Appendix B

Underpinning Specification:

To be read in conjunction with the Preliminaries and General Conditions.

WORKMANSHIP: The work shall be carried out in accordance with the Engineer's drawings and instructions and to the approval of the Architect and the Building Control Officer. This specification is intended to be used for mass concrete underpinning.

Any other sequence of operations or method of working proposed by the Contractor is to be submitted to the Architect and copied to the Engineer and agreed in writing a minimum of 14 days before work is to be commenced on site.

CONTRACTORS RESPONSIBILITIES: The Contractor shall be responsible for the safety of the underpinned structure and provide all necessary shoring, strutting and bracing to ensure its safety and stability at all times.

SERVICES: The Contractor is also to carry out a survey of the property and adjacent area to establish the location of obstructions such as service runs or drains. Any obstruction found is to be brought to the attention of the Architect / Engineer. The Contractor is to allow for any temporary support to the services or obstructions during the underpinning.

CONSTRUCTION SEQUENCE: The underpinning is to be undertaken in short sections not exceeding 1 metre in length. The underpinning is to be undertaken on a 'hit and miss' sequence as shown on the drawings.

No adjacent pin is to be excavated until a minimum 48 hours after the adjacent pin has been cast and packed up.

The Contractor is to provide drawings marked up to show the proposed sequence of underpinning a minimum of 14 days before work is commenced.

EXCAVATIONS: Excavation shall be to the depth and width shown on the drawings. However, where tree roots are encountered new underpins are to extend 600mm below the last trace of any root activity. The sides of the excavations shall be adequately shored and propped to prevent subsidence or slip of the soil. Soil faces behind the pin and at the formation level shall be undisturbed.

Any soil faces behind the underpinning that require to be retained shall be by precast concrete poling boards. The boards are to have holes to enable the void behind the boards to be grouted up. The poling boards are to be measured as left in.

INSPECTIONS: All excavations are to be inspected by the Engineer and/or the Building Control Officer. Minimum notice of 24 hours is to be given when excavations are ready for inspection.

PREPARATION: The sides of the completed pin are to be thoroughly cleaned and scabbled to the satisfaction of the Engineer.

The soffit of the existing footings is to be levelled off and cleaned of all loose or detrimental material.

No projecting partitions of the existing footings are to be trimmed except as shown on the drawings or directed by the Engineer.

The Contractor must provide shear keys.

Allow for 150 deep x 100 wide shear keys across width of scabbled interfaces at 1m maximum vertical centres. Minimum 2 per face. Form in timber or polystyrene.

ANTI-HEAVE PRECAUTIONS: Before carrying out concreting introduce anti-heave precautions in the form of clay master as directed by the Engineer to the faces of the excavation.

PLACING CONCRETE: The concrete for the underpinning is to be mass concrete and poured continuously to 75mm below the soffit of the existing footing. The concrete is to be fully compacted using a mechanical vibrator.

The top 75mm of the pin is to be filled to the full depth and width of the void with a well rammed C35 concrete using 5mm – 10mm coarse aggregate and “Conbex 100” expanding admixture by Messrs Fosroc UK Limited in accordance with their instructions. The filling of this void is to be undertaken 24 hours after the mass concrete has been poured.

CONCRETE GRADE: On works where a full specification has not been provided, a FND2 mix should be used. This has characteristic 28 day strength of 35N/mm² and is suitable for Class 2 sulphate soils.

OVER-EXCAVATION: Except where noted otherwise on the drawings, areas of over-excavation are to be backfilled with a granular material and compacted in 225mm layers to provide a stable sub-base compatible with the final finishes.

SPOIL: The contractor will include in his prices for the removal of all spoil arising from the works which is not suitable for backfilling purposes.

RECORDS: A full record of each section underpinned is to be kept on site and readily available for inspection by the Engineer or Building Control Officer.

GUARANTEE The Contractor is to provide a 10 year insurance backed guarantee for the underpinning works.

Form

Appendix C

Soil Investigation

DESK STUDY, GROUND INVESTIGATION & BASEMENT IMPACT ASSESSMENT REPORT

FOR

38 GLENLOCH ROAD
CAMDEN,
NW3 4DN

JOMAS ASSOCIATES LTD

SITE INVESTIGATION & SURVEYS
LAND DEVELOPMENT SUPPORT

Tel: 0843-289-2187

Report Title: Desk Study, Ground Investigation & Basement Impact Assessment Report for 38 Glenloch Road, Camden, NW3 4DN

Report Status: Final v1.1

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Prepared by: JOMAS ASSOCIATES LTD For MCKAY ESTATES LTD

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CONTENTS

Page

NON TECHNICCAL EXECUTIVE SUMMARY

McKay Estates Ltd ("The Client") has commissioned Jomas Associates Ltd, to prepare a Desk Study, Ground Investigation & Basement Impact Assessment Report for a site referred to as 38 Glenloch Road, Camden, NW3 4DN. A basement excavation is proposed beneath the existing residential building.

The aim of this report is to assess whether the ground conditions within the local area represent an impediment to the proposed development.

It should be noted that the table below is an executive summary of the findings of this report and is for briefing purposes only. Reference should be made to the main report for detailed information and analysis.

Desk Study	
Current Site Use	The site is currently configured for residential end use.
Proposed Site Use	The proposed development for this site is understood to comprise the extension of the existing building and a horizontal extension at basement level.
Site History	The site is shown as being used for undeveloped / agricultural use / amenity land within the Belsize Park area on the earliest available map (1871). By the map dated 1915, Glenloch Road has been formed and a residential house with garden built on site. The site appears to be in its current configuration and no significant changes are shown on site up to the present day. The surrounding area has been in use almost exclusively for residential properties, with the only significant industrial use being a garage 200m N of site, shown on maps dating 1951-1989.
Site Setting	The British Geological Survey indicates that the site is directly underlain by solid deposits of the London Clay Formation. No artificial deposits are reported within the site. These solid deposits are identified as Unproductive strata. The site does not lie within a groundwater Source Protection Zone. A review of the EnviroInsight Report indicates that a Source Protection Zone 2 is located 319m south of the site. The nearest abstraction (a non-potable abstraction) is reported 774m south-west of site. There are no surface water features reported within 250m of the site. There is a culvert 27m E of site.
Potential Sources	• Potential asbestos containing materials within existing buildings – on site (S1) • Potential made ground on site (S2) • Potential off-site current and historical industrial activities – garage 200m North 1950's – 1990's (S3)
Potential Receptors	• Construction workers (R1) • Maintenance workers (R2) • Neighbouring site users (R3) • Future site users (R4) • Building foundations and on site buried services (water mains, electricity and sewer) (R5)

	• Controlled Waters (Culvert) (R6)
Preliminary Risk Assessment	The risk estimation matrix indicates a low risk. Due to the potential presence of asbestos containing materials, an asbestos survey should be undertaken, with any asbestos containing materials found, removed under suitably controlled conditions. There should be no risk to end users from asbestos if the potential asbestos containing materials are removed by suitably qualified and experienced specialists under controlled conditions. No significant potential sources of contamination were identified during the desk based assessment. It is recommended that a number of soil samples obtained during the geotechnical investigation are analysed for a suite of general contaminants to confirm the lack of contamination within the site. No potential sources of ground gas have been noted, as a consequence ground gas monitoring is not considered to be necessary. However, groundwater information will be required for basement design. Consequently, it may be appropriate to measure ground gas concentrations at the same time to confirm that there is not an issue.
Potential Geological Hazards	The Groundsure data identifies a moderate risk of shrink/swell clay – for full details see Section 4. The clearance of the site, including removal of foundations and services is likely to increase the depth of Made Ground on the site. Foundations should not be formed within Made Ground or Topsoil due to the unacceptable risk of total and differential settlement. The presence of Made Ground derived from demolition material may be a source of elevated sulphate results associated with plaster from the previous structures. If such levels are noted then sulphate resistant concrete may be required.

Screening and Scoping	
Subterranean (Groundwater) Flow	The investigation should confirm the ground conditions beneath the site including if there is a relatively high groundwater table present beneath the site. This can then confirm the relative depths of the basement to the groundwater levels.
Land Stability	The Groundsure report has noted that there is a “moderate” risk of shrink-swell clay at the site. The ground investigation should determine the volume change potential of the underlying London Clay Formation. The investigation should also determine the possibility of encountering groundwater and the possibility of Made Ground and/or clay immediately beneath the site. Therefore, any issues relating to groundwater management and excavation stability.
Surface Flow and Flooding	No specific investigation required.

Ground Investigation	
Ground Conditions	The results of the ground investigation revealed a ground profile comprising Made Ground up to 1.65mbgl (and 0.72mbbl) overlying undisturbed deposits of the London Clay Formation to at least the base of the borehole at 5.0mbgl.
Environmental Considerations	Following generic risk assessments, lead, benzo(b)fluoranthene, benzo(a)pyrene and dibenz(ah)anthracene were detected in soils in excess of generic assessment criteria for the protection of human health within a 'residential with plant uptake' end-use scenario. No asbestos fibres were detected in the samples analysed in the laboratory. The only sample that was found to contain contaminants in excess of the GAC were obtained from TP1 at 0.4mbbl. These samples were obtained from below the existing basement level. The proposed development involves the extension of the basement. As a result, the basement floor is considered to provide a barrier to potential receptors, and as such pathways for contact with these non-volatile determinands will not be present. Therefore it is considered that no further action is required with regards to the elevated concentrations detected in TP1. The site is underlain by unproductive solid deposits of the London Clay Formation, and there are no abstractions, source protection zones or surface water features in close proximity to the site. The only water feature within 250m of the site is a Culvert 27m E of site. No evidence of potentially mobile contamination has been detected by the investigation. As a result, the risk to controlled waters is considered low. Calculating the Gas Screening Value using worst case results indicates Characteristic Situation 1. This would indicate that no special precautions are required. Assuming that the basement development is constructed to the necessary standards and guidelines it would provide a minimum of 2.5 gas protection points. No further remediation works are considered necessary, and the site is considered suitable for the proposed use. As with any ground investigation, the presence of further hotspots between sampling points cannot be ruled out. Should any contamination be encountered, a suitably qualified environmental consultant should be informed immediately, so that adequate measures may be recommended.
Geotechnical Considerations	At the current time, it is not known how it is proposed to construct the basement. It is assumed that a cantilever retaining wall installed using "underpinning" type construction methods. An excavation circa 3.5m deep would be required to form the basement within. Based upon the information obtained to date, it is considered that conventional foundations may be suitable for the proposed development. It is considered that an allowable bearing capacity of 90kPa at 3.5m bgl is possible. The exact allowable bearing capacity that could be achieved would need to be reviewed on receipt of initial foundation design. Assuming the use of a cantilever retaining wall, a check against sliding failure would need to be made to the retaining wall design. This may alter the above recommendations. Excavations will be required at the site for services and construction works. These are anticipated to remain stable for the short term only. It is recommended that the stability of all excavations should be assessed during construction. The sides of any excavations into which personnel are required to enter, should be assessed and where necessary fully supported. The progression of the basement excavation will need to consider the potential impact to existing structures both on and off site and provide adequate and appropriate support.

Ground Investigation	
	The basement excavation will be located beneath an existing structure. The progression of the basement excavation will need to consider the potential impact to existing structures both on and off site and provide adequate and appropriate support. During the investigation, groundwater was not observed. During return monitoring groundwater levels were recorded at between dry and 2.42mbgl. Due to the logged ground conditions and the lack of groundwater during drilling, it is considered most likely that the measured water represents surface water that has percolated through the near surface sails and been unable to drain through the underlying clay. Based on the results of chemical testing, the required concrete class for the site is DS-3 assuming an Aggressive Chemical Environment for Concrete classification of AC-2s within the Made Ground and DS-1 AC-1s within the London Clay in accordance with the procedures outlined in BRE Special Digest 1. If a cantilever retaining wall is utilised then a ground bearing floor slab could be used. Such a floor slab would also need to be suitably reinforced, to prevent buckling from the loadings imposed by the retaining wall. The floor slab (and basement walls) would need to be constructed to conform to BS: 8102 (2009).

Basement Impact Assessment	
Impact Assessment	The overall assessment of the site is that the creation of a basement for the existing development will not adversely impact the site or its immediate environs, providing measures are taken to protect surrounding land and properties during construction. The proposed basement excavation will be within 5m of a public pavement. It is also laterally within 5m of neighbouring properties. Unavoidable lateral ground movements associated with the basement excavations must be controlled during temporary and permanent works so as not to impact adversely on the stability of the surrounding ground and any associated services. During the construction phase careful and regular monitoring will need to be undertaken to ensure that the property above, is not adversely affected. This may mean that the property needs to be suitably propped and supported. From the studies that have been undertaken so far it is concluded that the construction of the building will not present a problem for groundwater. It is concluded that this site can be successfully developed without causing any problems to the subterranean drainage.

1 INTRODUCTION

1.1 Terms of Reference

1.1.1 McKay Estates Ltd ("The Client") has commissioned Jomas Associates Ltd ('Jomas'), to prepare a Desk Study, Ground Investigation & Basement Impact Assessment Report at a site referred to as 38 Glenloch Road, Camden, NW3 4DN.

1.1.2 Jomas' work has been undertaken in accordance with proposal dated 23 October 2017.

1.2 Proposed Development

1.2.1 The proposed development for this site is understood to comprise the horizontal extension of the existing basement north-eastwards beneath the footprint of the existing building. It is also understood that the existing basement and the floor of the lighwells will be lowered, It is understood that the end use of the property will remain a residential property with private gardens.

1.2.2 For the purpose of geotechnical assessment, it is considered that the project could be classified as a Geotechnical Category (GC) 2 site in accordance with BS EN 1997 (2004) Part 1. GC 2 projects are defined as involving:

- Conventional structures.
- Quantitative investigation and analysis.
- Normal risk.
- No difficult soil and site conditions.
- No difficult loading conditions.
- Routine design and construction methods.

1.2.3 This will be reviewed at each stage of the project.

1.3 Objectives

1.3.1 The objectives of Jomas' investigation were as follows:

- To present a description of the present site status, based upon the published geology, hydrogeology and hydrology of the site and surrounding area;
- To review readily available historical information (i.e., Ordnance Survey maps and database search information) for the site and surrounding areas;
- To conduct an intrusive investigation, to assess ground conditions and obtain geotechnical parameters to inform preliminary foundation design;
- To assess the potential impacts that the proposal may have on ground stability, the hydrogeology and hydrology on the site and its environs.

1.4 Scope of Works

1.4.1 The following tasks were undertaken to achieve the objectives listed above:

- A walkover survey of the site;

- A desk study, which included the review of a database search report (GeoInsight Report, attached in Appendix 2) and historical Ordnance Survey maps (attached in Appendix 3);
- An intrusive investigation to assess the underlying ground conditions;
- A basement impact assessment;
- The compilation of this report, which collects and discusses the above data, and presents an assessment of the site conditions, conclusions and recommendations.

1.5 Scope of Basement Impact Assessment

1.5.1 The scope of the BIA covers most items required under CPG4, with the exception of:

- Plans and sections to show foundation details of adjacent structures (due to not having access);
- Programme for enabling works, construction and restoration
- Evidence of consultation with neighbours
- Ground Movement Assessment (GMA), to include assessment of significant adverse impacts and Specific mitigation measures required, as well as confirmatory and reasoned statement identifying likely damage to nearby properties according to Burland Scale
- Construction Sequence Methodology
- Proposals for monitoring during construction.
- Drainage assessment

1.6 Limitations

1.6.1 Jomas Associates Ltd ('Jomas') has prepared this report for the sole use of McKay Estates Ltd in accordance with the generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon by any other party without the explicit written agreement of Jomas. No other third-party warranty, expressed or implied, is made as to the professional advice included in this report. This report must be used in its entirety.

1.6.2 The records search was limited to information available from public sources; this information is changing continually and frequently incomplete. Unless Jomas has actual knowledge to the contrary, information obtained from public sources or provided to Jomas by site personnel and other information sources, have been assumed to be correct. Jomas does not assume any liability for the misinterpretation of information or for items not visible, accessible or present on the subject property at the time of this study.

Whilst every effort has been made to ensure the accuracy of the data supplied, and any analysis derived from it, there may be conditions at the site that have not been disclosed by the investigation, and could not therefore be taken into account. As with any site, there may be differences in soil conditions between exploratory hole positions. Furthermore, it should be noted that groundwater conditions may vary due to seasonal and other effects and may at times be significantly different from those measured by the investigation. No liability can be accepted for any such variations in these conditions.

2 SITE SETTING & HISTORICAL INFORMATION

2.1 Site Information

2.1.1 The site location plan is appended to this report in Appendix 1.

Table 2.1: Site Information

Name of Site	-
Address of Site	38 Glenloch Road Camden NW3 4DN
Approx. National Grid Ref.	527165,184970
Site Area (Approx)	0.01 hectares
Site Occupation	An unoccupied residential dwelling
Local Authority	London Borough of Camden
Proposed Site Use	Residential with extension of existing basement

2.2 Walkover Survey

2.2.1 The site was visited by a Jomas Engineer on 7th December 2017. The following information was noted while on site.

Table 2.2: Site Description

Area	Item	Details
On-site:	**Current Uses:**	The site currently consists of an unoccupied residential building, in terrace-arrangement, with a rear garden.
	Evidence of historic uses:	None noted.
	Surfaces:	The majority of the site is covered by building footprint. The rear garden area is predominantly paved with a limited area of soft-landscaping adjacent to the northeast boundary.
	Vegetation:	There is some vegetation in the form of small trees and shrubs located in the soft-landscaping at the rear of the site.
	Topography/Slope Stability:	The site is generally level. With raised flower beds and a basement resulting in a slightly undulating levels.
	Drainage:	The site appears to have a standard drainage system.
	Services:	The site appears to be connected to normal statutory services.

Area	Item	Details
	Controlled waters:	No controlled waters were noted on site.
	Tanks:	No tanks were observed on site.
Neighbouring land:	**North:**	Residential.
	East:	Glenloch Road (residential street)
	South:	Residential.
	West:	Residential.

2.2.2 Photos taken during the site walkover are provided in Appendix 1.

2.3 Historical Mapping Information

2.3.1 The historical development of the site and its surrounding areas was evaluated following the review of a number of Ordnance Survey historic maps, procured from GroundSure, and provided in Appendix 3 of this report.

2.3.2 A summary produced from the review of the historical map is given in Table 2.3 below. Distances are taken from the site boundary.

Table 2.3: Historical Development

Dates and Scale of Map	Relevant Historical Information	
	On Site	**Off Site**
1871 1:1,056 1:2,500 1:10,560	Site is currently undeveloped agricultural / amenity land within the Belsize Park area.	The site is surrounded immediately by undeveloped agricultural land and woodland. Residential development is shown 110m SE in the form of Saint Margaret's Road An underground tunnel is shown running in a NE-SW orientation approx. 150m north. A ventilating shaft associated with said tunnel is shown 260m NE. Hampstead Ponds are shown 1km north.
1894-96 1:1,056 1:2,500 1:10,560	No significant changes.	Residential development of Belsize Avenue 100m NW. Saint Margaret's Road 110m SE is now listed as Belsize Park Gardens. Development of Fever **Hospital** 400m NE.
1915-20 1:1,056 1:2,500 1:10,560	Development of Glenloch Road has taken place and the site now comprises what appears to be a residential dwelling in terrace-arrangement with associated garden.	Development of residential property directly adjacent to the NW and SE boundaries of site. A **nursey** is shown 250m NE Tube station shown 300m NE. Tramway **depot** (L.C.C) shown 750m NE.

Dates and Scale of Map	Relevant Historical Information	
	On Site	Off Site
1935-38 1:2,500 1:10,560 (Mapping incomplete)	No significant changes from above. The site appears to be in its current configuration at this stage.	Development of Tudor Close adjacent to northern boundary. A cinema is shown 130m NE.
1951-55 1:1,250 1:2,500 1:10,560	No significant change	**Garage** shown 200m N of site.
1965-70 1:1,250 1:2,500 1:10,560	No significant change	No significant change
1974/77 1:1,250 1:10,000	No significant change	No significant change
1986 1:1,250 Mapping Error	No significant change	No significant change
1989-94 1:1,250 1:10,000	No significant change	Building 200m N of site no longer identified as a garage.
2002 1:10,000	No significant change	No significant change
2010 1:10,000	No significant change	No significant change
2014 1:10,000	No significant change	No significant change

2.4 Previous Site Investigations

2.4.1 No previous site investigation reports were provided to Jomas at the time of writing.

2.5 Unexploded Ordnance

2.5.1 Publicly available information has been assessed regarding the risk of Unexploded Ordnance affecting the site.

2.5.2 The initial data indicates that there is a moderate risk. No feature was identified during the historical map review that would suggest that the site or its surroundings had been subject to large scale high explosive or incendiary bombardment and would therefore not alter this assessment.

2.5.3 Moderate risk regions are those that show a bomb density of between 10 and 150 bombs per km^2 and that may contain potential WWII targets.

2.5.4 Therefore a watching brief should be maintained during below ground works, with site personnel made aware that there remains a potential, if negligible, risk of unexploded ordnance, Any suspicious item uncovered during site works should be reported immediately.

2.5.5 This does not comprise a full UXO risk assessment.

3 ENVIRONMENTAL SETTING

3.1.1 The following section summarises the principal geological resources of the site and its surroundings. The data discussed herein is generally based on the information given within the Groundsure Report (in Appendix 2).

3.2 Solid and Drift Geology

3.2.1 Information provided by the British Geological Survey indicates that the site is directly underlain by solid deposits of the London Clay Formation. An extract of the BGS description of the London clay Formation is provided below:

> *"bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. It commonly contains thin courses of carbonate concretions ('cementstone nodules') and disseminated pyrite."*

3.2.2 Superficial and artificial deposits are not reported within the site.

3.3 British Geological Survey (BGS) Borehole Data

3.3.1 As part of the assessment, publicly available BGS borehole records were obtained and reviewed from the surrounding area. The local records obtained are presented in Appendix 5.

3.3.2 The nearest such record was located approximately 228m north west of the site, and undertaken in 1900.

3.3.3 This showed the underlying ground conditions to comprise Made Ground to a depth of around 1.22mbgl.

3.3.4 The Made Ground was overlying "Clay" to the base of the borehole, at approximately 6.10mbgl. This is considered likely to represent the London Clay Formation.

3.3.5 All depths and measurements should be viewed as approximately, due to the age of the borehole and corresponding use of imperial measurements.

3.4 Hydrogeology & Hydrology

3.4.1 General information about the hydrogeology of the site was obtained from the Environment Agency website.

Groundwater Vulnerability

3.4.2 Since 1 April 2010, the EA's Groundwater Protection Policy uses aquifer designations that are consistent with the Water Framework Directive. This comprises;

- **Secondary A** - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers;
- **Secondary B** - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

- **Secondary Undifferentiated** - has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

- **Principal Aquifer** – this is a formation with a high primary permeability, supplying large quantities of water for public supply abstraction.

- **Unproductive Strata** - These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Source Protection Zones (SPZ)

3.4.3 In terms of aquifer protection, the EA generally adopts a three-fold classification of SPZs for public water supply abstraction wells.

- Zone I - or 'Inner Protection Zone' is located immediately adjacent to the groundwater source and is based on a 50-day travel time. It is designed to protect against the effects of human activity and biological/chemical contaminants that may have an immediate effect on the source.
- Zone II - or 'Outer Protection Zone' is defined by a 400-day travel time to the source. The travel time is designed to provide delay and attenuation of slowly degrading pollutants.
- Zone III - or 'Total Catchment' is the total area needed to support removal of water from the borehole, and to support any discharge from the borehole.

Hydrology

3.4.4 The hydrology of the site and the area covers water abstractions, rivers, streams, other water bodies and flooding.

3.4.5 The Environment Agency defines a floodplain as the area that would naturally be affected by flooding if a river rises above its banks, or high tides and stormy seas cause flooding in coastal areas.

3.4.6 There are two different kinds of area shown on the Flood Map for Planning. They can be described as follows:

Areas that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded:

- from the sea by a flood that has a 0.5 per cent (1 in 200) or greater chance of happening each year;

- or from a river by a flood that has a 1 per cent (1 in 100) or greater chance of happening each year.

(For planning and development purposes, this is the same as Flood Zone 3, in England only.)

- The additional extent of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1 per cent (1 in 1000) chance of occurring each year.

(For planning and development purposes, this is the same as Flood Zone 2, in England only.)

3.4.7 These two areas show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements.

3.4.8 Outside of these areas flooding from rivers and the sea is very unlikely. There is less than a 0.1 per cent (1 in 1000) chance of flooding occurring each year. The majority of England and Wales falls within this area. (For planning and development purposes, this is the same as Flood Zone 1, in England only.)

3.4.9 Some areas benefit from flood defences and these are detailed on Environment Agency mapping.

3.4.10 Flood defences do not completely remove the chance of flooding, however, and can be overtopped or fail in extreme weather conditions.

Table 3.1: Summary of Hydrogeology & Hydrology

Feature		On Site	Off Site	Potential Receptor?
Aquifer	**Superficial:**	-	-	**-**
	Solid:	Unproductive	Unproductive	**X**
Source Protection Zone		None	SPZ II reported 319m S of site.	**X**
Abstractions	Groundwater	None	4No. reported within 1km; nearest identified 774m SW of site.	**X**
	Surface water	None	None within 1km	**X**
	Potable water	None	None within 1km	**X**
Surface Water Features/Detailed River Network		None	No surface water features identified within 250m of site. 1No. detailed river network identified within 500m of site; identified as a culvert 27m E of site.	✓
Flood Risk		None	No environment agency flood zones within 250m RoFRaS – Very Low	-

3.5 Detailed River Network

3.5.1 As detailed within Table 3.1, a culvert is recorded to be present 27m east of the site. This culvert channels surface waters draining from the Hampstead Ponds, located 1km north of the site, to the River Thames, located ca 6km south of the site.

3.6 Radon

3.6.1 The site is reported not to lie within a Radon affected area, as less than 1% of properties are above the action level.

3.6.2 Consequently, no radon protective measures are necessary in the construction of new dwellings or extensions as described in publication BR211 (BRE, 2007).

4 GEOLOGICAL HAZARDS

4.1.1 The following are brief findings extracted from the GroundSure GeoInsight Report, that relate to factors that may have a potential impact upon the engineering of the proposed development.

Table 4.1: Geological Hazards

Potential Hazard	Site check Hazard Rating	Details	Further Action Required?
Shrink swell	Moderate	Ground conditions predominantly high plasticity. Do not plant or remove trees or shrubs near to buildings without expert advice about their effect and management. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and Building Research Establishment (BRE). There is a probable increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a probable increase in insurance risk during droughts or where vegetation with high moisture demands is present.	Yes
Landslides	Very low	Slope instability problems are unlikely to be present. No special actions are required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.	No
Ground dissolution soluble rocks	Negligible	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks.	No
Compressible deposits	Negligible	No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.	No
Collapsible Rock	Very Low	Deposits with the potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required.	No
Running sand	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.	No
Coal mining	N/A	There are no coal mining areas identified within 1000m of the site boundary.	No

Potential Hazard	Site check Hazard Rating	Details	Further Action Required?
Non-coal mining	N/A	29No. historical mining operations reported within 1km of site. All identified as air/ventilation/unspecified shafts. Nearest reported 265m NE of site.	No
Brine affected areas	N/A	-	No

4.1.2 In addition, the GeoInsight report notes the following:

- No historical surface ground working features are reported within 250m of the site.
- 70No. historical underground working features are reported within 1km of the site. All refer to air/ventilation/unspecified shafts and tunnels. Nearest is reported 144m N of site.
- No BGS Current Ground Working Features are reported within 1km of the site.
- A culverted river is noted to be present 27m east of the site.

4.1.3 The clearance of the site, including removal of foundations and services is likely to increase the depth of Made Ground on the site. Foundations should not be formed within Made Ground or Topsoil due to the unacceptable risk of total and differential settlement. The presence of Made Ground derived from demolition material may be a source of elevated sulphate results associated with plaster from the previous structures. If such levels are noted then sulphate resistant concrete may be required.

4.1.4 The BGS notes disseminated pyrite within the London Clay Formation and as such may be a source of elevated sulphate results. If such levels are noted then sulphate resistant concrete may be required.

4.1.5 The resultant thickness of Made Ground and the potential for clays beneath the proposed footprint would mean that in strict accordance with NHBC Chapter 4.2 a suspended floor slab would be required. However given the depth that the floor slab would be formed at it is considered that a ground bearing floor slab may be possible, dependant on the results of the geotechnical ground investigation.

4.1.6 Given that the BGS considers the area is not prone to groundwater flooding based on rock type, a relatively high groundwater table is not expected.

4.1.7 It is noted that the GeoInsight report indicates that the site is underlain by materials that are considered to pose a “moderate” risk of shrink / swell. It is likely that excavations to form the basement would take foundations below the zone where seasonal moisture content is likely to occur.

4.1.8 It is recommended that a ground investigation is undertaken to investigate geotechnical issues and to obtain parameters to aid foundation design.

5 HYDROLOGY AND FLOOD RISK

5.1 Hydrology and Flood Risk

5.1.1 In accordance with the NPPF Guidance, below is a review of flood risks posed to and from the development and recommendations for appropriate design mitigation where necessary. Specific areas considered are based on the requirements laid out in the "Camden Guidance for Subterranean Development" (2010). It should be noted that this document only outlines the sort of information that should be obtained to inform the Basement Impact Assessment. The Screening and Scoping section of the Basement Impact Assessment then uses this information when carried out in accordance with Camden Planning Guidance Basements and Lightwells (CPG4) (2015). This document is generally considered to be the most comprehensive Local Authority Guidance in the London area.

Table 5.1: Flood Risks

Flood Sources	Site Status	Comment on flood risk posed to / from the development
Fluvial / Tidal	Site is not within 250m of an Environment Agency Zone 2 or zone 3 floodplain. Risk of flooding from rivers and the sea (RoFRaS) rating very low.	Proposed development consists of alterations to an existing property The proposed extension to the basement is under the existing building footprint. As such there is no/negligible increase in impermeable areas hence no additional SUDS required.
Groundwater	Given the anticipated presence of London Clay (unproductive stratum), the risk from groundwater flooding is considered to be low. There are no BGS groundwater flooding susceptibility areas within 50m of the site	The proposed development will not increase the potential risk of groundwater flooding. Basement will be fully waterproofed as appropriate to industry standard. Low Risk
Artificial Sources	No artificial sources of surface water within 250m.	Low Risk
Surface Water / Sewer Flooding	The site is not within 250m of any surface water features. A culverted watercourse is located 27m east of the site. Condition, depth and location of surrounding infrastructure uncertain.	No significant increase in impermeable areas – no SUDS required Site and vicinity of site may be at risk from flooding from the nearby culverted watercourse, however any subsurface flooding is likely to be constrained by the underlying London Clay. In addition, the proposed development comprises an extension to the existing basement and therefore risk to the development is not increased by the extension. Development will utilise existing connection to sewers, gravity drainage and non-return valves Development unlikely to significantly increase the peak flow/volume of discharge from the site: Low Risk No further drainage assessment required.

Climate Change	Included in the flood modelling extents Site not within climate change flood extent area	Development should not significantly increase the peak flow and volume of discharge from the site Low risk posed to and from the development

5.1.2 Based on the available data, the site is in considered to be at low risk from identified potential sources of flooding. The basement can be constructed and operated safely in flood risk terms without increasing flood risk elsewhere and is therefore considered NPPF compliant.

Surface Water Flood Risk

5.1.3 Based on EA mapping, the site and highways surrounding the site are not within an area identified as a high risk for surface water flooding potential; site itself not likely to be inundated.

5.1.4 Although not included in the 2015 edition of CPG4, within the 2010 edition there is a list of streets within Camden that were flooded in 1975 and / or 2002. Glenloch Road is not included within that list and as such is not deemed to have a history of flooding.

No Significant Increase in Impermeable Areas

5.1.5 The site is defined by the footprint of the existing building; there is no opportunity to significantly increase impermeable areas and hence no further SUDS are required. The SUDS toolkit does not apply to this site.

5.2 Hydrogeology

5.2.1 The baseline hydrogeology of the site is based on available hydrogeological mapping, including the BGS online mapping, and generic information obtained from the Groundsure Report.

5.2.2 The available data indicates that the geology of the area consists of London Clay Formation, which is defined by the Environment Agency as an unproductive stratum. If present, it is unlikely that significant quantities of shallow groundwater are present beneath the site.

5.3 Sequential and Exception Tests

5.3.1 The Sequential Test aims to ensure that development does not take place in areas at high risk of flooding when appropriate areas of lower risk are reasonably available.

Sequential Test: within FZ1 and no additional dwelling hence pass by default.

5.3.2 Paragraph 19 of PPS25 recognizes the fact that wider sustainable development criteria may require the development of some land that cannot be delivered through the sequential test. In these circumstances, the Exception Test can be applied to some developments depending on their vulnerability classification (Table D.2 of PPS25). The Exception Test provides a method of managing flood risk while still allowing necessary development to occur.

Exception Test: FZ1 hence pass by default and low risk posed to and from other sources

5.4 Flood Resilience

5.4.1 In accordance with general basement flood policy and basement design, the proposed development will utilize the flood resilient techniques recommended in the NPPF Technical Guidance where appropriate and also the recommendations that have previously been issued by various councils.

5.4.2 These include:

- Basement to be fully waterproofed (tanked) and waterproofing to be tied in to the ground floor slab as appropriate: to reduce the turnaround time for returning the property to full operation after a flood event.
- Plasterboards will be installed in horizontal sheets rather than conventional vertical installation methods to minimise the amount of plasterboard that could be damaged in a flood event
- Wall sockets will be raised to as high as is feasible and practicable in order to minimise damage if flood waters inundate the property
- Any wood fixings on basement / ground floor will be robust and/or protected by suitable coatings in order to minimise damage during a flood event
- The basement waterproofing where feasible will be extended to an appropriate level above existing ground levels.
- The concrete sub floor as standard will likely be laid to fall to drains or gullies which will remove any build-up of ground water to a sump pump where it will be pumped into the mains sewer. This pump will be fitted with a non-return valve to prevent water backing up into the property should the mains sewer become full
- Insulation to the external walls will be specified as rigid board which has impermeable foil facings that are resistant to the passage of water vapour and double the thermal resistance of the cavity

6 LAND CONTAMINATION ASSESSMENT

6.1 Industrial and Statutory Consents

6.1.1 The Groundsure EnviroInsight Report provides information on various statutory and industrial consents on and in the vicinity of the site. The following section summarises the information collected from the available sources.

Table 6.1: Industrial and Statutory Consents

Type of Consent/Authorisation	On site	Off-site (within 500m of site, unless stated otherwise)	Potential to Impact on Site from a land contamination perspective
Discharge Consents.	None	None reported within 500m of the site.	X
Water Industry Act Referrals	None	None reported within 500m of the site.	X
Red List Discharges	None	None reported within 500m of the site.	X
List 1 and List 2 Dangerous Substances	None	None reported within 500m of the site.	X
Control of Major Accident Hazards (COMAH) and Notification of Installations Handling Hazardous Substances (NIHHS) Sites.	None	34No. reported; nearest identified 443m N of site at Royal Free Hospital.	X
Planning Hazardous Substance Consents	None	None reported within 500m of the site.	X
Category 3 or 4 Radioactive substances Authorisations	None	None reported within 500m of the site.	X
Pollution Incidents (List 2).	None	1No. reported 411m N of site for metal wastes causing a category 4 (no impact) on water, land and air.	X
Pollution Incidents (List 1)	None	None reported within 500m of the site.	X
Contaminated Land Register Entries and Notices.	None	None reported within 500m of the site.	X
Registered Landfill Sites.	None	None reported within 500m of the site. Nearest landfill located 1km west.	X
Waste Treatment and/or Transfer Sites.	None	Waste Rag Works 466m NE of site.	X
Fuel Station Entries	None	1No. reported 237m N of site. Status is given as 'open'.	X
Current Industrial Site Data.	None	14No. reported within 250m of site for electrical features; electrical equipment repair and servicing; petrol and fuel stations; construction and tool hire; and distribution and haulage.	✓

6.2 Landfill and Made Ground

6.2.1 According to the Environment Agency there are no licensed landfill sites within 1km of the site.

6.3 Environmental Risk - Legislative Framework

6.3.1 A qualitative risk assessment has been prepared for the site, based on the information collated. This highlights the potential sources, pathways and receptors. Intrusive investigations will be required to confirm the actual site conditions and risks.

6.3.2 Under Part IIA of the Environmental Protection Act 1990, the statutory definition of contaminated land is:

"*land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that:*

(a) significant harm is being caused or there is a significant possibility of such harm being caused; or

(b) pollution of controlled waters is being, or is likely to be, caused."

6.3.3 The Statutory Guidance provided in the DEFRA Circular 01/2006 lists the following categories of significant harm:

- death, disease, serious injury, genetic mutation, birth defects or the impairment of reproduction functions in human beings;
- irreversible adverse change, or threat to endangered species, affecting an ecosystem in a protected area (i.e. site of special scientific interest);
- death, serious disease or serious physical damage to pets, livestock, game animals or fish;
- a substantial loss in yield or value of crops, timber or produce; and
- structural failure, substantial damage or substantial interference with right of occupation to any building.

6.3.4 Contaminated land will only be identified when a 'pollutant linkage' has been established.

6.3.5 A 'pollutant linkage' is defined in Part IIA as:

"A linkage between a contaminant Source and a Receptor by means of a Pathway".

6.3.6 Therefore, this report presents an assessment of the potential pollutant linkages that may be associated with the site, in order to determine whether additional investigations are required to assess their significance.

6.3.7 In accordance with the National Planning Policy Framework, where development is proposed, the developer is responsible for ensuring that the development is safe and suitable for use for the purpose for which it is intended, or can be made so by remedial action. In particular, the developer should carry out an adequate investigation to inform a risk assessment to determine:

- whether the land in question is already affected by contamination through source – pathway – receptor pollutant linkages and how those linkages are represented in a conceptual model;

- whether the development proposed will create new linkages, e.g. new pathways by which existing contaminants might reach existing or proposed receptors and whether it will introduce new vulnerable receptors; and
- what action is needed to break those linkages and avoid new ones, deal with any unacceptable risks and enable development and future occupancy of the site and neighbouring land.

6.3.8 A potential developer will need to satisfy the Local Authority that unacceptable risk from contamination will be successfully addressed through remediation without undue environmental impact during and following the development.

6.4 Conceptual Site Model

6.4.1 On the basis of the information summarised above, a conceptual site model (CSM) has been developed for the site. The CSM is used to guide the investigation activities at the site and identifies potential contamination sources, receptors (both on and off-site) and exposure pathways that may be present. The identification of such potential "pollutant linkages" is a key aspect of the evaluation of potentially contaminated land.

6.4.2 The site investigation is then undertaken in order to prove or disprove the presence of these potential source-pathway-receptor linkages. Under current legislation an environmental risk is only deemed to exist if there are proven linkages between all three elements (source, pathway and receptor).

6.4.3 This part of the report lists the potential sources, pathways and receptors at the site, and assesses based on current and future land use, whether pollution linkages are possible.

6.4.4 Potential pollutant linkages identified at the site are detailed below:

Table 6.2: Potential Sources, Pathways and Receptors

Source(s)	Pathway(s)	Receptor(s)
• Potential asbestos containing materials within existing buildings – on site (S1) • Potential made ground on site (S2) • Potential off-site current and historical industrial activities – garage 200m North 1950's – 1990's (S3)	• Ingestion and dermal contact with contaminated soil (P1) • Inhalation or contact with potentially contaminated dust and vapours (P2) • Leaching through permeable soils, migration within the vadose zone (i.e., unsaturated soil above the water table) and/or lateral migration within surface water, as a result of cracked hard standing or via service pipe/corridors and surface water runoff. (P3) • Horizontal and vertical migration of contaminants within groundwater (P4) • Accumulation and migration of soil gases (P5) • Permeation of water pipes and attack on concrete foundations by aggressive soil conditions (P6)	• Construction workers (R1) • Maintenance workers (R2) • Neighbouring site users (R3) • Future site users (R4) • Building foundations and on site buried services (water mains, electricity and sewer) (R5) • Controlled Waters (Culvert) (R6)

6.5 Qualitative Risk Estimation

6.5.1 Based on information previously presented in this report, a qualitative risk estimation was undertaken.

6.5.2 For each potential pollutant linkage identified in the conceptual model, the potential risk can be evaluated, based on the following principle:

Overall contamination risk = Probability of event occurring x Consequence of event occurring

6.5.3 In accordance with CIRIA C552, the consequence of a risk occurring has been classified into the following categories:

- Severe
- Medium
- Mild
- Minor

6.5.4 The probability of a risk occurring has been classified into the following categories:

- High Likelihood
- Likely
- Low Likelihood
- Unlikely

6.5.5 This relationship can be represented graphically as a matrix (Table 6.3).

Table 6.3: Overall Contamination Risk Matrix

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High Likelihood**	Very High Risk	High Risk	Moderate Risk	Low Risk
	Medium	High Risk	Moderate Risk	Moderate Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate Risk	Low Risk	Very Low Risk
	Unlikely	Low Risk	Low Risk	Very Low Risk	Very Low Risk

6.5.6 The risk assessment process is based on guidance provided in CIRIA C552 (2001) *Contaminated Land Risk Assessment – A Guide to Good Practice*. Further information including definitions of descriptive terms used in the risk assessment process is included in Appendix 4.

6.5.7 The degree of risk is based on a combination of the potential sources and the sensitivity of the environment. The risk classifications can be cross checked with reference to Table A4.4 in Appendix 4.

6.5.8 Hazard assessment was also carried out, the outcome of which could be:

- Urgent Action (UA) required to break existing source-pathway-receptor link.
- Ground Investigation (GI) required to gather more information.
- Watching Brief there is no evidence of potential contamination but the possibility of it exists and so the site should be monitored for local and olfactory evidence of contamination.
- No action required (NA)

6.5.9 The preliminary risk assessment for the site is presented in Table 6.4 overleaf.

Table 6.4: Preliminary Risk Assessment for the Site

Sources	Pathways (P)	Receptors	Consequence	Probability of pollutant linkage	Risk Estimation	Hazard Assessment
• Potential asbestos containing materials within existing buildings – on site (S1) • Potential made ground on site (S2) • Potential off-site current and historical industrial activities – garage 200m North 1950's – 1990's (S3)	• Ingestion and dermal contact with contaminated soil (P1) • Inhalation or contact with potentially contaminated dust and vapours (P2) • Permeation of water pipes and attack on concrete foundations by aggressive soil conditions (P6)	• Construction workers (R1) • Maintenance workers (R2) • Neighbouring site users (R3) • Future site users (R4) • Building foundations and on site buried services (water mains, electricity and sewer) (R5)	Medium	Low	Moderate	GI – Ground Investigation
			Severe for Asbestos	Low	Moderate	
	• Accumulation and migration of soil gases (P5)		Severe	Unlikely	Low	
	• Leaching through permeable soils, migration within the vadose zone (i.e., unsaturated soil above the water table) and/or lateral migration within surface water, as a result of cracked hardstanding or via service pipe/corridors and surface water runoff. (P3) • Horizontal and vertical migration of contaminants within groundwater (P4)	• Neighbouring site users (R3) • Controlled Waters (Culvert) (R6) • Building foundations and on site buried services (water mains, electricity and sewer) (R5)	Medium	Unlikely	Low	

6.5.10 It should be noted that the identification of potential pollutant linkages does not necessarily signify that the site is unsuitable for its current or proposed land use. It does however act as a way of focussing data collection at the site in accordance with regulatory guidance in CLR 11.

6.6 Outcome of Risk Assessment

6.6.1 It is understood that the proposed development comprises the horizontal extension of the existing basement north-eastwards beneath the footprint of the existing building and the lowering of the existing basement and front light well.

6.6.2 The risk estimation matrix indicates a moderate risk as defined above.

6.6.3 Due to the potential presence of asbestos containing materials, an asbestos survey should be undertaken, with any asbestos containing materials found, removed under suitably controlled conditions. There should be no risk to end users from asbestos if the potential asbestos containing materials are removed by suitably qualified and experienced specialists under controlled conditions.

6.6.4 No significant potential sources of contamination were identified during the desk based assessment. It is recommended that a number of soil samples obtained during the geotechnical investigation are analysed for a suite of general contaminants to confirm the lack of contamination within the site.

6.6.5 No potential sources of ground gas have been noted, as a consequence ground gas monitoring is not considered to be necessary. However, groundwater monitoring will be required for basement design. Consequently, it may be appropriate to measure ground gas concentrations at the same time to confirm that there is not an issue.

6.7 List of Key Contaminants

6.7.1 The possible contamination implications for both on-site and off-site sources have been assessed based on the information presented in the report. This has been achieved using guidance publications by the Environment Agency, together with other sources.

6.7.2 In the case of the site uses identified as part of the desk study research, reference to DoE industry profiles would not indicate a specific use reference, although reference has been made to the miscellaneous industries profile

6.7.3 Based on recommendations within the guidance publications, an initial soil and water chemical testing suite would need to consider a range of contaminants as follows:

- *Metals*: cadmium, chromium, copper, lead, mercury, nickel, zinc;
- *Semi-metals and non-metals*: arsenic, boron, sulphur;
- *Inorganic chemicals*: cyanide, nitrate, sulphate and sulphide;
- *Organic chemicals*: aromatic hydrocarbons, aliphatic hydrocarbons, petroleum hydrocarbons, phenol, polyaromatic hydrocarbon;
- *Others*: pH, Asbestos

7 SCREENING AND SCOPING ASSESSMENT

7.1 Screening Assessment

7.1.1 Screening is the process of determining whether or not there are areas of concern which require a BIA for a particular project. This was undertaken in previous sections by the site characterisation. Scoping is the process of producing a statement which defines further matters of concern identified in the screening stage. This defining is in terms of ground processes in order that a site specific BIA can be designed and executed by deciding what aspects identified in the screening stage require further investigation by desk research or intrusive drilling and monitoring or other work.

7.1.2 The scoping stage highlights areas of concern where further investigation, intrusive soil and water testing and groundwater monitoring may be required.

7.1.3 A series of flowcharts have been used to identify what issues are relevant to the site. These flow charts are based on the London Borough of Camden's document "Guidance for subterranean development" (2015) (CPG4).

7.1.4 Each question posed in the flowcharts is completed by answering "Yes", "No" or "Unknown". Any question answered with "Yes" or "Unknown" is then subsequently carried forward to the scoping phase of the assessment.

7.1.5 The results of the screening process for the site are provided in Table 7.1 below. Where further discussion is required the items have been carried forward to scoping.

7.1.6 The numbering within the questions refers the reader to the appropriate question in CPG4. It should be noted that CPG4 is mainly concerned with the pond chain on Hampstead Heath, if other ponds / waterbodies may similarly affect the development Jomas will indicate this.

7.1.7 A Site Investigation is undertaken where necessary to establish base conditions and the impact assessment determines the impact of the proposed basement on the baseline conditions, taking into account any mitigating measures proposed.

Table 7.1: Screening Assessment

Query	Y / N	Comment
Subterranean (Groundwater) Flow (see CPG4 Figure 3)		
1a) Is the site located directly above an aquifer?	No	The site is directly underlain by Unproductive strata.
1b) Will the proposed basement extend below the surface of the water table?	Unknown	Shallow groundwater is unlikely to be present beneath the site as the site is directly underlain by solid deposits of the London Clay - identified as Unproductive aquifer. However, perched groundwater may be present.
2) Is the site within 100m of a watercourse, well (disused or used) or a potential spring line?	Yes	Culvert reported 27m E of site.

Query	Y / N	Comment
3) Is the site within the catchment of the pond chains on Hampstead Heath?	No	No surface water features reported within 250m of site.
4) Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?	No	The proposed development is to extend an existing basement. The new basement will extend out under an existing rear external space which is covered entirely by hard surfacing (paving slabs).
5) As part of the 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	There is no reason to believe that more water than at present will be or could be discharged to the ground.
6) Is the lowest point of the proposed excavation (allowing of any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath or spring line?	No	No surface water features reported within 250m of site.
Land Stability (see CPG4 Figure 4)		
1) Does the existing site include slopes, natural or manmade, greater than 7 degrees? (approximately 1 in 8)	No	
2) Will the proposed re-profiling of landscaping change slopes at the property to more than 7 degrees? (approximately 1 in 8)	Yes	A stepped slope will be constructed at the rear of the basement, stepping up to existing ground levels at the rear. However, it is assumed that the design of the stepped slope will take into account the risks of failure associated with the construction of the basement.
3) Does the developments' neighbouring land include railway cuttings and the like, with a slope greater than 7 degrees? (approximately 1 in 8)	No	Surrounding land is mostly residential in nature.
4) Is the site within a wider hillside setting in which the general slope is greater than 7 degrees? (approximately 1 in 8)	Yes	Glenloch Road slopes down in a NE to SW direction.
5) Is the London Clay the shallowest strata at the site?	Yes	The site is directly underlain by London Clay Formation.
6) Will any trees be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained?	No	No trees will be felled as part of this development and it is not considered likely that works will be undertaken in any root protection zones.
7) Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	Unknown	The site is directly underlain by the London Clay Formation. The site is reported to be in area at moderate risk from shrink-swell clays. No evidence of structural stress

Query	Y / N	Comment
		caused by seasonal shrink swell was noted during the walkover.
8) Is the site within 100m of a watercourse or a spring line?	Yes	Culvert reported 27m E of site.
9) Is the site within an area of previously worked ground?	No	Site first shown as developed by map dated 1915. No significant changes to site since then.
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 basement will extend into Unproductive strata, and it is therefore unlikely that a high groundwater table will be present.
11) Is the site within 50m of the Hampstead Heath ponds?	No	
12) Is the site within 5m of a highway or pedestrian 'right of way'?	Yes	The site faces onto a pavement and road on the south-eastern side.
13) Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes	It is likely that the basement foundations will increase the differential depth of foundations relative to neighbouring properties however this is dependent on the type and depth of foundations used at the neighbouring properties and this is currently unknown.
14) Is the site over (or within the exclusion of) any tunnels e.g. railway lines?	No	There are no reports of railway lines or tunnels within close proximity of the site.
Surface Flow and Flooding (see CPG4 Figure 5)		
1) Is the site within the catchment of the pond chains on Hampstead Heath?	No	
2) As part of the site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially different from the existing route?	No	The proposed development will add a basement within the existing footprint. This will not affect the run off at ground level.
3) Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No	The proposed development is to extend an existing basement. The new basement will extend out under an existing rear external space which is covered entirely by hard surfacing (paving slabs).
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	No surface waters in the area to be impacted.
5) Will the proposed basement result in changes to the quality of surface waters being received by adjacent properties or downstream watercourses?	No	No surface waters in the area to be impacted.
6) Is the site in an area identified to have surface water flood risk according to either the Local Flood	No	No nearby surface water features and not within an EA flood zone.

Query	Y / N	Comment
Risk Management Strategy or Strategic Flood Risk Assessment or is it at risk from flooding, for example because the proposed basement is below the static water level of a nearby surface water feature?		

7.2 Scoping

7.2.1 Scoping is the activity of defining in further detail the matters to be investigated as part of the BIA process. Scoping comprises of the definition of the required investigation needed in order to determine in detail the nature and significance of the potential impacts identified during screening.

7.2.2 The potential impacts for each of the matters highlighted in Table 7.1 above are discussed in further detail below together with the requirements for further investigations. Detailed assessment of the potential impacts and recommendations are provided where possible.

Subterranean (Groundwater) Flow

7.2.3 The investigation should confirm the ground conditions beneath the site including if there is a relatively high groundwater table present beneath the site. This can then confirm the relative depths of the basement to the groundwater levels.

7.2.4 The investigation should asses whether any potential significant contaminant migration risk to the culverted watercourse 37m east exists. At the desk study stage, the risk is considered to be low, given the absence of potentially mobile contaminant sources on site and the anticipated presence of low permeability London Clay underlying the site.

Land Stability

7.2.5 The Groundsure report has noted that there is a “moderate” risk of shrink-swell clay at the site. The ground investigation should determine the volume change potential of the underlying London Clay Formation.

7.2.6 The investigation should also determine the possibility of encountering groundwater and the possibility of Made Ground and/or clay immediately beneath the site. Therefore, any issues relating to groundwater management and excavation stability.

Surface Flow and Flooding

7.2.7 No specific investigation considered necessary.

8 GROUND INVESTIGATION

8.1 Rationale for Ground Investigation

8.1.1 The site investigation has been undertaken generally in accordance with Contaminated Land Report 11, BS10175, NHBC Standards Chapter 4.1, and other associated Statutory Guidance. If required, further targeted investigations and remedial option appraisal would be dependent on the findings of this site investigation.

8.1.2 The soil sampling rationale for the site investigation was developed with reference to EA guidance 'Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination' (Technical Report P5-066/TR).

8.1.3 The sampling proposal was designed in order to gather data representative of the site conditions.

8.2 Scope of Ground Investigation

8.2.1 The ground investigation was undertaken on 14th November 2017:

- 1No. window sample borehole to 5.0mbgl.
- 4No. Hand excavated trial pits up to 1.65mbgl

8.2.2 The work was undertaken in accordance with BS: 5930 'Code of Practice for Site Investigation' and BS: 10175 'Investigation of Potentially Contaminated Sites'. All works were completed without incident.

8.2.3 The investigation focused on collecting data on the following:

- Quality of Made Ground/ natural ground within the site boundaries;
- Presence of groundwater beneath the site (if any), perched or otherwise;

8.2.4 A summary of the fieldwork carried out at the site, with justifications for exploratory hole positions, are offered in Table 8.1 below.

Table 8.1: Scope of Intrusive Investigation

Investigation Type	No. of Exploratory Holes Achieved	Exploratory Hole Designation	Depth Achieved (mBGL)	Justification
Hand Dug Trial Pits	4	TP1 - 4	up to 1.65mbgl	To investigate existing building foundations and to determine the presence or not of tree roots.
Window Sample Boreholes	1	WS2	Up to 5mbgl	Investigate shallow ground condition and collect samples for chemical and geotechnical laboratory testing. To allow insitu geotechnical testing.

Investigation Type	No. of Exploratory Holes Achieved	Exploratory Hole Designation	Depth Achieved (mBGL)	Justification
Monitoring Well	1	WS2	4.70mbgl	Combined soil gas and groundwater monitoring well. WS2 – response zone within both Made Ground and London Clay

8.2.5 In all cases, all holes were logged in accordance with BS:5930 (2015).

8.2.6 Exploratory hole positions were measured in using tape and reel, as shown in the exploratory hole location plan presented in Appendix 1. The exploratory hole records are included in Appendix 6.

8.2.7 Where no standpipe was installed, the exploratory holes were backfilled with the arisings (in the reverse order in which they were excavated) and the ground surface was suitably reinstated. Installations were finished with a steel cover flush to the ground surface.

8.3 Trial Pits to Expose Foundations

8.3.1 Four hand excavated pits were undertaken to expose existing foundations.

8.3.2 TP1 was excavated in the west corner of the basement. The pit was extended to 0.85mbbl (metres below basement level), exposing four brick “steps” of 0.05m width each. The first step was measured to 0.43m depth; the remaining steps stepped down depths of between 0.07m and 0.09m. A fifth step of concrete stepped out 0.15m and was proven as the base of the foundation at 0.85mbbl.

8.3.3 TP2 was excavated inside the west corner of the rear room of the building an extended to 1.65mbgl. No step out was observed but the brick wall was followed down to the base of the pit.

8.3.4 TP3 was formed in the rear hallway on the northern side of the house. The base of the foundation was found at 0.95mbgl, with the foundations found to be of brickwork to 0.80mbgl over a concrete base that stepped out by 0.14m.

8.3.5 TP4a was formed at the rear of the house along a garden wall and adjacent to the building. The exposed garden wall footing was recorded as a 1.30mbgl of brick over concrete. The concrete stepped out to at least 0.16m but the base was not proven.

8.3.6 TP4b was formed at the rear of the house along a garden wall and adjacent to the building. The exposed building foundations were recorded as a 0.62mbgl of brick over concrete. The concrete stepped out by 0.02m but the base could not be proven.

8.3.7 Copies of the stratigraphical logs and sketches of the foundations can be found in Appendix 6.

8.4 Sampling Rationale

8.4.1 Our soil sampling rationale for the site investigation was developed with reference to EA guidance ‘Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination’ (Technical Report P5-066/TR).

8.4.2 The exploratory holes were positioned by applying a combined non-targeted sampling strategy, as well as sample locations positioned with reference to sources identified from the desk study and observations made on site.

8.4.3 Soil samples were taken from across the site at various depths as shown in the exploratory hole logs.

8.4.4 Jomas' engineers normally collect samples at appropriate depths based on field observations such as:

- appearance, colour and odour of the strata and other materials, and changes in these;
- the presence or otherwise of sub-surface features such as pipework, tanks, foundations and walls; and,
- areas of obvious damage, e.g. to the building fabric.

8.4.5 A number of the samples were taken from the top 0-1m to aid in the assessment of the pollutant linkages identified at the site. In addition, some deeper samples were taken to aid in the interpretation of fate and transport of any contamination identified.

8.4.6 Samples were stored in cool boxes (<4^{o}C) and preserved in accordance with laboratory guidance.

8.4.7 Disturbed samples were collected for geotechnical analysis.

8.4.8 Groundwater strikes noted during drilling, are recorded within the exploratory hole records in Appendix 6.

8.5 Sampling Limitations

8.5.1 WS1 was proposed to be drilled in the light well at the front of the property, however, it was not attempted due to the presence of buried services.

8.6 Insitu Geotechnical Testing

8.6.1 Insitu geotechnical testing included Standard Penetration Tests (SPT) to determine a 'N' value. This has been used to determine a relative density description of granular materials and has been used to help determine the undrained shear strength of cohesive materials.

8.7 Laboratory Analysis

8.7.1 A programme of chemical and geotechnical laboratory testing, scheduled by Jomas, was carried out on selected samples of Made Ground and natural strata.

Chemical Testing

8.7.2 Soil samples were submitted to i2 Analytical (a UKAS and MCerts accredited laboratory), for analysis.

8.7.3 The samples were analysed for a wide range of contaminants as shown in Table 8.2 below:

Table 8.2: Chemical Tests Scheduled

Test Suite	No. of tests	
	Made Ground / Topsoil	Natural
Jomas Basic Suite S3	2	0
Asbestos	2	0
Water Soluble Sulphate	2	1
Total Organic Carbon	2	0
Waste Acceptance Criteria	2	0

8.7.4 The determinands contained in the basic suite are as detailed in Table 8.3 below:

Table 8.3: Basic Suite of Determinands

DETERMINAND	LIMIT OF DETECTION (mg/kg)	UKAS ACCREDITATION	TECHNIQUE
Arsenic	1	Y (MCERTS)	ICPMS
Cadmium	0.5	Y (MCERTS)	ICPMS
Chromium	5	Y (MCERTS)	ICPMS
Chromium (Hexavalent)	0.02	N	Colorimetry
Lead	5	Y (MCERTS)	ICPMS
Mercury	0.5	Y (MCERTS)	ICPMS
Nickel	5	Y (MCERTS)	ICPMS
Selenium	1	PENDING	ICPMS
Copper	5	Y (MCERTS)	ICPMS
Zinc	45	Y (MCERTS)	ICPMS
Boron (Water Soluble)	0.5	N	ICPMS
pH Value	0.1 units	Y (MCERTS)	Electrometric
Sulphate (Water Soluble)	0.02g/l	Y (MCERTS)	Ion Chromatography
Total Cyanide	1	Y (MCERTS)	Colorimetry
Speciated PAH	0.1/0.4	Y (MCERTS)	GCFID
Phenols	5	Y (MCERTS)	HPLC
Total Petroleum Hydrocarbons (banded)	1	N	Gas Chromatography

8.7.5 To support the selection of appropriate tier 1 screening values, 2No samples were analysed for total organic carbon.

8.7.6 Laboratory test results are summarised in Section 11, with raw laboratory data included in Appendix 7.

Geotechnical Laboratory Testing

8.7.7 In addition to the contamination assessment, soil samples were submitted to the UKAS Accredited laboratory of i2 Analytical Ltd. for a series of analysis.

8.7.8 This testing was specifically designed to:

- to classify the samples; and
- to obtain parameters (either directly or sufficient to allow relevant correlations to be used) relevant to the technical objectives of the investigation.

8.7.9 The following laboratory geotechnical testing (as summarised in Table 8.4) was carried out:

Table 8.4 Laboratory Geotechnical Analysis

BS 1377 (1990) Test Number	Test Description	Number of tests
Part 2		
3.2	Moisture Content Determination	6
4.3 and 5.3	Liquid and Plastic Limit Determination (Atterberg Limits)	6
9.2 and 9.3	Particle Size Distribution - Sieving	1

8.7.10 The water soluble sulphate and pH results obtained as part of the chemical analysis was used in combination with BRE Special Digest 1 to allow buried concrete to be designed.

8.7.11 The results of the geotechnical laboratory testing are presented as Appendix 8 and discussed in Section 12 of this report.

9 GROUND CONDITIONS

9.1 Soil

9.1.1 Ground conditions were logged in accordance with the requirements of BS: 5930 (2015). Detailed exploratory hole logs are provided in Appendix 6. The ground conditions encountered are summarised in Table 9.1 below, based on the strata observed during the investigation.

9.1.2 Due to some of the holes being formed in the existing basement, depths are given as below ground level (m bgl), where ground level is taken as the outside level, and below basement level (m bbl).

Table 9.1: Ground Conditions Encountered

Stratum and Description	Encountered from	Base of strata	Thickness range (m)
Paving slab/concrete over light brown gravelly clay. Gravel consists of fine to coarse angular to sub-angular flint, brick and concrete. (MADE GROUND)	0.0mbgl 0.0mbbl	0.95m - 1.65m bgl 0.72mbbl	0.45 - 1.30
Light brown CLAY with occasional blue veins. (LONDON CLAY FORMATION)	1.30mbgl - 0.72mbbl	>5.00mbgl - >0.85mbbl	>0.13 - >3.70

9.1.3 Given the materials expected on site and the descriptions of these materials, provided by the BGS, (See Section 3.2), it is considered that the material observed in the exploratory holes represents Made Ground (disturbed deposits of the London Clay Formation) overlying undisturbed deposits of the London Clay Formation.

9.2 Hydrogeology

9.2.1 Groundwater was not reported during drilling in any of the exploratory holes.

9.2.2 During the post drilling monitoring (4No. return visits) groundwater was recorded at depths between 2.42mbgl and dry to 4.70mbgl within the London Clay Formation.

9.2.3 Given the recorded geology and the lack of groundwater reported during drilling, it is likely that the water levels recorded during monitoring does not represent a true groundwater level, and it likely due to surface water ingress into the well.

9.3 Physical and Olfactory Evidence of Contamination

9.3.1 Visual or olfactory evidence of contamination was not observed during the course of the investigation.

10 RISK ASSESSMENT – ANALYTICAL FRAMEWORK

10.1 Context and Objectives

10.1.1 This section seeks to evaluate the level of risk pertaining to human health and the environment which may result from both the existing use and proposed future use of the site. It makes use of the site investigation findings, as described in the previous sections, to evaluate further the potential pollutant linkages identified in the desk study. A combination of qualitative and quantitative techniques is used, as described below.

10.1.2 The purpose of generic quantitative risk assessment is to compare concentrations of contaminants found on site against screening level generic assessment criteria (GAC) to establish whether there are actual or potential unacceptable risks. It also determines whether further detailed assessment is required. The approaches detailed all broadly fit within a tiered assessment structure in line with the framework set out in the Department of Environment, Food and Rural Affairs (DEFRA), EA and Institute for Environment and Health Publication, Guidelines for Environmental Risk Assessment and Management.

10.1.3 It should be noted that the statistical tests carried out in this report in accordance with CL:AIRE and CIEH (2008) recommendations, are for guidance purposes only and the conclusions of this report should be approved by the local authority prior to any redevelopment works being undertaken.

10.2 Analytical Framework – Soils

10.2.1 There is no single methodology that covers all the various aspects of the assessment of potentially contaminated land and groundwater. Therefore, the analytical framework adopted for this investigation is made up of a number of procedures, which are outlined below. All of these are based on a Risk Assessment methodology centred on the identification and analysis of Source – Pathway – Receptor linkages.

10.2.2 The CLEA model provides a methodology for quantitative assessment of the long term risks posed to human health by exposure to contaminated soils. Toxicological data have been used to calculate Soil Guideline Values (SGV) for individual contaminants, based on the proposed site use; these represent minimal risk concentrations and may be used as screening values.

10.2.3 In the absence of any published SGVs for certain substances, or where the assumptions made in generating the SGVs do not apply to the site, JOMAS have derived Tier 1 screening values for initial assessment of the soil, based on available current UK guidance including the LQM/CIEH generic assessment criteria. Site-specific assessments are undertaken wherever possible and/or applicable. All assessments are carried out in accordance with the CLEA protocol.

10.2.4 CLEA requires a statistical treatment of the test results to take into account the normal variations in concentration of potential contaminants in the soil and allow comparisons to be made with published guidance.

10.2.5 The assessment criteria used for the screening of determinands within soils are identified within Table 10.1.

Table 10.1: Selected Assessment Criteria – Contaminants in Soils

Substance Group	Determinand(s)	Assessment Criteria Selected
Organic Substances		
Non-halogenated Hydrocarbons	Total Petroleum Hydrocarbons (TPHCWG banded)	S4UL
	Total Phenols	S4UL
Polycyclic Aromatic Hydrocarbons (PAH-16)	Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benz(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(ghi)perylene	S4UL
Volatile Organic Compounds (VOCs/sVOCs).	Toluene, Ethylbenzene	S4UL
	Benzene, Xylenes	S4UL
Inorganic Substances		
Heavy Metals and Metalloids	Arsenic, Cadmium, Chromium, Lead, Mercury, Nickel, Selenium, Copper, Zinc	S4UL
	Copper, Zinc, Nickel	BS: 3882 (2015).
Cyanides	Free Cyanide	CLEA v1.06
Sulphates	Water Soluble Sulphate	BRE Special Digest 1:2005

10.3 BRE

10.3.1 The BRE Special Digest 1:2005, 'Concrete in Aggressive Ground' is used with soluble sulphate and pH results to assess the aggressive chemical environment of future underground concrete structures at the site.

10.4 Site Specific Criteria

10.4.1 The criteria adopted in the selection of correct screening criteria from published reports as previously described, are provided within Tables 10.2.

Table 10.2: Site Specific Data

Input Details	Value
Land Use	Residential with plant uptake
Soil Organic Matter	1%

10.4.2 As the published reports only offer the option of selecting an SOM value of 1%, 2.5% or 6%, an SOM value of 1% has been used for the generation of generic assessment criteria, as 0.6% was the mean value obtained from laboratory analysis.

10.4.3 It is understood that the proposal for the site is to extend a basement beneath the existing residential property. The site will remain as “residential with plant uptake”.

11 GENERIC QUANTITATIVE RISK ASSESSMENT

11.1 Screening of Soil Chemical Analysis Results – Human Health Risk Assessment

11.1.1 To focus on the contaminants of potential concern (COPC), the results have been compared with the respective SGV/GAC. Those contaminants which exceed the SGV/GAC are considered to be the COPC. Those which do not exceed the respective SGV/GAC are not considered to be COPC and as such do not require further assessment in relation to the proposed development of the site.

11.1.2 Laboratory analysis for soils are summarised in Tables 11.1 to 11.3. Raw laboratory data is included in Appendix 7.

Table 11.1: Soil Laboratory Analysis Results – Metals, Metalloids, Phenol, Cyanide

Determinand	Unit	No. samples tested	Screening Criteria		Results (mg/kg)		No. Exceeding
			Source	Value (mg/kg)	Min	Max	
Arsenic	mg/kg	2	S4UL	37	16	16	0
Cadmium	mg/kg	2	S4UL	11	<0.2	<0.2	0
Chromium	mg/kg	2	S4UL	910	31	44	0
Lead	mg/kg	2	S4UL	200	140	420	1No.; TP1 at 0.40mbbl
Mercury	mg/kg	2	S4UL	40	<0.3	<0.3	0
Nickel	mg/kg	2	S4UL	180	23	38	0
Copper	mg/kg	2	S4UL	2400	38	78	0
Zinc	mg/kg	2	S4UL	3700	84	110	0
Total Cyanide [B]	mg/kg	2	CLEA v 1.06	33	<1	<1	0
Selenium	mg/kg	2	S4UL	250	<1.0	<1.0	0
Water Soluble Boron	mg/kg	2	S4UL	290	0.7	2.7	0
Phenols	mg/kg	2	S4UL	120	<1.0	<1.0	0

Table 11.2: Soil Laboratory Analysis Results – Polycyclic Aromatic Hydrocarbons (PAHs)

Determinand	Unit	No. Samples Tested	Screening Criteria		Result (mg/kg)		No. Exceeding
			Source	Value (mg/kg)	Min	Max	
Naphthalene	mg/kg	2	S4UL	2.3	<0.05	0.48	0
Acenaphthylene	mg/kg	2	S4UL	170	<0.05	<0.05	0
Acenaphthene	mg/kg	2	S4UL	210	<0.05	0.82	0
Fluorene	mg/kg	2	S4UL	170	<0.05	0.53	0
Phenanthrene	mg/kg	2	S4UL	95	0.45	7.7	0

Determinand	Unit	No. Samples Tested	Screening Criteria		Result (mg/kg)		No. Exceeding
			Source	Value (mg/kg)	Min	Max	
Anthracene	mg/kg	2	LQM GAC	2400	<0.05	1.1	0
Fluoranthene	mg/kg	2	S4UL	280	0.65	9.7	0
Pyrene	mg/kg	2	S4UL	620	0.53	7.6	0
Benzo(a)anthracene	mg/kg	2	S4UL	7.2	0.36	4.6	0
Chrysene	mg/kg	2	S4UL	15	0.28	4.0	0
Benzo(b)fluoranthene	mg/kg	2	S4UL	2.6	0.30	4.8	1No.; TP1 at 0.40mbbl
Benzo(k)fluoranthene	mg/kg	2	S4UL	77	0.21	2.2	0
Benzo(a)pyrene	mg/kg	2	S4UL	2.2	0.24	3.8	1No.; TP1 at 0.40mbbl
Indeno(123-cd)pyrene	mg/kg	2	S4UL	27	0.18	1.9	0
Dibenz(ah)anthracene	mg/kg	2	S4UL	0.24	<0.05	0.41	1No.; TP1 at 0.40mbbl
Benzo(ghi)perylene	mg/kg	2	S4UL	320	0.20	2.2	0
Total PAH	mg/kg	2	-	-	3.40	52.0	-

Table 11.3: Soil Laboratory Analysis– Total Petroleum Hydrocarbons (TPH)

TPH Band	Unit	No. Samples Tested	Screening Criteria		Result (mg/kg		No. Exceeding
			Source	Value* (mg/kg)	Min	Max	
C_8-C_{10}	mg/kg	2	S4UL	27	<0.1	<0.1	0
>C_{10}-C_{12}	mg/kg	2	S4UL	74	<2.0	3.6	0
>C_{12}-C_{16}	mg/kg	2	S4UL	140	<4.0	11	0
>C_{16}-C_{21}	mg/kg	2	S4UL	260	<1.0	45	0
>C_{21}-C_{35}	mg/kg	2	S4UL	1100	<10	100	0
Total TPH	mg/kg	2	-	-	<17.1	70.7	-

*lowest of aliphatics/aromatics used.

11.2 Asbestos in Soil

11.2.1 2No. samples of the Made Ground were screened in the laboratory for the presence of asbestos. The results of the analysis is summarised below in Table 11.4 below

Table 11.4: Asbestos Analysis – Summary

Sample	Screening result.	Quantification result (%)	Comments
WS2 – 0.50mbgl	None Detected	N/A	N/A
TP1 – 0.40mbgl	None Detected	N/A	N/A

11.3 Screening of Soil Chemical Analysis Results – Potential Risks to Plant Growth

11.3.1 Zinc, copper and nickel are phytotoxins and could therefore inhibit plant growth in soft landscaped areas. Concentrations measured in soil for these determinands have been compared with the pH dependent values given in BS:3882 (2015).

11.3.2 Adopting a pH value of greater than 7, as indicated by the results of the laboratory analysis, the following is noted;

Table 11.5: Soil Laboratory Analysis Results – Phytotoxic Determinands

Determinand	Threshold level (mg/kg)	Min (mg/kg)	Max (mg/kg)	No. Exceeding
Zinc	300	84	110	0
Copper	200	38	78	0
Nickel	110	23	38	0

11.4 Screening for Water Pipes

11.4.1 The results of the analysis have been assessed for potential impact upon water supply pipes. Table 11.6 below summarises the findings of the assessment:

Table 11.6: Screening Guide for Water Pipes

Determinand	Threshold adopted for PE (mg/kg)	Value for site data (mg/kg)	
		Min	Max
Total VOCs	0.5	N/A	N/A
BTEX	0.1	N/A	N/A
MTBE	0.1	N/A	N/A
EC5-EC10	1	<0.1	<0.1
EC10-EC16	10	<6	14.6
EC16-EC40	500	<11	145
Naphthalene	5	<0.05	0.48
Phenols	2	<1	<1

11.4.4 Determinands marked “N/A” were not analysed for as no evidence of their presence was obtained from the Desk Study.

11.4.5 The above results indicate that upgraded pipework may be required.

11.4.6 The water supply pipe requirements for this site should be discussed at an early stage with the relevant Utility provider.

11.5 Waste Characterisation and Disposal

11.5.1 The following comments are given as guidance and should be confirmed by the waste disposal facility accepting the waste. The waste disposal facility may have their own classification methodology and are under no obligation to honour the comments given below.

11.5.2 2No. samples were submitted to a UKAS and MCERTS accredited laboratory for Waste Acceptance Criteria testing. The results of TP2 at 1.40mbgl and TP4 at 0.30mbgl indicate that soil arisings meet the criteria for disposal as “stable non-reactive hazardous waste in non-hazardous landfill”. This is due to elevated concentrations of Total PAH; Sulphate; Total Dissolved Solids; and fluoride. The receiving facility will also review the full set of chemical test results.

12 SOIL GAS RISK ASSESSMENT

12.1 Soil Gas Results

12.1.1 Four return monitoring visits have been undertaken from 21st November to 12th December 2017, to monitor the well installed within the borehole at the site for groundwater levels. In addition, ground gas concentrations were also recorded to confirm the comments made in Section 6.6.

12.1.2 A complete set of monitoring results is included in Appendix 9 and is summarised below in Table 12.1.

Table 12.1: Summary of Gas Monitoring Data

Hole No.	CH_4 (%)	CO_2 (%)	O_2 (%)	H_2S (ppm)	VOCs (ppm)	Peak Flow Rate (l/hr)	Depth to water (m bgl)	Depth of installation (m bgl)
WS2	0.0 - 0.1	0.8 - 2.5	20.4 - 20.6	0	1 - 2	+0.6	2.42 - Dry	4.70

12.2 Screening of Results

12.2.1 Methane was reported to a maximum concentration 0.1% v/v. The carbon dioxide was noted to a maximum concentration of 2.5%. Oxygen levels during the monitoring visit ranged between 20.4% v/v and 20.6% v/v. Volatile organic compounds (VOCs) were detected during headspace monitoring of the monitoring well with a photo-ionisation detector at a maximum concentration of 2ppm. Carbon monoxide and hydrogen sulphide were not recorded above the detection limit of the machine.

12.2.2 The atmospheric pressure was noted to range between 998 and 1002mb. A peak flow rate of +0.6l/hr has been reported.

12.2.3 In the assessment of risks posed by hazardous ground gases and selection of appropriate mitigation measures, BS84985 (2015) identifies four types of development, termed Type A to Type D.

12.2.4 Type A buildings are defined as

> *"private ownership with no building management controls on alterations to the internal structure, the use of rooms, the ventilation of rooms or the structural fabric of the building. Some small rooms present. Probably conventional building construction (rather than civil engineering). Examples include private housing and some retail premises."*

12.2.5 Type A has been adopted as the relevant category for the proposed development.

12.2.6 The soil gas assessment method is based on that proposed by Wilson & Card (1999), which was a development of a method proposed in CIRIA publication R149 (CIRIA, 1995). The method uses both gas concentrations and borehole flow rates to define a characteristic situation based on the limiting borehole gas volume flow for methane and carbon dioxide. In both these methods, the limiting borehole gas volume flow is renamed as the Gas Screening Value (GSV).

12.2.7 The Gas Screening Value (litres of gas per hour) is calculated by using the following equation

GSV = (Concentration/100) X Flow rate

Where concentration is measured in percent (%)
and flow rate is measured in litres per hour (l/hr)

12.2.8 The Characteristic Situation is then determined from Table 8.5 of CIRIA C665.

12.2.9 To accord with C665, worst case conditions are used in the calculation of GSVs for the site. These have been summarised below in Table 12.2

12.2.10 A worst case flow rate of 0.6/hr (maximum reported) will be used in the calculation of GSVs for the site.

Table 12.2: Summary of Gas Monitoring Data

Gas	Concentration (v/v %)	Peak Flow Rate (l/hr)	GSV (l/hr)	Characteristic Situation (after CIRIA C665)
CO_2	2.5	0.6	0.015	1
CH_4	0.1	0.6	0.0006	1

12.2.11 The result of the GSV calculation would indicate that the site may be classified as Characteristic Situation 1, where no special precautions are required.

12.2.12 Due to the construction of a basement, the basement floor and walls will need to be constructed and water proofed such that they conform to BS: 8102 (2009), Grade 3 waterproofing. This would provide 2.5 protection points in accordance with BS: 8584 (2015).

13 SUMMARY OF RESULTS

13.1 Risk Assessment - Land Quality Impact Summary

13.1.1 Following the site investigation, the following is noted:

- It is understood that the proposed development will comprise the extension of an existing basement north-eastwards beneath the footprint of the existing building and lowering the floor level of the existing basement and front light well,
- No asbestos fibres were detected in the samples analysed in the laboratory.
- Following generic risk assessments, lead, benzo(b)fluoranthene, benzo(a)pyrene and dibenzo(ah)anthracene were detected in soils in excess of generic assessment criteria for the protection of human health within a 'residential with plant uptake' end-use scenario.
- The only sample that was found to contain contaminants in excess of the GAC were obtained from TP1 at 0.4mbbl. These samples were obtained from below the existing basement level. The proposed development involves the extension of the basement. As a result, the basement floor is considered to provide a barrier to potential receptors, and as such pathways for contact with these non volatile determinands will not be present. Therefore it is considered that no further action is required with regards to the elevated concentrations detected in TP1.
- The site is underlain by unproductive solid deposits of the London Clay Formation, and there are no abstractions, source protection zones or surface water features in close proximity to the site. The only water feature within 250m of the site is a Culvert 27m east of site. No evidence of potentially mobile contamination has been detected by the investigation. As a result, the risk to controlled waters is considered low.
- Calculating the Gas Screening Value using worst case results indicates Characteristic Situation 1. This would indicate that no special precautions are required. Assuming that the basement development is constructed to the necessary standards and guidelines it would provide a minimum of 2.5 gas protection points.
- No further remediation works are considered necessary, and the site is considered suitable for the proposed use.
- As with any ground investigation, the presence of further hotspots between sampling points cannot be ruled out. Should any contamination be encountered, a suitably qualified environmental consultant should be informed immediately, so that adequate measures may be recommended.

13.1.2 The above conclusions are made subject to approval by the statutory regulatory bodies.

13.2 Review of Pollutant Linkages Following Site Investigation

13.2.1 The site CSM has been revised and updated from that suggested in the desk study in view of the ground investigation data, including soil laboratory analysis results. Table

13.1 highlights whether pollutant linkages identified in the original CSM are still relevant following the risk assessment, or whether pollutant linkages, not previously identified, exist.

Table 13.1: Generic Quantitative Risk Assessment for the Site

Sources	Pathways (P)	Receptors	Relevant pollutant linkage?	Comment
• Potential asbestos containing materials within existing buildings – on site (S1) • Potential made ground on site (S2) • Potential off-site current and historical industrial activities – garage 200m North 1950's – 1990's (S3)	• Ingestion and dermal contact with contaminated soil (P1) • Inhalation or contact with potentially contaminated dust and vapours (P2) • Permeation of water pipes and attack on concrete foundations by aggressive soil conditions (P6)	• Construction workers (R1) • Maintenance workers (R2) • Neighbouring site users (R3) • Future site users (R4) • Building foundations and on site buried services (water mains, electricity and sewer) (R5)	✓	Concentrations of some determinands elevated above screening levels within soils sampled from beneath existing basement slab, but given the continued slab existence within the proposed development, pathways to relevant receptors do not exist. The findings of this report should be included in the construction health and safety file, with adequate measures put in place for the protection of construction and maintenance workers. Contact should be made with relevant utility providers to confirm if upgraded materials are required.
	• Accumulation and migration of soil gases (P5)		**X**	No gas protection measures required.
	• Leaching through permeable soils, migration within the vadose zone (i.e., unsaturated soil above the water table) and/or lateral migration within surface water, as a result of cracked hardstanding or via service pipe/corridors and surface water runoff. (P3) • Horizontal and vertical migration of contaminants within groundwater (P4)	• Neighbouring site users (R3) • Controlled Waters (Culvert) (R6) • Building foundations and on site buried services (water mains, electricity and sewer) (R5)	**X**	Risks to controlled waters are low.

14 GEOTECHNICAL ENGINEERING RECOMMENDATIONS

14.1 Ground Investigation Summary

14.1.1 No detailed structural engineering design information, with respect to the type of construction and associated structural loadings, was provided at the time of preparing this report. Consequently, a detailed discussion of all the problems that may arise during the proposed redevelopment scheme is beyond the scope of this report.

14.1.2 Practical solutions to the difficulties encountered, both prior to, and during construction, are frequently decided by structural constraints or economic factors. For these reasons, this discussion is predominantly confined to remarks of a general nature, which are based on site conditions encountered during the intrusive investigations.

14.1.3 It is understood that the proposed development comprises the extension of an existing basement.

14.2 Geotechnical Results Summary

14.2.1 A complete set of exploratory hole logs can be found in Appendix 6. Copies of the Geotechnical Laboratory Test Results can be found in Appendix 8.

14.2.2 The results of the ground investigation revealed a ground profile comprising Made Ground (up to 1.30m thick), overlying light brown blue veined medium strength clay to the base of the boreholes at 5mbgl.

14.2.3 A summary of ground conditions obtained from the ground investigation and subsequent laboratory testing, is provided in Table 14.1 below.

Table 14.1: Laboratory Test Data Summary

Strata	Made Ground	London Clay
Encountered from	0.0 m bgl 0.0 m bbl	1.30m bgl 0.72m bbl
Base of strata	0.95m - 1.65m bgl 0.72m bbl	>5.00m bgl >0.85m bbl
Thickness range (m)	0.45 - 1.30	>0.13 - >3.70
SPT 'N' Value	6	6 - 12
Inferred Shear Strength (kPa)	-	27 - 54
Moisture content (%)	34	31 - 36
Liquid Limit (%)	84	62 - 88
Plastic Limit (%)	31	22 - 31
Plasticity Index (%)	53	40 - 59
Corrected Plasticity Index (%)	33.92	37.20 - 59
NHBC Volume Change Classification	Medium	Medium to High

14.3 Undrained Shear Strength

14.3.1 Standard Penetration Tests were undertaken at regular intervals throughout the drilling of the borehole. The results of the SPTs have then been used along with the correlation suggested by Stroud (1974) to infer the undrained shear strength of the clays.

$c_u = f_1 \times N$ can be applied,

in which

c_u= mass shear strength (kN)

f_1 = constant

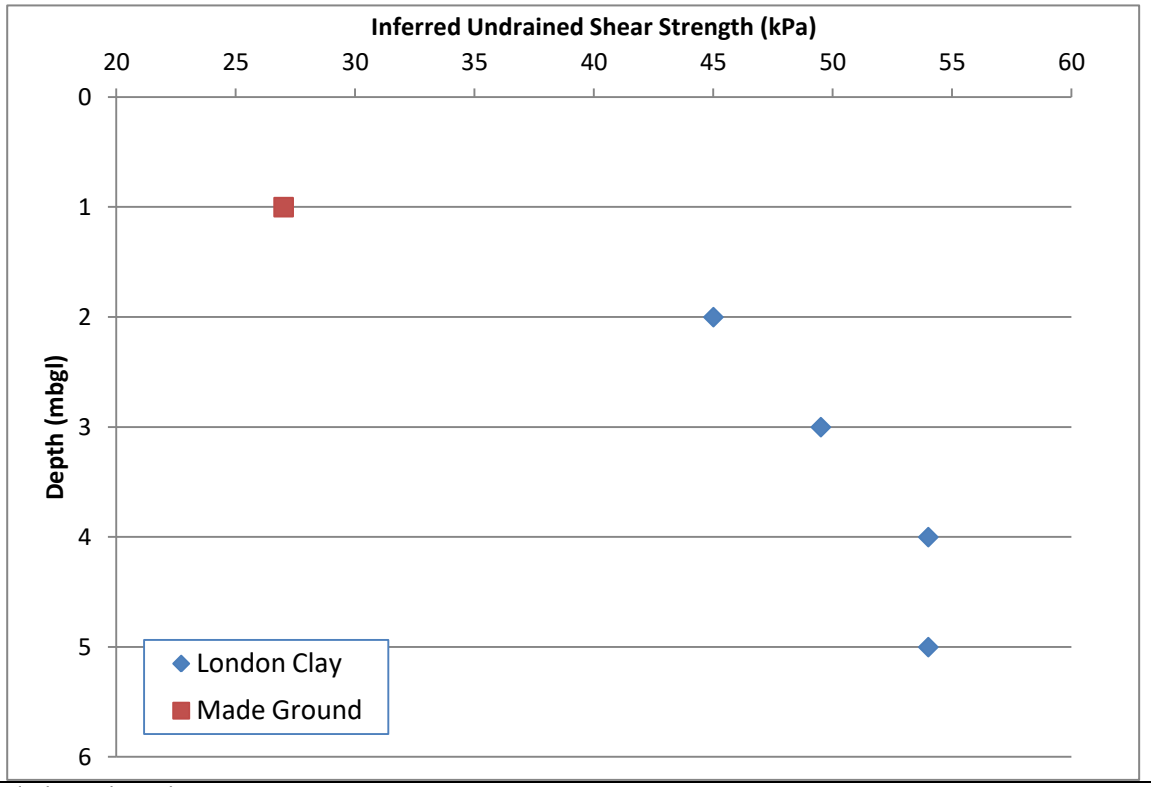
N = SPT Value achieved during boring operations

14.3.2 The constant f_1 is dependent on the plasticity of the material. For the London Clay it the plasticity index has been shown to exceed 27% and therefore a value of 4.5 has been adopted.

14.3.3 The graph below shows the shear strength profile of the London Clay Formation encountered at the site, based on the SPT to shear strength correlation described above.

14.3.4 Made Ground was reported to a depth of 1.30mbgl and as such the SPT carried out at 1.00mbgl was undertaken in both Made Ground and London Clay. N_{equi} was calculated and both materials were found to have an 'N' value of 6.

Figure 14.1: Inferred Undrained Shear Strength vs Depth



14.4 Foundations

14.4.1 For details of the existing foundations, as exposed in TP1 – TP4 across the site please refer to Section 8.3.

14.4.2 At the current time, it is not known how it is proposed to construct the basement. It is assumed that a cantilever retaining wall installed using "underpinning" type construction methods will be employed.

14.4.3 It is considered likely that an excavation circa 3.5m deep would be required to form the basement within.

14.4.4 Based upon the information obtained to date, it is considered that conventional foundations may be suitable for the proposed development. It is considered that an allowable bearing capacity of 90kPa at 3.5mbgl is possible.

14.4.5 The exact allowable bearing capacity that could be achieved would need to be reviewed on receipt of initial foundation design. This would include a check against sliding failure would need to be made to the retaining wall design. This may alter the above recommendations.

14.4.6 The above comments are indicative only based on limited ground investigation data. Foundations should be designed by a suitably qualified Engineer. Once structural loads have been fully determined a full design check in accordance with BS EN 1997 should be undertaken to confirm suitability of foundation choice.

14.5 Concrete in the Ground

14.5.1 Sulphate attack on building foundations occurs where sulphate solutions react with the various products of hydration in Ordinary Portland Cement (OPC) or converted High-Alumina Cement (HAC). The reaction is expansive, and therefore disruptive, not only due to the formation of minute cracks, but also due to loss of cohesion in the matrix.

14.5.2 In accordance with BRE Special Digest 1, as there are less than 10 results in the data set the highest value has been taken.

14.5.3 Table 14.2 summarises the analysis of the aggressive nature of the ground for each of the strata encountered within the ground investigation.

Table 14.2: Concrete in the Ground Classes

Stratum	No. Samples	pH range	WS Sulphate (highest) (mg/l)	Design Sulphate Class	ACEC Class
Made Ground	4	7.8 - 9.8	1590	DS-3	AC-2s
London Clay	1	8.3	320	DS-1	AC-1s

14.6 Ground Floor Slabs

14.6.1 Given that there is to be a basement formed on the site as an extension to an existing lower ground level, it is expected that the finished floor level would be approximately 3m below current ground level.

14.6.2 Due to the presence of cohesive ground with a high volume change potential, in accordance with NHBC Chapter 4.2, a suspended floor slab would be recommended. The depth of clear void beneath the suspended floor slab will be dependant on the floor type used.

14.6.3 Under suspended in-situ concrete ground floor, a minimum void of 150mm is required. Whilst under suspended precast concrete and timber floors a minimum of 300mm is required.

14.6.4 However, given the depth that the basement floor slab is proposed, it is likely that the floor slab would be below the zone of influence of tree roots (dependant on species and size). If it can be shown that this is the case, then a ground bearing floor slab integrated with the cantilever retaining wall could be used. Formations of the structures should be inspected by a competent person. Any loose or soft material should be removed and replaced with well-graded, properly compacted granular fill or lean mix concrete.

14.6.5 Given that the floor slab will be formed under the existing building, it is unlikely that inclement weather would affect the excavations, however the formation should be blinded if left exposed for more than a few hours.

14.6.6 If a ground bearing floor slab is used, then a base of properly compacted granular fill or lean mix concrete should be installed beneath the slab.

14.6.7 The basement floor slab would also need to be suitably reinforced, not only to distribute the structural loading but also to ensure that the floor slab can prop the retaining walls and does not buckle from the lateral pressures imposed by the cantilever retaining walls.

14.6.8 The floor slab (and basement walls) would need to be constructed to conform to BS: 8102 (2009).

14.7 Excavations

14.7.1 Excavations will be required at the site for services and construction works. These are anticipated to remain stable for the short term only.

14.7.2 It is recommended that the stability of all excavations should be assessed during construction. The sides of any excavations into which personnel are required to enter, should be assessed and where necessary fully supported. Given the proximity of the adjacent properties it is considered unlikely that excavations could be battered back to a safe angle.

14.7.3 The basement excavation will be located beneath an existing structure. The progression of the basement excavation will need to consider the potential impact to existing structures both on and off site and provide adequate and appropriate support.

14.8 Retaining Walls

14.8.1 At the current time, it is not known how the retaining walls to the basement will be constructed. It is assumed that the retaining walls will be of the cast in-situ cantilever type. These would be formed in short sections to underpin the existing walls.

14.8.2 These walls would need to be designed to both withstand the earth pressures and to be able to transfer the above loading successfully i.e. the retaining wall should be designed to act as a foundation for the structure.

14.8.3 A check against sliding failure would need to be made to the retaining wall design. This may alter the above recommendations regarding allowable bearing capacities.

14.8.4 At the current time, insufficient structural information is available to allow details of the retaining wall to be determined. Given the obtained information, it is considered that a friction angle for the materials could be taken as 0° in its undrained state.

14.8.5 Given the proposed depth of the basement, it is considered that heave precautions will not be required at the base of the underpinned walls. However, where underpinning extends up above 3m bgl it would be recommended that heave precautions are included. Given the high volume change potential of the underlying clays these should consist of 35mm void or the equivalent thickness of compressible material adjacent to the foundation.

14.9 Ground Movement

14.9.1 CIRIA C580 Table 2.5 uses information on the damage to walls of buildings based on Burland et al (1977), Boscardin and Cording (1989) and Burland (2001) to categorise damage into 5 categories. A summary of Table 2.5 from CIRIA C580 is provided below.

14.9.2 It would be generally good practise to ensure that the design and construction should aim to limit damage to all buildings to a maximum of Category 2 (Slight) as set out in CIRIA Report 580. LB Camden require that damage is limited to Category 1 (Very Slight).

Table 14.3: Summary of CIRIA C580 Table 2.5 (after Burland et al (1977), Boscardin and Cording (1989) and Burland (2001))

Category of damage		Description of Typical Damage	Approximate crack width (mm)	Limiting tensile strain (%)
0	Negligible	Hairline cracks of less than about 0.1mm are classes as negligible.	< 0.1	0.0-0.05
1	Very Slight	Fine cracks that can easily be treated during normal decoration. Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection.	<1	0.05-0.075
2	Slight	Cracks easily filled. Redecoration probably required. Several slight fractures showing inside of building. Cracks are visible externally and some repointing may be required externally to ensure weather tightness. Doors and windows may stick slightly	<5	0.075-0.15
3	Moderate	The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable linings. Repointing of external brickwork and possibly a small amount of brickwork to be	5-15 or a number of cracks >3	0.15 – 0.3

Category of damage		Description of Typical Damage	Approximate crack width (mm)	Limiting tensile strain (%)
		replaced. Doors and windows sticking. Service pipes may fracture. Weather-tightness often impaired.		
4	Severe	Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Windows and frames distorted, floors sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Service pipes disrupted.	15-25 but also depends on number of cracks	>0.3
5	Very Severe	This requires a major repair involving partial or complete rebuilding. Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion. Danger of instability.	Usually >25 but depends on number of cracks	

14.9.3 The first three categories (namely Negligible, Very Slight and Slight categories) are generally regarded as acceptable for buildings where no structural damage is permissible.

14.9.4 Using an underpinning methodology, it is considered that in the short term maintaining the category of damage to category 1 or less could be relatively easily achieved. It would be recommended that a full inspection of the property is undertaken prior to starting work and a watching brief of the structure, the excavations and the adjacent structure is maintained during the works.

14.9.5 In the long term, a suitably designed and constructed retaining wall should provide sufficient support to ensure that post construction movement is minimal and the post construction damage classification of any cracks caused in the short term should not get worse. It is considered unlikely that new cracks would occur post construction.

14.9.6 This advice is provided based on the limited ground investigation undertaken and is not a full Ground Movement Assessment.

14.10 Groundwater Control

14.10.1 During the investigation, groundwater was not observed. During return monitoring groundwater levels were recorded at between 2.42mbgl and dry to 4.70mbgl.

14.10.2 On each visit, the groundwater level was noted to differ greatly. Given the recorded geology and the lack of groundwater reported during drilling it is likely that the water levels recorded during monitoring does not represent a true groundwater level, and it likely due to surface water ingress into the well.

14.10.3 Subject to seasonal variations, it is not considered unlikely that groundwater would be encountered during site works.

15 BASEMENT IMPACT ASSESSMENT

15.1 Proposed Changes to Areas of External Hardstanding

15.1.1 The proposed basement is beneath an existing building, with a small additional area beneath an area of hard paving. It is not considered likely that any additional areas of hardstanding will be created.

15.1.2 It is not considered necessary to undertake any further investigations, studies or impact assessment in relation to the proposed changes to areas of external hard-standing.

15.2 Past Flooding

15.2.1 The National Planning Policy Framework sets strict tests to protect people and property from flooding which all local planning authorities are expected to follow.

15.2.2 When assessing the site specific flood risk and the potential for historic flooding to reoccur the above guidance recommends that , historic flooding records and any other relevant and available information including flood datasets (e.g. flood levels, depths and/or velocities) and any other relevant data, which can be acquired are assessed.

15.2.3 although not included within the 2015 version of CPG4, within the 2010 edition includes a table summarising the streets and roads in Camden that were affected by flooding in the events in 1975 and 2002. The address of the site is not included on this list.

15.2.4 The site is not in an area which has been knowingly affected by flooding in the past, nor is it located within 250m of a known area of flood risk from rivers or the sea. The site is considered unlikely to be at risk from flooding from the culvert 37m east, and the the proposed extension to the existing basement will not lead to an increase in risk in this regard.

15.3 Geological Impact

15.3.1 The published geological maps indicate that the site is directly underlain by solid deposits of the London Clay Formation. This was confirmed by the intrusive investigation.

15.3.2 At the depths that the basement would be constructed at the London Clay is unlikely to be prone to seasonal shrinkage and swelling that arises due to changing water content in the soil. This is due to a lack of significant vegetation capable of removing water within the zone of influence; the extensive hard cover minimising the amount of water entering the ground and the lack of proven groundwater. Given the recorded geology and the lack of groundwater reported during drilling it is likely that the water levels recorded during monitoring does not represent a true groundwater level, and it likely due to surface water ingress into the well.

15.4 Hydrology and Hydrogeology Impact

15.4.1 Based on all the information available at the time of writing, the risk of flooding from groundwater is considered to be low. The proposed basement is unlikely to have a

detectable impact on the local groundwater regime. Appropriate water proofing measures should be included within the whole of the proposed basement wall/floor design as a precaution.

15.4.2 The proposed dwelling will lie outside of flood risk zones and is therefore assessed as being at a very low probability of fluvial flooding.

15.4.3 There are no surface water features on or in the immediate vicinity of the site. It is therefore not anticipated that the site will make any impact upon the hydrology of the area.

15.4.4 The information available suggests that the site lies in an area that is not at risk of surface water flooding. Flooding via this source is therefore considered to be low.

15.4.5 The proposed basement construction is considered unlikely to create a reduction of impermeable area in the post development scenario.

15.4.6 No risk of flooding to the site from artificial sources has been identified.

15.5 Impacts of Basement on Adjacent Properties and Pavement

15.5.1 The proposed basement excavation will be within 5m of a public pavement. It is also within 5m of neighbouring properties.

15.5.2 Unavoidable lateral ground movements associated with the basement excavations must be controlled during temporary and permanent works so as not to impact adversely on the stability of the surrounding ground, any associated services and structures.

15.5.3 It is recommended that the site is supported by suitably designed temporary support. This will ensure that the adjacent land is adequately supported in the temporary and permanent construction. Alternatively, the excavation should proceed in a manner that maintains the integrity of the ground on all sides.

15.5.4 Careful and regular monitoring of the structure will need to be undertaken during the construction phase to ensure that vertical movements do not adversely affect the above property with the “flying freehold”. If necessary the works may have to be carried out in stages with the above structure suitably propped and supported.

15.5.5 It will be necessary to ensure that the basements are designed in accordance with the NHBC Standards and take due cognisance of the potential impacts highlighted above. This may be achieved by ensuring best practice engineering and design of the proposed scheme by competent persons and in full accordance with the Construction (Design and Management) Regulations. This will include:

- Establishment of the likely ground movements arising from the temporary and permanent works and the mitigation of excessive movements;
- Assessment of the impact on any adjacent structures (including adjacent properties and the adjacent pavement with potential services);
- Determination of the most appropriate methods of construction of the proposed basements;

- Undertake pre-condition surveys of adjacent structures;
- Monitor any movements and pre-existing cracks during construction;
- Establishment of contingencies to deal with adverse performance;
- Ensuring quality of workmanship by competent persons.

15.5.6 Full details of the suitable engineering design of the scheme in addition to an appropriate construction method statement should be submitted by the Developer to London Borough of Camden.

16 REFERENCES

Groundsure EnviroInsight Report Ref HMD-377-4439259 December 2017

Groundsure GeoInsight Report Ref HMD-377-4439260 December 2017

Environment Agency (2004) *Model procedures for the management of land contamination*. CLR11. Bristol: Environment Agency

National Planning Policy Framework. Department for Communities and Local Government, March 2012

Code of Practice for Site Investigations BS5930: 2015

Investigation of Potentially Contaminated Sites – Code of Practice BS10175: 2011

BRE Report BR211; Radon: Protective measures for new dwellings, 2007

British Standards Institution (2015) BS 5930:2015 *Code of practice for site investigations*. Milton Keynes: BSI

CIRIA C580, Embedded retaining walls – guidance for economic design

APPENDICES

APPENDIX 1 – FIGURES

APPENDIX 2 – GROUNDSURE REPORTS

APPENDIX 3 – OS HISTORICAL MAPS

APPENDIX 4 – QUALITATIVE RISK ASSESSMENT METHODOLOGY

APPENDIX 5 – BGS BOREHOLE RECORDS

APPENDIX 6 – EXPLORATORY HOLE RECORDS

APPENDIX 7 – CHEMICAL LABORATORY TEST RESULTS

APPENDIX 8 – GEOTECHNICAL LABORATORY TEST RESULTS

APPENDIX 9 – SOIL GAS MONITORING TEST RESULTS

APPENDICES

APPENDIX 1 – FIGURES