure will be modified in the new development. The large rear garden of the adjacent site at No.22, with the building at No.22 located some 15 metres away from the nearest works, is approximately 1 m higher than the site, retained by a boundary wall which will not be altered by the proposed development. *There will be no risk or stability impact to the development or adjacent sites due to slopes.*

Ground movements caused by the excavation and construction of the proposed development will be minimal. *Damage impact to garage structures has been assessed as Category 0 (Negligible) in accordance with the Burland Scale. The closest neighbouring houses, 20 and 22 Crediton Hill, are outside the zone of influence of the works.*

The BIA demonstrates that the proposed development, which is remote from sensitive receivers, will cause no impacts relating to land stability, hydrogeology and surface water flow, and is at very low risk of flooding.

2.0 Introduction

The purpose of this assessment is to consider the effects of a proposed lower ground floor development at 20 Crediton Hill, London, NW6 1HP, on the local hydrology, geology and hydrogeology. The site location is presented in Figure 1.

The information contained within this BIA has been produced specifically to meet the requirements set out by Camden Planning Guidance - Basements and Lightwells (CPG4, July 2015) and the Local Plan 2017: Policy A5 Basements - in order to assist the London Borough (LB) of Camden with their decision making process.

The BIA has been reviewed and approved by Corrado Candian, MEng CEng MICE, and Philip Lewis, BSc CGeol FGS, who both have more than 15 years' relevant experience of design and assessment of residential and commercial developments.

The contractor's representative is Phil Jones, BSc CEng MICE, of Abbey Pynford Foundations Ltd, who will ultimately be responsible for the final design and construction. He has reviewed the relevant geo-structural information and provided confirmation of the suitability and buildability of the scheme, within the guidelines provided by LB Camden. Mr Jones has more than 30 years' relevant experience.

The architect for the proposed scheme, Predrag Maric of PM&A Architects, designed and built the existing structure in 1985 and in 2007 added a basement level to one of the adjacent garages (LB Camden reference 2007/2959/P) utilising underpinned foundations. The architect's knowledge of the site and ground conditions is therefore extensive.

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

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

2.1 Sources of Information

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

- Site walkover and discussion with residents, 2nd November 2016;
- Ordnance Survey Mapping and Historical Mapping;
- Barton, N. (1992), The Lost Rivers of London, Historical Publications Ltd, London;
- British Geological Survey, 1:50,000 Geological Sheet 256, North London (Solid & Drift) and Geology of Britain Viewer (online);
- Environment Agency Flood Risk Mapping (online);
- LB Camden, Strategic Flood Risk Assessment (produced by URS, 2014);
- LB Camden, Floods in Camden, Report of the Floods Scrutiny Panel (2013);
- CIRIA, C760 Embedded retaining walls - Guidance for Economic Design (2017);
- LB Camden, Planning Guidance (CPG4) - Basements and Lightwells (July 2015);
- LB Camden, The Local Plan 2017: Policy A5 Basements;
- LB Camden, Camden Geological, Hydrogeological and Hydrological Study - Guidance for Subterranean Development (produced by Arup, 2010);

- LB Camden, Development Policy (DP) 27 - Basements and Lightwells;
- Tomlinson, M.J. (2001) Foundation Design and Construction.
- ASUC, Guidelines for Safe and Efficient Basement Construction Directly Below or Near to Existing Structures, 2nd Edition, 2016.

2.2 Existing and Proposed Development

The Application site is to the rear of 20 Crediton Hill and currently comprises a hard standing forecourt and a single-storey studio building at ground level. The development site is level. On the eastern boundary, there is a change in elevation downward to the adjacent cricket field of 2.5 metres, which is currently retained by its own lower level, and where variable, by the existing continuous deep concrete foundations of the existing studio building on upper garden level. This does not represent a natural slope but rather the addition of Made Ground to level the garden area during construction of the gardens and garages at 20 Crediton Hill prior to and in 1959 / 1960. This is confirmed by the site investigation records. The current retaining structures (studio's existing deep concrete foundation wall) will be modified in the new development, and the difference in elevation between the cricket field and the new Lower Ground Floor will be approximately 1.0m, which shall be retained by an RC wall.

The rear garden of the adjacent site at No.22 is approximately 1.0m higher than the site at No.20, retained by a brick boundary wall in good condition which will not be altered by the proposed development. Across the wider area of Crediton Hill and adjoining streets, the slopes are less than 7°. This is confirmed by LB Camden mapping data (figure 7) and OS data which indicates a slope of approximately 1:20 north to south along Crediton Hill.

The foundation level of the existing building on site is 2.2m below ground level (bgl) for the existing studio building. The adjacent garages (numbered 4, 5 and 6 on the structural drawings) are owned by the applicant. Garage No.4 has a basement below with foundations at 3.0m bgl. The remaining garages' foundations are at approximately 0.45m bgl (confirmed by records from 2007 Garage 4 basement works).

Existing and Proposed development drawings are presented in Appendix 3.

The proposed development consists of retention and minor modifications of the existing single-storey studio building and construction of a new lower ground floor within the footprint of the existing studio. The existing foundations at 2.2m bgl will be underpinned. The existing wooden deck to the studio will be removed and a new patio garden formed at lower ground floor level, between the studio and the eastern boundary fence. RC retaining walls and a lower ground floor slab will be constructed with a steel frame supporting the existing ground floor structure.

The formation level of the lower ground floor slab and underpinned foundations will be at 3.75m bgl (1.55m below existing foundation level) with no other works at deeper levels or outside the footprint of the existing studio building and wooden deck.

The existing 75m^2 of hard standing forecourt will be removed and replaced with a proprietary layered, permeable, drive-over green grass-block patio.

The main building at 20 Crediton Hill is >15m from the proposed development. It has a basement level founded at 3.0m bgl and flank walls on shallow strip foundations assumed to be at 0.5m bgl. There are three garages (labelled 1, 2 and 3) which are approximately >6m from the development, with strip foundations at 0.45m bgl.

The adjacent property at 22 Crediton Hill is >15m from the proposed development. It does not have a basement. The walls are assumed to sit on shallow strip foundations which, due to the level difference, are 1m above the ground level at the site.

During the site walkover all structures appeared in good condition and there was no evidence of ground movements or subsidence. No flooding or ground movement are reported by residents.

3.0 Desk Study

3.1 Site History

The site history has been researched by reference to historical maps, key extracts from which are presented in figures 2, 3, 4 and 5 of Appendix 1.

Prior to 1870 the site is indicated as being within a field. The 1871 – 1879 map (figure 2) indicates the site to be part of the gardens for a large residential property, Treherne House. The garden's boundaries are in the same position as the current site boundaries. Immediately to the south west a copse of trees and a pond are indicated, within approximately 75m of the site boundary. To the east is a large, open field. To the north and south are gardens and fields associated with other large, residential properties. A water course, which approximately follows the course of a tributary of the River Fleet (figure 12), is apparent to the north east of Finchley Road within a culvert, which then follows Finchley Road to the south east, and then runs to the south west in parallel with the route of the railway. This water course is >150m from the site boundary.

The 1896 map (figure 3) indicates the site and adjacent sites are largely unchanged. The field to the east is now marked as a cricket field. The former copse to the south west now appears to be a small, excavated pit.

The 1915 map (figure 4) indicates extensive change to the surrounding area, with Crediton Road (now known as Crediton Hill) in existence with housing indicated broadly as can be found today. The adjacent 20 and 22 Crediton Road are built and occupy the same footprint as at present. The site area forms the garden of 20 Crediton Road. The pit and pond areas have been replaced by 18 and 20 Crediton Road.

The site remained largely unchanged until 1960, and the World War II Bomb Damage Map (figure 6) does not indicate any bomb damage to the site or adjacent properties. The 1960 – 1974 map indicates the creation of a car parking area and six garages at 20 Crediton Hill. The three easterly garages and the car parking area in front of them comprise 50% of the site area, with the remaining area still indicated as garden.

In 1985 the current studio on site was constructed, and in 2007 a basement was added to Garage 4. There have been no other significant changes since 1985.

3.2 Geology

The British Geology Survey (BGS) map of the area (North London, Sheet 256) indicates that the site is underlain by the London Clay Formation (figure 8), which comprises blue clay which becomes brown when weathered with occasional bands of fine silty sand and nodular lumps of pyrite and selenite. These soils were formed approximately 34 to 56 million years ago in the Palaeogene Period in a local environment previously dominated by deep seas.

A site Investigation (Appendix 2) was undertaken and the London Clay was encountered at 1.75m bgl, underlying Made Ground. The London Clay was proven to 10.0m bgl, the terminating depth of the borehole.

3.3 Hydrogeology

The Environment Agency (EA) Groundwater Protection Policy uses aquifer designations that are consistent with the Water Framework Directive. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) and also their role in supporting surface water flows and wetland ecosystems.

The Bedrock geology underlying the site (London Clay Formation) has been classified as Unproductive Strata, or a non-aquifer. These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

LB Camden data (Figure 11) indicates the site is not within a groundwater source protection zone.

The site investigation, undertaken in September 2016, encountered no groundwater. Subsequently, monitoring has been undertaken in October 2016 and has proven that no groundwater or perched water is present to 8.0m bgl, which is >4.0m below the proposed lower ground floor base slab level. Monitoring will continue over the winter period to confirm that groundwater will not impact upon, or be impacted by, the proposed development.

3.4 Hydrology, Drainage and Flood Risk

With reference to Barton's (1992) The Lost Rivers of London, the site is approximately within 300m of two tributaries of the lost River Westbourne (figure 12). The easterly tributary, which is indicated to be the closest, has been located on historical maps (see Section 3.1) as a culverted waterway, no closer than 150m to the east and south of the site. The westerly tributary is indicated as being >250m to the west of the site. Neither of these tributaries will have an impact on the site or the adjacent properties as a result of constructing the proposed development.

There are no surface water features within 500m of the site.

The site is not within the catchment of the Hampstead Heath Pond Chain, which are more than 1km away to the east.

The site surface area is currently 100% of hardstanding or buildings, and therefore infiltration to ground will be limited to cracks / gaps in hard surfacing and leakage from drains, with the remaining rainfall discharged to the local sewer network. The proposed development provides an additional 75m^2 of permeable site area. This offers slight betterment as some rainfall will potentially infiltrate to ground / be attenuated. However, discharge flows to the existing sewer network will be broadly similar to existing levels and the drainage will be discharged into the existing as a part of the planning entry.

The Environment Agency RoFRaS database provides an indication of river and coastal flood risk at a national level. The data considers the probability that the flood defences will overtop or breach by considering their location, type, condition and standard of protection. RoFRaS data for the study site indicates the property is in an area with a Very Low (less than 1 in 1000) chance of flooding in any given year.

Modelling of surface water flooding has been undertaken by the Environment Agency the site is shown as having a 'very Low' risk of flooding from surface water (figure 10).

4.0 Screening

A screening process has been undertaken in accordance with the most recent guidance from Camden Council (CPG 4, 2015) and the findings are described below.

4.1 Subterranean (Groundwater) Flow

Question	Response	Details
1a. Is the site located directly above an aquifer?	No	The site is located on the London Clay Formation, a designated Unproductive Strata. See figure 8 and Section 3.2.
1b. Will the proposed basement extend beneath the water table surface?	No	Groundwater monitoring on site indicates dry conditions to at least 8m below ground level / >4m below proposed basement slab level. See Section 3.3.
2. Is the site within 100mof a watercourse, well (used / disused) or potential spring line?	No	There are no current watercourses, wells or spring lines within 100m. However, tributaries of the River Westbourne historically ran within approximately 100m of the site, which have now been culverted. See figure 12 and Section 3.4.
3. Is the site within the catchment of the pond chains on Hampstead Heath?	No	The site is 1km west of the Heath Ponds and not within the catchment. See Section 3.4.
4. Will the proposed basement development result in a change in the proportion of hardsurfaced / paved areas?	Yes	The proposed development will result in an increase in permeable area. See Sections 3.4 and 5.1.
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	Although there will be an increase in permeable site area, due to the underlying London Clay no significant increase in attenuation by soils is anticipated. See 3.4 and 5.1.
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	No local ponds within the surrounding area to the site.

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	The site area is flat / level. There are elevation changes between adjacent sites, controlled by retaining walls. See Sections 2.2 and 6.1.
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 site boundary to the north is with 22 Crediton Hill – there will be no changes to the boundary. To the east, the boundary with the cricket field will be reduced by approximately 1.25m, and retained by an RC wall. See Section 2.2 and Appendix 3.
3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately1 in 8)?	No	There are no slopes greater than 7 degrees adjacent to the site. Crediton Hill has a slope of approximately 1:20 from north to south (calculated from OS map topographic data). The cricket field is flat / level. See Section 2.2 and Appendix 3.
4. Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately1 in 8)?	No	Crediton Hill has a slope of approximately 1:20 from north to south (calculated from OS map topographic data). See Section 2.2 and Appendix 3.
5. Is the London Clay the shallowest strata at the site?	Yes	The London Clay Formation is the shallowest natural strata. See figure 8 and Sections 3.2 and 5.2.
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?	Yes	Removal of a low quality pear tree will be advised is recommended as sound husbandry. See Arboricultural Report, Appendix 4, and Section 5.3.
7. Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?	No	From the site walkover and discussions with local residents, no history of shrink-swell subsidence is known at or adjacent to the site. See Section 2.2.
8. Is the site within 100m of a watercourse or a potential spring line?	No	There are no current watercourses, wells or spring lines within 100m. However, tributaries of the River Westbourne historically ran within approximately 250m of the site. See figure 12 and Section 3.4.
9. Is the site within an area of previously worked ground?	No	Historical map data and LB Camden's records indicate the site has not been historically worked. See figure 7 and Section 2.2.

Question	Response	Details
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 located on the London Clay Formation, a designated non aquifer. See figure 8 and Section 3.3. Groundwater monitoring on site indicates dry conditions to at least 8m below ground level / >4m below proposed basement slab level.
11. Is the site within 50m of the Hampstead Heath Ponds?	No	The site is 1km west of the Heath Ponds and not within the catchment. See Section 3.4.
12. Is the site within 5m of a highway or pedestrian right of way?	No	The site is set back at the rear of 20 Crediton Hill and is not within 5m of the highway.
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	No	The proposed development will have foundations lower than the garages (1,2, 3), parts of 20 Credition Hill (areas without basement) and 22 Crediton Hill. All are at a significant distance from the proposal and outside the zone of influence. See Sections 2.2 and 5.4.
14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No	Network Rail, Transport for London and Utility companies have been consulted. See figure 13 and Appendix 7.

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 is 1km west of the Heath Ponds and not within the catchment. See Section 3.4.
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 increase in permeable area is considered to slightly reduce the discharge flows from their existing levels. See Sections 3.4 and 5.1.
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No	The proposed development will result in an increase in permeable area. See Sections 3.4 and 5.1.
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 increase in permeable area is considered to slightly reduce the discharge flows from their existing levels. See Sections 3.4 and 5.1.

Question	Response	Details
5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	There will be no changes to the quality of the surface water discharged.
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.	No	Review of EA and Strategic Flood Risk Assessment data indicates the site is at very low risk of flooding from all sources, including surcharged sewers, surface water flow (pluvial), groundwater and rivers. See figures 9 and 10 and Section 3.4. Groundwater monitoring on site indicates dry conditions to at least 8m below ground level / >4m below proposed basement slab level. See Section 3.3.

4.4 Non-Technical Summary of Screening Process

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

- Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?
- Is the London Clay the shallowest strata at the site?
- 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?

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

Although neighbouring structures are all outside the zone of influence of the proposed construction works, summary assessment is presented in Section 5.4.

5.0 Scoping

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

5.1 Changes in the proportion of hard surfaced / paved areas

The proposed development increases permeable site area by approximately 75m^2, where currently there is hardstanding, providing some potential infiltration / attenuation of rainwater. Peak discharge flows to the local sewer network will not be greater than the existing condition and are likely to be slightly reduced. The drainage strategy, of interest for Thames Water and LB Camden as part of the Planning process, remains as existing at present.

There are no additional risks or impacts created by this change.

5.2 The London Clay Formation

The London Clay Formation is the shallowest naturally occurring soil at the site, underlying shallow Made Ground. The London Clay is a high plasticity clay that is known to be at risk from shrinking and swelling, due to changes in moisture content, either from seasonal weather variations or from water demand from trees.

A site walkover has been undertaken and local residents consulted, and there have been no known ground movements at or adjacent to the site. The current foundations on site are 2.2m bgl, and therefore the proposed deepening of the foundations to 3.75m bgl will further reduce any potential influence from trees / vegetation or moisture variation at surface. It should also be noted that the Arboriculture Report (Appendix 6) indicates there is only one tree off the Application site, a low quality pear tree, which will be removed, and therefore there will be no likelihood of shrinking / swelling occurring due to water demand from trees. The pear tree is approximately 7.5m from the existing building and proposed development.

5.3 Trees to be Felled / Tree Protection Zones

The Arboriculture Report (Appendix 6) indicates there is only one tree off the Application site, a low quality pear tree, which will be removed in accordance with good husbandry. There are no tree protection zones on site. The pear tree is approximately 7.5m from the existing building and proposed development.

5.4 Differential Depth of Foundations Relative to Neighbouring Properties?

Relative foundation depths between the proposed development and neighbouring structures are indicated within the architect's drawings (Appendix 3) and described in the conceptual site model (Section 6.1).

There is a basement level partially underlying the main house at 20 Crediton Hill with shallow foundations beneath the rest of the structure. There is no basement at 22 Crediton Hill and all foundations are considered to be shallow. These properties are >15m away from the proposed works. Considering a conservative assessment of potential ground movements, the zone of influence from the works may extend up to 4 x the proposed excavation depth, broadly as described in CIRIA C760. It is therefore considered that these properties are outside of the zone of influence and will not be impacted by the works.

Garages 1, 2 and 3 are >6m from the proposed development. Although founded at shallow depth the adjoining Garage 4 has a basement founded at 3.0m bgl. The Party Wall between Garage 4 and Garage 3 has been underpinned to the full depth of the basement. Considering

the proposed depth of excavation, the shallow depth of underpinning proposed (1.55m), the proximity of the garages to the works and the protection offered by the basement below Garage 4 (effectively shielding garages 1, 2 and 3) there is considered to be minimal ground movement influencing the garages. Damage to these structures can conservatively be estimated as falling within Category 0 (Negligible) in accordance with the Burland Scale.

6.0 Construction Methodology

6.1 Conceptual Site Model

The Conceptual Site Model is described below:

- The proven ground conditions are 1.75m of Made Ground overlying London Clay.
- There is no groundwater present at the site at levels that will encounter the lower ground floor, in either the permanent case or the temporary case during construction.
- The site is flat / level.
- The rear garden and the property at No.22 Crediton Hill are approximately 1.2m higher than the site elevation, and the rear garden is retained by the existing boundary wall that will remain in place and will not be affected by the proposed development.
- Approximately 75m^2 of permeable site area will be created by removal of the hard standing forecourt, replaced by a proprietary layered, permeable, drive-over green grass-block patio.
- The adjacent cricket field is 2.5m lower than the site elevation, with the site's shallow soils currently retained by the existing studio's foundations. This does not represent a natural slope but rather the addition of Made Ground to level the garden area during construction of the gardens and garages at 20 Crediton Hill. The current retaining structure (studio's foundations) will be modified in the new development, and the difference in elevation between the cricket field and the lower ground floor slab will be approximately 1.0m, retained with an RC wall.
- The current buildings on site foundations' levels are: 2.2m below ground level (bgl) for the studio; 3.0m bgl for Garage 4 with basement; approximately 0.45m bgl for the single storey garages, further away from the proposed works.
- The proposed development will incorporate underpinned foundations, RC retaining walls and an RC lower ground floor slab at 3.75m bgl.
- The main building at 20 Crediton Hill is >15m from the proposed development. It has a large basement level founded at 3.0m bgl and flank walls on shallow strip foundations assumed to be at 0.5m bgl. There are three garages >6m from the proposed development with strip foundations at 0.45m bgl. Garage 4 has a basement founded at 3.0m bgl.
- The adjacent property at 22 Crediton Hill is >15m from the proposed development. It does not have a basement. The walls are assumed to sit on shallow strip foundations which, due to the level difference, are conservatively estimated to be 1m above the ground level at the site.

6.2 Outline Geotechnical Design Parameters

The following outline, *conservative* geotechnical parameters have been determined, based on the site investigation data presented in Appendix 2 and relevant guidance (see Section 2.1).

Parameter	Made Ground	London Clay	Notes
Density kN/m^3	18	19	C580/760 Table 5.6
Undrained Shear Strength, Cu (kPa)	n/a	45 – 100	At 2.5m, 45kPa + 7_z
Bearing Capacity (kPa)	n/a	110	At 3.75m, FOS = 2.5
Young's Modulus, Eu (MPa)	8	22.5	At 3.75m, Eu = 430Cu
Coeff. Of Compressibility, M_v	0.4	0.2	Tomlinson, p77.
Drained (v') / undrained (v) Poison's ratio	0.2 / n/a	0.2 / 0.5	Tomlinson, p74.
Plasticity Index (%)	n/a	55	Very High Plasticity

At the site, the London Clay has been determined to be a very high plasticity clay of medium to high strength.

6.3 Outline Temporary and Permanent Works Proposals

The Contractor for the works will be Abbey Pynford Foundations Ltd, who will at the appropriate development phase present detailed design, construction sequencing and method statements. At the current stage of development, the following outline design works proposals are presented for assessment during Planning consultations.

The proposed scheme requires excavated stem base underpinning to form retaining walls for the lower ground floor, with the limited height (maximum 1.0m) rear garden retaining wall with the cricket grounds formed by similar technique. These reinforced concrete underpinning and retaining wall structures will be propped in the temporary case, in accordance with best practise, and will benefit in the permanent condition from the permanent propping provided by the steel structural frame. The toe of the stem bases and retaining walls will be propped by the reinforced basement floor slab.

The stem bases will be excavated in short sections, temporarily propped and constructed in line with the Association of Specialist Underpinning Contractors (ASUC) Guidelines for Safe and Efficient Basement Construction Directly Below or Near to Existing Structures, 2nd Edition, 2016. This guidance has been endorsed by the Health and Safety Executive (HSE) and Abbey Pynford are contributing authors. This construction methodology is considered to provide a “high stiffness” retaining wall, which will minimise any potential for ground movements.

All concrete works are intended to be formed by waterproof concrete. Internal steel portal frames within the lower ground floor will correspond to the existing steel portal frames of the ground floor structure.

6.4 Control of Construction Works

The construction works will be closely controlled in accordance with ASUC guidelines. As there is no groundwater on site within the construction elevations, no ground water instability issues are anticipated. Adequate temporary site drainage will be provided at all times to ensure safe working conditions and to prevent the softening of the underlying clay prior to construction.

Groundwater monitoring will continue over the winter period 2016/17 to confirm that groundwater will not impact upon, or be impacted by, the proposed development.

Despite the ground movement and damage impact analysis indicating Negligible (Category 0) damage to the neighbouring buildings during construction, movement monitoring of the boundary wall and the neighbouring garage buildings will be undertaken during the construction stage and trigger levels will be set as a precautionary measure. A specification for movement monitoring will be incorporated into the final construction scheme and will be agreed with the Party Wall Surveyor, as necessary, and the Building Control Officer.

6.5 Non-Technical Summary

Assuming design and construction in accordance with best practise, undertaken with all the reasonable skill and care expected from an experienced and competent contractor, the proposed development should proceed as detailed within this assessment. The development will be controlled in accordance with standard Building Control and Party Wall Award criteria.

7.0 Basement Impact Assessment

The purpose of this assessment is to consider the effects of a proposed lower ground floor development on the local hydrology, geology and hydrogeology. The BIA has been produced specifically to meet the requirements set out by Camden Planning Guidance - Basements and Lightwells (CPG4, July 2015) and The Local Plan 2017: Policy A5 Basements - in order to assist the London Borough (LB) of Camden with their decision making process.

The assessments have been undertaken by appropriately qualified professionals in accordance with the criteria of CPG4.

7.1 Geology and Land Stability

The site is underlain by the London Clay Formation. This formation typically comprises firm to stiff clay of medium to high strength and is a suitable bearing stratum for the proposed development's foundations. This has been confirmed by the Site Investigation.

The risk of movement and damage to this development due to shrink and swell of the London Clay is negligible, considering the proposed deep foundations, the lack of trees and the existing conditions on site, which show no evidence of historical movements or damage.

The site is level and is not situated in a wider hillside environment of slopes of 7° or more. The BIA has concluded that there will be no risk or stability impact to the development or adjacent sites due to slopes.

The nearest neighbouring houses are >15m from the proposed development and not qwithin the zone of influence. Damage Impact to the closest structures 9 (garages) has been assessed as Category 0 (Negligible) in accordance with the Burland Scale.

7.2 Hydrogeology and Groundwater Flooding

The London Clay is designated as unproductive strata. The BIA has concluded there is no risk of groundwater flooding or potential for impacting the wider hydrogeological environment. Groundwater monitoring confirms the underlying soils are dry to >4m below the proposed lower ground floor level.

7.3 Hydrology and Surface Water Flow

The site, the adjacent properties and Crediton Hill have not been affected by flooding. The BIA has concluded there is no risk of flooding to the proposed development and the proposed development will not impact on the wider hydrological environment.

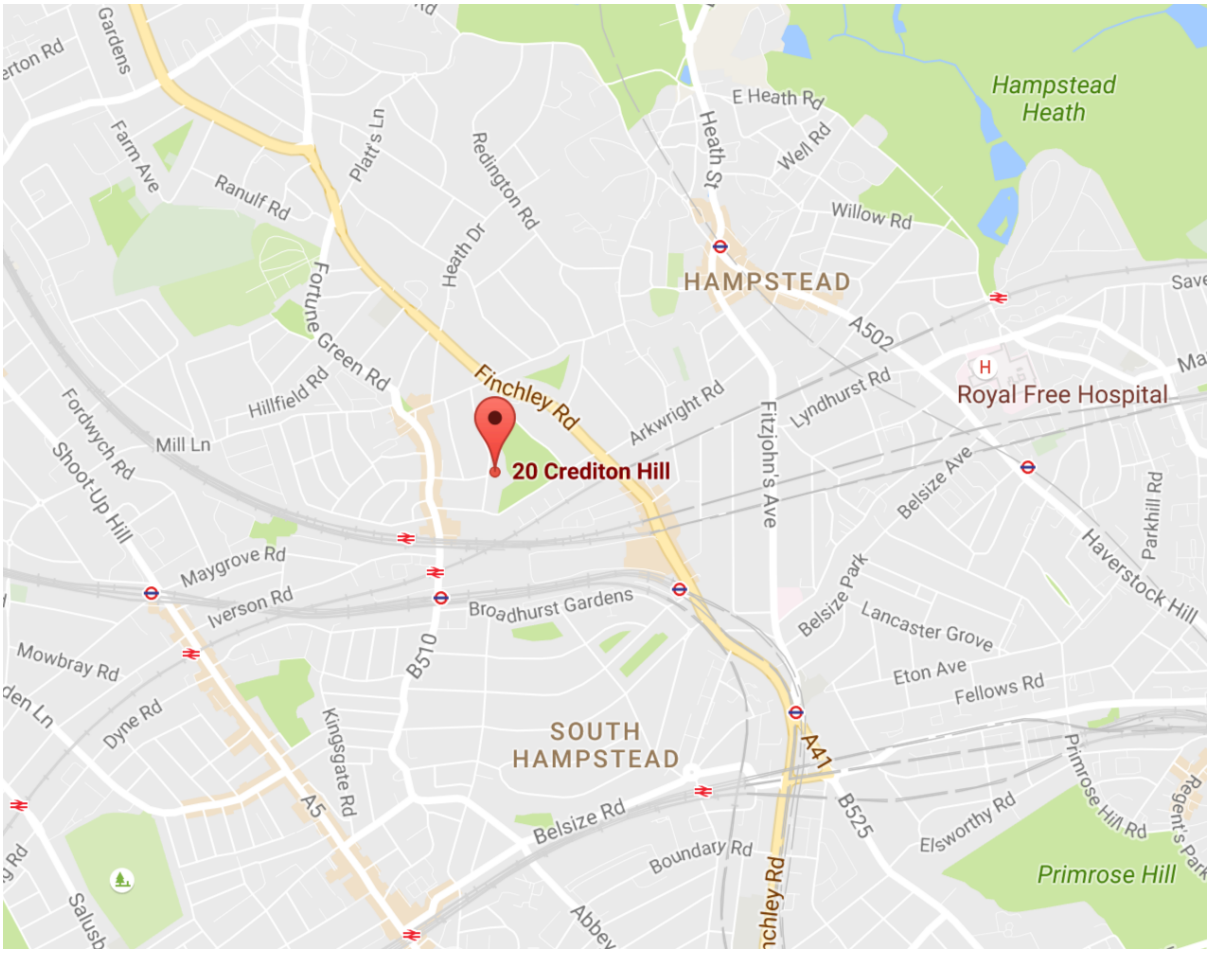
7.4 Residual Risks and Mitigation

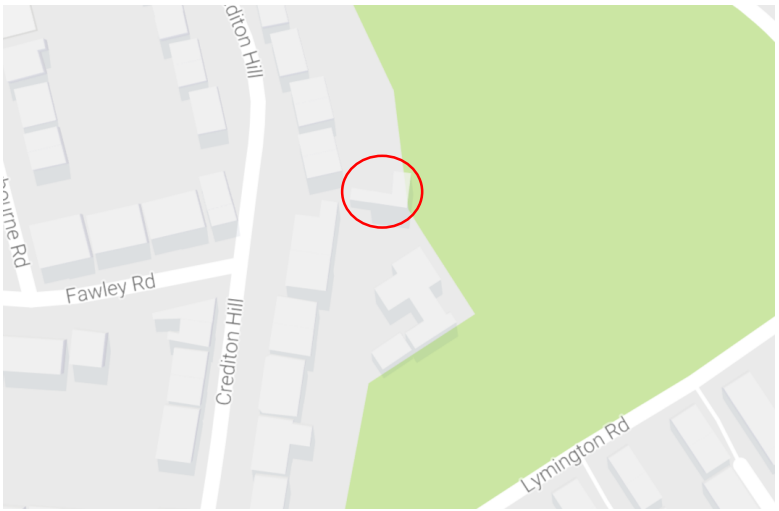
No residual risks have been identified and no additional mitigation is proposed.

As a contingency, and in accordance with best practise, a ground movement monitoring plan should be set out at design stage and should include a movement monitoring strategy, instrumentation and action plans, including defining trigger levels. Monitoring should include precise levelling or reflective survey targets being installed on the boundary wall and adjacent garage buildings. This should be agreed under the Party Wall Act. Both No.20 and No.22 are located well outside the 20' (6.0m) distance of matters dealt with by Party Wall observations.

Appendix 1 Desk Study References

Figure 1 Site Location Plan





The site comprises a studio and garages to the rear of the main house at 20 Crediton Hill, immediately adjacent a cricket field and residential gardens.

Figure 2 Historical Map Extract, OS 1:2,500 1871-1879

Figure 3 Historical Map Extract, OS 1:10,560 1896

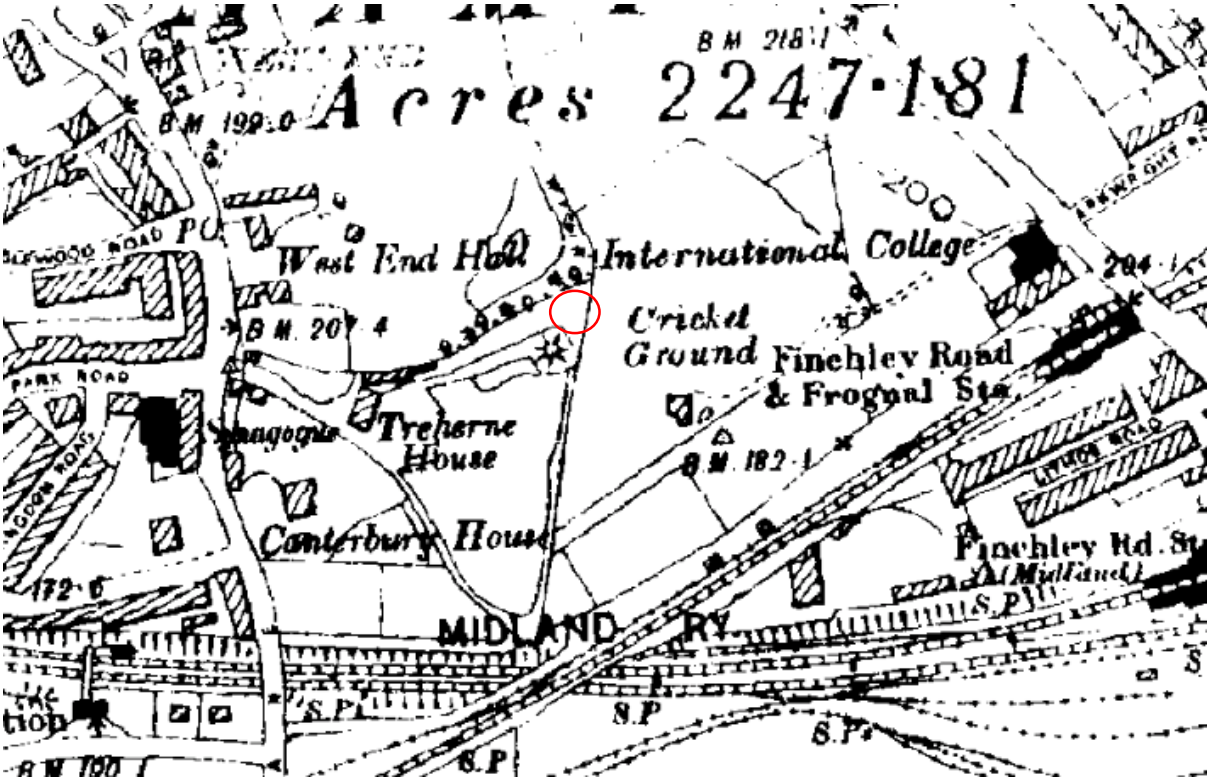


Figure 4 Historical Map Extract, OS 1:2,500 1915

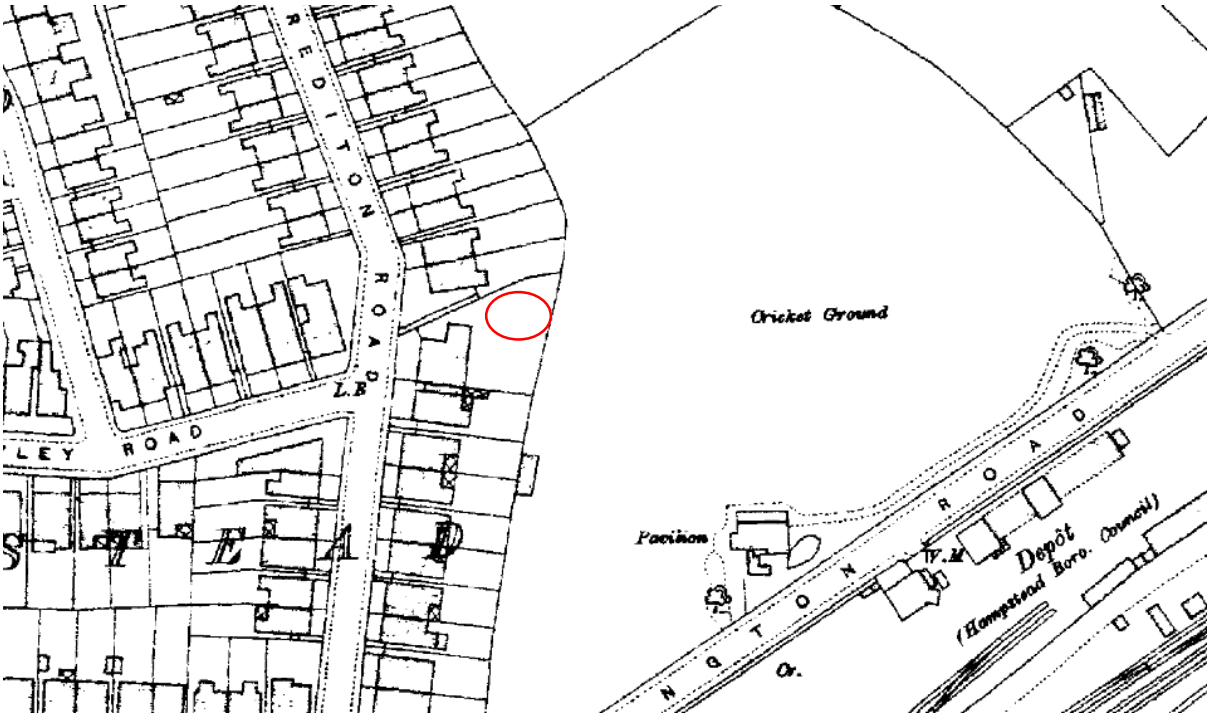


Figure 5 Historical Map Extract, OS 1:1,250 1960-1974

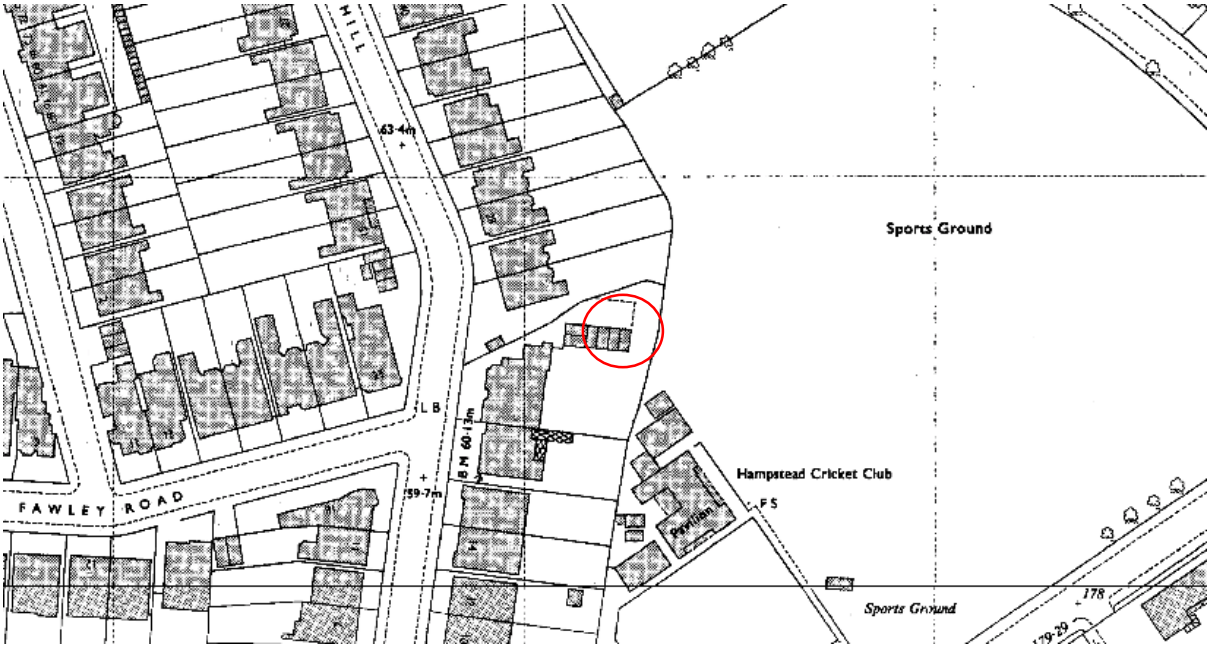
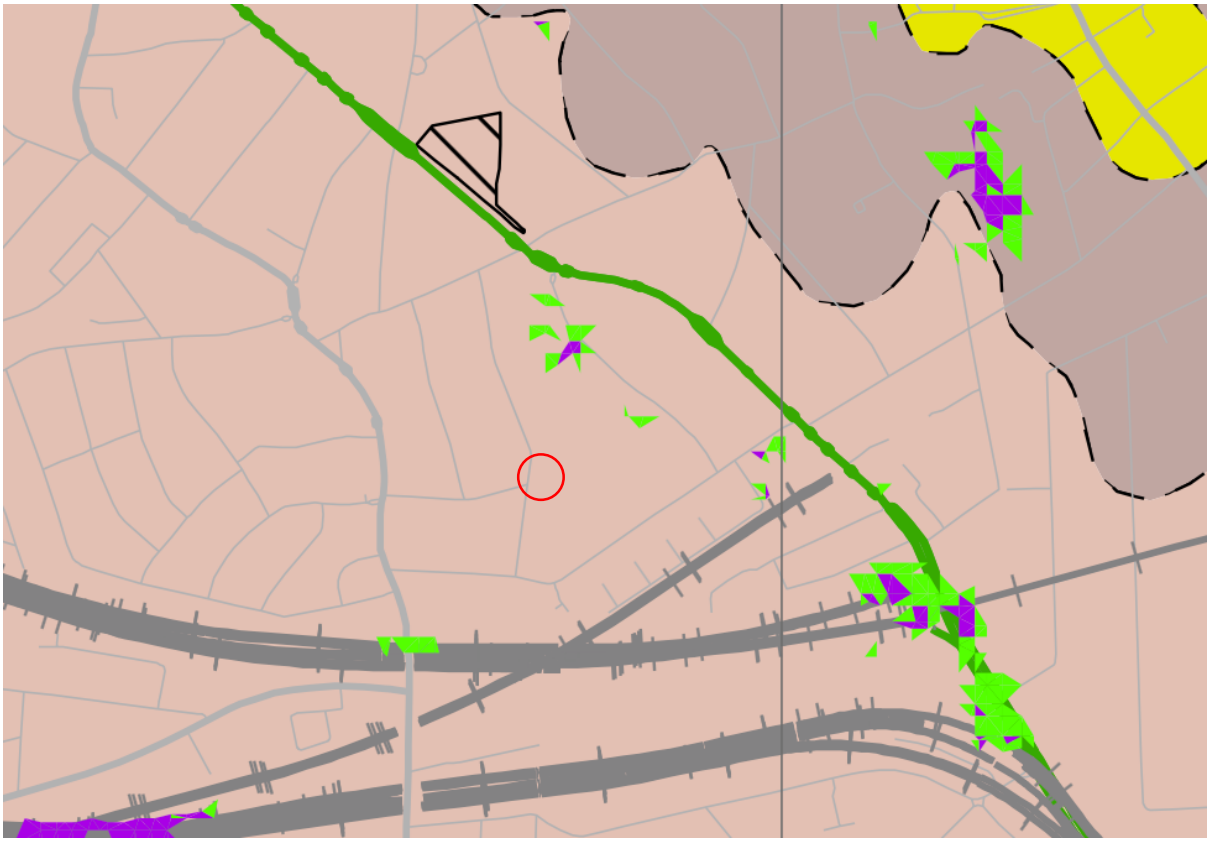


Figure 6 WW2 Bomb Damage Map Extract

Figure 7 Slope Angle and Worked Ground Map, LB Camden (GHHS figure 16)



Slopes in green, 7 – 10 degrees; Slopes in purple, >10 degrees.

Figure 8 Geological Map Extract, BGS (Geology of Britain Viewer)

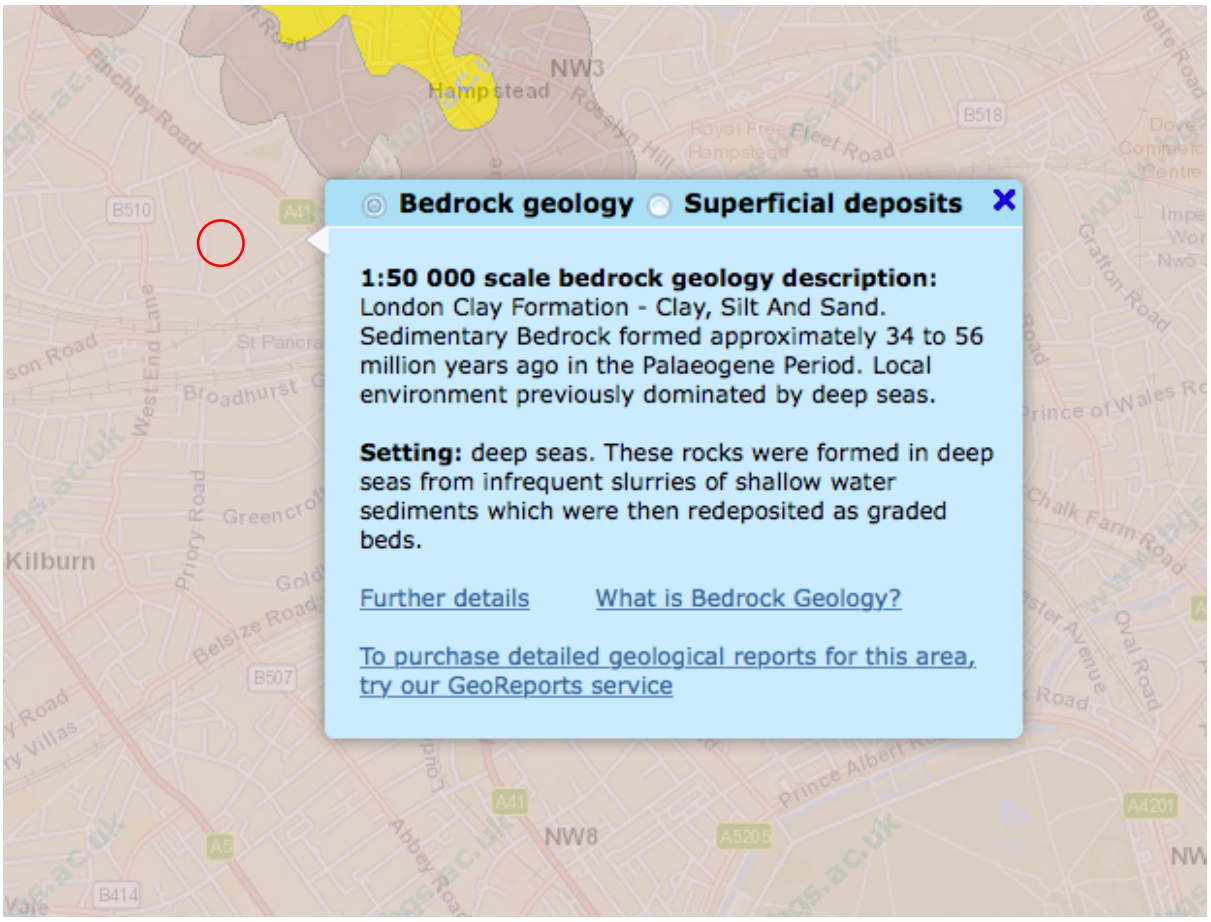


Figure 9 Flooded Streets Map, LB Camden (GHHS Figure 15)

The highlighted streets are known to have flooded in 1975 and 2002. The site (within the red circle) has not been affected by historic flooding.

Figure 10 Flood Risk Map, Environment Agency (Surface Water Flood Risk)

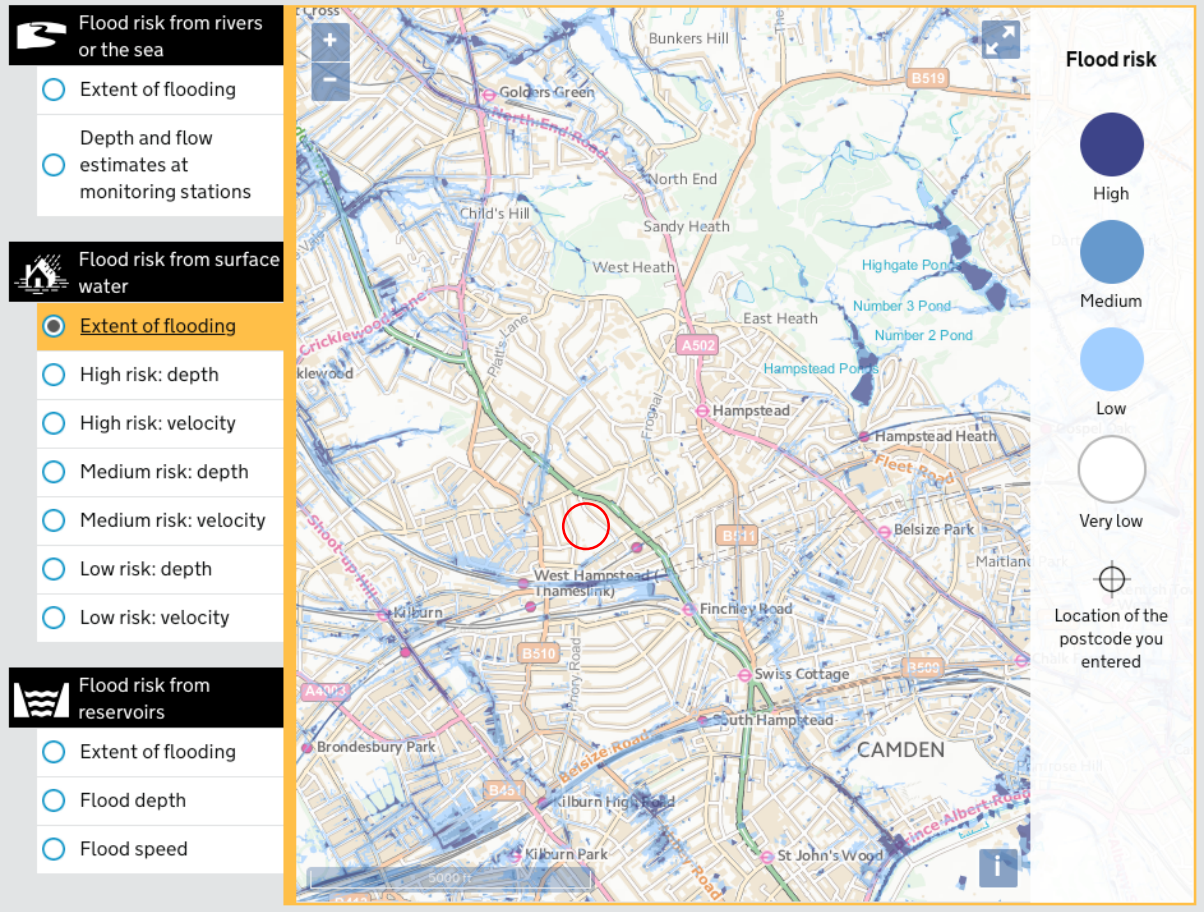


Figure 11 Groundwater Source Protection Zone, LB Camden (GHHS Figure 8)

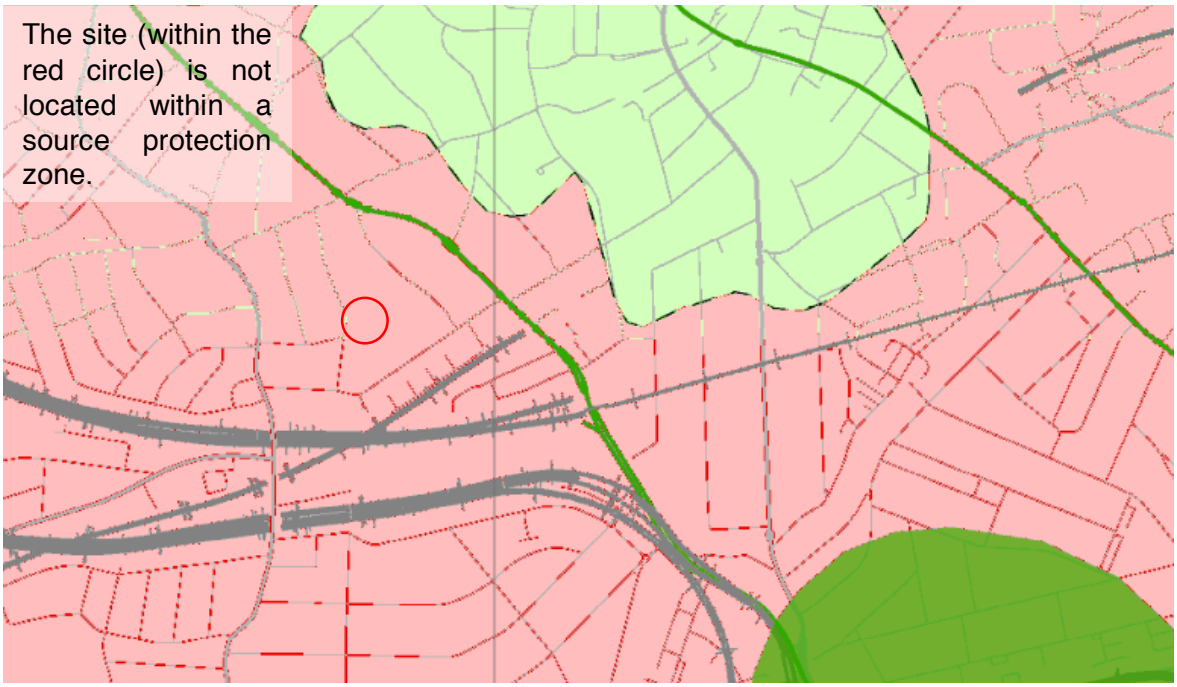


Figure 12 Lost Rivers of London, Barton (LB Camden GHHS Figure 11)

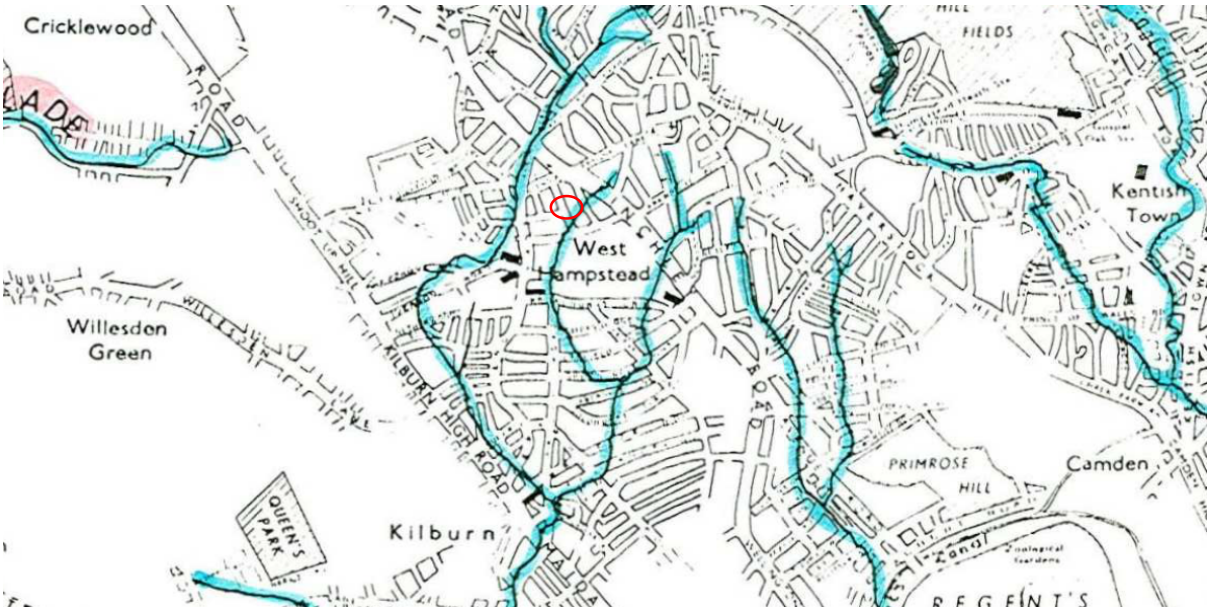
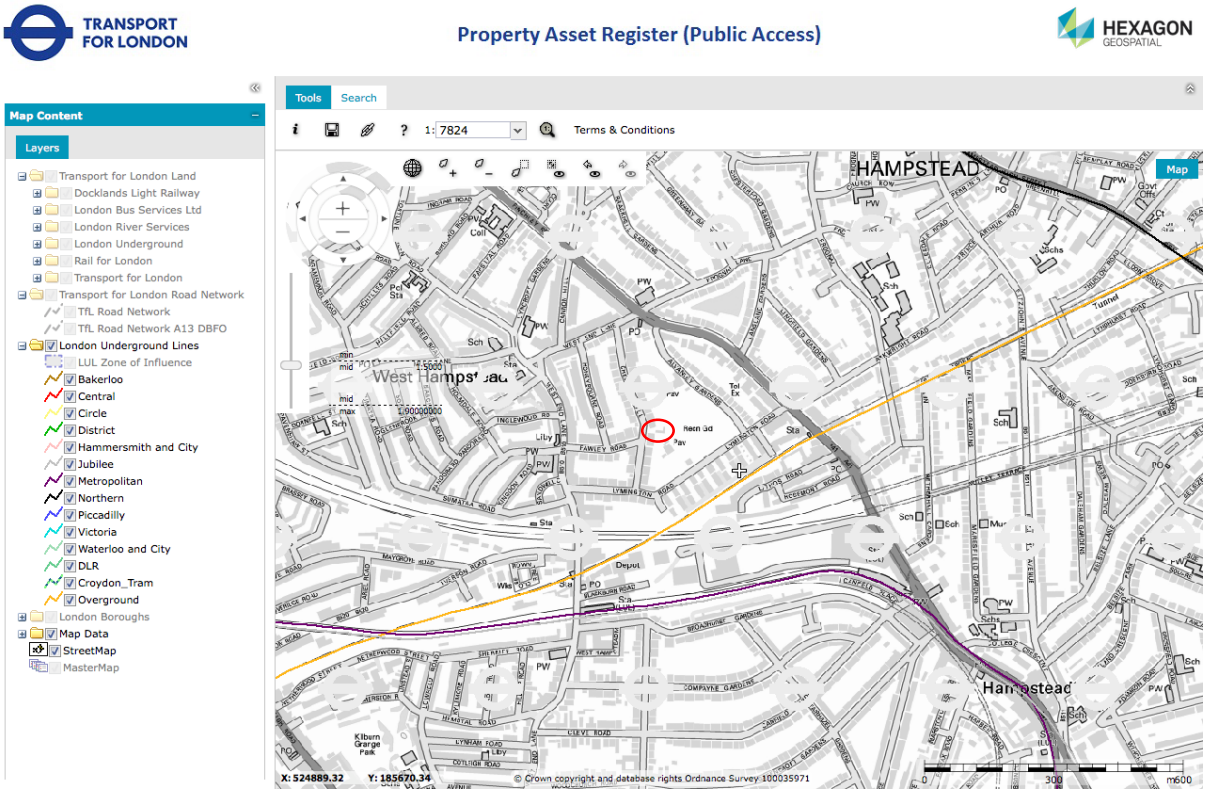


Figure 13 Transport for London Property Asset Register



Appendix 2 Site Investigation Data

Appendix 3 Existing and Proposed Development Drawings

Appendix 4 Arboricultural Report

Appendix 5 Utility and Infrastructure Consultations