GEOFIRMA
GEOTECHNICAL & CIVIL ENGINEERING CONSULTANTS

Basement Impact Assessment

31 Daleham Gardens, London NW3 5BU

Report No: 2023-002-SIM-DAL Rep.003

Date: 28/04/2023

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DOCUMENT CONTROL SHEET

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Andrea Carapia	**Checked by**	**MEng**

PREAMBLE

The basis of this report comprised essentially a review of the available documented information from a variety of sources, together with (where appropriate) meetings and discussions with relevant authorities and other interested parties. The information reviewed should not be considered exhaustive and has been accepted in good faith by Geofirma Ltd as providing a true description of site conditions and the proposed scheme. However, no liability can be accepted for the detailed accuracy or otherwise of any of the reports or documents prepared by others for the Client or for third parties, or for any associated errors or omissions.

The liability of Geofirma Ltd in respect of the information contained in the report will not extend to any third party.

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1.0 NON-TECHNICAL SUMMARY

1.0.1 The site location is 31 Daleham Gardens, NW3 5BU. The national grid reference of the site is 526673 185076 and the site is approximately 0.07 Ha.

1.0.2 The previous building on this site suffered extensive damage in a fire in 2017, leaving it structurally unsound and hence the building was demolished.

1.0.3 At the time of the ground investigation the site was vacant land with no visible buildings present.

1.0.4 The proposed project includes the redevelopment of the site to deliver a multi- storey apartment block, consisting of approximately 14 new units over 5 levels. The site levels fall from the west to east and hence the ground floor of the western part of the building shall cut into this slope to form a part basement. Due to the sloping profile of the site the ground floor slab will be approximately 5 m below existing ground level (approximately 81.5 m OD) at the western extent of the proposed building. At the eastern extent adjacent to the pavement of Daleham Gardens, the ground floor slab will be close to the existing ground level of approximately 77 m OD, hence minimal basement.

1.0.5 The following assessments are presented:

- Desk Study
- Screening
- Scoping
- Additional evidence/assessments (as required)
    - Site investigation (as a separate document)
    - Ground movement assessment (as a separate document)
    - Flood risk assessments and Surface water drainage strategy/SUDS assessment (as a separate document)

1.0.6 The BIA has been authored by Ebenezer Adenmosun with sections checked by Neil Morris of Geofirma Ltd. The Flood Risk Assessment and Drainage Strategy has been authored by Nathan Rowe and reviewed by Andrew Dye of Subteno Engineering Consultants.

Table 1: Authors and Qualifications

Contributors	Qualifications	Experience
Ebenezer Adenmosun	BEng(Hons) ACGI MSc DIC CEng MICE FGS RoGEP (Grade - Adviser)	Geotechnical director with thirty years' experience in dealing with the geotechnical design of complex underground structures
Neil Morris	BSc (Hons) MSc CGeol FGS PIEMA RoGEP (Grade – Adviser)	Chartered Geologist with twenty five years' experience in geological interpretation and geo-environmental engineering
Nathan Rowe	BSc (Hons) IEng MICE	13 years experience in Civil Engineering and below-ground drainage design ranging from residential properties to 20Ha Data Centres
Andrew Nye	HNC Civil Engineering	Director with 30 years experience in Civil and Structural Engineering. Undertaken numerous projects in residential, commercial and retail sector
Andrea Carapia	MEng	Associate Structural Engineer with 10 years of experience
Phil Issacs	FIStructE, CEng, MEng, PhD	Structural Engineer Director with 11 years of experience

1.0.7 The ground condition beneath the site comprise Made Ground, the Claygate Member and the London Clay formation. The ground conditions are described in further details in section 3.2 of this report and in the Geotechnical Interpretative Report prepared by Geofirma Ltd.

1.0.8 The basement section of the structure shall be formed by first installing an embedded retaining wall which shall be either sheet or bored piling techniques.

1.0.9 The Contractor shall monitor the position, vibrations and movements of the elevations of the adjacent properties around the perimeter of the proposed excavation. The monitoring shall be undertaken by a specialist survey company.

1.0.10 The BIA has assessed land stability and the impacts of the proposed development on neighbouring structures. Based on analytical models employed, the damage to the boundary walls shall be Category 0 and the damage to 31a Daleham Gardens and 33

Daleham Gardens shall be Category 0 in accordance with the Burland Scale. Refer to the Ground Movement Assessment report in appendix 5 for details.

1.0.11 The BIA has identified no potential slope stability impacts.

1.0.12 The BIA has identified no potential hydrogeological impacts to the existing site and surroundings.

1.0.13 The BIA has identified low flood risk from the proposed development.

1.0.14 This is a live document and further detailed assessment will be ongoing as the design and construction progress.

1.0.15 This document is to be read in conjunction with reports by others. Refer to Architect's and Structural Engineers drawings for site layout, plans and sections of the properties.

2.0 INTRODUCTION

The purpose of this assessment is to consider the effects of a proposed basement development at The site location which is 31 Daleham Gardens, NW3 5BU on the local hydrology, geology and hydrogeology and potential impacts to neighbours and the wider environment. The site location is presented in Figure 1.

Figure 1: Site Location

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

2.1 AUTHORS

The BIA has been written by Ebenezer Adenmosun and with sections checked by Neil Morris both of Geofirma Ltd. The Structural Engineers for the scheme are Phil Isaacs and Andrea Carapia of Simple Works. The summary of the other contributors qualifications and experience are given in Table 1.

2.2 SOURCES OF INFORMATION

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

- Geotechnical Interpretative Report, 31 Daleham Gardens, London, NW3 5BU. Report Ref.2023-002-SIM-DAL Rep 002. Rev.1. Date April 2023;
- Ground Movement Assessment Report, 31 Daleham Gardens, London, NW3 5BU. Report Ref.2023-003-SIM-DAL Rep 003. Rev.0. Date April 2023;
- Site walkovers on the 21st December 2022 and 31st January 2023 by Ebenezer Adenmosun;
- STM Environmental Contaminated Land Risk Assessment – Phase 1 Desk Study Report for 31 Daleham Gardens, London, NW3 5BU. Report Reference PH-2021-000087. Date 23/08/2021;
- Groundsure Historical Maps – Site Details 31 Daleham Gardens;
- Flood Risk Assessment and Drainage Strategy, 31 Daleham Gardens. Rep Ref.S221216-SUB-99-XX-FRA-C-00001 Rev.01. Date 25th January 2023;
- Information published or explicitly provided by the Environment Agency;
- Information published on the Local Planning Authority website;
- Camden Flood Risk Management Strategy 2022-2027;
- LBC Section 19 Flood Investigation Report on 12th and 25th July 2021 Flood Incidents;
- Camden Flood-SuDS Pro Forma;
- British Geological Society Mapping;
- A site specific topographical survey;
- 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);

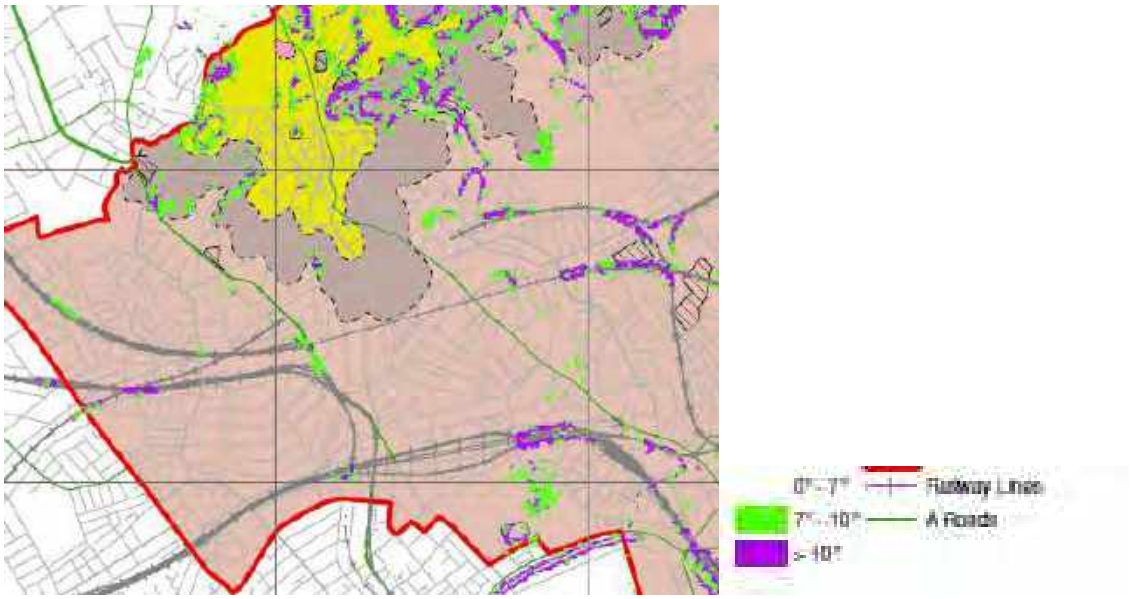
- LB Camden, Local Plan Policy A5 Basements (2017);
- The history of the Lost Rivers in Camden (March 2010).

2.3 EXISTING AND PROPOSED DEVELOPMENT

2.3.1 The Application site is located on Daleham Gardens, with the site slope from west to east with the Belsize Railway tunnels running beneath 31a Daleham Gardens, the neighbouring property.

2.3.2 The site is not within a wider hillside setting and based on the GHHS Slope Angle Map Figure 16 the slope angle fall in the range of 0 to 7º. The site topographic survey indicates the maximum slope level at the site is approximately 6º.

Figure 2: GHHS Slope Angle Map



2.3.3 The site has no structures located within its boundary. The site is bounded by masonry brick walls along southern boundary, and a wooden fence on the northern boundary.

2.3.4 Adjacent to the proposed development are:

31a Daleham Gardens which is a 3/4 storey brick work building. Fronting on Daleham Gardens the lower ground floor of the building comprises four garages with a forecourt. To the rear the building is three storeys. The building has no basements, however, the garage to the front of the site is cut into the sloping profile of the site. The building is likely to be founded on shallow traditional foundations. The building looks to be in a good condition.

33a Daleham Gardens is a single storey prefabricated building set back from Daleham Gardens likely to be founded on traditional shallow foundations due to the anticipated light loadings. The condition of the building is unknown.

2.3.5 Neighbouring gardens and trees are present at the rear of the properties and these will be protected in accordance with *the Camden Local Plan 2017.*

2.3.6 Based on available information the Belsize New Railway Tunnel is located below 31a Daleham Gardens. The current estimates are that the tunnel is located in excess of 25 m below the current ground level. This current information is based on record information from Network Rail NRG archives. The current asset owners have been consulted.

2.3.7 Proposed development drawings are presented in Appendix 1.

2.3.8 The proposed development will utilise a embedded retaining wall system (sheet or contiguous bored piled) following a methodology similar to the following:

a) Levelling of the site and enabling works to allow the entry of the construction work and formation of the working platforms.

b) Installation of the embedded retaining wall to required toe levels (to be determined at the detailed design stage).

c) Installation of capping beam. Likely to be stepped due to current site profile.

d) Installation of temporary works as shown in sketch No 1803-XX-SK-05 necessary to limit movements in the boundary wall with 31a Daleham Gardens.

e) Excavate soil required to form the basement excavation.

f) Installation of basement slab.

g) Removal of the temporary props restraining the boundary wall.

2.3.9 The construction works are likely to take place over a 2 year duration, however, details are solely indicative at this stage.

3 DESK STUDY

3.1 SITE HISTORY

3.1.1 The property was likely built in the 1800's as a single large residential property which was divided into flats later in the 20th century. The main building suffered extensive damage in a fire in 2017, leaving it structurally unsound and hence the building was demolished. At the time of the ground investigation the site was vacant land with no visible buildings present.

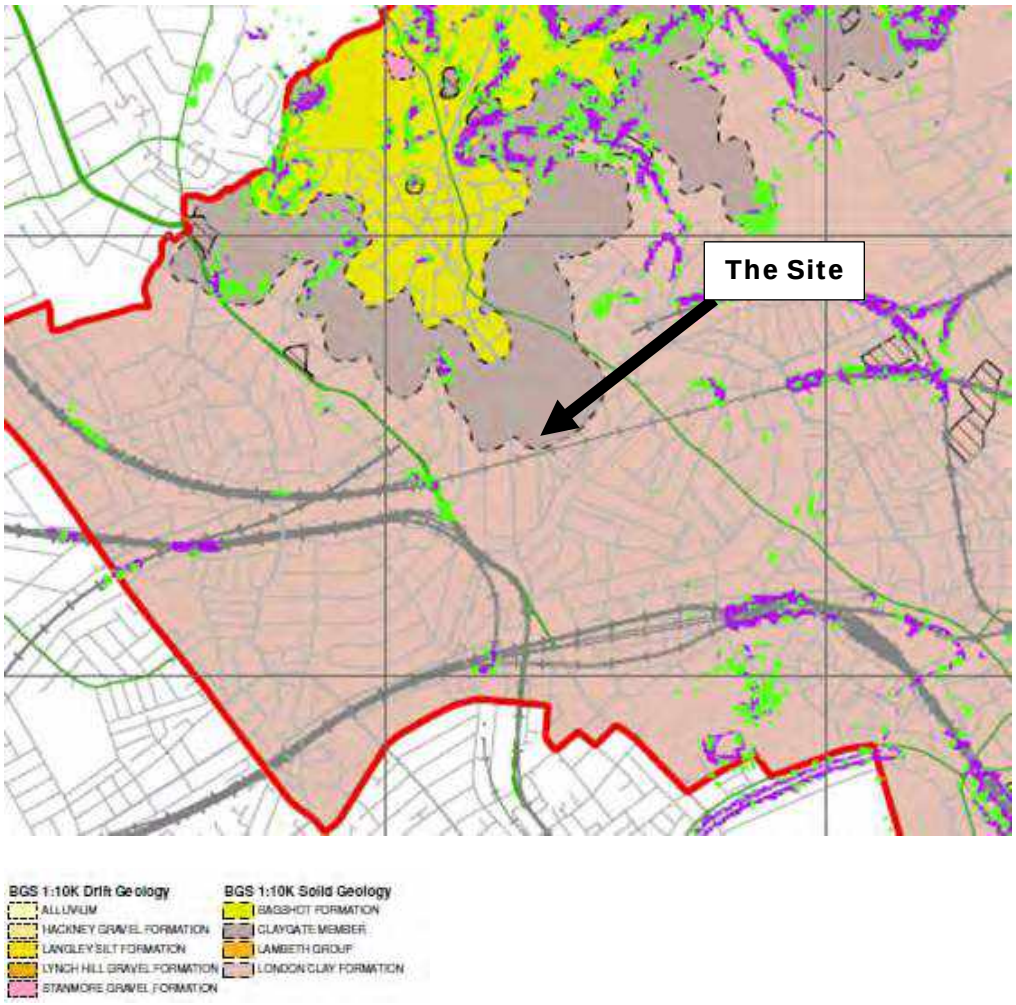
The site is also very close to the alignment of the Belsize Railway Line, which passes under 31a Daleham Gardens according to available information (see Figure 3). The tunnel was built between 1865 and 1867 as part of the Midland Main Line.

Figure 3: Plan Showing Location of Belsize Tunnel in Relation to Site From 1953 Historical Map

3.2 GEOLOGY

The published geology based on the British Geological Survey (BGS) map 1:50,000 geological map series, solid and drift, indicates the site is underlain directly by the Claygate Member and the London Clay Formation. The site is very close to the boundary between the Claygate Member and the London Clay (see Figure 4).

Figure 4: Geology Map



The published geology (BGS) for the Site consists of the Claygate Member of the London Clay Formation, comprising dark grey clays with sand laminae, passing up into thin alternations of clays, silts and fine-grained sand, with beds of bioturbated silt. The stratum is underlain by the London Clay Formation, comprising silty clay diffusely interbedded with sandy clayey silt; it is commonly glauconitic, with several layers of calcareous concretions.

The Claygate Member is distinguished from the underlying London Clay Formation by the laminated character and the relative abundance of sand layers. The boundary of the Claygate Member is drawn at the base of the lowest sand bed, conformable on silty clay with common sandy clayey silt interbeds. In practical terms, it is taken at the 'lowest sandy horizon mappable in the field' (Lake et al. 1986).

Superficial deposits are not mapped or anticipated within the project area.

Table 2: Summary of Published Geology

Geological Unit	Description	Composition	BGS Lexicon Description
Superficial	None	-	-
Bedrock	Claygate Member (Parent unit is the London Clay Formation)	Clay, silt and sand	Comprises dark grey clays with sand laminae, passing up into thin alternations of clays, silts and fine-grained sand, with beds of bioturbated silt. Ferruginous concretions and septarian nodules occur in places.
	London Clay Formation	Clay, silt and sand	Comprises dark grey clays with sand laminae, passing up into thin alternations of clays, silts and fine-grained sand, with beds of bioturbated silt. Ferruginous concretions and septarian nodules occur in places.

The site specific ground investigation is discussed in report ref 2023-002-SIM-DAL/Rep.002 Rev.1 produced by Geofirma Ltd and included in appendix 3 of this report describes the ground conditions in further details.

The ground condition beneath the site comprise Made Ground, which typically comprises a mixture of clayey gravelly SAND and gravelly sandy CLAY with the gravels being fragments of fine to coarse flint, brick, tile and concrete. Underlying the Made Ground is the Claygate Member, which typically comprises firm greyish orange mottled brown gravelly sandy CLAY, however, in BH2 at 2.0 m bgl a medium dense brown orange mottled clayey SAND band is present. Beneath the Claygate Member is the London Clay generally comprising firm to stiff slightly sandy fissured silty CLAY with micaceous inclusions on the fissured surfaces. The thicknesses and depths of the strata are summarised in Table 3.

The groundwater conditions encountered during the groundwater monitoring is summarised in Table 4.

Table 3: Proven Ground Conditions

Strata	Depth to Top (m bgl)	Thickness (m)
Made Ground	0.00	0.9 (BH2) to 3.6 BH1A)
Claygate Member	0.9 to 3.6	2.5
London Clay Formation	5.5 (BH1A) to 6.5 (BH2)	Not proven

Table 4: Summary of Groundwater Conditions

	Response Zone (m)	Date of Groundwater Monitoring and depth m bgl (estimated levels in m OD)	
		06/02/23	09/03/23
BH1A	6 to 10	3.25 (75.00)	3.20 (75.05)
BH2	2 to 6	5.49 (74.94)	Dry

3.3 HYDROGEOLOGY

Due to the moderately permeable nature of the Claygate Member deposits when compared to the London Clay Formation, surface water precipitation tends to flow through them and be stored within the stratum as a local aquifer, with spring lines forming at the ground surface at the junction with the Claygate Member (medium permeability) and at the junction of the Claygate Member with the London Clay Formation (low permeability). The Environment Agency classifies the Claygate Member as a Secondary A Aquifer of medium vulnerability and of mixed permeability.

The aquifer status for the identified strata together with an estimate of vulnerability is given in Table 5, below.

It is important to note that a highest monitored groundwater level of 3.2 m bl (75.05 m OD) was encountered in BH1A. Since the response zone is between 6 and 10 m bgl, it would suggest the water could be sub artesian.

It should also be noted that a groundwater strike was encountered during the drilling of BH1A at 1.8 m bgl, which is at approximately 76.5 m OD, which is likely to be perched in the Made Ground. On completion of the drilling there was no water in the borehole, which would appear to indicate the groundwater was perched, however this shall be confirmed prior to commencing the construction works.

The monitored groundwater level are still below the proposed dig level, but to mitigate groundwater monitoring will be continued at the site to assess a true indication of the groundwater response to seasonal factors and weather conditions.

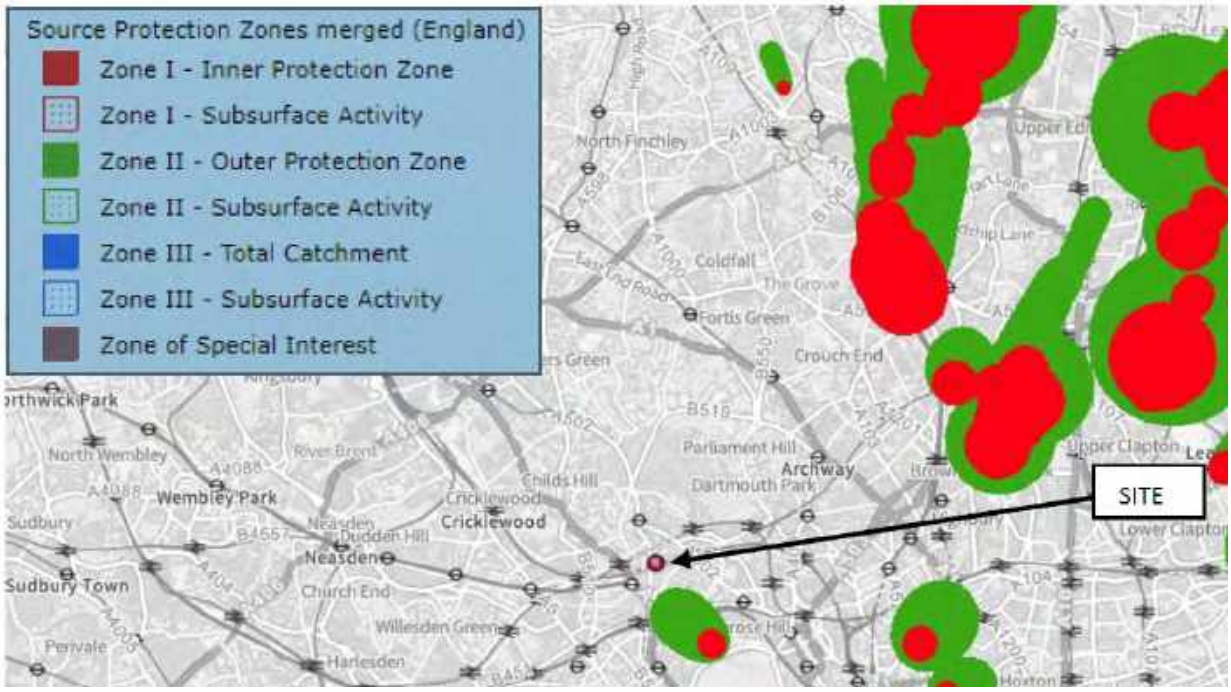
It should also be noted that since the site is close to a stratigraphical boundary, as stated above. There is a risk of spring lines affecting the development. The continued groundwater monitoring will assist in mitigating this risk.

Table 5: Aquifer Designation and Strata Vulnerability

Geological Unit	Strata	Aquifer Designation	Vulnerability
Bedrock	Claygate Member	Secondary A. Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifer. The stratum is underlain by the London Clay Formation, which is designated as unproductive strata.	Medium

LB Camden data and the Flood Risk Assessment indicates the site is not within a groundwater source protection zone (See GHHS Figure 8 and Figure 2.4.3 Flood Risk Assessment and Drainage Strategy).

Figure 5: Lost Camden Source Protection Zones

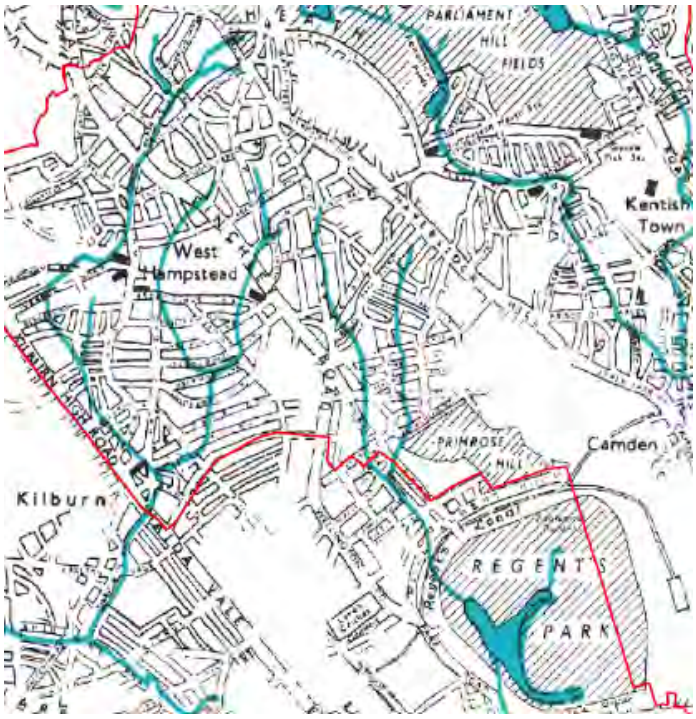


3.4 HYDROLOGY, DRAINAGE AND FLOOD RISK

There are no surface water bodies located within 250 m of the site based on the Groundsure Report which was included in the Phase 1 Desk Study produced by STM Environmental in August 2021. The closest surface water body to the site is Hampstead No 1 pond, which is approximately 1.2 km from the site as dictated by the Hampstead Heath Map (see Figure 13 of the Camden GHHS).

A review of the 'Watercourses' plan from Bartons 'Lost Rivers of London' (see Figure 6) indicates various historical water courses that were present within the Camden area. The closest historical water body to 31 Daleham Gardens was the lost River Tyburn. The main source of the River Tyburn was Shepherd's Well (shown as Conduit Wells in the 1870-1871 Groundsure Historical Map), which was located at the corner of Fitzjohn's Avenue and Lyndhurst Road which is approximately 150 m to the north of our site. In the late 1870's when the houses were built on Fitzjohn's Avenue the water was culverted into a sewer behind the houses to flow south to Regent's Park and into the Thames. The culvert is likely to be positioned at its closest point approximately 50 to 100 m to the west of our site on its southernly journey towards Regent's Park.

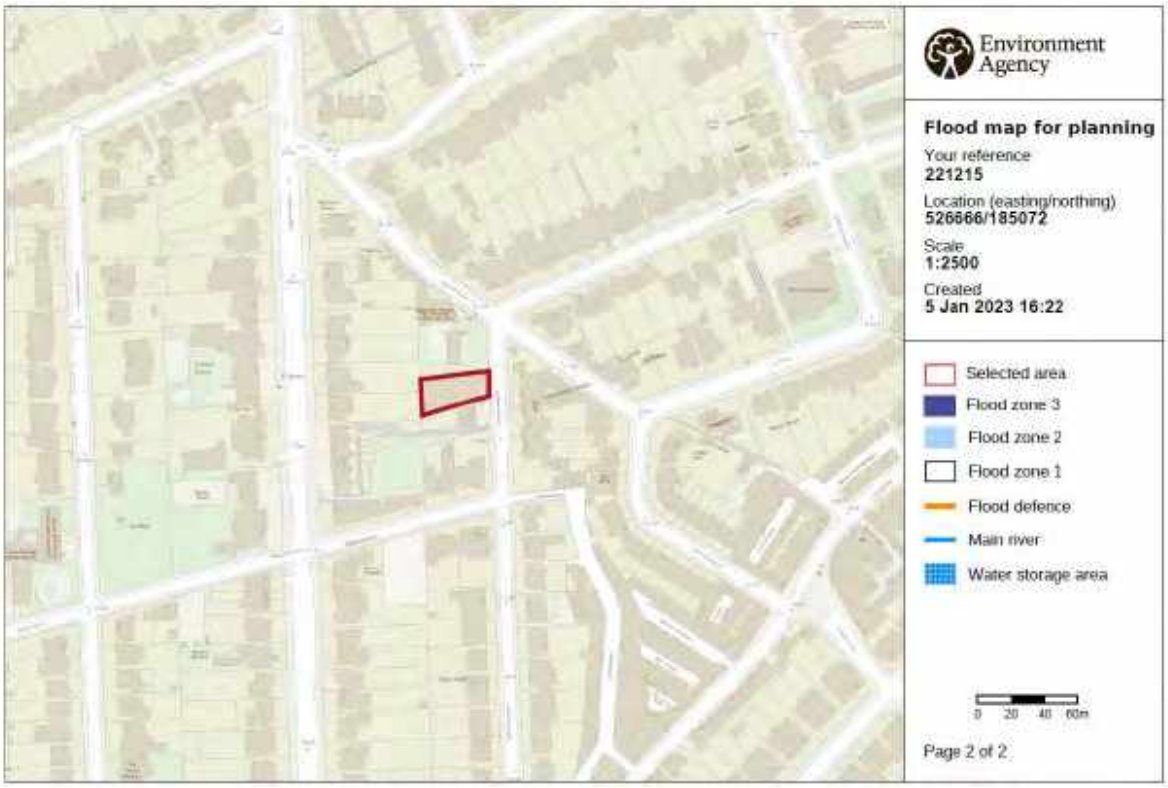
Figure 6: Lost Rivers of London Excerpt



As part of the drainage strategy rain gardens and a below ground attenuation tank are proposed to ensure surface water runoff can be managed over the lifetime of the development.

The site is classified being located in Flood Zone 1 as shown in Figure 7 from the scheme FRA and Drainage Strategy. Figure 6 also shows the site has very low risk of surface water flooding. The findings of the ground investigation indicates the highest groundwater level monitored in the boreholes was approximately 1.5 m below the anticipated dig level of 76.55 m OD. Note the water encountered is likely to be perched within the Claygate Member. *The site falls within a CDA - reference Group3_005.*

Figure 7: Environment Agency Flood Map



4.0 SCREENING

4.1 SUBTERRANEAN GROUND WATER FLOW

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

Table 6: Screen Process - Subterranean Ground Water Flow

Question	Response	Details
1a. Is the site located directly above an aquifer?	Yes	The site is located above a Secondary A Aquifer, defined as permeable layers capable of supporting water supplies at a local scale. See Table 5.
1b. Will the proposed basement extend beneath the water table surface?	No	The findings of the ground investigation indicates the highest groundwater level monitored is approximately 1.5 m below the anticipated dig level of 76.55 m OD (see Table 4). Note the water present could be subartesian, and hence monitoring should be continued to assess potential variation of the groundwater level due to seasonal and weather factors. Although, the groundwater level measured is anticipated to be below the proposed dig level, it should also be noted that a groundwater strike was encountered within Made Ground during drilling at 1.8m in BH1A (approx. 76.5m OD). On completion of the drilling BH1A and removal of the casing no groundwater was present in the hole, which would indicate the strike was due to perched water, however, this will be confirmed prior to commencing the excavation works on site.
2. Is the site within 100 m of a watercourse, well (used / disused) or potential spring line?	Yes	The closest surface water body to the site is Hampstead No 1 pond, which is approximately 1.2 km from the site as dictated by the Hampstead Heath Map (see Figure 13 of the Camden GHHS). The closest historical water body to 31 Daleham Gardens was the lost River Tyburn. The main source of the River Tyburn was Shepherd's Well (shown as Conduit Wells in the 1870-1871 Groundsure Historical Map), which was located at the corner of Fitzjohn's Avenue and Lyndhurst Road which is approximately 150 m to the north of our site. The site is close to the boundary of the Claygate Member and the London Clay, so it is potentially close to a spring line.
3. Is the site within the catchment of the pond chains on Hampstead Heath?	No	The closest surface water body to the site is Hampstead No 1 pond, which is approximately 1.2 km from the site as dictated by the Hampstead Heath Map (see Figure 13 of the Camden GHHS). Refer to section 3.4 of this Report.

4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	Yes	The proposed development shall result in an increase in the total impermeable area from 0% to 67%. (refer to Drawing 1803-SMW-XX-XX-DR-C-0001-P1 in FRA and Drainage Strategy Report).
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)?	Yes	Currently since the site has no cover/ development all rainfall and run-off is presently being discharged directly to the ground. However, water will be discharged into the ground using rain gardens and an attenuation tank.
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	The site is located approximately 1.2 km from the catchment of the pond chains on Hampstead Heath. No live spring line have been recorded on the site.

4.2 SLOPE STABILITY

Table 7: Screen Process – 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 GHHS Slope Angle Map indicates the slopes are shallower than 7º. This is further confirmed by the attached topographical survey (Appendix 3) which indicates the site slopes gradually fall from west to east at an angle of approximately 5.8º. A fall of approximately from approximately 52.5 m OD to 50 m OD from west to east across the site.
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	No proposed steepening of the site slope profile is identified as part of this development.
3. Does the development neighbour land, including railway cuttings and the like, with a slope	No	The adjoining sites similarly fall from west to east as 31 Daleham Gardens. The existing site will have retaining walls installed to

greater than 7 degrees (approximately 1 in 8)?		enable the construction of the basement and these retaining walls shall be designed to carry the lateral loading from the surrounding sites.
4. Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately1 in 8)?	No	Refer to section Figure 2.
5. Is the London Clay the shallowest strata at the site?	No	No the Claygate Member. Refer to Table 3.
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	The on-going design and planning process is undertaken in consultation with the project arboriculturist and the consulting architect, no further assessment is considered necessary.
7. Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?`	No	No evidence of shrink swell subsidence at the site or neighbouring buildings.
8. Is the site within 100m of a watercourse or a potential spring line?	Yes	See Table 6, point 2. Maybe be greater than 100 m away, but has been discussed in scoping.
9. Is the site within an area of previously worked ground?	No	Refer to Figure 4 as no worked ground shown on map.
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 Claygate Formation is classed as Secondary A aquifer. The proposed basement maximum dig is 1.5 m above the measured water level. Refer to Table 4
11. Is the site within 50m of the Hampstead Heath Ponds?	No	Refer to section 3.4 of the report.
12. Is the site within 5m of a highway or pedestrian right of way?	Yes	However, the section to be excavated shall be further than 5 m from the highway or pedestrian right of way. The pavement and kerb shall be monitored as part of the monitoring programme during the construction works.
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes	The GMA in appendix 5 assesses the impact of this and relative difference between boundary wall and new foundation.
14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	Yes	See Figure 3. This current information is based on record

		information from Network Rail NRG archives.

4.3 SURFACE WATER AND FLOODING

Table 8: Screen process – Surface Water and Flooding

Question	Response	Details
1. Is the site within the catchment of the ponds chains on Hampstead Heath?	No	Refer to 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?	Yes	An increase in the impermeable area on a site will result in greater rainfall run-off.
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	Yes	Refer to Drawing 1803-SMW-XX-XX-DR-C-0001-P1 in FRA and Drainage Strategy Report (See Appendix 4).
4. Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	No	The site is however with a Critical Drainage Area (CDA), which is discussed in more detail in the scoping section of the report.
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 in the quality of surface water received by neighbouring properties of downstream watercourses.
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	However, the site does fall with a Critical Drainage Area (Refer to section 4.5 of the FRA and Drainage Strategy report in Appendix 4.

4.4 NON-TECHNICAL SUMMARY OF SCREENING PROCESS

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

- Is the site located directly above an aquifer?
- Will the proposed basement extend beneath the water table surface?
- Is the site within 100 m of a watercourse, well (used / disused) or potential spring line?
- Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?
- 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)?
- 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.
- 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?
- 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.
- 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?
- Is the site within 5 m of a highway or pedestrian right of way.
- Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?

4.3.2 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.

5.0 SCOPING

5.1 INTRODUCTION

The following issues in this section have been brought forward from the Screening process for further assessment.

5.2 IS THE SITE LOCATED DIRECTLY ABOVE AN AQUIFER?

The Claygate Formation are classed as Secondary A aquifer. Based on the BGS map for the area the site lies very close to the boundary of the Claygate Member and the London Clay Formation, which is an aquiclude. The highest groundwater monitoring level of 75.05 m OD was encountered at the site, which is approximately 1.5 m below the basement dig level.

5.3 WILL THE PROPOSED BASEMENT EXTEND BENEATH THE WATER TABLE SURFACE?

The proposed basement is anticipated to be above the water table, however, there are two factors that must be considered. Firstly, a groundwater strike was encountered at 1.8 m bgl which is at approximately 76.5 m OD. This groundwater strike is suspected to be perched based on the groundwater monitoring subsequently performed. Secondly, groundwater is likely to fluctuate subject to seasonal changes and could be impacted by rainfall. Therefore, it is recommended groundwater monitoring in continued to assist in mitigating this risk and a decision made before construction as whether dewatering will be necessary during the excavation phase. The use of sheet piles will also reduce/prevent water flowing into the excavation during its formation, particularly because there could water bearing sand lenses in the Claygate Member, and hence perched water.

5.4 IS THE SITE WITHIN 100 M OF A WATERCOURSE, WELL (USED / DISUSED) OR POTENTIAL SPRING LINE?

The site is close to the boundary of the Claygate Member and the London Clay, so it is potentially close to a spring line. The site may not be within 100 m of this boundary, however, it has been discussed as part of this scoping exercise. This consideration may be linked to the possibility that the water encountered in BH1A could be sub artesian. The groundwater monitoring has indicated the water level is below the dig level, however, the groundwater will be monitored regularly up to the commencement of construction to enable a continual assessment of the risk. If the rising of the current groundwater level is assessed to be a risk, dewatering may be necessary during construction. The use of a sheet pile wall will also reduce/prevent the entry of water into the excavation during construction.

5.5 WILL THE PROPOSED BASEMENT DEVELOPMENT RESULT IN A CHANGE IN THE PROPORTION OF HARD SURFACED/PAVED AREA?

The site currently has no hard surface/paved area and as seen from drawing 1803-SMW XX-XX-DR-C-0001-P1 in the FRA and Drainage Strategy a proportion of the site will be covered by hard surfacing and paving as part of this project. The FRA and Drainage Strategy describes how the rainfall and the resulting surface run-off will be managed by using a green roof, functional rain gardens and below ground attenuation. The proposed site shall be approximately 67 % impermeable and 33 % permeable surfacing. Drawings related to the drainage strategy for this scheme are included in appendix 4.

5.6 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)?

Currently surface water is being discharge directly into the ground as the site has been dug up as part of the demolition process. The site will have more impermeable surfacing after the development of the site than it currently has, so more will have to be discharge into the ground via below ground attenuation and rain gardens. Hence the requirement for the drainage strategy implementation. Drawings related to the drainage strategy for this scheme are included in appendix 4.

5.7 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?

Currently the site has no visible drainage as the site was dug up as part of the demolition process at the site. The new site drainage is described in detail in the FRA and Drainage Strategy report (See Appendix 4). The scheme shall ensure rainfall and surface water flow is managed over the lifetime of the project. Drawings related to the drainage strategy for this scheme are included in appendix 4.

5.8 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?

The London Borough of Camden SFRA, figure 6a Rev 2 identifies a number of Critical Drainage Areas (CDA) within the borough. Section 4.2 of the SFRA describes these as hydrological catchments where "multiple and interlinked sources of flood risk cause flooding in one or more Local Flood Risk Zones during severe weather". The site falls within a CDA - reference Group3_005.

An area within a CDA may not necessarily be at higher risk of flooding but falls within a catchment area that contributes to a flooding hotspot elsewhere. The LBC Section 19 Flood Investigation Report, into the Flood incidents on 12th and 25th July 2021, Revision 003 dated 20/06/2022 identifies local LBC Flood Hotspots. The Belsize Park Swiss Cottage Hotspot) is close to the site hence the surface water management of this proposed development has been designed as described in the FRA and Drainage Strategy (see Appendix 4) to ensure flood risk is not increased elsewhere.

5. 9 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?

Trees will be felled to the rear of the site closest to the western boundary. The removal of trees can often result in volumetric change in the soil as a result of the change in moisture content in the soil. The classification tests undertaken in the Claygate Member indicate the soil has medium volume change potential. The moisture content values also indicate potential signs of soil desiccation to depths of 3 m to 4 m. However, it should be noted that the foundations for the new development to the rear of the site will be up to 5 m bgl. This is below the depth zone of where shrinkage and swelling of the soil is likely.

The removal of trees to the rear of the site are unlikely to impact neighbouring 56 Fitzjohns Avenue because as stated by the arboriculturist's report that the roots are likely constrained by the existing boundary wall.

The on-going design and planning process is undertaken in consultation with the project arboriculturist and the consulting architect and hence no further assessment is considered necessary.

5.10 IS THE SITE WITHIN 5M OF A HIGHWAY OR PEDESTRIAN RIGHT OF WAY?

The site is within 5 m of a pedestrian right of way to the eastern boundary, Daleham Gardens. Excavations to the east of the site will be shallow (circa 1/1.5 m bgl), as the ground levels along the eastern boundary of the site are close to the proposed slab level of approximately 76.55 m OD. The excavations are therefore unlikely to impact the pedestrian right of way and Highway due to the distance and minimal depth.

5.11 WILL THE PROPOSED BASEMENT SIGNIFICANTLY INCREASE THE DIFFERENTIAL DEPTH OF FOUNDATIONS RELATIVE TO NEIGHBOURING PROPERTIES?

Sketch No:1803-XX-SK-05 shows the significant increase in the differential depth of the foundations relative to neighbouring properties. The maximum dig will be approximately 5 m bgl relative to the boundary wall and 3 m bgl relative to 31a and 33a Daleham Gardens. The retaining walls will be designed to accommodate the surcharge from the neighbouring building and have been taken into account in the GMA which is presented in appendix 5. As shown in the sketch 1803-XX-SK-05, restraints will be installed to limit the 31a Daleham Gardens boundary wall movements.

5.12 IS THE SITE OVER (OR WITHIN THE EXCLUSION ZONE OF) ANY TUNNELS E.G. RAILWAY LINES?

The Belsize Railway Tunnel runs beneath 31a Daleham Gardens. Consultation with Network Rail Asset protection has commenced and a response is being awaited. At this stage the depth of the tunnel crown has not been confirmed, but it is anticipated to be in excess of 25 m bgl. This current information is based on record information from Network Rail NRG archives. The impact of the piling required to form the basement excavation shall be considered on the tunnel during the detailed design phase. Necessary monitoring and other mitigations shall be implemented if the pile wall is deemed to be in the tunnel zone of influence for tunnel movements or vibrations.

6.0 BASEMENT IMPACT ASSESSMENT

6.1 SITE INVESTIGATION

A site investigation has been performed by Geofirma Ltd at the above named site. For the reports discussing the factual and interpretation of the site investigation refer to Appendix 3.

6.2 FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

The Flood Risk Assessment and Drainage Strategy has been written by Subteno Engineering Consultants Ltd. Refer to Appendix 4 for the report and relevant scheme drawings.

6.3 GROUND MOVEMENT ASSESSMENT

A Ground Movement Assessment has been undertaken by Geofirma Ltd. Refer to Appendix 5 for the report.

7.0 CONSTRUCTION METHODOLOGY/ENGINEERING STATEMENTS

7.1 OUTLINE GEOTECHNICAL DESIGN PARAMETERS

The Geotechnical Design Parameters are discussed in detail in the Geotechnical Interpretative Report in Appendix 3.

The summary of the Geotechnical Parameters is provided in Table 9 to accompany the ground conditions in Table 3 section 3.2.

Table 9: Summary of Geotechnical Design Parameters

Stratum	Typical thickness Range (m)	Bulk Density (kN/m^3)	C_u (kN/m^2)	Φ'_{cv} (°)	m_v (m^2/MN)	$E_{u\ (ULS)\ wall}$ (MN/m^2)	$E_{u\ (SLS)\ wall}$ (MN/m^2)	$E_{u\ settlemsnt}$ (MN/m^2)	$E'_{(ULS)wall}$ (MN/m^2)	$E'_{(SLS)\ wall}$ (MN/m^2)	$E'_{settlemsnt}$ (MN/m^2)
Made Ground	0.9 to 3.6	18	-	28	-	10	10	-	7.5	7.5	-
Claygate Member	2.5	18	50	24	0.2	25	50	15	18.75	37.5	12.5
London Clay Formation	Not Proven	19	80 + 5z	23	0.1	40 +2.5z	80 + 5z	24 + 5z	30 + 1.875z	60 + 3.75z	18 + 1.125z

(1) z is measured below the surface of the London Clay

7.2 OUTLINE TEMPORARY AND PERMANENT WORKS PROPOSALS

7.2.1 Retaining Walls.

The current proposal stated by the Structural Engineer comprise the installation of a retaining wall around the building footprint to provide the temporary works necessary to form the basement. The retaining wall shall also be left in place to form the permanent works. The pile length installed shall vary from west to east due to the varying depth of the basement. To the west of the site the excavation and hence retained height shall be approximately 5 m high, whilst to the east closest to the Daleham Gardens pavement and road the excavation will be 1.5 m to 1 m.

Additional temporary works shall also be required to support the adjacent boundary wall with 31a Daleham Gardens and limit movements. The current proposal is to install raking props connecting the boundary wall and the retaining wall capping

beam (see Sketch No 1803-XX-SK-05). The outline propping proposal are shown in Sketch No 1803-XX-SK-05.

An RC liner wall shall be constructed on the inside of the retaining wall.

The retaining walls shall be also designed to carry earth pressures, surcharge loading as well as potential hydrostatic loads both in the short and long term.

7.2.2 Foundations

At this stage the foundation are proposed to be a slab. The slab has been shown as a RC slab 600 mm thick and should be constructed on the Claygate Member. There is a possibility the formation level may have to be strengthened either by replacing the Made Ground where present with structural fill or undertaking ground treatment.

7.2.3 Temporary Propping

As discussed in section 7.2.1, temporary propping shall be used to restrain movements in the boundary wall with 31a Daleham Gardens.

7.2.4 Dewatering

The ground level slab is above the monitored groundwater levels, however, potentially there could be perched water levels in the Made Ground. The groundwater levels may also be related to season variations, so it is recommended groundwater monitoring is continued until the construction phase is commenced, and then a decision made on whether groundwater control is required. The use of sheet piles may negate/reduce the requirement for dewatering.

7.2.5 Drainage strategy/SUDS proposals (including assessment calculations).

The drainage strategy and SUDS proposals are discussed in detail in Appendix 4.

The report include the calculations and drawings.

7.3 PROPOSED SEQUENCE OF WORKS

7.3.1 Before the commencement of the excavation work condition surveys shall be performed on the adjacent structures and boundary wall. The impact associated with the installation of the piles shall be assessed on the adjacent structures in advance of the works.

7.3.2 Installation of the piles, followed by the construction of the capping beam.

7.3.3 The excavation shall be excavated to full depth following an agreed methodology

7.3.4 The raking props supporting the boundary wall shall be removed.

7.3.5 It is contractor's responsibility to take all the necessary steps to ensure that the structure is adequately propped, shored, and braced during the progress of the works and excess of deflections and deformations of structure do not occur.

7.3.6 To ensure that the retained engineer's intent is correctly interpreted by the contactor, they will be required to submit all temporary works proposals to review a minimum of 7 working days prior to commencing excavation.

7.3.7 The contractor should submit a dewatering strategy to ensure a strategy is agreed should water be encountered. The use of sheet piling is likely to reduce the inflow of water into the excavation, if present.

7.4 GROUND MOVEMENT AND DAMAGE IMPACT ASSESSMENT

7.4.1 A Ground Movement Assessment (GMA) has been carried out in accordance with the guidance provided in CIRIA C760 and takes into account the construction methodology and site specific ground and groundwater conditions. The ground model determined from the ground conditions has been modelled using PLAXIS 2D to assess the potential movements.

7.4.2 The impact of the excavation works has been assessed on the neighbouring properties 31a and 33a Daleham Gardens. The impact of the excavation has also been assessed on the boundary wall between 31a and 31 Daleham Gardens in the GMA in appendix 5.

Table 10: Classification of Visible Damage to Walls CIRIA C760

Category of damage	Description of typical damage (ease of repair is underlined)	Approximate crack width (mm)	Limiting tensile strain ε_{lim} (per cent)
0 Negligible	Hairline cracks of less than about 0.1 mm are classed as negligible.	< 0.1	0.0–0.05
1 Very slight	Fine cracks that can easily be treated during normal decoration. Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection.	< 1	0.05–0.075
2 Slight	Cracks easily filled. Redecoration probably required. Several slight fractures showing inside of building. Cracks are visible externally and some repointing may be required externally to ensure weathertightness. Doors and windows may stick slightly.	< 5	0.075–0.15
3 Moderate	The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable linings. Repointing of external brickwork and possibly a small amount of brickwork to be replaced. Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired.	5–15 or a number of cracks > 3	0.15–0.3
4 Severe	Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Windows and frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Service pipes disrupted.	15–25 but also depends on number of cracks	> 0.3
5 Very severe	This requires a major repair involving partial or complete rebuilding. Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion. Danger of instability.	usually > 25 but depends on number of cracks.	

7.4.3 In accordance with the Burland Scale, the damage impacts are assessed as:

Table 11: Summary of Damage Category to Structures in Zone of Influence of the Excavation

Structure	Category of Damage (Burland Scale)
31a Daleham Gardens	0
33a Daleham Gardens	0

The rationale behind the categorisation of the damage is described in more detail in the GMA in Appendix 4.

Based on the PLAXIS 2D analysis discussed in the GMA, the boundary walls behind the sheet pile wall are anticipated to move up to 4 mm (see Table 12). Taking into account the possible installation movements of up to 5 mm, the total horizontal movements of the boundary walls surrounding the site (to the rear and sides) could range between 6 to 10 mm, taking into account the installation effects.

Table 12: Summary of Ground Movements

		Foundation 31a		Boundary wall		Left wall (31a side)		right wall (33a side)		Foundation 33a	
		Propped	Unpropped	Propped	Unpropped	Propped	Unpropped	Propped	Unpropped	Propped	Jnpropped
Section A-A	Horizontal	-	3.5	-	4.0	-	5.5	2.5	17.0	1.5	4.0
	Vertical	-	2.5	-	1.0	-	2.0	1.0	1.0	1.0	3.0
Section B-B	Horizontal	-	-	-	3.0	-	10.0	2.5	11.0	-	-
	Vertical	-	-	-	1.0	-	0.5	1.0	0.5	-	-

*Note boundary wall movements do not include installation effect which could be up to 5 mm in accordance with CIRIA760 guidance. All units in mm.

7.5 CONTROL OF CONSTRUCTION WORKS

The construction works will be closely controlled for the duration of the basement construction. A structural monitoring proposal should be prepared in advance of the piling and excavation works which should include the following:

- The location of the proposed monitoring points
- The frequency at which the monitoring readings should be taken
- Verification of the maximum allowable lateral deflection (to be agreed with the client).
- Allocate responsibility to an appropriate party to review the retaining wall and adjacent building movements
- Provide a detailed procedure stating the actions necessary (and parties responsible for undertaking the actions) should the trigger movements be exceeded.

The monitoring must be undertaken using monitoring points placed on the capping beam to determine lateral deflections of the capping beam, and the wall. As well as markers points being installed on the adjacent buildings.

The monitoring of the wall movements must take into account agreed trigger level values as discussed in sections 7.4.3 and 9.7 of CIRIA C760. If the wall deflection exceeds the pre-defined target values agreed, excavation works should be stopped and mitigation measures such as the installation. The mitigation measures must be agreed between the Client, the Main Contractor, the Engineer and the wall designer to ensure a wholistic, realistic and practical approach is applied to controlling the wall movements.

If sheet piling is used, due to the anticipated vibrations and noise disturbance, the necessary preconstruction impact assessments will be undertaken and the site neighbours and Camden Council consulted as part of this process. Noise and vibration monitoring shall be included as part of the works control process.

8.0 SUMMARY

The Conceptual Site Model (CSM) is discussed and described in the Ground Movement Assessment written by Geofirma Ltd (See Appendix 5). It describes the ground and groundwater conditions, assumed ground model, the construction proposals and the anticipated impact of the basement construction.

The BIA has concluded the following:

- The site investigation has confirmed the Claygate Member is the founding stratum for the proposed development.
- To the rear of the site where the proposed foundations for the development shall be closest to the trees. However the foundation to the rear of the site will be at a depth of approximately 5 m, which will be below the zone where the ground is affected impacted by shrinking and swelling.
- The Ground Movement Assessment has concluded that the Damage impact to surrounding structures within the zone of influence will be within the following:

Table 12: Summary of Damage Category to adjacent buildings

Structure	Category of Damage (Burland Scale)
31a Daleham Gardens	0
33a Daleham Gardens	0

Lateral movements in the boundary wall between 31a and 31 Daleham Gardens are not anticipated to exceed 10 mm, if the excavation is undertaken in a competent way, and the boundary wall is temporarily restrained as shown on sketch 1803-XX-SK-05

- The BIA has concluded that the risk to instability due to the sloping of the site is minimal both by inference from available data, and a site walkover inspection by a register ground engineering professional (Advisor level).
- The BIA has concluded that the risk of groundwater flooding and flooding from sewers or surface water to the site is minimal. The site does falls within a CDA, however, the surface water management of the proposed development has been designed as described in the FRA and Drainage Strategy to ensure flood risk is not increased elsewhere.

- The BIA has concluded that there will be no impact to the wider hydrogeological and hydrological environment as a result of the proposed development.