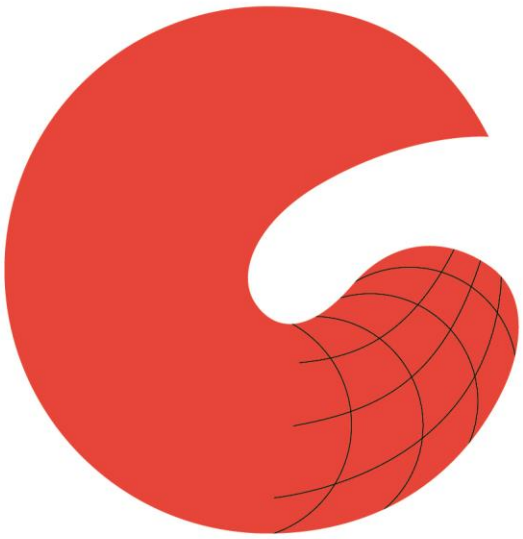

create
CONSULTING
ENGINEERS LTD

11-12 INGESTRE ROAD, LONDON, NW5 1UX

Basement Impact Assessment – Volume 1 of 4

Basement Impact Assessment

pro forma 1v0

Introduction

A Basement Impact Assessment (BIA) is required for all planning applications with basements in Camden.

Basement Impact Assessments must be prepared in general accordance with policies and technical procedures contained within the documents listed below.

- Guidance for Subterranean Development (GSD). Issue 01. November 2010. Ove Arup & Partners.
- Camden Planning Guidance (CPG): Basements (March 2018).
- Camden Local Plan 2017[1] (: Policy A5 Basements and Policy CC3 Water and flooding.

The BIA should demonstrate that schemes:

- maintain the structural stability of the building and neighbouring properties;
- avoid adversely affecting drainage and run off or causing other damage to the water environment;
- avoid cumulative impacts upon structural stability or the water environment in the local area.

The BIA should evaluate the impacts of the proposed basement considering hydrology, hydrogeology and land stability via the process described by the GSD and make recommendations for the detailed design.

Note that the full requirements of the policy include preventing impacts to a wider range of criteria which are not specifically addressed by this guidance note, but which should be considered by the applicant, in consultation with the London Borough of Camden (LBC).

In determining proposals for basements and other underground development, the Council will require an assessment of the scheme's impact on drainage, flooding, groundwater conditions and structural stability in the form of a Basement Impact Assessment and where appropriate, a Basement Construction Plan.

11-12 Ingestre Road, London, NW5 1UX

Basement Impact Assessment

2017/3735/NEW

For

Four Quarters (Ingestre Road) Ltd

Project Ref: CB/CS/P17-1282/05

August 2018

Revisions & additional material

Document History and Status

Revision	Date	Purpose/Status	File Ref	Author	Check	Review
Draft	June 2018	Pre-Planning	CB/CS/P17-1282/05 Draft	A Warren	R Griffiths Y Saleh	C Buchanan
Final	July 2018	Pre-Planning	CB/CS/P17-1282/05	A Warren	R Griffiths Y Saleh	C Buchanan

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Last saved	July 2018
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Author	Andrew Warren
Project Director	Colin Buchanan
Project Number	CB/CS/P17-1282/05
Project Name	11-12 Ingestre Road, London, NW5 1UX
Planning Reference No.	2017/3735/NEW

Additional supporting documents

Please note – the review process will be quicker if these are submitted as Word documents or searchable PDFs.

Date	Version	Produced by

Please list all revisions here: 1

Date	Version	Produced by

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- *Geotechnical Plots*
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Non-Technical Summary

1.1.1 The site location is located in the London Borough of Camden, approximately 375m west of Tufnell Park tube station and approximately 600m northwest of Kentish Town tube station**.** The nearest postcode is NW5 1XH.

1.1.2 The site is situated in a predominantly residential area. The site is approximately 0.18 hectares in area and comprises a part two, part three-storey redundant building, originally built as an elderly person's home and currently still used for this purpose and as offices.

1.1.3 The site building comprises four wings arranged around a central courtyard.

1.1.4 The area generally slopes from east to west, with the site built up and accessed on several levels. The western corner of the site forms the lowest level and the eastern corner the highest, accessed via stairs from Ingestre Road (east). The southern area is built and accessed at the higher level, consistent with adjacent (Tideswell and Hambrook) properties, with a low-lying courtyard in the southwest corner with overgrown shrubbery and mature trees. A retained wall forms the southern boundary and boundary to the central site access, with the courtyard accessed via Ingestre Road (west).

1.1.5 The central courtyard is paved and the service area to the northeast of the building is covered by hardstanding. Adjacent to the eastern site boundary there is a building used for gas / electricity intake and storage for chemicals for the maintenance of the care home. In the western corner, there is a brick-built solid fuel store.

1.1.6 The proposed development is to comprise the demolition of existing buildings and the erection of a six storey plus single storey basement building accommodating 50 Assisted Living residential apartments with associated communal facilities and ancillary café, salon and mini gym, together with external spaces, car lift, basement parking, laundry, plant, CCTV, lighting, access, landscaping, infrastructure and other ancillary works.

1.1.7 The following assessments are presented:

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

1.1.8 The authors of the assessments are:

Report By:	Andrew Warren BSc (Hons), MSc, FGS
Technical Review:	Rob Griffiths BSc (Hons), MSc, FGS, CGeol Yousef Saleh BEng (Hons), M.I.Struct.E
Approved By:	Colin Buchanan BSc (Hons), FGS

1.1.9 The construction methods proposed are outlined in the following points. The Construction Method Statement (CMS) to form the basement comprises:

- Ensure all live services which lead to site are disconnected before commencing work.
- Remove all obstructions from site.
- Ensure all buried existing concrete foundations are removed from the boundary area and within the line of piling.
- Set out the line of contiguous piles within the boundary and probe the area before work commence.
- Check the adequacy of piling mat for piling machine which is to be used on site.
- Check the pile design and ensure the design is adequate and provides the support for the retained areas, such as footpaths/highways and existing rear retaining wall.
- Check the sequence of piling method.
- No piles are to be installed close to each other in the same day to avoid collapsing.
- Check all piles are installed and occurred before excavation starts on site.
- Reduce the ground gradually within site boundary.
- Monitor and record any movement of contiguous piles.
- Construct all pile caps, basement slab, walls and capping beam.
- Construct ground floor slab which offers lateral stability to all basement walls.

1.1.10 A structural monitoring strategy to control the works and impacts to neighbouring structures will comprise as follow:

- All structures in the neighbourhood to be surveyed before construction commence on site (conditional survey and structural survey).

1.1.11 The BIA has assessed land stability and the impacts of the proposed development on neighbouring structures will be between Category 1 of the Burland Scale, subject to confirmation the adjacent property foundations have been piled.

1.1.12 The BIA has identified the following *potential slope stability impacts:*

- A single tree within the Site boundary is to be felled. This is an immature Cypress and is not protected. Therefore, no mitigation measures are proposed;
- The Site is within 5m of a pedestrian right of way. There are no mitigation measures for this scenario.

1.1.13 The BIA has identified existing Site runoff is directly to the combined drain within Ingestre Road. Create Consulting Engineers' Flood Risk Assessment and Drainage Strategy for the Site (report reference JJ/CC/P17-1282-08 Rev A) states the following: 'To help retain as much surface water as possible onsite, the following SUDS measures will be incorporated into the scheme:

- Approximately 549.0 m^2 of blue roofs, attenuating rainfall from the entire roof area (approximately 904.0 m^2);
- A total of 141.0 m^2 of geo cellular attenuation across the site providing approximately 53.0 m^3 of storage, comprised of:
  - 85.0 m^2 of geo cellular attenuation to the rear of the site, 400 mm in depth with 800 mm cover to provide 32.0 m3 of storage;
  - 56.0 m^2 of geo cellular attenuation at the front of the site, 400 mm in depth with 800 mm cover to provide 21.0 m3 of storage.'

1.1.14 The proposed basement will be excavated within impermeable London Clay. Therefore, there are no hydrogeological impacts from the proposed development.

1.1.15 Create Consulting Engineers' Flood Risk Assessment and Drainage Strategy for the Site (report reference JJ/CC/P17-1282-08 Rev A) has identified a very low flood risk for the proposed development.

2 Introduction

2.1.1 The purpose of this assessment is to consider the effects of a proposed basement development at 11-12 Ingestre Road, London NW5 1UX *on the local hydrology, geology and hydrogeology and potential impacts to neighbours and the wider environment. The site location is presented in Figure 1 above.*

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

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

2.2 Authors

2.2.1 The BIA has been *authored/reviewed/approved by:*

Report By: Andrew Warren BSc (Hons), MSc, FGS
Senior Geotechnical Consultant, Create Consulting Engineers Ltd

Technical Review: Rob Griffiths BSc (Hons), MSc, FGS, CGeol
Director, Spectrum Geotechnical Services
Yousef Saleh BEng (Hons), MIStructE
Technical Director (Structures), Create Consulting Engineers Ltd

Approved By: Colin Buchanan BSc (Hons), FGS
Technical Director, Create Consulting Engineers Ltd

2.3 Sources of Information

2.3.1 Key reports, drawings and accessed websites pertinent to this assessment are detailed in the table below.

Document/Website	Author/Publisher	Date
Online flood maps, groundwater mapping, groundwater abstraction locations, landfill sites, pollution incidents and nitrate vulnerable zones. Available via Hons) search	Environment Agency (EA)	Accessed July 2017
British Geological Survey 1:50,000 series, Solid and Drift, Sheet 256 North London	British Geological Survey	2006

Document/Website	Author/Publisher	Date
BGS Geoindex – Geology and borehole records - www.bgs.ac.uk/geoindex	British Geological Survey	Accessed July 2017
The Lost Rivers of London	Nicholas Barton	1992
Thames Water asset plans (Appendix C)	Thames Water	2017
Camden Planning Guidance – Basements and Lightwells CPG4	London Borough of Camden	July 2015
Architects Plan	Marek Wojciechowski Architects	March 2017
www.old-maps.co.uk	Old-maps.co.uk	Accessed July 2017
Groundsure Enviro Insight Report GS-4125670 and Geo Insight Report GS-4125671	Groundsure Ltd	25 July 2017

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

- Site walkover was carried out and a visual inspection of the site, existing structure and exterior of the adjoining properties on 13 July 2017. A summary of the observations made during the site visit are included in Section 3.0 of this report, with photographs presented in Appendix B*;*
- The site history has been assessed by reviewing available historical mapping. The historical plans which have been reviewed comprised only readily available records and may be limited; however, the information available to date indicates that additional searches are unlikely to add to our understanding of the site*;*
- Reference has been made to the BGS 1:50,000 Solid and Drift map of the area, Sheet 256 (North London), which indicates there may be Head superficial deposits (not confirmed) beneath the site underlain by London Clay Formation bedrock*;*
- The Environment Agency hydrogeology maps for the area classifies the bedrock beneath the site as an Unproductive Aquifer which is described as *'negligible significance for water supply or river base flow';*
- Current/historical hydrological data has been assessed using with reference to Enviro Insight Report (Appendix A) and Lost Rivers of London, Barton 1992*;*
- Flood risk mapping provided within Groundsure Insight Report and Flood Risk Assessment undertaken by Create Consulting (Ref: JJ/CS/P17-1282/08*);*
- 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); and
- LB Camden's Audit Process Terms of Reference
- Department for Communities and Local Government. National Planning Policy Framework. March 2012.
- DEFRA / Environment Agency, Model Procedures for the Management of Land Contamination, CLR11, September 2004.
- DEFRA, Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance, April 2012
- NHBC and Environment Agency. Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008 Volume 1
- Department of the Environment, Transport and the Regions, Environment Agency and Institute of Environmental Health. Guidelines for Environmental Risk Assessment and Management. HMSO July 2000.
- CIRIA Guide C580: Embedded Retaining Walls: Guidance on economic design, 2003
- Eurocode 7: Geotechnical design Part 2 ground investigation and testing, EN 1997-2:2007
- London Borough of Camden, June 2003. *Floods in Camden: Report of the Floods Scrutiny Panel.*

2.4 Existing and Proposed Development

Site Location

2.4.1 The site is located in the London Borough of Camden, approximately 375m west of Tufnell Park tube station and approximately 600m northwest of Kentish Town tube station**.** The nearest postcode is NW5 1XH.

2.4.2 The site is located on Ingestre Road and accessed from the northeast, via Burghley Road and to the west (pedestrian access only) from Little Green Street, via Highgate Road (B518). For planning, the site boundary includes a section of Ingestre Road (red boundary), as detailed below in Figure 3.1. However, this report if focused on the proposed development site as illustrated by the green boundary in Figure 2.1 below.

Figure 2.1: Site Location Plan

Site Description

2.4.3 A site walkover was undertaken on 13 July 2017, as detailed in the following paragraphs, with photographs taken during the site walkover presented in Appendix B.

2.4.4 The site is situated in a predominantly residential area. The site is approximately 0.18 hectares in area and comprises a part two, part three-storey redundant building, originally built as an elderly person's home and currently still used for this purpose and as offices.

2.4.5 The site building comprises four wings arranged around a central courtyard (see Figure 3.2 overleaf) and the view of current building / site is shown in Photos 1 to 5 in Appendix B.

2.4.6 The area generally slopes from east to west, with the site built up and accessed on several levels. The western corner of the site forms the lowest level and the eastern corner the highest, accessed via stairs from Ingestre Road (east). The southern area is built and accessed at the higher level, consistent with adjacent (Tideswell and Hambrook) properties, with a low-lying courtyard in the southwest corner with overgrown shrubbery and mature trees (see Photos 4 and 7). A retained wall forms the southern boundary and boundary to the central site access, with the courtyard accessed via Ingestre Road (west).

2.4.7 The central courtyard is paved and currently bused for vehicle parking and general storage (see Photo 6) and the service area to the northeast of the building is covered by hardstanding and used for parking and general storage (see Photo 8). Adjacent to the eastern site boundary there is a building used for gas / electricity intake and storage for chemicals used for the maintenance of the care home. In the western corner, there is a brick built fuel store (see Photo 10) with black staining on the external brickwork.

2.4.8 A plan of the existing development site layout is presented in Figure 2.2 below.

Figure 2.2: Existing Layout of the development site

2.4.9 Little Green Street (to the west) is a narrow single carriageway road flanked with Victorian dwellings on both sides. The access from Little Green Street into Ingestre Road is restricted to emergency vehicles only.

2.4.10 The surrounding Ingestre Road estate comprises a mid-20th century residential development with a community centre and nursery. The estate comprises flat-roofed buildings from two to five storeys in height with undercroft vehicle access leading to resident garages. The building to the north is Grangemill, a nine-storey residential building beyond which lies the North London Line viaduct.

2.4.11 Adjacent infrastructure includes Ingestre Road, which is within the Site boundary, as per Figure 2.1

2.4.12 Underground infrastructure includes services within the adjacent Ingestre Road and a railway tunnel 28m north of the Site. The railway tunnel is outside the zone of influence for the Ingestre Road development. As part of Create Consulting Engineers' Flood Risk Assessment and Drainage Strategy (ref. JJ/CS/P17-1282/08 Rev A), Thames Water were contacted as part of the pre-

development enquiry. For reference, this correspondence is reproduced in Appendix C of this report.

2.4.13 The proposed development is to comprise the demolition of existing buildings and the erection of a six storey plus single storey basement building accommodating 50 Assisted Living residential apartments with associated communal facilities and ancillary café, salon and mini gym, together with external spaces, car lift, basement parking, laundry, plant, CCTV, lighting, access, landscaping, infrastructure and other ancillary works.

2.4.14 Architectural plans are included in Appendix D at the rear of the report. Drawing No. 27463-A-P11-01a (Ground Floor) is reproduced below as Figure 2.3, which gives a plan view of the proposed development.

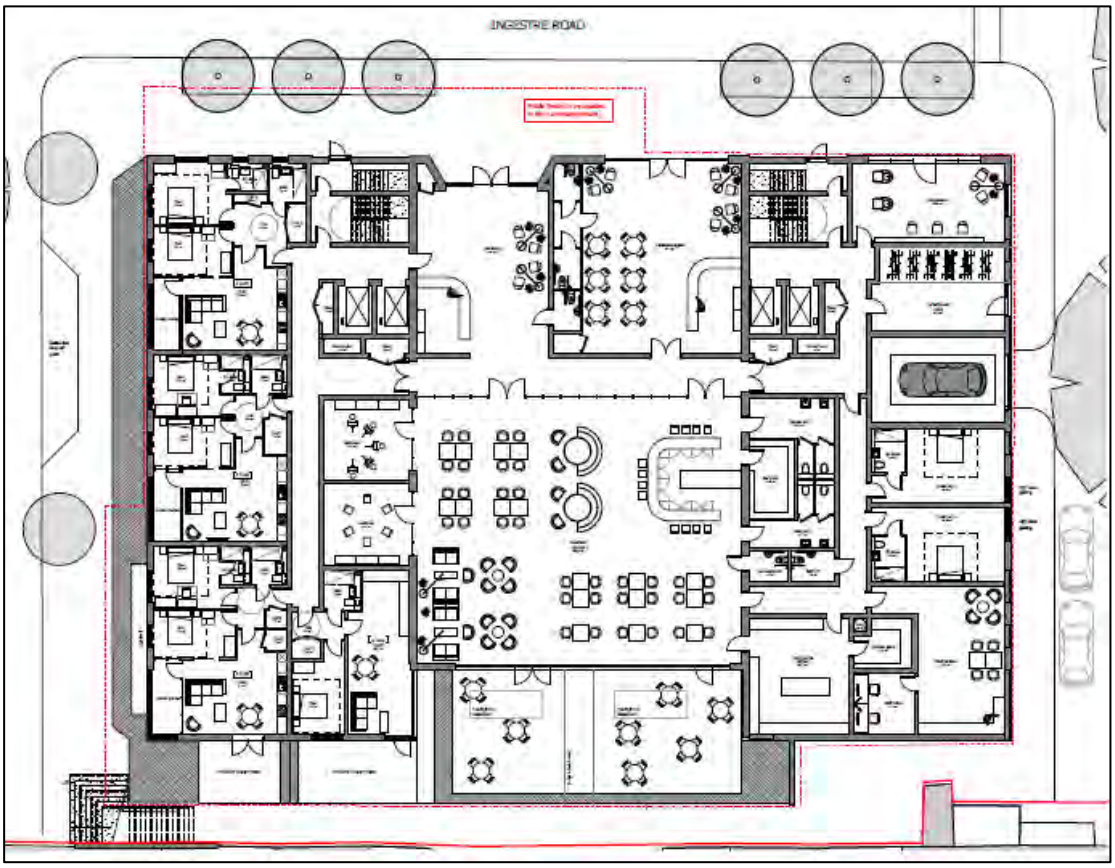


Figure 2.3: Proposed Development Plan (Ground Floor)

2.4.15 The proposed development will utilise the following construction techniques:

- Use of contiguous piles on site is more robust method for forming basement and permanent structure to retain earth and support surcharge loads from construction and existing structures.
- Contiguous pile to be designed as cantilevers and un-propped during excavationuntil the ground floor slab is constructed.

2.4.16 The development is expected to commence in late 2018 and is anticipated to be completed within 24 months. The start date will be dependent on receipt of consent and the programme of the appointed Principal Contractor

3 Desk Study

3.1 Site History

3.2.1 The site history has been assessed by reviewing available historical mapping. The historical plans which have been reviewed comprised only readily available records and may be limited; however, the information available to date indicates that additional searches are unlikely to add to our understanding of the site.

3.2.2 The historical development of the site is summarised in Table 3.1, below.

Dates	Site Use	Surrounding Land Use
1850-51 (1:5,280)	The site was undeveloped and shows the site to be located within Kentish Town.	Green Street (now Highgate Road) is shown to the west of the site and Junction Road (now Fortress Road) is to the southeast.
1871-72 (1:1,056)	The site is shown to be undeveloped.	Development along Highgate Road is shown to the west/southwest of site and railway is shown to the north, with Highgate Station at intersection with the Highgate Road. Burghley Road and associated residential dwellings have been constructed to the south of the site.
1895 (1:1,056)	The site remains undeveloped	The railway to the north has been expanded and further development to the south including Lady Somerset Road and the northern section of Burghley Road. A school and Imperial Laundry have been established to the east/southeast
1915 (1:2,500)	The site forms part of the Electric Generating Station, although the subject site is shown to be undeveloped area (with trees).	Two main buildings associated with the Electric Generating Station are located to the southwest and northeast of the site with associated railway sidings. No other significant changes evident.
1936 (1:2,500)	The eastern strip of the site is covered by landscaped area around the adjacent Harbor Works site.	The building to northeast is shown to be Harbor Works (Iron Strip & Bar) and the southwest building a Staff Hotel for the railway. No other significant changes evident.
1954 (1:1,250)	No changes evident	The area to the south is now shown as allotment garden. No other significant changes evident.
1966-67 (1:1,250)	No changes evident.	The Harbor Works is no longer shown, although the building remains. No other significant changes evident.
1970 (1:2,500)	The site (landscaped area) has been cleared (long with the wider area) for impending development.	The surrounding buildings have been removed and the area around the site cleared for impending development.
1973-75 (1:1,250)	The current building is shown and labelled as 'Old People's Home'.	The adjacent present day structures surrounding the site (Grangemill, Calver, Hambrook Court, Tideswell, and Fletcher Court) are all shown.
1990-96 (1:10,000)	No changes evident.	No significant changes evident.
Google Earth 2006	No changes evident.	No significant changes evident.
Google Earth 2017	No changes evident.	No significant changes evident.

Table 3.1: Historical Review

3.2.3 In summary, the site remained undeveloped until early 1970's with the exception of the eastern strip of the site which formed part of the landscaped area for the adjacent Harbor Works site between c. 1936 and late 1960's, prior to the area being cleared for the development of the

Ingestre Road estate in the early 1970s and the site forming an Old People's home in the current layout.

Unexploded Ordnance (UXO)

3.3.3 An historical record bomb search was undertaken in the vicinity of 11-12 Ingestre Road and the results are shown in Figure 3.1 below.

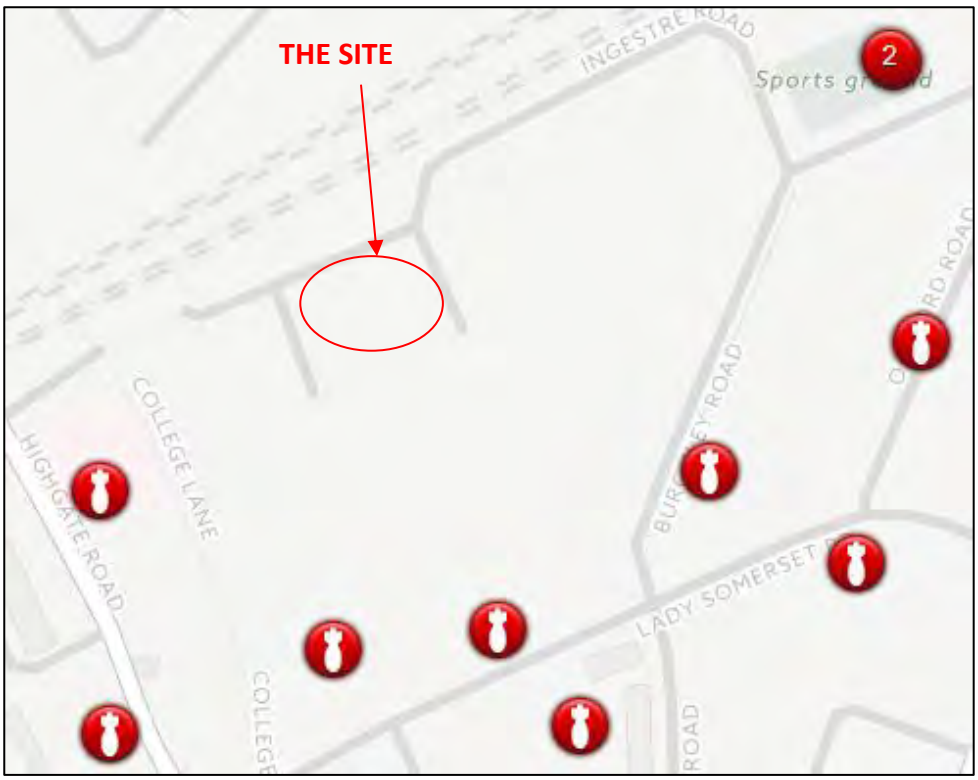


Figure 3.1: WW2 Bomb Location Map (Source: The Bomb Sight Project)

3.3.4 The findings of the search identified no potential bomb sites within close proximity of the Site which suggests a low UXO risk on this site and the historical review identified no obvious signs of bomb damage to the buildings in the area post WW2.

3.4 Geology

3.4.1 Reference has been made to the BGS 1:50,000 Solid and Drift map of the area, Sheet 256 (North London), which indicates there may be Head superficial deposits (not confirmed) beneath the site underlain by London Clay Formation bedrock. Figure 3.2 (below) is an extract from Camden Council's Geological, Hydrogeological and Hydrological Study and details geology and slope angles within the Borough.

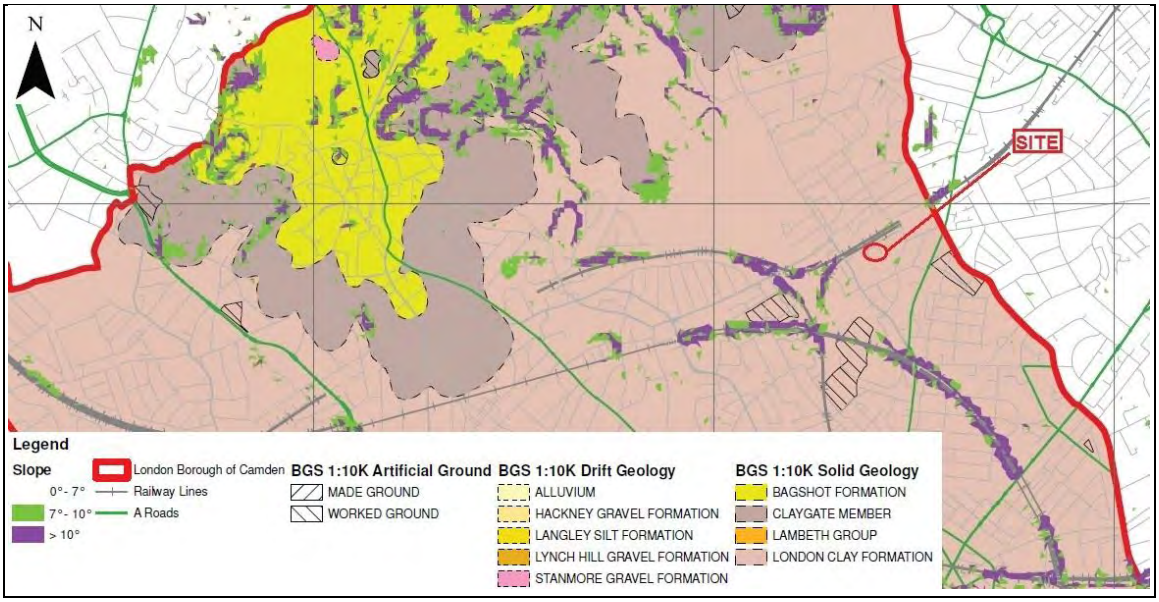


Figure 3.2 Camden Geology and Slope Angle Map

3.4.2 There are no online BGS borehole records in the immediate vicinity of the site, with the nearest being:

- TQ28NE24, located approximately 300m to the east, recorded London Clay from surface and to a depth of 14.3 metres;
- TQ28NE161, located approximately 250m to southeast, recorded London Clay over Made Ground to a depth of 7.3 metres; and
- TQ28NE23, located approximately 200m to west, recorded London Clay to a depth of 21.3 metres.

3.4.3 The Groundsure Geo Insight report (Appendix A) provides data on coal and non-coal mining areas and potential ground stability hazards for the UK that may affect the site. The mining and potential ground stability hazards identified in the Groundsure report are summarised in Table 3.2 below.

Details	On-site	Risk
Landslips	No	No Hazard
Bedrock Faults	No	No Hazard
Historical Surface Ground Workings (landscaping around adjacent industrial site use)	Yes	Hazard (eastern area of site)
Historical Underground Workings	No	No Hazard
Mining Instability	No	No Hazard
Man-Made Mining Cavities	No	No Hazard
Natural Cavities	No	No Hazard
Coal Mining Affected Area	No	No Hazard
Non-Coal Mining Affected Area (rare and localised)	No	No Hazard
Potential for Collapsible Ground Stability Hazards	Yes	Very Low
Potential for Compressible Ground Stability Hazards	Yes	Negligible
Potential for Ground Dissolution Stability Hazards	Yes	Negligible
Potential for Landslide Ground Stability Hazards	Yes	Very Low
Potential for Running Sand Ground Stability Hazards	Yes	Negligible
Potential for Shrinking or Swelling Clay Ground Stability Hazards	Yes	Moderate

Table 3.2: Mining and Potential Ground Stability Hazards.

3.5 Hydrogeology

3.5.1 The Environment Agency hydrogeology maps for the area classifies the bedrock beneath the site as an Unproductive Aquifer which is described as *'negligible significance for water supply or river base flow'*.

3.5.2 According to the Environment Agency, the site is not located within a designated Groundwater Source Protection Zone.

3.5.3 There are no groundwater abstraction licences within 1km of the site.

3.6 Hydrology, Drainage and Flood Risk

3.6.1 There are no present-day primary, secondary or tertiary rivers identified within the site boundary or within 500m of the site boundary.

3.6.2 There is a culvert identified trending northwest - southeast approximately 400m to the southwest (see Groundsure Enviro Insight Report Drawing 6e, p42 in Appendix C), which is believed to be associated with the lost tributary of the former River Fleet which formerly flowed through this area, as illustrated in Figure 3.3 below.

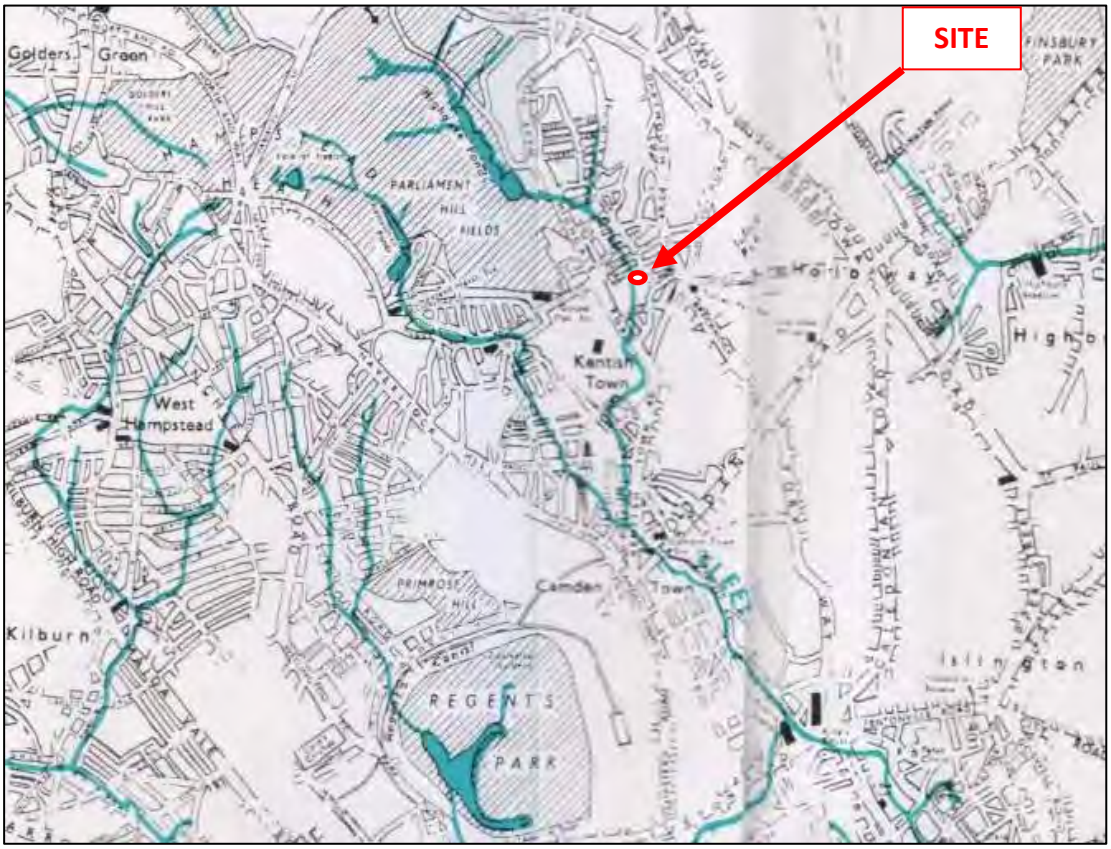


Figure 3.3: Lost Rivers of London, Barton 1992

3.6.3 There are no licensed surface water abstractions within 1km of the site.

3.6.4 The site is located in Flood Zone 1 according to the Environment Agency's indicative flood map, with the site having less than 1:1000 probability of fluvial and tidal flooding in any one year (the lowest level indicated on their mapping) and therefore is at low risk from flooding.

3.6.5 The site *is not within the catchment of the Hampstead Heath Pond Chain, which is 930m to the northwest.*

3.6.6 The site surface area is currently 94% impermeable, comprising buildings and areas of hardstanding for access, parking and patio areas. The soft landscaped areas are for shrubs and a tree, see photographs B. Currently, surface water flows to the combined sewer within Ingestre Road, see Thames Water service plans presented in Appendix C.

3.6.7 The proposed surface area will be 100% *percent impermeable, being covered in a building.* However, SUDS are proposed as part of the development, please refer to Create Consulting Engineers' Flood Risk Assessment and Drainage Strategy (report reference JJ/CC/P17-1282-08 Rev A). The SUDS will help retain as much surface water as possible onsite, with the following SUDS measures incorporated into the scheme:

- Approximately 549.0 m^2 of blue roofs, attenuating rainfall from the entire roof area (approximately 904.0 m^2);
- A total of 141.0 m^2 of geo cellular attenuation across the site providing approximately 53.0 m^3 of storage, comprised of:
    - 85.0 m2 of geo cellular attenuation to the rear of the site, 400 mm in depth with 800 mm cover to provide 32.0 m3 of storage;
    - 56.0 m2 of geo cellular attenuation at the front of the site, 400 mm in depth with 800 mm cover to provide 21.0 m3 of storage.'

3.6.8 Being located in an Environment Agency classified Flood Zone 1, the Site has a very low risk from surface water flooding. Camden Council's 'Local Development Framework' document 'Camden Development Policies 2010-2025' details areas of the borough that have been affected by surface water flooding. Figure 3.4, below, indicates the roads proximal to the Site were subject to floding in 2002. However, there is no evidence the Site was subject to flooding. The Site is not at risk of flooding from reservoirs or sewers.

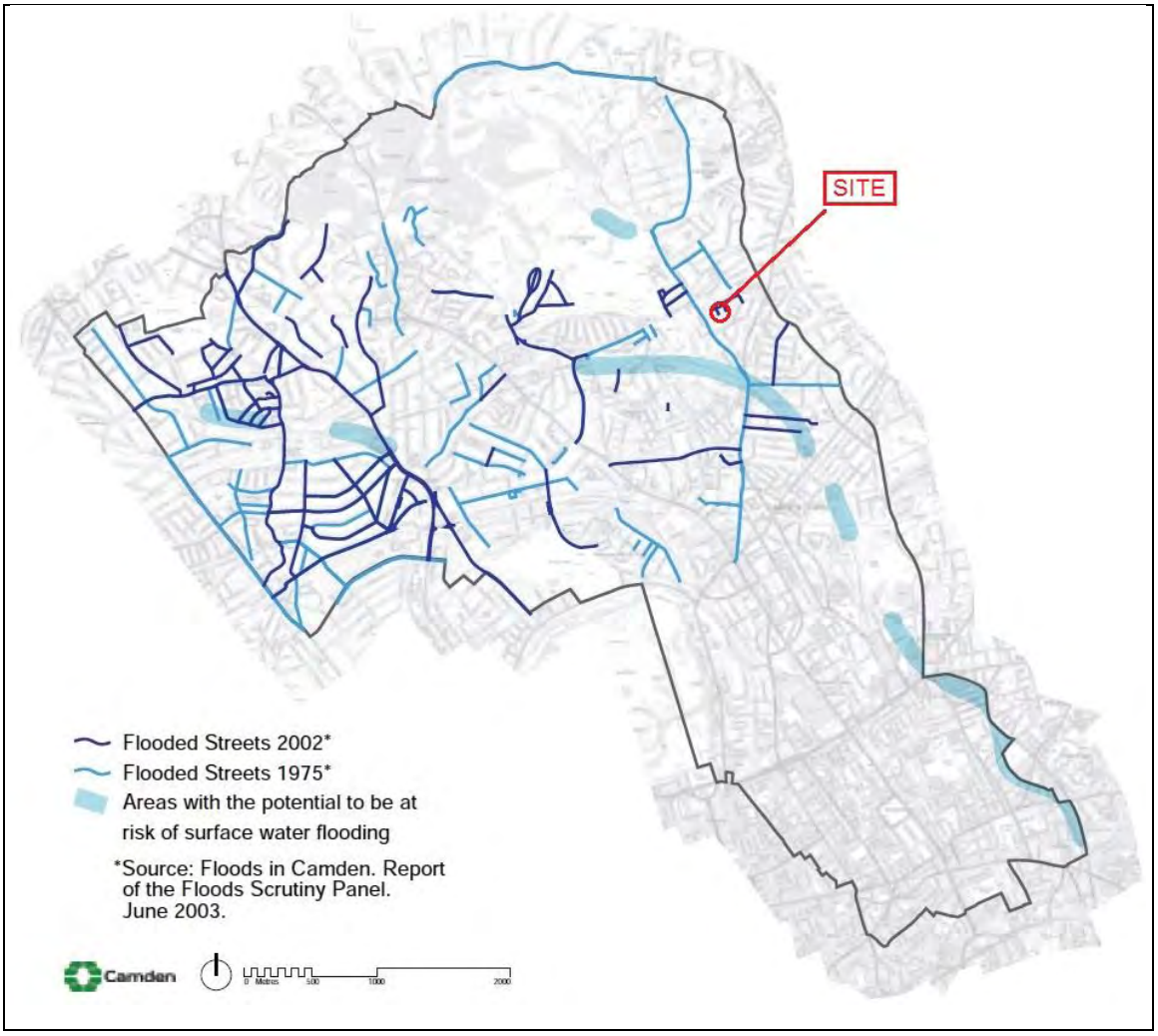


Figure 3.4 Surface water flooding

3.6.9 The Site is located within a Critical Drainage Area. However, the Site itself is not at risk from flooding, being effectively located in an island within the CDA.

3.7 Other Information

Radon

3.7.1 The site is in a lower probability radon area as less than 1% of properties are above the action level, with no radon protective measures necessary in construction of new dwellings.

Trees

3.7.2 There are a number of mature trees and shrubs within the low-lying courtyard in the southwest corner of the site, adjacent to retaining wall that forms the southern site boundary in this area.

Ecology

3.7.3 According to data from the Groundsure report, there are no Sites of Special Scientific Interest, Special Areas of Conservation (SAC), Special Protection Areas (SPA), Areas of Natural Outstanding Beauty (AONB), Local Nature Reserves, Nitrate Vulnerable Zones or any other environmental

designations within 1km of the site. However, according to the ecology report prepared for this project, there are semi-natural habitats in lines of trees between Burghley Road and Ingestre Road and on the cuttings of the railway land 50m to the north, which is designated of Borough Importance for nature conservation. Some 500m to the north is the edge of the extensive green space of Hampstead Heath which is of Metropolitan Importance for Nature Conservation and in part, at the ancient woodland of Hampstead Heath Woods, a statutorily designated Site of Special Scientific Interest (SSSI).

Environmental Regulatory Records

3.7.4 Information on potentially significant environmental issues and controls at the site and surrounding area have been sourced directly from the regulatory authorities via the Groundsure database. Copies of the Groundsure Enviro Insight report is provided in Appendix A and a summary provided in Table 3.3 below.

Public Record	On site or off site	Features
Landfill & Waste Sites (Environment Agency, Local Authority & British Geological Survey)	On site	None.
	Off site	None located within 500m of the site.
Environmental Permits (Environment Agency and Local Authority)	On site	None.
	Off site	None located within 500m of the site.
Current Land Use	On site	No industrial site use identified.
	Off site	Electricity substations identified 103m to east, 138m to west, 166m to northwest, 219m to northwest and 239m to northeast.
Historical Land Use	On site	No historical industrial site uses identified.
	Off site	The following historical industrial site uses were identified within 500m if the site: • Railway tunnels 22m, 125m & 198m to the north; • Former electricity substation located 24m to northwest; • Sawmill 420m to the north (1894); • Fire station 421m to the north; • Tanks 186m to northwest, 382m to west & 455m to south; and • Garages located 171m to northeast, 267m to west, 440m to north, 472m to east & 500m to northeast.

Table 3.3: Available Environmental Information

Underground Utility Services

3.7.4 The underground service utility providers were contacted to confirm the location of underground services servicing the site and the local area and the responses to these requests are provided in Appendix C.

London Underground

3.7.5 The location of the London Underground lines were confirmed using the ARCGIS online information providing a true representation of the London Underground network in relation to the site, as provided in Figure 3.4 below. The nearest London Underground asset is located 230m to the southeast.

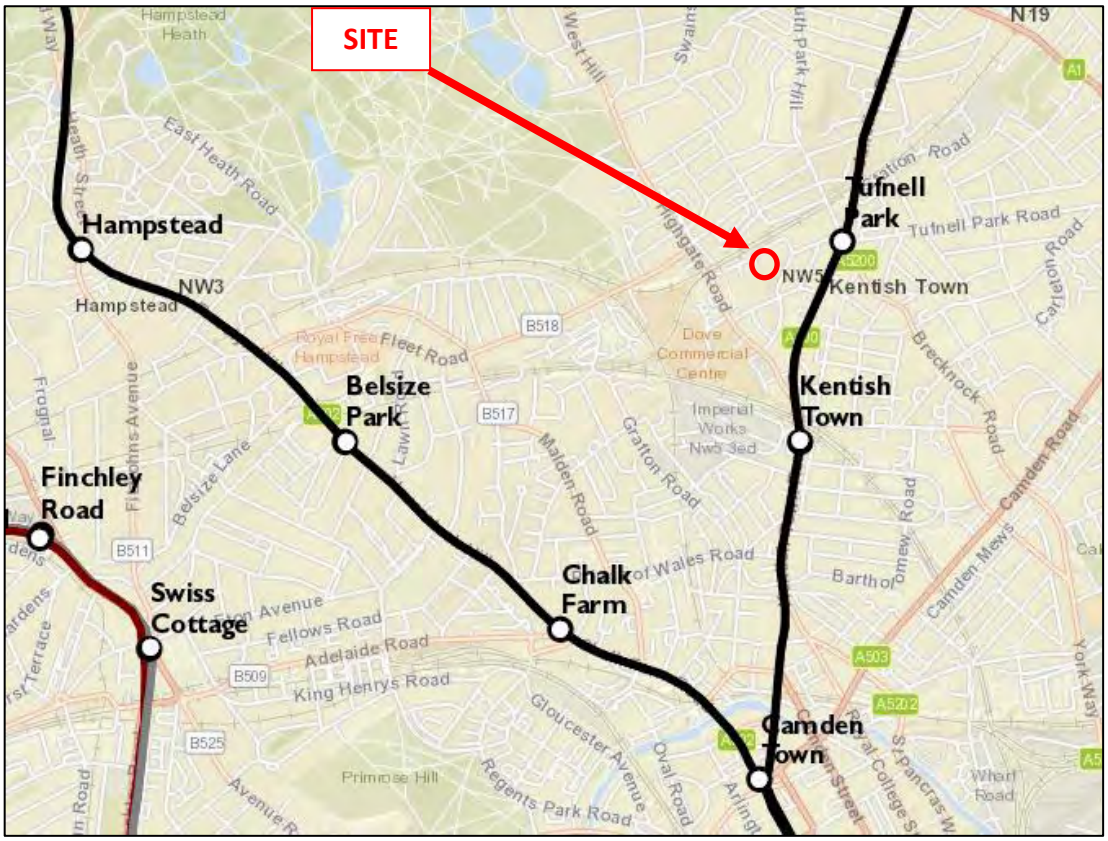


Figure 3.4: **London Underground Network**

Overground Railway

3.7.5 The location of the London over ground lines were confirmed using available historical Ordnance Survey mapping and through information provided in the Groundsure Geo Insight report (Appendix A).

3.7.6 There is a Network Rail tunnel trending in a northeast / southwest direction, located 28m north of the Site.

Post Office Tunnels

3.7.7 The location of the post office tunnels were confirmed using online information and provided as Figure 3.5 below. The site is located to the north of Kentish Town (i.e. off the map).

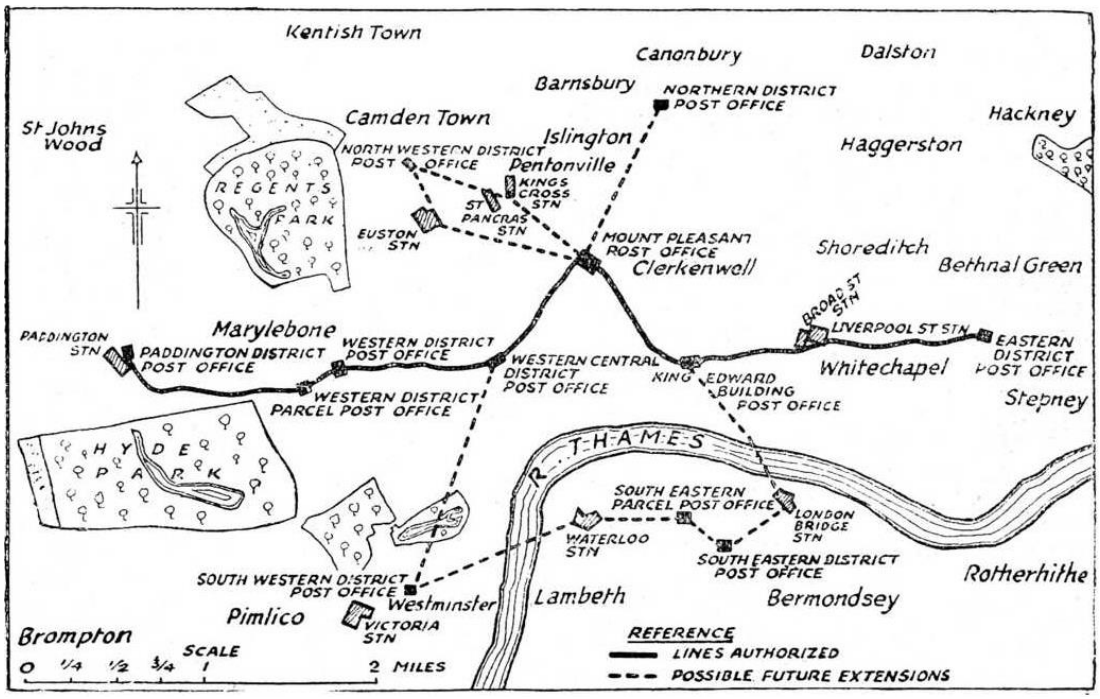


Figure 3.5: **Post Office Tube Railway Route, London**

4 Screening

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

Question	Response	Details
1a. Is the site located directly above an aquifer?	No	The Site is over a unproductive aquifer (London Clay)
1b. Will the proposed basement extend beneath the water table surface?	No	Any groundwater present would be perched.
2. Is the site within 100mof a watercourse, well (used / disused) or potential spring line?	No	Based on EA website and groundsure report, no watercourses, reservoirs or wells or springs within 100m
3. Is the site within the catchment of the pond chains on Hampstead Heath?	No	The site is located approximately 930m southeast of the nearest FEH Hampstead Heath pond boundary.
4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	Yes	Currently there are several small soft landscaped areas within the Site boundary. The proposed development does not include any areas for landscaping.
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	Surface water will continue to be discharged via existing surface water sewers.
6. Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath) or spring line?	No	There are no ponds in locality of the Site. Given the scale of the proposed basement and the Site's distance from any local water bodies, proposed development will not significantly affect flow to any ponds and therefore do not consider any mitigation measures are required.

4.5 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 topography at the Site an surrounding area does not include any slopes >7°. As detailed in Figure 3.2.
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 proposed development does not include any slopes greater than 7°.
3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately 1 in 8)?	No	The adjoining land does not include any slopes greater than 7°. All transport infrastructure is outside the zone of influence from development at the site.

Question	Response	Details
4. Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately1 in 8)?	No	The area falls generally to the west and north, below the threshold of 7°.
5. Is the London Clay the shallowest strata at the site?	No	CCE undertook a ground investigation at the site, recording Made Ground and in one instance, Alluvium over the London Clay
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	Currently, there is an immature Cypress within the Site boundary. This tree is not within a protection zone and will be removed as part of the proposed development.
7. Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?`	No	There are no indications within the historical maps. No evidence of springs was noted during the Site walkover.
8. Is the site within 100m of a watercourse or a potential spring line?	No	There are no known river, pond, reservoir, spring or well within 100 m of the Site. Although the Site is proximal to the course of the former River Fleet, this is now culverted and part of the Thames Water Sewer network, indicated to be approximately 150m east of Site.
9. Is the site within an area of previously worked ground?	No	The only significant previous works were former buildings within the Site building footprint. A ground investigation at the site recorded Made Ground soils to a maximum depth of 2.10m.
10. Is the site within an aquifer. If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No	The Site is underlain by London Clay, which is classified by the EA as unproductive strata.
11. Is the site within 50m of the Hampstead Heath Ponds?	No	The Site is approximately 980m southeast of the nearest Hampstead Heath pond.
12. Is the site within 5m of a highway or pedestrian right of way?	Yes	The Site is located adjacent to Ingestre Road.
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	No	While the foundation type of adjacent properties is not known, low rise residential properties located 18m west and 20m east are likely to have shallow spread foundations. Based on the age, site history and location, the high-rise property, Grangemill, located 13m north will have piled foundations. The Hambrook building (numbers 9 – 12 and 17 to 20) and Tideswell building (numbers 5-12) have undercrofts and will likely have piled foundations. Properties 25-29 Hambrook and 1-4 Tideswell are low-rise residential. However, these are located behind a retaining wall with respect to the site.

Question	Response	Details
14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No	The Site is outside the area indicated for Post Office tunnels (see paragraph 5.5 of this report). The closest railway tunnel is located 28m northwest of the Site.

4.6 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 located 930m southeast of the nearest Hampstead Heath pond FEH boundary.
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 majority of the Site currently discharges to the public sewer network (combined sewer).
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	Yes	The impermeable area of the Site will be increased following development with existing landscaped areas built upon.
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 currently predominantly comprises hardstanding. Therefore, minimal change to surface water runoff is anticipated.
5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	All foul sewerage will be connected to the public sewer network.
6. Is the site in an area identified to have surface water flood risk according to either the Local Flood Risk Management Strategy or the Strategic Flood Risk Assessment or is it at risk from flooding, for example because the proposed basement is below the static water level of nearby surface water feature.	Yes	The Environment Agency surface water flood maps indicate the site to be at 'very low' risk from surface water flooding.

4.7 Non-Technical Summary of Screening Process

4.7.1 The screening process has highlighted several aspects of the proposed development that require further investigation / discussion. These are summarised in the bullet points below and addressed in Section 5.0 of this report:

- The proposed basement will result in an increase in hard surfaced area;
- The site is indicated to be at risk from surface water flooding;
- A single tree (immature Cypress) is located within the proposed development site;
- The proposed basement is within 5.0m of a highway and pedestrian right of way; and
- There is a difference in depth between the proposed basement and foundations of adjacent properties.

4.7.2 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 Scoping

5.1.1 In order to establish the likely impacts of the proposed development on neighbouring sites and the local geology and hydrology of the area, a scoping exercise for this assessment was undertaken.

Surface water flow and flooding

5.1.2 Aspects of the surface water flow and flooding screening process are discussed in Table 5.1 below.

Question No.	Question	Discussion
3	Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	• The impermeable area of the Site will be increased following development. However, SUDS are proposed as part of the development, which will reduce peak runoff rates to the local sewer network.
6	Is the Site in an area known to be at risk from flooding?	• The subject site is located in an Environment Agency designated 'Flood Zone 1', with a very low risk from surface water flooding. • Notwithstanding, Create Consulting Engineers have undertaken a Flood Risk Assessment and Drainage Strategy for the proposed development, report reference JJ_CS_P17_1282_08. The findings of the flood risk assessment are summarised later in this report.

Table 5.1 Surface water flow and flooding scoping discussion

Subterranean (groundwater flow)

5.1.3 Aspects of the groundwater flow screening process are discussed in Table 5.2 below.

Question No.	Question	Discussion
4	Will the proposed basement development result in a change in the proportion of hard surface / paved areas?	• Currently there are several small soft landscaped areas within the subject site. However, while there are no areas of landscaping included within redevelopment plans, SUDS are proposed, which will reduce peak runoff rates to the local sewer network. • To help understand the groundwater regime beneath the Site, a ground investigation is proposed, including groundwater level monitoring. The findings of the ground investigation are discussed later in report.

Table 5.2 Subterranean groundwater flow scoping discussion

Land Stability

5.1.4 Aspects of the land stability screening process are discussed in Table 5.3 below.

Question No.	Question	Discussion
6	Will any trees be felled as part of the proposed development?	• Yes, a tree (immature Cypress) will be felled. However, this tree is not within a protected zone.
12	Is the Site within 5m of a highway or pedestrian right of way	• As with all excavations there is the potential for ground movement beyond the excavation that may impact adjoining properties. To help determine ground conditions, obtain material properties and help determine the groundwater regime beneath the site, a ground investigation has been undertaken, as detailed in Section 8.0 of this report. Following the ground investigation, ground movement assessment for proximal properties and infrastructure has been undertaken (see Section 9.0 of this report).
13	Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties	

Table 5.3 Land stability scoping discussion

6 Site Investigation / Additional Assessments

6.1 Site Investigation

6.1.1 A ground Investigation was carried out on the subject site between 2nd and 10th August 2017 to support the basement assessment and design solution for the proposed development.

6.1.2 The investigation comprised the drilling of 2No. cable percussion (BH01 and BH02) boreholes and 1No. windowless sample / rotary borehole by means of a Comacchio 205 hydraulic drill rig (BH03) to a maximum depth of 25 metres. The purpose of the investigation was to confirm ground conditions at the location of the proposed basement and extension including the groundwater table and collected shallow samples for contamination assessment.

6.1.3 The location of the exploratory holes is illustrated in Figure 6.1 below.

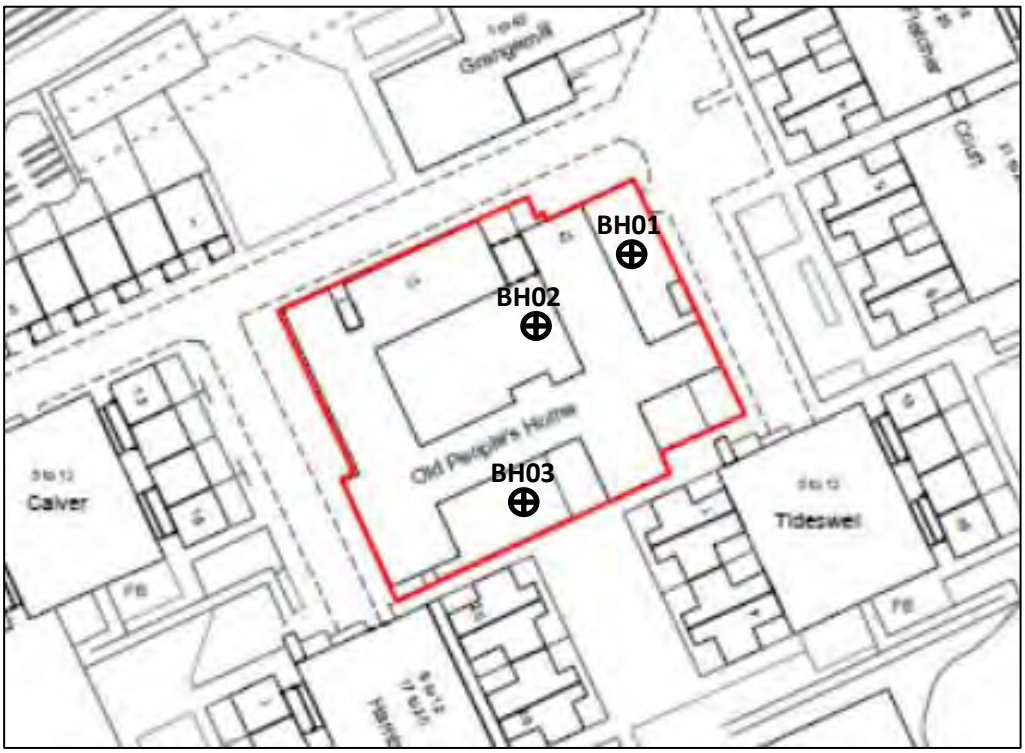


Figure 6.1: Exploratory Hole Locations

6.1.4 The soil arisings from each borehole were logged by a suitably qualified Engineer, in line with the relevant British Standard (BS 5930 and Eurocode 7). The borehole logs are provided in Appendix E.

6.1.5 Representative disturbed and bulk disturbed samples were taken from the boring tools at regular intervals throughout the depth of the borehole. Undisturbed 100mm diameter samples (U100) were taken in the cohesive material, at regular intervals throughout the depth of the borehole (cable percussion boreholes only) and in-situ Standard Penetration Tests (SPTs) were carried out

at varying depths. Disturbed samples were collected and submitted for laboratory chemical and geotechnical testing.

6.1.6 On completion of the borehole, a ground gas / groundwater monitoring standpipe was installed in each borehole to a maximum depth of 16.0m and sealed above the slotted bottom zone of the pipe. A protective cover was installed flush with the ground surface.

6.1.7 Ground gas / groundwater monitoring was then undertaken on three separate occasions, the findings of which is discussed later in the report, with ground gas monitoring record sheets presented in Appendix E.

Ground Conditions

6.1.8 Ground conditions encountered are summarised in the following paragraphs, with exploratory borehole logs presented in Appendix E, laboratory geotechnical test results presented in Appendix E, geotechnical plots are presented in Appendix E and laboratory chemical test results presented in Appendix E.

6.1.9 Three 25m boreholes were formed at the site, as detailed in Figure 6.1. The findings of the boreholes are detailed in the following paragraphs.

Hardstanding

6.1.10 Hardstanding (macadam) was encountered from ground level to 0.10m. While concrete was recorded within BH02 from 0.20m to 0.30m.

Made Ground

6.1.11 Made Ground was encountered in all three exploratory boreholes to depths of between 1.70m and 2.10m below ground level (bgl). The Made Ground comprised both granular and cohesive horizons. The granular Made Ground generally comprised sandy gravel of brick and concrete. While the cohesive Made Ground generally comprised a gravelly clay, with the gravel predominantly comprising flint, brick and concrete. Laboratory test results from Made Ground samples are summarised in Table 6.1 below, with test certificates presented in Appendix E.

Laboratory test	No. of Tests	Result Range
pH	2	8.8
Water soluble sulphate (SO_4)	2	0.05 – 0.12g/l
Total sulphur	2	0.07 – 0.12%

Table 6.1 Made Ground laboratory geotechnical test results

6.1.12 A total of 3No. SPTs were recorded within the Made Ground, providing N-values of N=5, N=15 and N=16, as detailed in the SPT depth plot, Appendix E.

Possible Made Ground

6.1.13 During the formation of BH01 and BH02, a 'firm buff-brown gravelly (flint) clay' was recorded to depths of 2.20m and 2.10m, respectively. It was not possible to conclusively determine if the material was Made Ground, so this has been recorded as 'possible Made Ground'.

6.1.14 No SPTs were recorded within this material.

Organic Soils (Alluvium)

6.1.15 Within BH03, the Made Ground was underlain an organic clay, being described as 'Soft brown organic clay'. This material had an organic odour and was recorded at a depth of between 2.10m and 2.50m bgl. The presence of the organic soils is possibly related to the River Fleet, which is indicated to have been proximal to the site (see Figure 6.2) prior to being culverted and diverted.

6.1.16 A single SPT was undertaken within the organic clay soil and recorded an N-value of N=11, as detailed in the SPT depth plot in Appendix E.

Weathered London Clay

6.1.17 Underlying the Made Ground / organic soils, Weathered London Clay was recorded to depths of between 11.80m and 14.10m below ground level. The Weathered London Clay was generally described as 'Stiff brown mottled grey / orange-brown silty clay'.

6.1.18 A total of 12 No. SPTs were recorded within the Weathered London Clay, with corrected N_{60} values in the range of N_{60}=8 to N_{60}=36. The SPT tests undertaken within the first half metre of the Weathered London Clay recorded N-values pertaining to a 'soft' material. However, the N-values were seen to increase in value with depth, see SPT depth plot (Appendix E).

6.1.19 Geotechnical laboratory testing undertaken on the Weathered London Clay are summarised in Table 6.2 below and presented in full in Appendix E.

Laboratory test	No. of Tests	Result Range
Moisture content (w)	7	27.9 - 37.1%
Plasticity index (I_p)	7	42 - 50% (CH)
Dry Density	3	1.44 – 1.58Mg/m^3
Bulk Density	5	1.51 – 1.95Mg/m^3
Unconsolidated Undrained Triaxial Test (c_u)	3	86 – 124kN/m^2
Mv	2	0.04-0.089
Cv	2	0.074-5.4
pH	2	7.9 - 8.0
Water soluble sulphate (SO_4)	2	0.84 - 1.5g/l
Total sulphur	2	0.13 – 0.18%

Table 6.2 Weathered London Clay laboratory geotechnical test results

6.1.20 Moisture content tests undertaken on Weathered London Clay samples recorded a decrease in moisture content with depth, as detailed in the moisture content plot, Appendix E.

6.1.21 The Plasticity index test results for the Weathered London Clay all plot above the A-Line, indicating the material is predominantly a clay and of high plasticity (CH), as detailed in the Plasticity Chart, Appendix E.

6.1.22 The three unconsolidated, undrained triaxial tests undertaken within the Weathered London Clay recorded shear strength values in the range of 86kPa and 124 kPa and increased in value with depth, confirming the material description of 'stiff'.

London Clay

6.1.23 Underlying the Weathered London Clay, London Clay was recorded to a maximum depth of 25m. The base of the London Clay was not recorded. The London Clay was generally described as 'Very stiff grey slightly silty clay with trace of selenite crystals'.

6.1.24 A total of 17 No. SPTs were recorded within the London Clay, with corrected N60-values in the range of N_{60}=32 to N_{60}=50, corresponding to a material strength of stiff to very stiff. SPTs recorded within the London Clay were seen to increase in value with depth, as detailed in the SPT depth plot, Appendix E.

6.1.25 Geotechnical laboratory testing undertaken on the London Clay are summarised in Table 6.3 below and presented in full in Appendix E.

Laboratory test	No. of Tests	Result Range
Moisture content (w)	6	16.3% - 57.2%
Plasticity index (I_p)	6	42% - 51% (CH)
Dry Density	3	1.43 – 1.51Mg/m^3
Bulk Density	3	1.84 – 1.91Mg/m^3
Unconsolidated Undrained Triaxial Test (c_u)	3	81 – 209kN/m^2
pH	2	7.9 - 8.4
Water soluble sulphate (SO_4)	2	0.59 – 1.20g/l
Total sulphur	2	0.35 – 0.51%

Table 6.3 London Clay laboratory geotechnical test results

6.1.26 Moisture content tests undertaken on London Clay samples were generally consistent with depth, in the range of 25% to 30%, with the exception of a single sample at 23.5m bgl from BH03, which recorded a moisture content of 57.2%. A plot detailing moisture content test results with depth is presented in Appendix E.

6.1.27 The Plasticity index test results for the Weathered London Clay all plot above the A-Line, indicating the material is predominantly a clay and of high plasticity (CH), as detailed in the Plasticity Chart, Appendix E.

6.1.28 Three unconsolidated, undrained triaxial tests undertaken within the London Clay recorded shear strength values in the range of 81kPa and 209kPa. An anomalous test result was recorded at 23.5m bgl from BH03, which recorded a shear strength (cu) of 81kPa, at 20% strain, where the test was aborted. The geotechnical laboratory description of the test sample details two distinct materials: the upper material (top 210mm) was described as 'very stiff grey brown silty clay', while

the lower material (30mm) was described as: 'very soft grey brown silty clay'. During the test, the geotechnical laboratory reported the upper sample was simply pushed into the lower sample. Following termination of the test, a hand shear vane test undertaken within the upper material recorded a shear strength >150kPa, while the hand shear vane test undertaken within the lower material recorded a shear strength of 15kPa. The geotechnical laboratory notes for this test are presented with the geotechnical laboratory test results in Appendix E.

6.1.29 It is surmised BH03 encountered a fracture within the London Clay, which has become a conduit for perched groundwater, resulting in localised softening of the surrounding material. Moisture content test results from this sample recorded a value of 57.2%, 20% higher than other samples tested within the London Clay.

Groundwater

6.1.30 During exploratory hole formation, groundwater was not encountered in any of the boreholes.

6.1.31 During subsequent groundwater monitoring of boreholes, groundwater was recorded at depths of between 0.88m and 6.30m bgl. However, this is considered to represent perched groundwater and does not equate to the groundwater table. Groundwater monitoring results are presented in Appendix E.

Soil Contamination Assessment

6.1.32 The Made Ground encountered across the site predominantly comprised gravelly sandy clay of variable strength with flint and chalk gravel, brick, concrete and tarmacadam and less glass and plastic.

6.1.33 Groundwater was not encountered during in any of the exploratory holes on this site. No obvious visual or olfactory signs of contamination were observed during the fieldwork.

6.1.34 Samples of Made Ground were collected from various locations and depths across the site and submitted for chemical testing at Derwentside Testing Services, a UKAS/MCERTS accredited laboratory based in Consett. The testing comprised a range of organic and inorganic parameters including asbestos, metals, Total Petroleum Hydrocarbons (TPH) and Polyaromatic Hydrocarbons (PAH).

6.1.35 The soil characteristics have been assessed with reference to LQM/CIEH 'Suitable 4 Use Levels' (S4ULs) for human health risk assessment (2015). In the case of lead a DEFRA Category 4 Screening Level has been adopted.

6.1.36 The soil chemical testing results have been compared to residential end use without home grown produce and using the organic matter results (1%) where appropriate.

6.1.37 A summary of the chemical test results are provided in Table 6.4 below and laboratory certificates are provided in Appendix E.

Location (mg/kg)	BH01 0.3m	BH02 0.7m	BH02 1.4m	BH03 0.6m	BH03 1.7m	Site Specific Assessment Criteria (SSAC) – Residential without home grown produce
Material	MG	MG	MG	MG	MG	-
Asbestos	ND	ND	ND	ND	ND	***<0.001%***
Metals						
Arsenic	7.0	12	28	12	14	***40***
Barium	120	52	59	41	77	***-***
Beryllium	<0.2	0.4	0.6	0.9	0.9	***1.7***
Boron, Water Soluble	1.0	1.3	1.1	1.7	2.4	***11,000***
Cadmium	0.3	<0.1	<0.1	0.1	0.1	***85***
Total Chromium	9.3	18	26	38	33	***907***
Hexavalent Chromium	<1.0	<1.0	<1.0	<1.0	<1.0	***6***
Copper	25	23	24	32	52	***7,100***
Lead	17	68	59	20	88	***310****
Mercury	<0.05	0.24	0.18	<0.05	0.20	***56***
Nickel	6.6	12	14	33	29	***181***
Selenium	<0.5	<0.5	<0.5	<0.5	<0.5	***430***
Vanadium	47	37	52	75	66	***1,170***
Zinc	40	40	45	67	74	***40,000***
Inorganics						
pH	11.1	8.8	8.3	7.6	7.7	-
Cyanide – Total	<0.1	0.1	0.1	0.2	0.3	-
Cyanide – Free	<0.1	<0.1	<0.1	0.1	0.1	-
Organic Matter (%)	7.7	0.9	1.1	1.0	2.6	*1 2.5 6*
Sulphate Aq Extract (mg/l)	33	230	290	280	1400	-
Sulphide	12	38	35	<10	24	-
Sulphate, Total (%)	0.09	0.09	0.08	0.08		-
Extractable Petroleum Hydrocarbons (C10-C35)	2400	<10	<10	<10	<10	-
Petroleum Hydrocarbons						
Aliphatic C5-C6	<0.01	-	-	-	-	*42 78 160*
Aliphatic C6-C8	<0.01	-	-	-	-	*100 230 530*
Aliphatic C8-C10	<0.01	-	-	-	-	*27 65 150*
Aliphatic C10-C12	<1.5	-	-	-	-	*130 330 770*
Aliphatic C12-C16	10	-	-	-	-	*1100 2400 4400*
Aliphatic C16-C21	33	-	-	-	-	*65000 92000 110000*
Aliphatic C21-C35	300	-	-	-	-	*65000 92000 110000*
Aromatic C5-C7	<0.01	-	-	-	-	*370 690 1400*
Aromatic C7-C8	<0.01	-	-	-	-	*860 1800 3900*
Aromatic C8-C10	<0.01	-	-	-	-	*47 110 270*
Aromatic C10-C12	<0.9	-	-	-	-	*250 590 1200*
Aromatic C12-C16	12	-	-	-	-	*1800 2300 2500*
Aromatic C16-C21	68	-	-	-	-	*1900 1900 1900*
Aromatic C21-C35	760	-	-	-	-	*1900 1900 1900*
TPH Ali/Aro Total	1200	-	-	-	-	-

Location (mg/kg)	BH01 0.3m	BH02 0.7m	BH02 1.4m	BH03 0.6m	BH03 1.7m	Site Specific Assessment Criteria (SSAC) – Residential without home grown produce		
Phenols - Monohydric	<0.3	0.4	1.4	0.4	<0.3	*750*	*1300*	*2300*
Polyaromatic Hydrocarbons	1.3	0.17	0.30	<0.10	<0.10	-		
Naphthalene	0.03	<0.03	<0.03	<0.03	<0.03	*2.3*	*5.6*	*13*
Acenaphthylene	<0.03	<0.03	<0.03	<0.03	<0.03	*2900*	*4600*	*6000*
Acenaphthene	<0.03	<0.03	<0.03	<0.03	<0.03	*3000*	*4700*	*6000*
Fluorene	0.08	<0.03	<0.03	<0.03	<0.03	*2800*	*3800*	*4500*
Phenanthrene	0.34	0.05	0.06	<0.03	<0.03	*1300*	*1500*	*1500*
Anthracene	<0.03	<0.03	<0.03	<0.03	<0.03	*31000*	*35000*	*37000*
Fluoranthene	0.011	0.07	0.10	<0.03	<0.03	*1500*	*1600*	*1600*
Pyrene	0.25	0.06	0.07	<0.03	<0.03	*3700*	*3800*	*3800*
Benzo(a)anthracene	0.07	<0.03	0.04	<0.03	<0.03	*11*	*14*	*15*
Chrysene	0.10	<0.03	0.04	<0.03	<0.03	*30*	*31*	*32*
Benzo(b)fluoranthene	0.10	<0.03	<0.03	<0.03	<0.03	*3.9*	*4.0*	*4.0*
Benzo(k)fluoranthene	<0.03	<0.03	<0.03	<0.03	<0.03	*110*	*110*	*110*
Benzo(a)pyrene	<0.03	<0.03	<0.03	<0.03	<0.03	*3.2*	*3.2*	*3.2*
Indeno(123cd)pyrene	0.03	<0.03	<0.03	<0.03	<0.03	*45*	*46*	*46*
Dibenzo(ah)anthracene	<0.03	<0.03	<0.03	<0.03	<0.03	*0.31*	*0.32*	*0.32*
Benzo(ghi)perylene	0.15	<0.03	<0.03	<0.03	<0.03	*360*	*360*	*360*

Table 6.4: Soil Chemical Testing

Key
* Screening criteria (for lead) from Category 4 Screening Levels
Units are mg/kg unless shown otherwise
Concentrations highlighted in **red** (bold) exceed the SSAC.
Concentration sin red (not bold) are elevated concentrations with no SSAC.
MG – Made Ground
ND – non detect
"-" not tested

6.1.38 All potential organic and inorganic contaminants present within the Made Ground beneath the soft landscaped areas were confirmed as being significantly below the assessment criteria for residential end use (without home grown produce) in all the samples collected and tested.

6.1.39 The concentration of Extractable Petroleum Hydrocarbons (ETPH) in BH01 (2,400 mg/kg) appeared elevated, so a speciated Petroleum Hydrocarbon test was undertaken on this sample. None of the speciated carbon banding group concentrations exceeded their respective SSACs. The source of this elevated level of ETPH is considered likely to be related to organic material. All made ground across the Site will be removed as part of the proposed site development, thereby removing any potential risks associated with this material to future Site users.

6.1.40 Asbestos was not detected in any of the samples collected and screened.

Ground Gas Monitoring

6.1.41 On 20 September 2017, ground gas measurements were taken from each of the monitoring wells installed. The monitoring comprised the measurement of concentrations of methane, carbon dioxide, oxygen, carbon monoxide and hydrogen sulphide gases collected within the monitoring well followed by the measurement of gas flow using a GA5000 infrared gas analyser with flow pod.

6.1.42 The results of the gas monitoring undertaken are summarised in Tables 6.5 below and provided in Appendix E.

		BH01	BH02	BH03
Parameter	**Unit**			
Methane (CH_4)	% by volume	0.0	0.0	0.0
Carbon Dioxide (CO_2)	% by volume	1.7 - 6.2	0.6 – 6.5	10.5 - 12.8
Oxygen (O_2)	% by volume	16.2 – 20.4	13.3 - 20.5	7.4 – 15.1
Hydrogen Sulphide (H_2S)	Parts per million	0.0	0.0	0.0
Carbon Monoxide (CO)	Parts per million	0.0 – 2.0	0.0	0.0
Gas Flow	Litres per hour	0.5 – 0.7	-6.5 - 0.8	0.4 – 0.7
Standing Water Level	Metres below ground level	0.88 - 4.38	4.88 - 6.30	3.18 - 6.30

Table 6.5: Ground Gas and Groundwater Monitoring Results

6.1.43 The ground gas concentrations measured from the boreholes confirmed the presence of up to 12.8% by volume carbon dioxide with corresponding depleted oxygen concentrations (7.4% by volume). The highest concentration of ground gas was recorded within BH03, where organic clay soils (possible alluvium) were recorded at a depth of 2.10m to 2.50m. The lateral extent of the organic clay soils is not known. Notwithstanding, elevated concentrations of carbon dioxide were recorded within BH01 and BH02, at concentrations of 6.2%v/v and 6.5%v/v respectively. However, organic soils were not recorded at these two locations.

6.1.44 No methane was detected in any of the boreholes.

6.1.45 The gas flow measures from the boreholes were relatively low and ranged from 0.4 to 0.8 litres per hour. A negative gas flow of 6.5 litres per hour was recorded within BH01.

6.1.46 The assessment of gas risk uses the concentration present and the flow rate measured, which gives you the gas screening value (GSV). Using this method, the GSV for the areas identified across this site have been established and a gas risk rating assigned in accordance BS8485 (2015) to identify a Characteristic Situation (CS) as outlined in CIRIA C665. These are identified as follows:

- CS1 – very low hazard potential (<0.07 GSV)
- CS2 – low hazard potential (0.07 to <0.7 GSV)
- CS3 – moderate hazard potential (0.7 to <3.5 GSV)
- CS4 – moderate top high hazard potential (3.5 to <15 GSV)
- CS5 – high hazard potential (15 to <70 GSV)
- CS6 – very high hazard potential (>70 GSV)

6.1.47 Current guidance for ground gas monitoring is to provide monitoring over a minimum period of three months to establish ground gas regime, with at least one the visits undertaken during low (<1005 mb) or falling atmospheric conditions, so further ground gas monitoring will be required to meet this requirement and fully establish the ground gas regime across the site.

6.1.48 However, for the purposes of this assessment and in the absence of this data requirement, using current guidance (BS8485:2015) to assess the worst case GSVs, using the highest concentration detected on the site and the highest gas flow measured on the site, the worst case GSV for carbon dioxide would be as follows:

- Carbon dioxide GSV would be 12.8% v/v (BH03) X 0.8 l/hr (BH02) **= 0.1024 l/hr**

6.1.49 The worst case GSV for carbon dioxide would therefore suggest that CS2 classification would be appropriate for this site, subject to further confirmatory monitoring. However, it should be noted that all soft organic clay soils and made ground confirmed to be present across the Site will be removed as part of the development works (basement excavation), thereby removing these potential sources of the elevated carbon dioxide identified.

6.1.50 On this basis it is considered likely that gas protection measures would likely not be required for the proposed development although further monitoring would be required to confirm this. Alternatively, as a conservative approach, low level gas protection measures may need to be employed. The protection measures that would need to be employed would include suspended flooring, all joints and penetrations sealed, ventilated void, in-ground venting and a gas resistant membrane, subject to detailed design.

6.2 Flood Risk Assessment

Hydrological Setting

6.2.1 Regents Canal is located approximately 1.55km to the south of the site. The River Thames is located approximately 5.40km to the south of the site and, being located downstream of Teddington Lock, is tidal at this location. The River Fleet has been culverted and now located 125m east of the Site. The River Fleet has been entirely incorporated within the sewer network, being owned and maintained by Thames Water.

Flood Risk from Fluvial & Tidal Sources

6.2.2 The site lies within the Environment Agency's (EA) Flood Zone 1 which is described within the NPPF Technical Guidance as having a less than 1 in 1000-year annual probability of river or tidal flooding (<0.1%) in any one year.

6.2.3 Given the proximity to the nearest watercourse and that the site is located in Flood Zone 1, it is considered that the site is adequately protected from, and not at risk of fluvial/tidal flooding.

Flood Risk from Groundwater

6.2.4 The site does not lie within any Groundwater Source Protection Zones, as identified by the Environment Agency mapping. A BGS borehole record located 200.0 m west of the site identifies the presence of groundwater at a depth of 78.0 mbgl.

6.2.5 Due to the depth at which groundwater was found the flood risk from groundwater is considered to be low.

6.2.6 Appropriate mitigation measures against flooding from groundwater are summarised in Table 6.6 below.

Flood Risk from Artificial Water Bodies

6.2.7 There are no artificial water bodies within the immediate vicinity of the site. The closest is a series of reservoirs associated with Hampstead Heath located approximately 1.0 km northwest of the site.

6.2.8 Whilst the site is not directly at risk of flooding as a result of a reservoir breech, it is located on a dry island, within the flood flow path from the reservoirs associated with Hampstead Heath.

6.2.9 Appropriate mitigation measures against flooding from artificial water bodies are summarised in Table 6.6 below.

Flood Risk from Public Sewers

6.2.10 A combined sewer (of unknown size) drains along Ingestre Road in a westerly direction. A second combined sewer (of unknown size) drains in a northerly direct along the access road on the eastern boundary of the site.

6.2.11 A Thames Water Sewer Flooding History Enquiry confirms no historic records of any surcharging sewers in the vicinity of the site. No significant issues have been identified at the site, and the risk of sewer flooding is considered to be low. The residual risk still remains from a blocked sewer or the effects of climate change.

6.2.12 Appropriate mitigation measures against flood risk from public sewers are summarized in Table 6.6 below.

Flood Risk from Surface Water Flooding

6.2.13 Environment Agency Surface Water Flood Maps show that the site is at a 'very low' risk of surface water flooding from extreme rainfall.

6.2.14 The site is located within a Critical Drainage Area. However, the Site itself is not at risk from flooding, effectively being located on an island within the CDA.

6.2.15 Appropriate flood resilient and resistant design, as noted in Table 6.6, are proposed for the residual risk of surface water flooding of the site.

Flood Risk from Water Mains

6.2.16 A potable water main (125 mm in diameter) supplies Ingestre Road immediately north of the site. A water hydrant is located on the northern boundary of the site on Ingestre Road.

6.2.17 Flood risk from this source is considered to be a residual risk with the main threat being from internal pipe work during any building works. Flooding from this source poses a residual risk to the proposed development.

Flood History

6.2.18 A review of the SFRA and PFRA have no records of any historic flood events, from all sources, impacting the site. Mapping within Camden's SFRA shows Ingestre Road to have been affected by flooded in 2002, however, it is unclear if the site was affected during this event. Given the fact the site is not shown to lie within any surface water flood zones it is anticipated that if this flooding did impact the site it was very localised and of minimal depths.

Flood Risk Summary

6.2.19 In summary, the risk of flooding from all sources is generally considered to be low, however, a number of mitigation measures are recommended to address and manage the residual risk from these forms of flooding in Table 6.6.

Impact to Flood Risk of Surrounding Areas

6.2.20 Given the low flood risk present on site and the drainage improvements proposed, it is considered that the development of the site will not increase the risk of flooding in other areas, surrounding the site.

Type of Flooding	Issue	Mitigation Measures	Justification	Residual Risk *
Flooding from surface and foul water – sewer blockage/surcharging and intense rainfall	Blockages or surcharges in the site drainage or the public sewer network in the site vicinity may result in flooding of the site.	• Routine inspection and maintenance of the site and public drainage systems by the site owner and Thames Water. • Monitor flood risk throughout the life of the development in order to confirm the risk posed to the scheme over time. • A drainage survey should be undertaken to confirm the route and condition of any existing site drainage (if necessary) to inform the need for any upgrades to the network and diversion of any existing assets. • The detailed design should confirm if necessary that the drainage (below ground) serving the site is appropriately sized and any necessary upgrades to the current drainage is undertaken and agreed with Thames Water and building control as necessary.	These measures will ensure flood risk from these sources is minimised.	Low
Flooding from water mains (internal water supply system)	Flooding of the water supply and distribution system may result in flooding of the building.	• Routine inspection of the site and public water supply and distribution system by the site owner and Thames Water.	Will ensure the risk of flooding is minimised.	Low
Flooding from water mains (external water supply system)	Flooding may result if the customer supply main, on the northern site border on Ingestre Road, is damaged	• Ensure there is no damage to the customer supply main during construction. • Design and construction of water supply systems to current best practice standards. • Routine inspection and maintenance of assets by Thames Water.	Will ensure the risk of flooding is minimised.	Low
Artificial Water Bodies	Breach of reservoir embankments and overland flow in the unlikely event of a failure. Flooding from this source is considered to pose residual risk to the proposed development.	• Consider as part of a basic flood warning and evacuation plan. • External areas will be profiled so as any runoff will be directed away from the building and into the roads. • Floor levels/thresholds of the proposed buildings will be raised as high as reasonably practicable	These measures will ensure flood risk from these sources is minimised.	Low

Type of Flooding	Issue	Mitigation Measures	Justification	Residual Risk *
Flooding from Surface Water	EA mapping indicates that the site is at 'very low' risk of flooding as a result of extreme rainfall and runoff from overland flow. Residual risks remain associated with events in excess of those modelled/the drainage system design capacity.	• External areas will be profiled so as any runoff will be directed away from the building and into the roads. • Floor levels/thresholds of the proposed buildings will be raised as high as reasonably practicable. • Inclusion of sustainable drainage to ensure attenuation is provided to ensure the site or surrounding area does not flood during the 100 year plus 40% climate change event.	Will ensure the consequences of any flooding is minimised.	Low
Flooding from perched groundwater	Perched groundwater may be present, given the scheme will include a basement.	• Incorporate appropriate waterproofing into substructure design and any below ground services; • Consider the need for dewatering during construction as part of the detailed design.	Will ensure the risk of flooding is minimised.	Low

Table 6.6 Flood Risk Mitigation Measure

7 Construction Methodology/ Engineering Statements

7.1 Outline Geotechnical Design Parameters

Ground Model

7.1.1 This section of the report should be read in conjunction with the Section 8.0 (Ground Conditions), which recorded Made Ground, underlain by Organic Clay (Alluvium), underlain by solid strata of Weathered London Clay and London Clay.

7.1.2 A summary of geotechnical design parameters have been provided in Table 7.1 below.

Design values	Depth to base (m)	Υ (kN/m^3)	C_u (kN/m^2)	A	τ_{int}	C' (Kn/m^2)	Ground-water
Made Ground / Alluvium	2.2	16	20	0.9	18	0	-
Weathered LC	12.7	18	80	0.7	56	0	-
London Clay	25+	18.4	150	0.89	134	0	>25m

Table 7.1 Geotechnical Design Parameters

Design Factors

- Permanent design load: EC7 DA1b
- Base capacity Q_{bu} (Υ_{Rb}) = 1.3 from set R4
- Shaft capacity Q_{su} (Υ_{Rs}) = 1.3 from set R4

Pile Resistance

7.1.3 The following calculations are based on driven pre-cast concrete piles of width 0.45m taken to a depth of 12m below ground level. Ignoring the first 4.0m to allow for basement construction, the following is calculated:

- Pile resistance R = base resistance + shaft resistance
- $R_{des} = (Q_{bu} / \Upsilon_{Rb}) + (Q_{su} / \Upsilon_{Rs})$

Base Resistance

- $Q_{bu.des} = (Ap.(s_c.N_c.c_u + \sigma_q)/ \Upsilon_{Rb})$ where:
- Ap is the cross sectional area of the pile (Bp2);
- $\sigma_q = \sigma_v$ at base of pile (20m);
- N_c and s_c are bearing capacity factors. Therefore:
- $Q_{bu} = (0.2025 \times (1 \times 9 \times 150 + 143) / 1.3) =$ **233kN**

Shaft Resistance

- $Q_{su.des} = (4B_p.\tau_{int}.dz)/ \Upsilon_{Rs}$
- Weathered LC: $Q_{su.des}$ = (4 x 0.45 x 56 x 6)/1.3 = **465Kn**

7.1.4 Where $\tau_{int}.= \alpha.c_u$ and α is calculated by: $\alpha=0.55\left(\frac{40}{Lp/D0}\right)^{0.2}\left(\frac{c_u}{\sigma'_{v0}}\right)^{-0.3}$

7.1.5 Therefore, design capacity of a 450mm diameter pile of 12.0m length is R_{des}= 233+465 = **698kN**

Buried Concrete

7.1.6 Based on the chemical laboratory test results (BRE SD1 suite) and in accordance with BRE Special Digest 1: 2005 (Concrete in Aggressive Ground), the following criteria have been determined. A total of 6No. BRE SD1 chemical suits were undertaken on soil samples from the Made Ground, Weathered London Clay and London Clay horizons.

7.1.7 The site is classified as 'brownfield' and the local geology (London Clay) is indicated to contain pyrite (i.e. sulphide) and groundwater conditions are considered to be 'static'. Laboratory chemical testing recorded water soluble sulphate concentrations in the soil of between 50mg/l and 1500mg/l, acid soluble sulphate concentrations of between 0.14% and 0.42%. Therefore, the Design Sulphate Class for the site is considered to be "**DS-2**". pH values of between 7.9 and 8.8 were also recorded. Therefore, the "Aggressive Chemical Environment for Concrete (ACEC)" class for concrete in the ground is indicated to be **AC-1s**.

Earthworks

7.1.8 The extent of organic soils west of BH03 will need to be established. In areas where the Alluvial soils extend below formation level, these will need to be excavated out and replaced with engineered fill.

7.2 Outline Temporary and Permanent Works Proposals

Conceptual Design

7.2.1 Based on the assessment of potential impacts, initial concept design solutions are set out below to demonstrate how the temporary and permanent works might be progressed as part of the detailed design process.

7.2.2 Construction of the new basement is envisaged as a watertight reinforced concrete box up to the respective external ground level. This box will be generally formed as a sequence of contiguous piles to form part of permanent perimeter walls.

7.2.3 The contiguous piles will be designed to support the soil around the basement and resist any imposed load from highway, etc.

7.2.4 Once all piles are installed and the basement excavation is complete, all pile caps, internal columns, basement slab and walls will be constructed, refer to CREATE drawing No. 1282-04/100 'Basement Plan and Section' provided in Appendix D.

7.2.5 Ground floor reinforced concrete slab will be constructed between internal columns/wall and perimeter walls to act as rigid plate and offers lateral stability to all retained materials at ground level, refer to CREATE drawing No. 1282-04/101 'Ground Floor Plan and Section' provided in Appendix D.

Consents

7.2.6 Agreement will be required with the Highway Authority, given that the basement walls and contiguous piles will retain the adjacent pavement/highway. Also agreement for support to the existing rear retaining wall would be through the Approval in Principle submission and approval process.

Construction Method Statement (CMS) to form the basement

7.2.7 Construction of the basement will require the following sequence of works:

- Ensure all live services which lead to site are disconnected before commencing work;
- Remove all obstructions from site;
- Ensure all buried existing concrete foundations are removed from the boundary area and within the line of piling;
- Set out the line of contiguous piles within the boundary and probe the area before work commence;
- Check the adequacy of piling mat for piling machine which is to be used on site;
- Check the pile design and ensure the design is adequate and provides the support for the retained areas, such as footpaths/highways and existing rear retaining wall;
- Check the sequence of piling method;
- No piles are to be installed close to each other in the same day to avoid collapsing;
- Check all piles are installed and occurred before excavation starts on site;
- Reduce the ground gradually within site boundary;
- Monitor and record any movement of contiguous piles;
- Construct all pile caps, basement slab, walls and capping beam; and
- Construct ground floor slab which offers lateral stability to all basement walls.

7.3 Ground Movement and Damage Impact Assessment

7.3.1 The proposed development is for a stand-alone 5-storey building with a basement. The structure is to be supported with piles, which will also form a contiguous wall for the basement. Anticipated pile depths are 12.0m below ground level (35.3m AOD), with basement formation level 4.0m bgl (44.3m AOD).

7.3.2 Ground movement during basement construction can occur as a result of the basement construction (piling) and due to the excavation of soil from the basement area, which results in a bending moment on the wall from earth pressure. The methodology for calculating ground movement in CIRIA document C580 'Embedded Retaining Walls, Guidance For Economic Design, 2003', has been followed, with calculation sheets presented in Appendix F.

7.3.3 Structures within the vicinity of the proposed development and distances from the proposed basement are detailed in Table 7.1 and Figure 7.1 below.

Structure	Distance and direction
Retaining wall	3.30m SSE
25 Hambrook	5.50m SSE
9 to 12 and 17 to 20 Hambrook	5.50m SSE
1 Tideswell	5.50m SSE
5 to 12 Tideswell	5.50m SSE
No.s 13-16 Calver	17.80m WSW
Grangemill building	13.10m NWN
Network Rail Tunnel	32.30m NWN
No.s 3-8 Fletcher Court	20.30m ENE

Table 7.1 Local structures

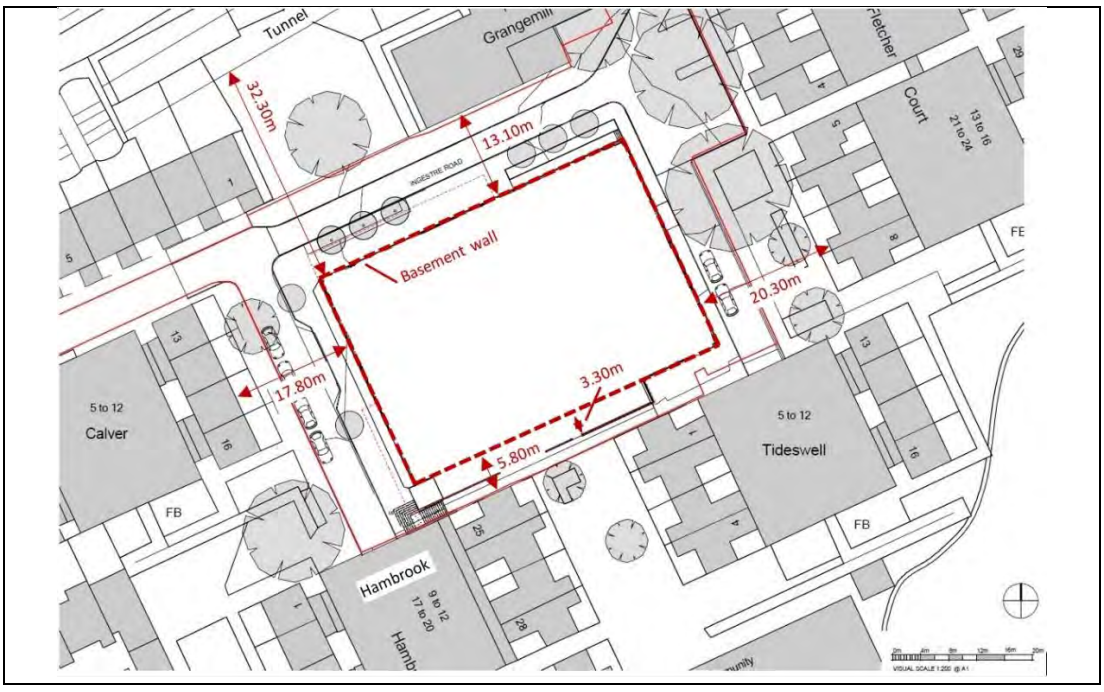


Figure 7.1 Distance to local structures

7.3.4 Predicted ground movements for 13-16 Calver (Sheets 18, 19 and 20 Appendix F), 3-8 Fletcher Court (Sheets 21, 22 and 23 Appendix F), 27 Hambrook and 3 Tideswell are indicated to be in the 'negligible' category (Sheets 11, 16 and 17, Appendix F). For the negligible category, Table 2.5 of Ciria C580 describes the typical expected damage as 'Hairline cracks of less than about 0.1mm'.

7.3.5 The Grangemill building is 23m tall and built on infilled ground (historical map data indicates a former railway cutting at this location) and includes concrete columns as part of the structure. Therefore, the likely foundations are piles. Being located 13.10m from the proposed basement and supported by piles, any ground movement impacting upon the Grangemill building is anticipated to be in the 'negligible' category.

7.3.6 The Network Rail tunnel located 32.30m northwest of the Site is outside the zone of influence from basement construction and will therefore not be impacted upon by ground movement.

7.3.7 Nos. 25 and 26 Hambrook and 1 and 2 Tideswell have been assessed as a 'moderate' damage category (Sheets 11 to 15, Appendix F). Typical damage associated with a moderate rating comprises: '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 brick work to be replaced. Doors and windows sticking. Service pipes may fracture. Weather tightness often impaired'.

7.3.8 The 'moderate' damage rating for 25 & 26 Hambrook and 1 & 2 Tideswell is based on these structures having a worst-case scenario of shallow spread foundations. However, were it determined these structures, or the adjacent retaining wall are founded on piles, this rating can be reduced to negligible.

7.3.9 If the foundation type for the Hambrook and Tideswell buildings cannot be determined, a moderate category of damage from basement construction would not be acceptable. Therefore, to minimise any damage during construction, a temporary propping system as per Figure 6.2 below, should be incorporated. Once the rear ground floor slab is constructed, it will act as a rigid plate to resist ground movement.

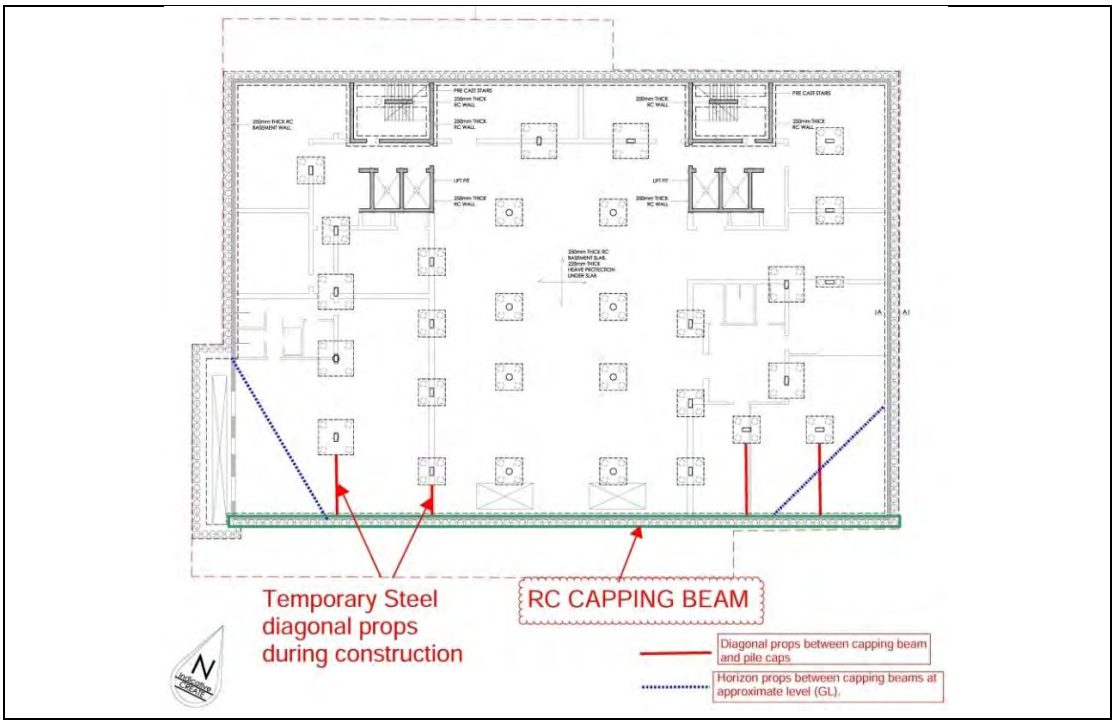


Figure 7.2 Ground movement mitigation props

7.4 Control of Construction Works

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

- A visual structural survey to be carried out by the contractor or specialist to adjacent neighbour buildings, roads and footpaths;
- Record any defects to walls etc. on plan, report any wide cracks/defects to structural engineer for advice;
- Place monitoring instruments across the cracks and record values ;
- Monitoring to be carried out on weekly or fortnightly and record any movements;
- Report any critical movement to structural engineer for assessment during construction;
- Contingency actions, contractor to programme for an immediate action if any remedial work is required to rectify/repair to any defects during construction;
- Further monitoring is required by the contactor after the project is complete.

8 Basement Impact Assessment

8.1.1 The Conceptual Site Model (CSM) is described below and is presented in Section 7.1 and Appendix E.

- The proven ground conditions are Made Ground / Alluvium, underlain by weathered London Clay, which is in turn underlain by London Clay. The proposed basement will sit within the weathered London Clay.
- The monitored groundwater levels were recorded between 0.88m and 6.30m bgl. However, this comprises perched water within the underlying soils.
- The site reduces in elevation from east to west by 1.6m over a distance of 56m.
- The existing building foundations are shallow spread foundations (assumed, based on building height). As part of the demolition and basement construction works, these will be grubbed out.
- The proposed development will be founded by means of driven pre-cast concrete piles to a depth of 12.0m bgl, within the weathered London Clay.
- The depths of neighbouring foundations/basements have not been confirmed. However, based on the building type, they are likely to be piled.
- The distance to the highway / footpath is 0.0m – the Site is located adjacent to Ingestre Road.
- The nearest tunnel is 28m to the north, which is outside the zone of influence of the proposed basement. Adjacent utilities located within Ingestre Road include a combined sewer.
- Potential impacts are considered to be negligible.
- Proposed mitigation is not required.
- There are no residual impacts from this basement construction.

8.2 Land Stability/Slope Stability

8.2.1 The site investigation has identified a suitable founding stratum of weathered London Clay.

8.2.2 The risk of movement and damage to this development due to shrink and swell of the London Clay) has been mitigated by designing a heave pad at formation level. The predicted heave of the London Clay from basement construction at the Site is in the order of 6mm.

8.2.3 A Ground Movement Assessment has concluded that ground movements caused by the excavation and construction of the proposed development will be minimal. The Damage Impact to surrounding structures within the zone of influence has been assessed as Category 1, in accordance with the Burland Scale, subject to confirmation of adjacent structures being supported on piles. To mitigate against any potential movement, diagonal and horizontal props

with a reinforced capping beam are to be incorporated as part of the construction, as per Figure 8.1, below.

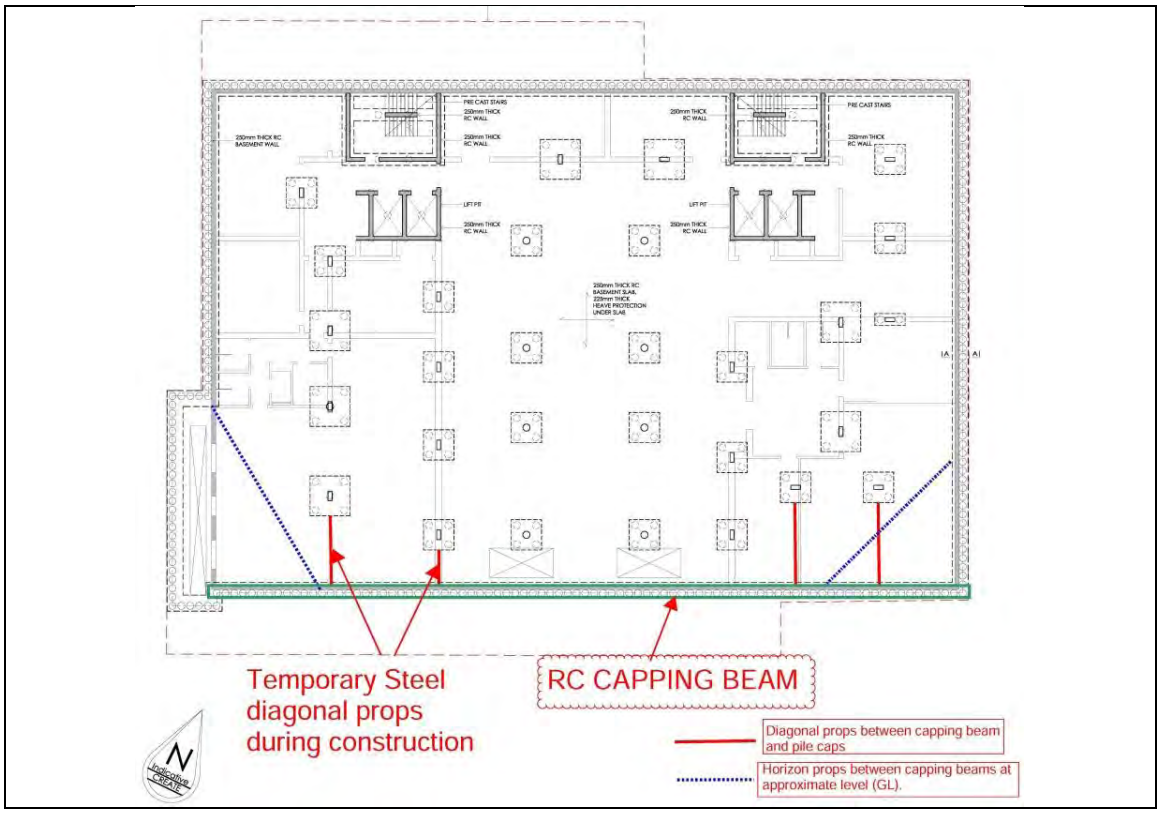


Figure 8.1 Ground movement mitigation props

8.2.4 The BIA has concluded that there will not be risks or stability impacts to the development or adjacent sites due to slopes.

8.3 Hydrogeology and Groundwater Flooding

8.3.1 The BIA and CCE flood risk assessment report (ref. JJ_CS_P17_1282_08 Rev. A FRA & Drainage Strategy, dated July 2018) have concluded there is a very low risk of groundwater flooding.

8.3.2 The BIA and CCE flood risk assessment report (ref. JJ_CS_P17_1282_08 Rev. A FRA & Drainage Strategy, dated July 2018) have concluded there are no impacts to the wider hydrogeological environment.

8.4 Hydrology, Surface Water Flooding and Sewer Flooding

8.4.1 The BIA and CCE flood risk assessment report (ref. JJ_CS_P17_1282_08 Rev. A FRA & Drainage Strategy, dated July 2018) have concluded there is a very low risk of surface water/sewer flooding. There is however, a residual risk. Therefore to mitigate against this include:

- Routine inspection and maintenance of the site and public drainage systems by the site owner and Thames Water;
- Monitor flood risk throughout the life of the development in order to confirm the risk posed to the scheme over time;

- A drainage survey should be undertaken to confirm the route and condition of any existing site drainage (if necessary) to inform the need for any upgrades to the network and diversion of any existing assets; and
- The detailed design should confirm if necessary that the drainage (below ground) serving the site is appropriately sized and any necessary upgrades to the current drainage is undertaken and agreed with Thames Water and building control as necessary.

8.4.2 The BIA and CCE flood risk assessment report (ref. JJ_CS_P17_1282_08 Rev. A FRA & Drainage Strategy, dated July 2018) have concluded there are reduced impacts to the wider hydrological environment. Mitigation measures proposed include SUDS.

Appendix A: Desk Study References

- Groundsure Enviro Insight Report
- Groundsure Geo Insight Report

Camden

Groundsure
LOCATION INTELLIGENCE

Create Consulting Engineers Ltd

109-112 Temple Chambers, 3-7 TEMPLE AVENUE,
LONDON, EC4Y 0HP

Groundsure Reference:	GS-4125671
Your Reference:	P17-1282
Report Date	25 Jul 2017
Report Delivery Method:	Email - pdf

Geo Insight

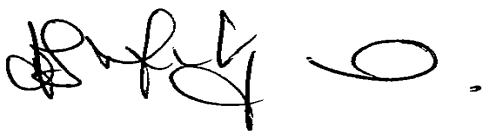
Address: 11, INGESTRE ROAD, LONDON, NW5 1UX

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Geo Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above Groundsure reference number.

Yours faithfully,



Managing Director
Groundsure Limited

Enc.
Groundsure Geo Insight

Geo Insight

Address:	**11, INGESTRE ROAD, LONDON, NW5 1UX**
Date:	**25 Jul 2017**
Reference:	**GS-4125671**
Client:	**Create Consulting Engineers Ltd**

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W E

SW S SE

Aerial Photograph Capture date:	07-Jun-2015
Grid Reference:	528794,185755
Site Size:	0.18ha

Groundsure
LOCATION INTELLIGENCE

Contents Page

Overview of Findings

The Groundsure Geo Insight provides high quality geo-environmental information that allows geo-environmental professionals and their clients to make informed decisions and be forewarned of potential ground instability problems that may affect the ground investigation, foundation design and possibly remediation options that could lead to possible additional costs.

The report is based on the BGS 1:50,000 and 1:10,000 Digital Geological Map of Great Britain, BGS Geosure data; BRITPITS database; Non-coal mining data and Borehole Records, Coal Authority data including brine extraction areas, PBA non-coal mining and natural cavities database, Johnson Poole and Bloomer mining data and Groundsure's unique database including historical surface ground and underground workings.

For further details on each dataset, please refer to each individual section in the report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1: Geology 1:10,000 Scale		
1.1 Artificial Ground	1.1 Is there any Artificial Ground/ Made Ground present beneath the study site at 1:10,000 scale?	No
1.2 Superficial Geology and Landslips	1.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site at 1:10,000 scale?*	No
	1.2.2 Are there any records of landslip within 500m of the study site boundary at 1:10,000 scale?	No
1.3 Bedrock, Solid Geology and Faults	1.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
	1.3.2 Are there any records of faults within 500m of the study site boundary at 1:10,000 scale?	No

Section 2: Geology 1:50,000 Scale		
2.1 Artificial Ground	2.1.1 Is there any Artificial Ground/ Made Ground present beneath the study site?	No
	2.1.2 Are there any records relating to permeability of artificial ground within the study site*boundary?	No
2.2 Superficial Geology and Landslips	2.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site?*	No
	2.2.2 Are there any records of permeability of superficial ground within 500m of the study site?	No
	2.2.3 Are there any records of landslip within 500m of the study site boundary?	No
	2.2.4 Are there any records relating to permeability of landslips within the study site* boundary?	No

Section 2: Geology 1:50,000 Scale

2.3 Bedrock, Solid Geology and Faults	2.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
	2.3.2 Are there any records relating to permeability of bedrock ground within the study site boundary?	Yes
	2.3.3 Are there any records of faults within 500m of the study site boundary?	No

Section 3: Radon

3. Radon	3.1Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?	The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.
	3.2Radon Protection	No radon protective measures are necessary.

Section 4: Ground Workings	On-site	0-50m	51-250	251-500	501-1000
4.1 Historical Surface Ground Working Features from Small Scale Mapping	4	10	15	Not Searched	Not Searched
4.2 Historical Underground Workings from Small Scale Mapping	0	3	3	15	3
4.3 Current Ground Workings	0	0	0	0	0

Section 5: Mining, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000
5.1 Historical Mining	0	0	0	3	0
5.2 Coal Mining	0	0	0	0	0
5.3 Johnson Poole and Bloomer Mining Area	0	0	0	0	0
5.4 Non-Coal Mining*	0	0	0	0	0
5.5 Non–Coal Mining Cavities	0	0	0	0	0
5.5 Natural Cavities	0	0	0	0	0

Section 5: Mining, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000
5.6 Brine Extraction	0	0	0	0	0
5.7 Gypsum Extraction	0	0	0	0	0
5.8 Tin Mining	0	0	0	0	0
5.9 Clay Mining	0	0	0	0	0

Section 6: Natural Ground Subsidence	On-site
6.1 Shrink-Swell Clay	Moderate
6.2 Landslides	Very Low
6.3 Ground Dissolution of Soluble Rocks	Negligible
6.4 Compressible Deposits	Negligible
6.5 Collapsible Deposits	Very Low
6.5 Running Sand	Negligible

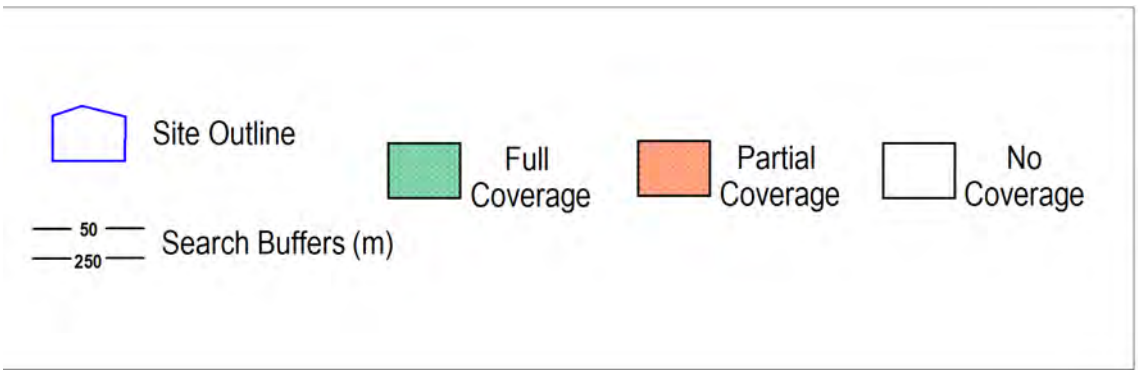
Section 7: Borehole Records	On-site	0-50m	51-250
7 BGS Recorded Boreholes	0	0	2

Section 8: Estimated Background Soil Chemistry	On-site	0-50m	51-250
8 Records of Background Soil Chemistry	1	0	0

Section 9: Railways and Tunnels	On-site	0-50m	51-250	250-500
9.1 Tunnels	0	1	3	Not Searched
9.2 Historical Railway and Tunnel Features	0	24	42	Not Searched
9.3 Historical Railways	0	1	1	Not Searched
9.4 Active Railways	0	8	26	Not Searched
9.5 Railway Projects	0	0	0	0

1:10,000 Scale Availability

1_10,000 Availability Legend



Availability of 1:10,000 Scale Geology Mapping

The following information represents the availability of the key components of the 1:10,000 scale geological data.

ID	Distance	Artificial Coverage	Superficial Coverage	Bedrock Coverage	Mass Movement Coverage
1	0.0	Some deposits are mapped	Full	Full	No coverage
2	727.0	Some deposits are mapped	Full	Full	No coverage
3	1165.0	Some deposits are mapped	Full	Full	No coverage
4	1386.0	Some deposits are mapped	Full	Full	No coverage

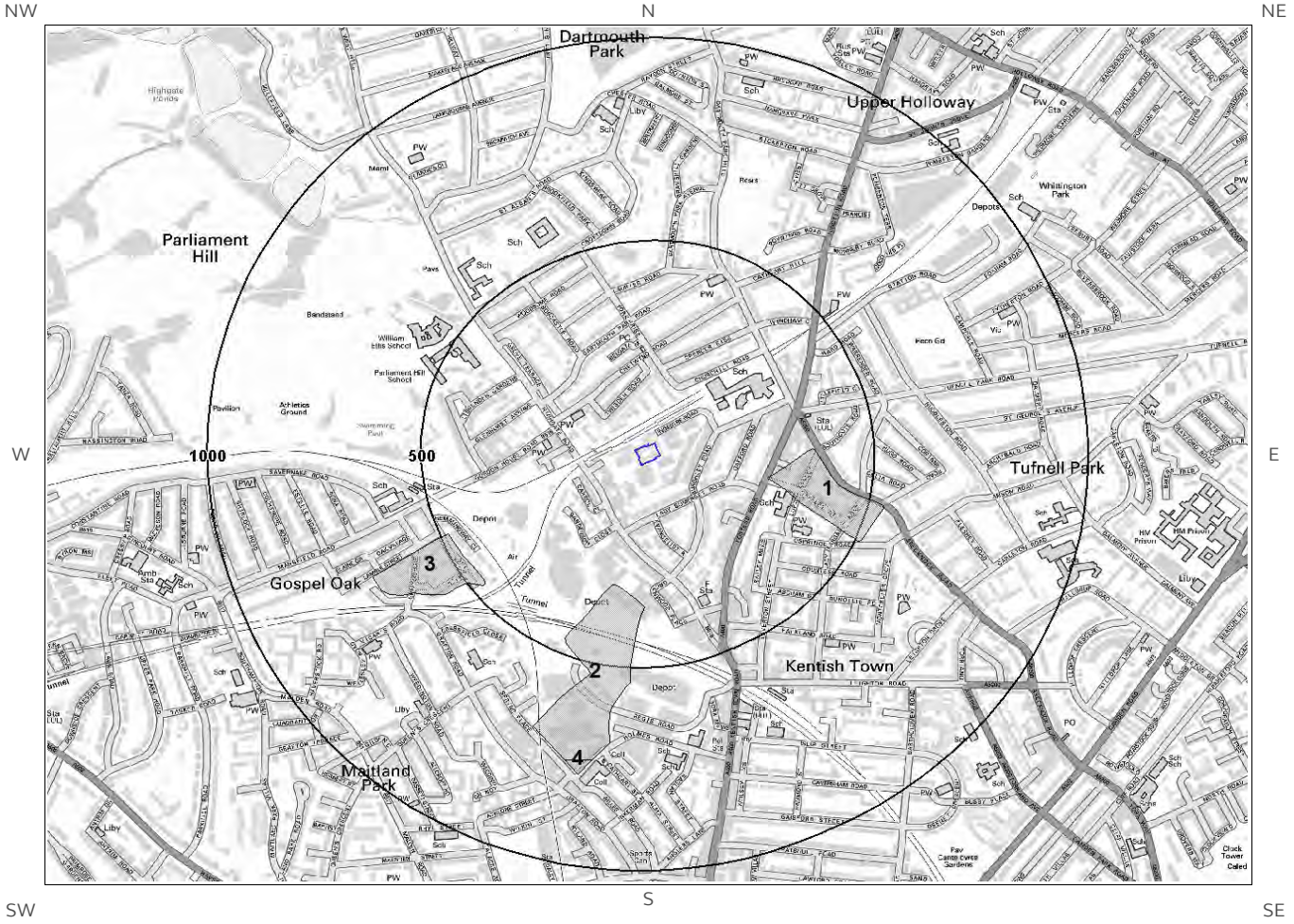
Guidance: The 1:10,000 scale geological interpretation is the most detailed generally available from BGS and is the scale at which most geological surveying is carried out in the field. The database is presented as four types of geology (artificial, mass movement, superficial and bedrock), although not all themes are mapped or available on every map sheet. Therefore a coverage layer showing the availability of the four themes is presented above.

The definitions of coverage are as follows:

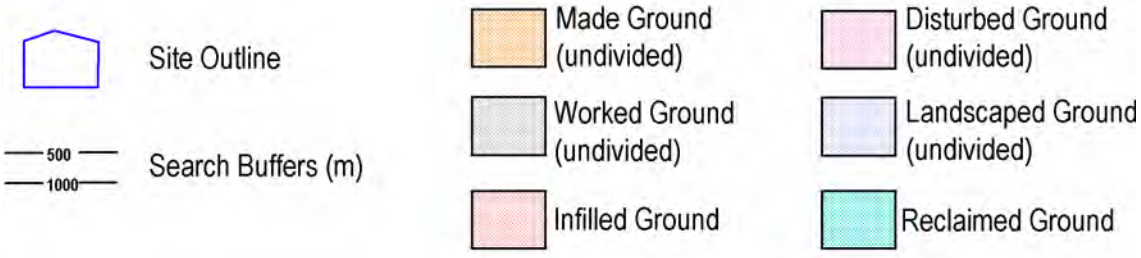
Geology	Full Coverage	Partial Coverage	No Coverage
Bedrock	The whole tile has been mapped	Some but not all the tile has been mapped	No coverage
Superficial	The whole tile has been mapped	Some but not all of the tile has been mapped	No coverage
Artificial	Some deposits are mapped on this tile	-	No deposits are mapped
Mass Movement	Some deposits are mapped on this tile	-	No coverage

1 Geology (1:10,000 scale).

1.1 Artificial Ground Map (1:10,000 scale)



Artificial Ground Legend



1. Geology 1:10,000 scale

1.1 Artificial Ground

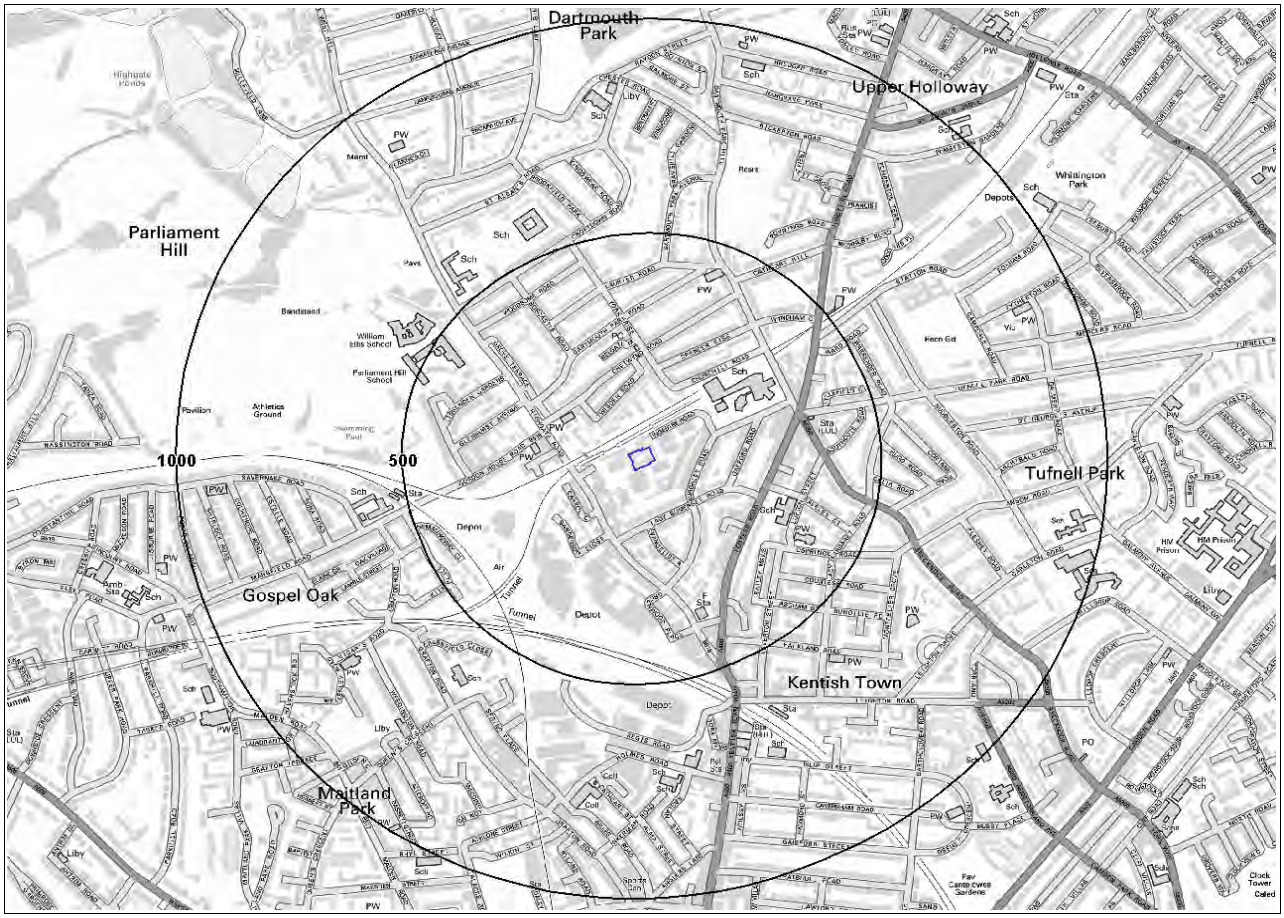
The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

Are there any records of Artificial/ Made Ground within 500m of the study site boundary at 1:10,000 scale? Yes

ID	Distance	Direction	LEX Code	Description	Rock Description
1	256.0	E	WGR-UKNOWN	Worked Ground (Undivided)	Unknown/unclassified Entry
2	300.0	S	WGR-UKNOWN	Worked Ground (Undivided)	Unknown/unclassified Entry
3	463.0	SW	WGR-UKNOWN	Worked Ground (Undivided)	Unknown/unclassified Entry

1.2 Superficial Deposits and Landslips Map (1:10,000 scale)

NW N NE



W E

SW S SE

Artificial Ground Legend

Site Outline

500
1000
Search Buffers (m)

1.2 Superficial Deposits and Landslips

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping

1.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary at 1:10,000 scale? No

Database searched and no data found.

1.2.2 Landslip

Are there any records of Landslip within 500m of the study site boundary at 1:10,000 scale?

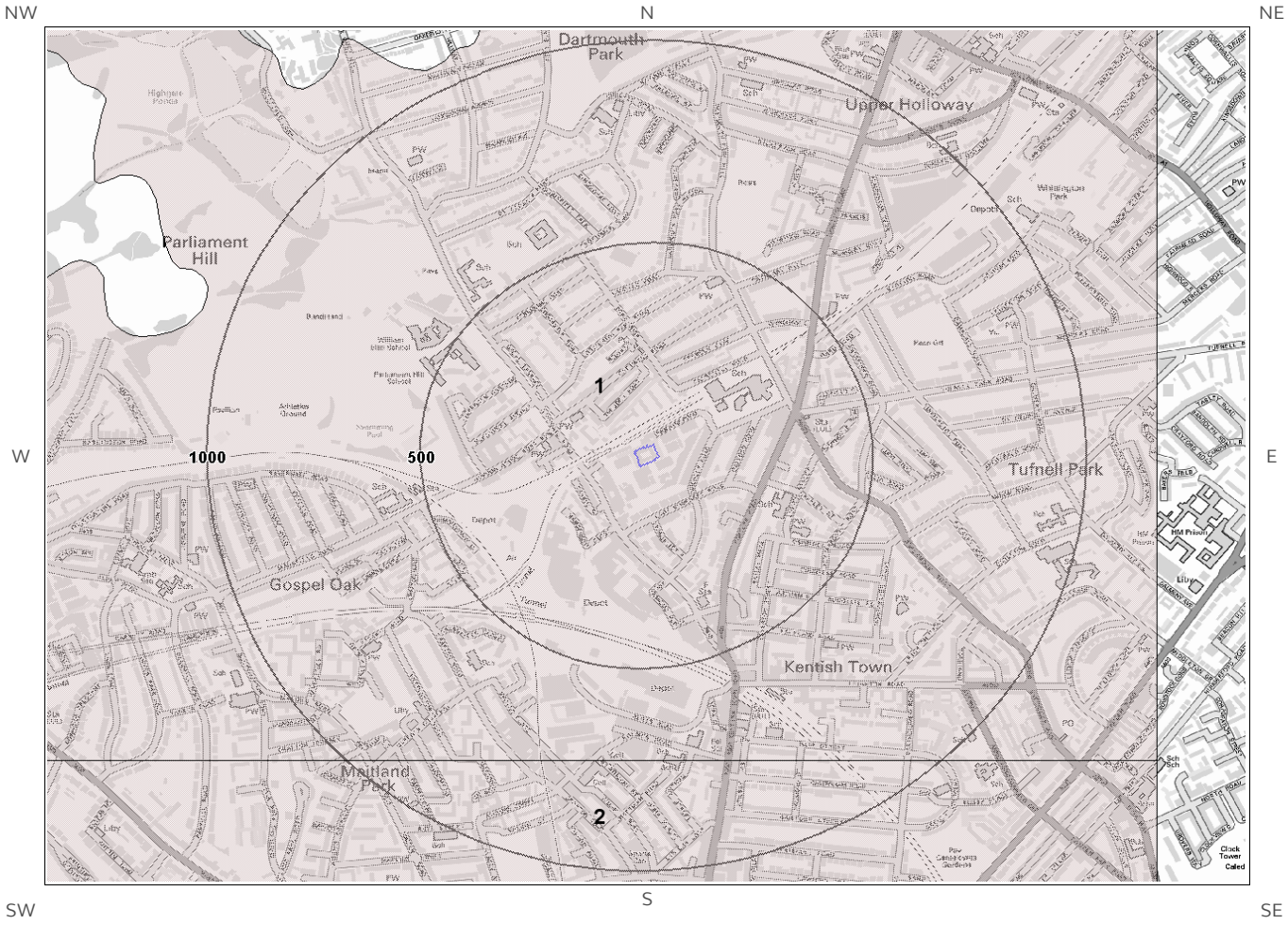
No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:10,000 scale

This Geology shows the main components as discrete layers, these are: Artificial / Made Ground, Superficial / Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

1.3 Bedrock and Faults Map (1:10,000 scale)



Bedrock and Faults Legend

Site Outline

500
1000
Search Buffers (m)

1.3 Bedrock and Faults

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

1.3.1 Bedrock/ Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary at 1:10,000 scale.

ID	Distance (m)	Direction	LEX Code	Description	Rock Age
1	0.0	On Site	LC-CLAY	London Clay Formation - Clay	Eocene Epoch

1.3.2 Faults

Are there any records of Faults within 500m of the study site boundary at 1:10,000 scale? No

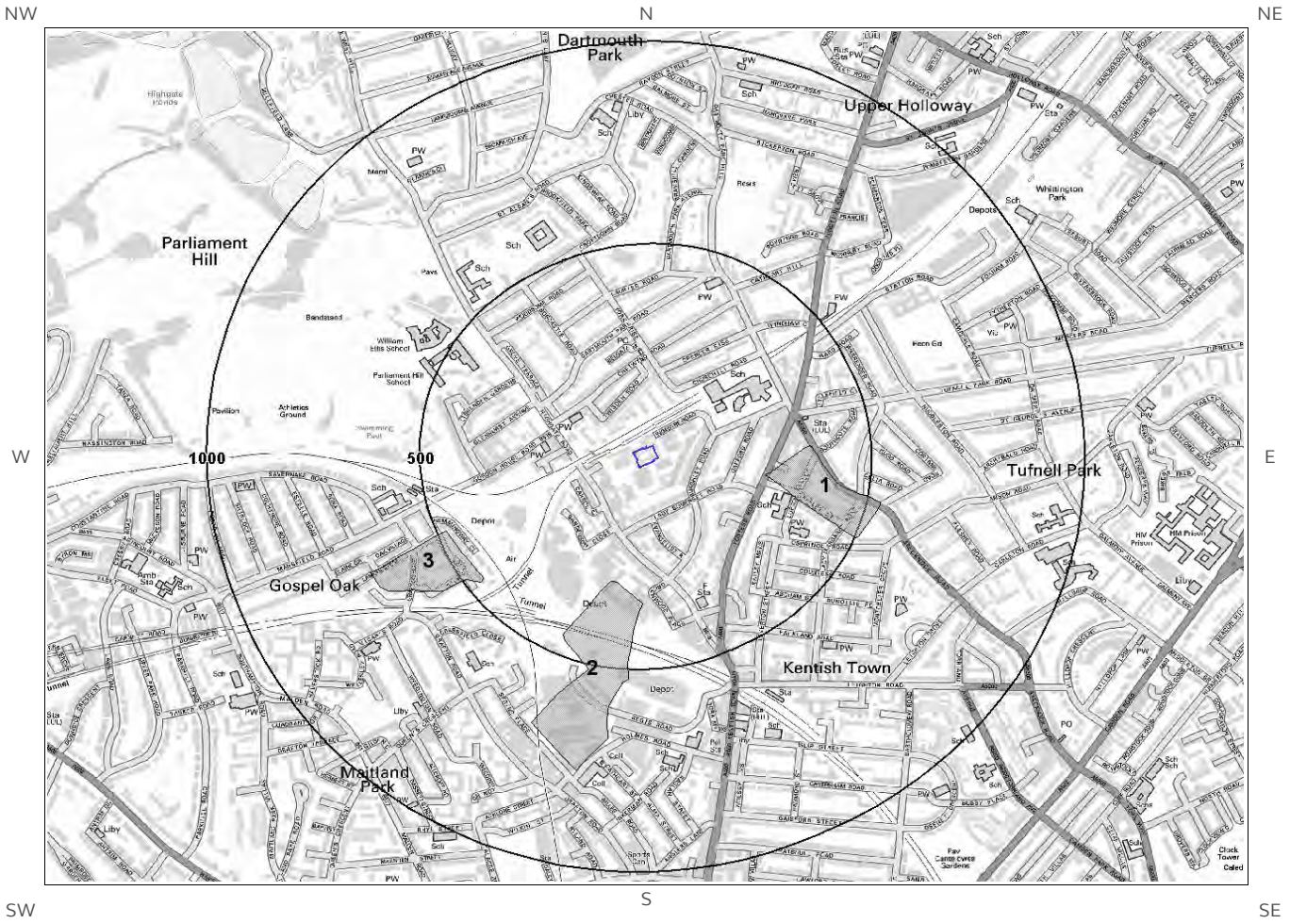
Database searched and no data found at this scale.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of great Britain at 1:10,000 scale.

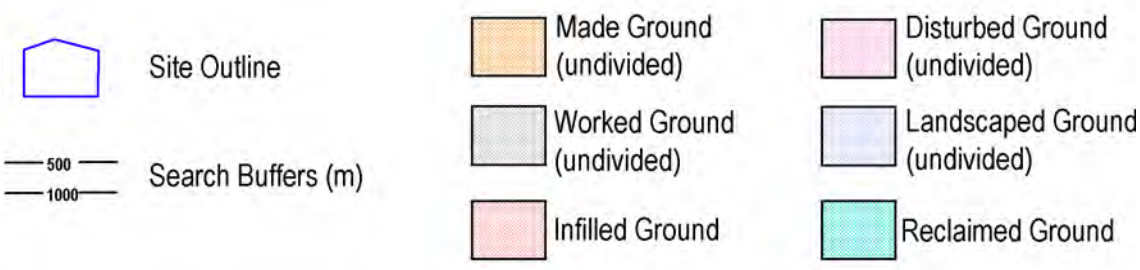
This Geology shows the main components as discrete layers, these are: Bedrock/ Solid Geology and linear features such as Faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

2 Geology 1:50,000 Scale

2.1 Artificial Ground Map



Ground Workings Legend



2. Geology 1:50,000 scale

2.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 256

2.1.1 Artificial/ Made Ground

Are there any records of Artificial/ Made Ground within 500m of the study site boundary? Yes

ID	Distance (m)	Direction	LEX Code	Description	Rock Description
1	253.0	E	WGR-VOID	WORKED GROUND (UNDIVIDED)	VOID
2	287.0	S	WGR-VOID	WORKED GROUND (UNDIVIDED)	VOID
3	456.0	SW	WGR-VOID	WORKED GROUND (UNDIVIDED)	VOID

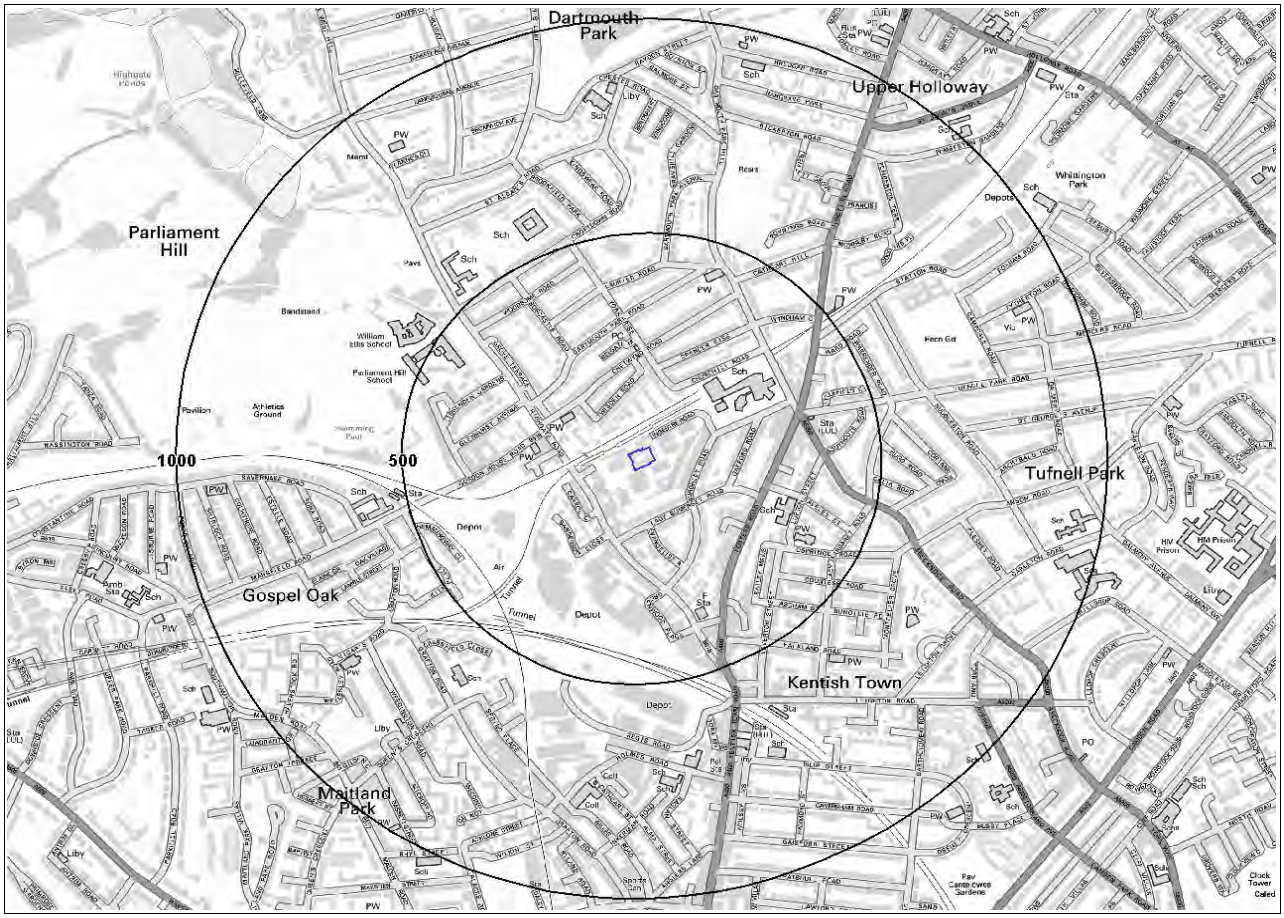
2.1.2 Permeability of Artificial Ground

Are there any records relating to permeability of artificial ground within the study site boundary? No

Database searched and no data found.

2.2 Superficial Deposits and Landslips Map (1:50,000 scale)

NW N NE



W E

SW S SE

Ground Workings Legend

Site Outline

500
1000
Search Buffers (m)

2.2 Superficial Deposits and Landslips

2.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary? No

Database searched and no data found.

2.2.2 Permeability of Superficial Ground

Are there any records relating to permeability of superficial ground within the study site boundary? No

Database searched and no data found.

2.2.3 Landslip

Are there any records of Landslip within 500m of the study site boundary? No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

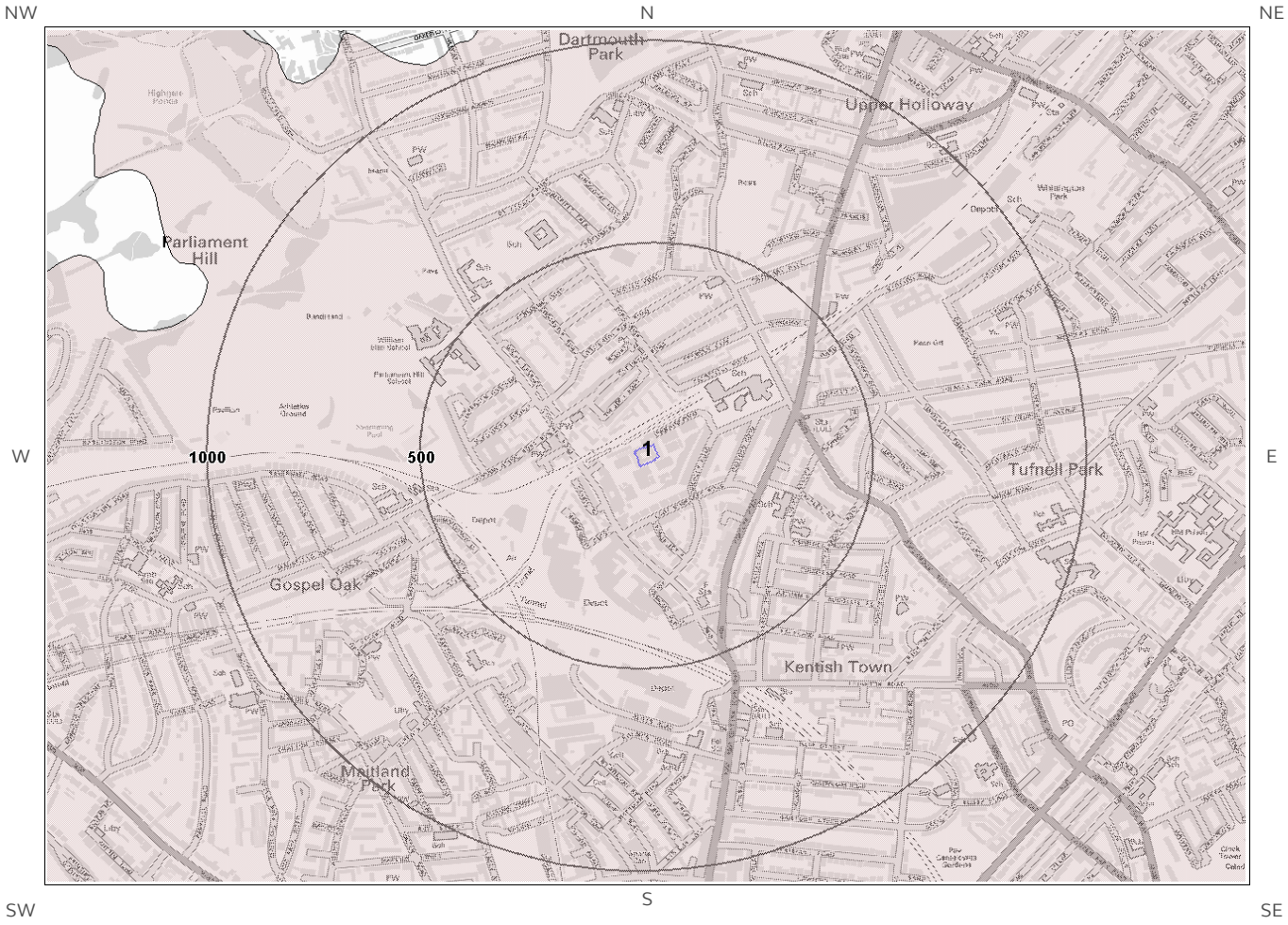
This Geology shows the main components as discrete layers, there are: Artificial/ Made Ground, Superficial/ Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

2.2.4 Landslip Permeability

Are there any records relating to permeability of landslips within the study site boundary? No

Database searched and no data found.

2.3 Bedrock and Faults Map (1:50,000 scale)



Ground Workings Legend

Site Outline

500
1000
Search Buffers (m)

2.3 Bedrock, Solid Geology & Faults

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 256

2.3.1 Bedrock/Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary:

ID	Distance	Direction	LEX Code	Rock Description	Rock Age
1	0.0	On Site	LC-XCZS	LONDON CLAY FORMATION - CLAY, SILT AND SAND	YPRESIAN

2.3.2 Permeability of Bedrock Ground

Are there any records relating to permeability of bedrock ground within the study site boundary? Yes

Distance	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Mixed	Moderate	Very Low

2.3.3 Faults

Are there any records of Faults within 500m of the study site boundary? No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/Solid Geology and linear features such as Faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nation wide coverage.