Alex Midgen

18 Redington Road, London, NW3 7RG

Basement Impact Assessment

25250-01 (01)

DECEMBER 2011

CONTENTS

FIGURES

APPENDICES

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Basement Impact Assessment

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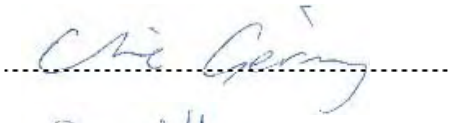
Project Manager	Clive Gerring BSc PhD FGS	
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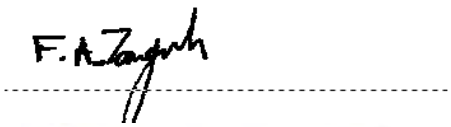
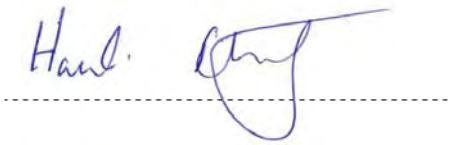
Reviewed and Approved by	Faraj Arfa-Zangeneh BSc MSc CEng C.WEM Principal Hydrologist & Flood Risk Engineer	
Reviewed and Approved by	Hamdi El-Ghonemy BSc PhD CGeol FGS Associate Director of Hydrogeology	

1. INTRODUCTION

1.1 Instructions

On the instructions of Mr Alex Midgen (the 'Client'), RSK Environment Limited (RSK) have produced a Basement Impact Assessment for a residential property at 18 Redington Road, located within the Frognal and Fitzjohns Ward of the London Borough of Camden.

The project was commissioned in order to obtain and collate information on the geological, hydrogeological and hydrological characteristics of the site and thence to assess the potential impacts at the site and its vicinity from the proposed redevelopment of the site with a new residential property. The proposed redevelopment involves the lateral excavation into this sloped site to provide additional basement accommodation.

1.2 Regulatory Context

The current project is designed to be compliant with guidance provided by the London Borough of Camden (LB Camden) in their guidance document 'Camden Planning Guidance for Basements and Lightwells, CPG4' and its supporting study 'Camden Geological, Hydrogeological and Hydrological Study' produced for the London Borough of Camden by ARUP in November 2010. All the technical analysis and recommendations contained within the planning guidance are taken from this latter study, which is treated as the evidence base and technical advice when the London Borough of Camden are assessing Basement Impact Assessments.

This guidance applies to all developments in LB Camden that propose a new basement development, or an extension to existing basement accommodation where planning permission is required. LB Camden will only permit basement and other underground development where it can be demonstrated that it will not cause harm to the built and natural environment, including to the local water environment and ground stability.

Addressing these issues requires the submission of a Basement Impact Assessment (BIA). A BIA will be specific to a particular site and proposed development, but includes the following stages:

- *Screening*; the identification of any matters of concern with regard to hydrogeology, hydrology or ground stability, which should be investigated.
- *Scoping*; produces a statement which defines further the matters of concern identified at the screening stage.
- *Site Investigation and Study*; this is undertaken to establish the baseline conditions. This can be done by utilising existing information and/or collecting new information.
- *Impact Assessment*; this is undertaken to determine the impact of the proposed basement on the baseline conditions, taking into account any mitigation measures proposed.
- *Review and Decision-Making*; this final stage is undertaken by LB Camden and consists of an audit of the information supplied and a decision on the acceptability of the impacts of the basement proposal.

1.3 Background

By way of background to the current project, a single phase of site investigation was previously undertaken at the site by Soil Consultants Limited, as detailed in their report no.4967/HA/OT, dated February 2011. On the basis of information provided within that

report, Morrish Consulting Engineers produced a 'Structural and Hydrology Report' for the proposed redevelopment of the site (report no.10149, dated August 2011).

These documents have been made available to RSK as part of the current project.

1.4 Project Brief

The work undertaken for the current project included the following tasks:

- A site reconnaissance survey;
- Liaison with the planning consultants (DP9), the architects (Design Solutions) and the structural engineers (Morrish) for the project;
- Construction of a deep cable-percussive borehole at the site to confirm the underlying ground and groundwater conditions;
- A review of all salient information contained within the above mentioned reports;
- A review of the local ground conditions, hydrology and hydrogeology of the site, including reference to the 'Camden Geological, Hydrogeological and Hydrological Study' produced for LB Camden by ARUP; and
- An assessment of the potential impacts of the proposed development on groundwater flow, surface flow and flooding and slope/ground stability (in accordance with the screening assessment flowcharts provided within Camden Planning Guidance document CPG4).

1.5 Standards and Limitations

This report should be considered in the light of any changes in legislation, statutory requirement or industry practices that may have occurred subsequent to the date of issue.

2. SITE DETAILS

2.1 Geographical Setting

The site is located at National Grid reference TQ 259, 858, as shown on **Figure 1**. The site lies within a natural hillslope setting, which descends in a southwesterly direction from the high ground of Hampstead Heath to the northeast to the lower ground of West Hampstead to the southwest. The topography in the area is undulating, formed from a series of valleys cut into the slope and their associated interfluves. The largest of these features is located approximately 170m west of the site and is a shallow valley associated with a former tributary of the River Westbourne. This dissection of the regional slope is associated with former drainage of the heathland in this area.

2.2 Site Description

The site occupies a rectangular plot, orientated with its long axis northeast to southwest and measuring about 44m by 21m in size. The site is accessed via Redington Road, which forms the southwestern boundary of the site. The site is bounded to the northwest and southeast by detached residential properties. The northeastern boundary of the site comprises the grounds of No.22 Redington Road, which extends partially behind the site, with a tennis court adjacent to the subject site's boundary. It is understood that a subterranean garden room is present beneath the tennis court to the rear of No.20 Redington Road, but does not appear to encroach on the site boundary to the northeast of the subject site. The remainder of the northeastern boundary comprises the grounds of a multi-storey building (Merlin House), which is utilised as residential flats.

The current property at 18 Redington Road comprises a large two-storey detached house surrounded by garden areas, paving and a driveway. The site is set out on three levels: The bottom of the driveway (street level along Redington Road); the top of the driveway; and the ground floor level of the house. All elevations used in this report are given as metres above site datum (mSD), which were utilised in the Soil Consultants and Morrish reports. The ground rises steeply to the northeast from Redington Road, initially rapidly from +49.9mSD (equivalent to approximately +102mAOD) at the entrance to +52.69mSD at the top of the driveway, and to +55.5mSD at the level of the house and increasing gently to +55.9mSD at the rear of the property. The ground level changes are accommodated by retaining walls with steps at intervals. Raised landscaping at the northeast extent is at a level of +57.4mSD. The ground level of the adjacent property to the northeast (Merlin House) is at approximately +59.5mSD.

At street level, to the side of the driveway is a garage, which is cut into the lower garden area. The driveway leads to a second garage, which is situated beneath a front terrace, set at the level of the main house (+55.39mSD). The main house has a small existing basement, which is currently utilised as a workshop. Existing basement level is at +53.27mSD.

The current site layout is shown in **Figure 2**.

2.3 Details of Proposed Development

The proposed redevelopment will involve the demolition of the existing house and garages and construction of a new two- to four-storey house connected to a single-storey garage at the front of the property.

The site currently comprises three levels, a configuration that will be retained in the new development. The new upper level will be approximately equivalent to the ground floor level of the existing property (approximately +55.5mSD). The middle level will extend beneath the

central and front part of the proposed property at the floor level of the existing basement workshop (approximately +52.33mSD). The proposed lowest level will extend from the centre of the proposed house to the front of the site adjacent to Redington Road (to an elevation of approximately +49.3mSD).

Nominal amounts of excavation will be required at the highest part (northeast) of the site. The most significant excavation will occur in the centre of the site, to a depth in excess of approximately 6.2m to facilitate construction of the new lower and middle levels. The depth of excavation decreases to approximately 3.5m to the front of the property to form the semi-basement lowest level close to adjacent street level.

As the site is to be benched, retaining structures will be designed to ensure that stability is maintained both in the temporary and permanent cases. A piled wall or sheet piles are being considered for retaining structures during construction. Reinforced Concrete walls are envisaged in all areas below ground level. The superstructure will be constructed using load bearing masonry walls and a reinforced concrete floor structure.

With respect to foundations, it is understood that a raft with mass concrete strip footings around the edges is being considered.

Underground drainage will be designed and connected to the existing public drainage system.

A proposed development layout section is shown in **Figure 2**.

2.4 Ground Conditions

2.4.1 General Assessment

The published 1:50,000 scale geological map (Sheet No. 256 ‘North London’) and 1:10,560 scale geological map (TQ28NE) indicate that bedrock deposits of the Bagshot Formation immediately underlie the site area. The Bagshot Formation caps the highest ground in the Hampstead Heath/Highgate district and comprises yellow and ochreous-brown fine-grained sand, which is silty and clayey in parts, and contains laminae of pale-grey clay and sporadic unit of grey silty clay, clayey silt and fine sand. The base of this formation is mapped to lie close to Redington Road, to the southwest of the site.

The Bagshot Formation is underlain by the Claygate Member, which constitutes the uppermost unit of the London Clay Formation. The Claygate Member consists of alternating beds of clayey silt, very silty clay, sandy silt and silty fine-sand. The remainder of the underlying London Clay Formation generally comprises silty clay.

An extract of the geological map is shown in **Figure 3**.

2.4.2 Site Investigation Data

As noted above, a site investigation was previously undertaken at the site by Soil Consultants Limited (January 2011). Three boreholes were undertaken to 5.5m depth. These boreholes encountered the Bagshot Formation comprising yellow-brown sandy clay to clayey or silty sand with orange / grey mottling. The silt and clay / sand content was found to be variable, ranging from silty sand with bands of clay to clay with laminations of silty sand. This formation was proved to a depth of 5.1m (+50.8mSD) at the higher (northeast) end of the site; to 5.4m (+49.8mSD) in the middle of the site; and to 3.4m (+49.33mSD) at the lower (southwestern) end of the site. The base of the Bagshot Formation was inferred to slope gently downwards towards Redington Road (towards the southwest).

The Claygate Member was encountered beneath the Bagshot Formation and comprised light brown sandy clay and brown-grey silty sand. Groundwater was encountered in the lowest (southwestern) part of the site at 3.5m below ground level (+49.30mSD) and was subsequently monitored to lie between 3.75m bgl (+49.05mSD) and 4.06m bgl (+48.74mSD).

As part of the current investigation, a deep cable-percussive borehole (BH1) was drilled from the current level of the existing house (+55.5mSD), extending to 17m bgl (+38.5mSD). This borehole encountered the Bagshot Formation extending to a depth of 5.6m bgl (+49.9mSD). The Bagshot Formation was encountered as interbedded and laminated orangey-brown and grey sandy silty clay, and clayey fine sand. No groundwater or water seepages were encountered within the Bagshot Formation.

Beneath the Bagshot Formation, the Claygate Member was encountered as brown and grey interbedded silty very clayey fine sand and sandy clayey silt/silty clay, with a 4.6m thick silty clay layer between 9.1m bgl and 13.7m bgl.

Groundwater was encountered within the uppermost part of the Claygate Member at 5.6m below ground level (+49.9mSD). During and immediately after the site works the water level rose to 4.8m bgl (+50.7mSD), but subsequent groundwater monitoring indicates that the water level has settled at 5.8m bgl (+49.7mSD). During the drilling, the fine clayey sands and silts collapsed in the presence of water in the borehole, indicating potential 'running sand' conditions, which could possibly account for the initial increase in water level before settling to a post-site works equilibrium level. The water was sealed out in the borehole at 9.1m (+46.4mSD) within the 4.6m thick clay layer. Groundwater was encountered throughout the depth +49.7mSD to +46.4mSD, although it was not possible to determine whether there was a single or multiple water strikes over this interval as it was not possible to seal groundwater out. Water was encountered again below the clay layer at 13.7m bgl (+41.8mSD), rising under sub-artesian pressure to 10.6m bgl (+44.9mSD), with strong seepage noted at 16m bgl.

As part of the current investigation, groundwater levels were also monitored within Soil Consultants Limited boreholes WS1 (+55.9mSD) and WS3 (+52.8mSD). WS1 was dry and water was measured at +48.47mSD in WS3.

The current data indicate that there is a sloping water table present within the Claygate Member. The water table currently lies at +49.7mSD in the northeast of the site, decreasing to +48.47mSD in the southwest of the site. These findings are consistent with the anticipated conditions on the southwesterly sloping site.

An indicative geological cross section is shown in **Figure 4**.

The borehole log and soil testing laboratory certificates for BH1 are included as **Appendix A**.

3. BASEMENT IMPACT ASSESSMENT

3.1 Hydrogeology (subterranean (groundwater) flow screening)

This section of the report provides requisite information for the purpose of 'subterranean (groundwater) flow' screening in accordance with CPG4 and addresses all questions raised within the relevant section of that document. A table summarising the screening flowcharts is shown in **Appendix B**.

3.1.1 Aquifer Designation

Based on the published geological map, the hydrogeology of the site would be characterised by the presence of an unconfined shallow aquifer comprising the Bagshot Formation. The underlying Claygate Member, although comprising a variable and generally lower permeability sequence, is also considered to be an aquifer. Both these units are classified by the Environment Agency (EA) as Secondary (A) Aquifers.

The underlying London Clay Formation is classified as a non-aquifer (non-productive stratum).

3.1.2 Groundwater Flow and Depth to Groundwater

Due to the more permeable Bagshot Formation and Claygate Member capping the highest ground in the area, groundwater within these geological units is recharged via surface precipitation and infiltration. Groundwater in the site area is anticipated to flow in a general southwesterly direction, i.e. radially away from, and down-gradient of Hampstead Heath in accordance with the topography in the site area. Some element of westerly flow may be present towards the valley of the former tributary of the River Westbourne, located approximately 170m west of the site.

As detailed in **Section 2.4.2** above, no groundwater was encountered within the Bagshot Formation at the site. However, a sloping water table has been identified within the Claygate Member. This water table currently lies at +49.7mSD in the northeast of the site, decreasing to +48.47mSD in the southwest of the site. These findings are consistent with the anticipated conditions on the southwesterly sloping site.

The ground floor level of the proposed development is at an elevation of +49.33mSD, although excavation would actually be to a greater depth to facilitate floor slab and foundation construction. In the upper (northeast) part of the site, the encountered groundwater level is approximately 0.4m above proposed floor level and in the lower (southwest) part of the site water level is currently approximately 0.86m below proposed floor level. It should be noted, however, that Soil Consultants recorded a slightly higher water level in the southwest of the site, resting only 0.28m beneath proposed floor level, and that groundwater levels are likely to fluctuate seasonally. The proposed ground floor level will, therefore, intersect the identified water table in the northeast of the site.

As such, it will be necessary to control water during the construction period. Discussions with the structural engineer indicate that sheet piling may be utilised in the temporary case to exclude water and to facilitate basement construction. Further, retaining structures will be required with respect to maintaining the stability of excavations (see **Sections 3.3.1** & **3.3.6**). Sheet piling could potentially be toed into the clay layer (encountered at 9.1m below ground level in BH1) to form a cut-off, allowing dewatering of the excavation and basement/foundation construction. Once the basement is constructed in the permanent case, the sheet piling could be removed. Whilst this has a short-term impact of forming a temporary groundwater obstruction and the requirement of dewatering, this will be far outweighed by the

long-term benefits of not having a permanent cut-off structure beneath the proposed development, ensuring long-term drainage.

Although the proposed development will extend into the uppermost part of the identified water table, particularly in the northeast where the watertable intersects the structure, and locally where foundations and drainage are present, it is considered that the depth of penetration into the water bearing stratum will be limited. In addition, the absence of a permanent cut-off structure beneath the development will allow movement of water around and beneath the proposed structure.

Discussions with the structural engineer indicate that full consideration will be given to the effects of hydrostatic pressures acting on the proposed structure and to waterproofing.

It is, therefore, considered that the proposed development would not have a significant impact upon groundwater levels or flows beneath the site and that no harm will be caused.

3.1.3 Springs, Wells and Watercourses

The geological boundary between the Bagshot Formation and underlying Claygate Member, which may potentially form a spring line, is mapped as lying to the southwest of the site, along Redington Road.

However, as noted in **Section 2.4.2**, no groundwater was encountered within the Bagshot Formation, but was instead encountered beneath this geological boundary, in the Claygate Member. The encountered water table appears to decrease in elevation towards the southwest, as would be anticipated from the local topography. Thus, although the proposed development will cut this geological boundary, the encountered ground conditions are unlikely to be conducive to the formation of springs in the site area. Further, as noted in **Section 3.1.2** above, although the proposed development will extend into the uppermost part of the identified water table, it is considered that the depth of penetration will be relatively limited and is unlikely to have any significant effect upon groundwater flows. In addition, both current and historical maps do not indicate the presence of any obvious springs immediately down-gradient of the site area. It should also be noted that the area surrounding and down-gradient of the site is heavily urbanised and that several properties on the southern side of Redington Road, where the geological boundary is indicated to lie, are cut into the slope in that area, with development levels below ground level, indicating that there is unlikely to be a gross problem with groundwater seepage in that area.

A search of publicly available BGS records indicates that there are no known water wells within 250m of the site. Reference to the Envirocheck environmental database report included within the Soil Consultants Limited report indicates that there are no known water abstractions within 250m of the site. In terms of aquifer protection, information available on the EA website indicates that the site does not lie within a currently designated groundwater Source Protection Zone (SPZ).

With reference to current and historical map data and figures 12 and 14 of the ARUP report, the site does not lie within the vicinity of any sensitive surface water features or surface water catchment and drainage areas.

With reference to ‘The Lost Rivers of London’ (Barton 1992) and ‘London’s Lost Rivers (Talling, 2011), a tributary of the River Westbourne formerly occupied the topographic valley located approximately 170m west of the site. The upper reaches of this river were made up of a number of minor streams to the west of Hampstead, although the main source was considered to be a pond (no longer present) on Branch Hill to the north of the site. The current

watercourse is culverted and flows in a sewer beneath Redington Gardens. It is considered that the proposed development will have no impact on any nearby watercourses.

On the basis of the encountered ground conditions and the absence of any known water features in the site's vicinity, it is considered that the proposed new basement structure will not be affected by water levels in any local pond or spring lines, which could otherwise result in groundwater draining into basement/excavation space, with the exception of the identified natural water table on the existing slope.

3.1.4 Changes to Surface Cover and Drainage

Under the proposed development plans, the existing front garden area will be excavated and replaced by a garage at proposed ground floor level with a terrace over the top. Although this will remove some soft landscaping, this is a small area and the impact would be small as the garden area is currently partially underlain by an existing garage. The existing house is to be replaced with a new house on a similar footprint and with external paved and soft landscaped areas. There is therefore unlikely to be any significant changes to surface water run-off. It is understood that an appropriately qualified consultant or engineer will be engaged to ensure that mandatory requirements are met.

Therefore, under the proposed development, it is considered highly unlikely that there would be any changes to recharge of the underlying ground that might result in changes to groundwater flow or level, or change the degree of saturation of the ground, which could potentially affect stability. Therefore no harm would be caused.

3.2 Hydrology (surface flow and flooding screening)

This section of the report provides requisite hydrological information for the purpose of 'surface flow and flooding' screening in accordance with CPG4 and addresses all questions raised within that section of the document. A table summarising the screening flowcharts is shown in **Appendix B**.

3.2.1 Nearest Watercourse

There are no ponds, streams or drainage ditches on or immediately adjacent to the site. With reference to current and historical map data and figures 12 and 14 of the ARUP report, the site is not within the immediate vicinity of any sensitive surface water features or surface water catchment and drainage areas.

As noted above, a tributary of the River Westbourne formerly occupied the topographic valley located approximately 170m west of the site. The current watercourse is culverted and flows in a sewer beneath Redington Gardens

The site is not located in an area where any known sensitive springs, shallow wells or watercourses are present and the proposed development works are, therefore, not considered to present a risk to, or likely to harm or affect any changes to, any shallow hydrological features.

3.2.2 Drainage and Surface Cover

No SUDS components, such as soakaways that allow water to soak into the ground, are current proposed for the redevelopment works that would result in surface water flows (e.g. rainfall and run-off) being materially changed from the existing route. It is proposed to retain and utilise the existing sewer system at the site.

It is considered highly unlikely that there will be any significant changes to surface water run-off, as previously noted, it is understood that an appropriately qualified consultant or engineer will be engaged to ensure that mandatory requirements are met.

It is, therefore, considered that there will be no effect on the way that rainfall and surface water are transmitted away from the site and no harm will be caused.

3.2.3 Flood Risk

Information available on the Environment Agency website confirms that the site does not lie within 250m of any Zone 2 or Zone 3 Environment Agency Flood Zones. Additionally, there are no EA classified floodplains, flood defences, or areas benefitting from flood defences within 250m of the site. Reference to the EA website also indicates that the site does not lie within an area shown as being at risk from flooding from reservoirs.

With respect to potential flooding from surface water run-off, Figure 15 of the ARUP report shows a flood map for LB Camden. The site does not lie within an area known to have historically flooded or in an area with the potential to be at risk of surface water flooding. CPG4 provides a list (p.29) of streets in LB Camden that have historically been affected by surface water flooding. Redington Road does not appear on this list.

The current data indicate that there is a sloping water table present within the Claygate Member, which is affecting part of the proposed underground excavation. Hence, there is a risk of groundwater ingress into the proposed basement.

Although the risk is small British Standard (BS) 8102 recommends that basements with a depth greater than 4m below ground level (bgl) should be designed to allow for fluctuations in the water table of up to 1m. It also offers guidance for the design and waterproofing of basements and defines 4 grades as follows:

- Grade 1: Basic Utility. Car parking, plant rooms (excluding electrical equipment), workshops. Some seepage and damp patches tolerable;
- Grade 2: Better Utility. Workshops and plant rooms requiring drier environments; retail storage areas. No water penetration but moisture vapour tolerable;
- Grade 3: Habitable. Ventilated residential and working areas including offices, restaurants etc., leisure centres. Dry environment. Active measures to control internal humidity may be necessary
- Grade 4: Special. Archives and stores requiring controlled environment. Totally dry environment. Active measures to control internal humidity probably essential.

Based on BD 8102, the proposed basement car parking excavation will be designed to the appropriate grade therefore reducing the risk posed to the basements from groundwater ingress.

With respect to foul water drainage systems, on the basis that the foul water sewerage system for the proposed redevelopment meets the specifications of Thames Water this should ensure that the systems have sufficient capacity to prevent overloading under the normal range of operating conditions.

From the development proposals supplied, the existing property is to be replaced by a similar, though larger, single residential dwelling, and there does not appear to be a predicted increase in foul water discharge to the surrounding sewer network, therefore the flood risk from artificial drainage systems is considered to be low. As previously noted, it is understood that mandatory requirements will be met and that an appropriately qualified engineer or consultant will be engaged as the design process develops.

A sewer flooding history enquiry has revealed that the flooding records held by Thames Water indicate that there have been no incidents of flooding in the site area as a result of surcharging public sewers. A copy of the Thames Water sewer flooding history report is given in **Appendix C**.

The existing sewer asset map provided by Thames Water indicates that the combined sewers located in the vicinity of Redington Road fall topographically down-gradient and away from the site and are therefore unlikely to direct any surface water flooding towards the site. A copy of the Thames Water asset plan is given in **Appendix C**.

The Level 1 North London Strategic Flood Risk Assessment (SFRA) was completed in August 2008 and provides a useful regional overview of various forms of flood risk, however, the SFRA is not designed to provide the relevant detail at a site-specific scale. A brief review of the regional SFRA mapping has confirmed that the site lies in Flood Zone 1 and has not been affected by any other forms of flooding in the past.

3.3 Slope and Ground Stability (slope stability screening)

This section of the report provides requisite information for the purpose of 'slope stability' screening in accordance with CPG4 and addresses all questions raised within that section of the document. A table summarising the screening flowcharts is shown in **Appendix B**.

3.3.1 Slope Stability

The 1:50,000 scale geological map for the area indicates that the site does not lie within an 'Area of Significant Landslide Potential'. No mapped areas of landslips are present in the site's vicinity and the natural ground stability hazards dataset supplied by the BGS (included in the Soil Consultants report) gives the hazard rating for landslides in the site area as 'very low'. The BGS landslide potential map is reproduced as figure 17 of the ARUP report.

Information obtained from a site reconnaissance, site plans and Ordnance Survey maps indicates that the general site area slopes variably at angles between 3^{o} and 6^{o} towards the southwest and west as part of the wider undulating hillslope environment. Greater slope angles were noted locally in the site area (i.e. Oak Hill Way located approximately 40m west of the site, up to approximately 9^{o}). However, it should be noted that the immediate site area is heavily urbanised and slopes at the site / in the site's vicinity may have been cut or altered historically or as part of developments and landscaping.

The slope angle map produced as figure 16 of the ARUP report indicates that slope angles in the site area are less than 7^{o} and that the site does not neighbour any land that contains cuttings/embankments or any other feature with slope angles in excess of 7^{o}. The 7^{o} slope angle criterion has been adopted by ARUP in relation to a minimum angle of stability of 8^{o} for slopes in London Clay and the Claygate Member. However, it should be noted that slopes at the site are cut into the Bagshot Formation (medium-dense clayey fine sand / firm sandy clay), in which stable angles for natural slopes are likely to be in excess of 15^{o} to 20^{o}.

Notwithstanding the above, as part of the proposed development it is proposed to cut the site by at least 6.2m, to a depth of at least +49.33mSD (ground floor level) in the northeast of the site, although excavation would locally be to a greater depth to facilitate floor slab and foundation construction. The Claygate Member was encountered as silty very clayey fine sand and sandy clayey silt / silty clay from +49.9mSD and groundwater has been monitored to rest within the Claygate Member at +49.7mSD in the area of the proposed cut. Therefore, the Claygate Member and water table would 'daylight' at the base of the proposed excavation, which could potentially result in 'running sand' conditions and ground instability. Therefore, some form of retention will be required for the cuttings and, as described in **Section 3.1.2**,

discussions with the structural engineer indicate that this is likely to take the form of sheet piling. This could potentially be employed in the temporary case to exclude water and maintain the stability of excavations. It is understood that in the permanent case, the retaining walls will be designed to resist lateral earth pressures and hydrostatic pressures.

It is understood that benching at the site will be retained and there are no plans for re-profiling or landscaping the site that could potentially result in slope stability issues.

It is, therefore, considered that slope stability can be maintained through the proper design and construction of mitigation measures, similar to those outlined above.

3.3.2 Shrink/Swell Clays

The shallow geology beneath the site comprises mixed granular and cohesive Bagshot Formation deposits. The geotechnical assessment of these materials presented in the Soil Consultant's report records the Bagshot Formation as sandy clay to clayey or silty sand. The silt & clay / sand content was found to be variable, ranging from silty sand with bands of clay to clay with laminations of silty sand. These soils were proven to a depth of 5.1m (+50.8mSD) at the higher end of the site, to 5.4m (+49.8mSD) in the middle part of the site and to 3.4m (+49.33mSD) at the lower part of the site, indicating a gently sloping geological boundary.

The cohesive fraction of the Bagshot Formation had a firm to stiff consistency and the results of Atterberg limit testing classified the cohesive material as a low to high plasticity clay. The volume change potential of the cohesive fraction ranged from low to medium and Soil Consultants considered that, using NHBC tables, the Bagshot Formation soils should be considered to be of low volume change potential. Therefore, suitable founding depth would need to be taken into account with regard to the removal of trees and the future growth of retained trees.

It is understood that an existing oak tree and a crab apple tree are to be removed from the upper level as part of the development. A review of existing information indicates that the foundations for the proposed development are unlikely to be affected by removal of these trees. Similarly, it is considered that removal of the trees is unlikely to have any significant impact upon the existing foundations of the adjacent property (No.16 Redington Road). It is understood that the structural engineer will confirm this preliminary assessment.

It is also understood that some post-development re-planting may be proposed. Due consideration should be given to the potential effects on shrinkable soils.

3.3.3 Compressible/Collapsible Ground

The natural ground stability hazards dataset supplied by the BGS (included in the Soil Consultants report) gives the maximum hazard rating for compressible ground and collapsible ground at the site as 'no hazard'.

3.3.4 Settlement/Heave of Underlying Soils

Although particle size distributions indicate that the Claygate Member soils beneath the site are highly variable (40% to 62% fine sand, the remainder silt and clay in approximately equal proportions), Atterberg Limit determinations on some of these materials indicate that they are likely to behave as intermediate to high plasticity clays of medium volume change potential.

Therefore, the resulting removal of overburden due to excavation and subsequent reloading from the building may potentially cause some vertical ground movement in the underlying soils, the final magnitude depending on the net loading applied at the formation level.

Consideration should, therefore, be given to providing heave protection measures to the floor slab and foundations to mitigate this.

3.3.5 Mining, Quarrying and Landfilling

Information obtained for the Soil Consultants report, the natural ground stability hazards dataset supplied by the BGS and geological and historical mapping indicate that there are no recorded mines, quarries or landfills within a 250m radius of the site.

The site does not, therefore, lie within any known areas of previously worked ground or landfilling that could lead to instability issues.

3.3.6 Structural Stability of Adjacent Properties

The grounds of No.22 Redington Road and Merlin House form the northeastern boundary of the site. A brick retaining wall supports a tennis court set at an elevated level of +59.5mSD to the immediate rear of the site. It is understood that a garden room is present beneath the tennis court approximately 7m north of the site. A large detached residential property (No.22 Redington Road) is located 4.3m northwest of the site, as is another large detached residential property (No.16 Redington Road) located 8.1m southeast of the site. A search of LB Camden website indicates that No.16 Redington Road is a Grade II listed building. The public highway of Redington Road forms the site's southwestern boundary.

Below ground construction has the potential to cause some movements in the surrounding ground. However, it is understood that ground movements and/or instability will be managed through the proper design and construction of mitigation measures.

As the site is to be cut and benched, retaining structures will be carefully designed to ensure that stability is maintained both in the temporary and permanent cases. A piled wall or sheet piles are being considered for retaining structures during construction. Reinforced concrete walls are envisaged in all areas below ground level.

The proposed development will also result in differential foundation depths between the site and adjacent properties and as such it is understood that the Party Wall Act will be considered. For basement developments in densely built urban areas, the Party Wall Act (1996) will usually apply because neighbouring houses would typically lie within a defined geometrical "halo" around the proposed basement works. Specifically, the Party Wall Act applies to any excavation that is within 3m of a neighbouring structure; or that would extend deeper than that structure's foundations; or which is within 6m of the neighbouring structure and which also lies within a zone defined by a 45^{o} line from the foundations of that structure. Discussion with the structural engineer indicates that the Party Wall process will be followed in due course.

3.3.7 Dewatering

Due to the likely presence of groundwater above the level of proposed excavations in the northeast part of the site, temporary groundwater control will be necessary to control water during the construction period.

The dewatering scheme will need to be designed with great care. The area of excavation and dewatering can be carefully retained, and groundwater excluded by sealing the sheet piling into the underlying clay which will mean that dewatering could be undertaken without any significant effects on groundwater levels beyond the retained area.

3.3.8 Infrastructure

Direct contact with London Underground Limited (LUL) confirms that there are no LUL tunnels, tunnel exclusion zones, or other buried infrastructure within 50m of the site area.

Correspondence with LUL is included in **Appendix D.**

A Thames Water utilities search has been undertaken for the site and indicates that there are no assets beneath or in the site vicinity beneath the site that would be affected by the proposed development. The site is within 5m of an existing highway, in which buried services are present. However, it is proposed to reutilize these service connections as part of the proposed development and, therefore, the proposed development will not impact on any critical infrastructure.

Correspondence with Thames Water is included in **Appendix E**.

It is, therefore, considered that there is no buried infrastructure in the site vicinity that could be affected by the proposed basement structure.

4. CONCLUSIONS

- The proposed redevelopment will involve the demolition of the existing house and lateral excavation to create basement accommodation. The most significant excavation will occur in the northeast of the site, to a depth in excess of approximately 6.2m to facilitate construction of the new lower and middle levels.

- Drilling of a new borehole (BH1) and a desk study review of existing information indicate that the site is underlain by the Bagshot Formation and Claygate Member. Groundwater was encountered in the Claygate Member at a level that will intersect the development in the highest (northeast) part of the site.

- Some form of retaining structures and dewatering will be required in the temporary case to facilitate construction. This scheme should be designed to minimise impacts during the construction phase.

- In the permanent case, although discrete parts of the new basement will extend into the uppermost part of the identified water table, particularly in the northeast where the watertable intersects the structure, and locally where foundations and drainage are present, it is considered that the depth of penetration into the water bearing stratum will be limited and should cause no harm to groundwater flows or levels.

- The site does not lie within the vicinity of any known sensitive watercourses, wells or springlines that might be adversely affected by the proposed development.

- It is understood that there are no proposed surface cover or drainage changes that will adversely affect the hydrology or hydrogeology in the site area or result in any increased flood risk. It is understood that mandatory requirements will be met and that an appropriately qualified engineer or consultant will be engaged as the design process develops.

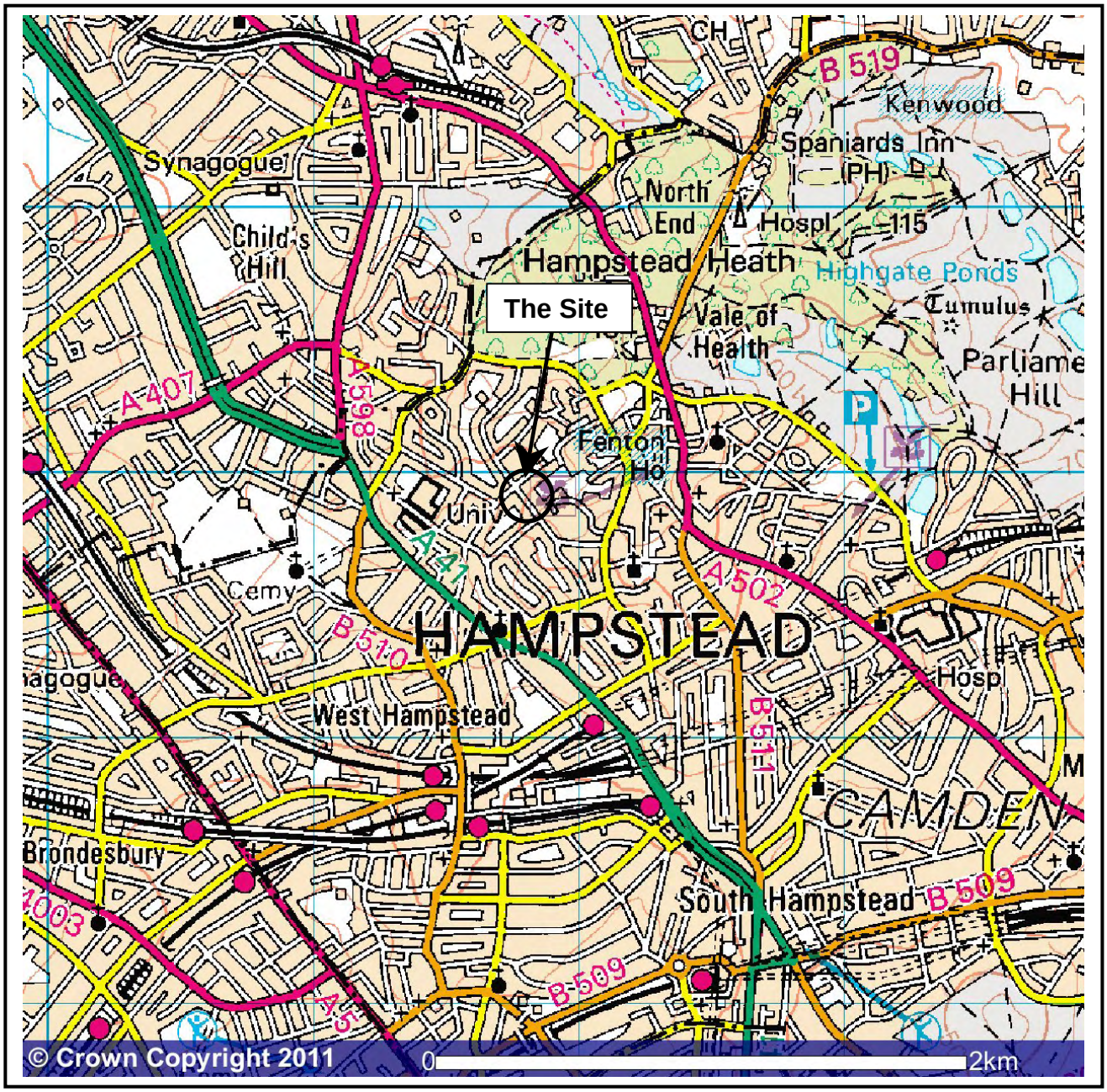
- The proposed development with require significant excavation at the site and will result in differential foundation depths between the site and adjacent properties. The potential for any ground movement can be mitigated through proper design and construction methodology.

- The proposed development is unlikely to result in any changes to slopes, surface water flow or ground water flow that could result in local ground or slope instability.

- The proposals are therefore considered to satisfy Camden's guidance on basements and other underground development.

A table summarising the screening flowcharts is shown in **Appendix B.**

FIGURES

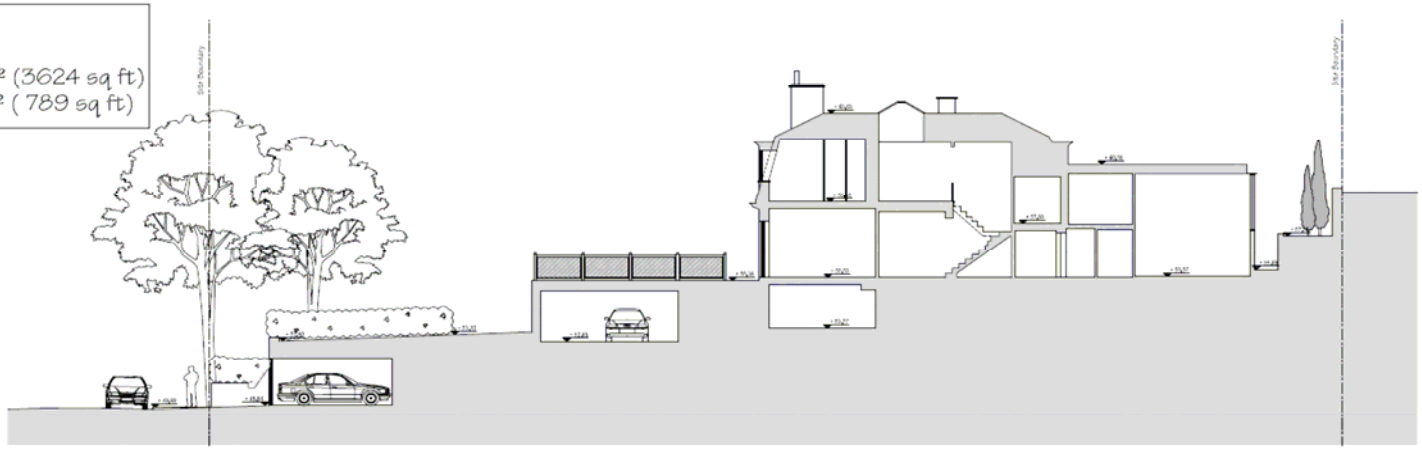


RSK	**SITE LOCATION PLAN**	**Client: Alex Midgen**	**Figure No: 1**
		Site: 18 Redington Road	**Job No: 25250-01 (01)**
		Scale: See scale bar	**Source: OS**

Proposed House
Total Gross Internal Areas
House = 588m² (6329 sq ft)
Garage Level = 323m² (3476 sq ft)

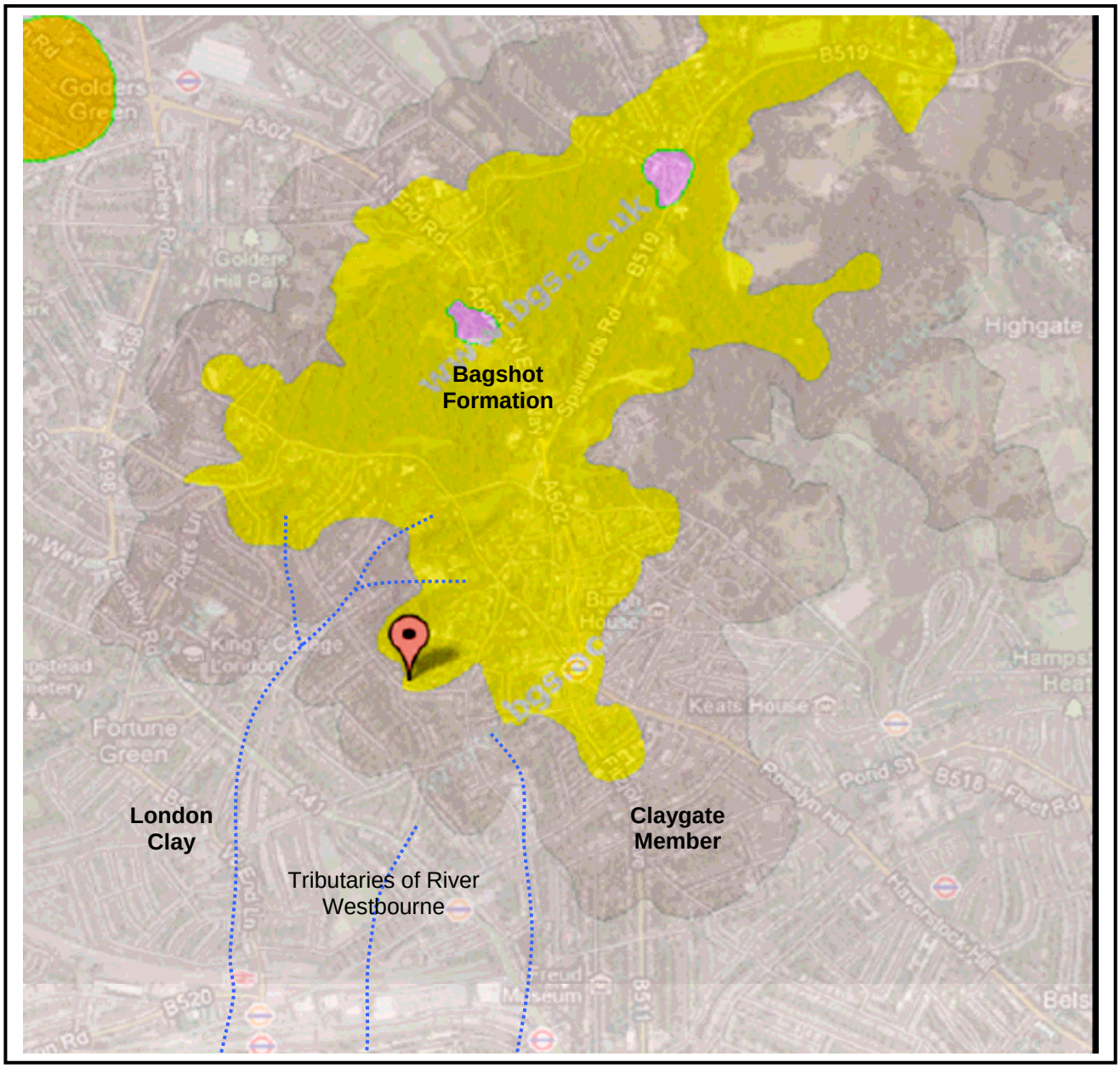
Proposed Cross Section B-B through Site
Scale 1:100 @A1

Existing House
Total Gross Internal Areas
House = 336m² (3624 sq ft)
Garages+Workshop = 73m² (789 sq ft)



Existing Cross Section A-A through Site
Scale 1:100 @A1

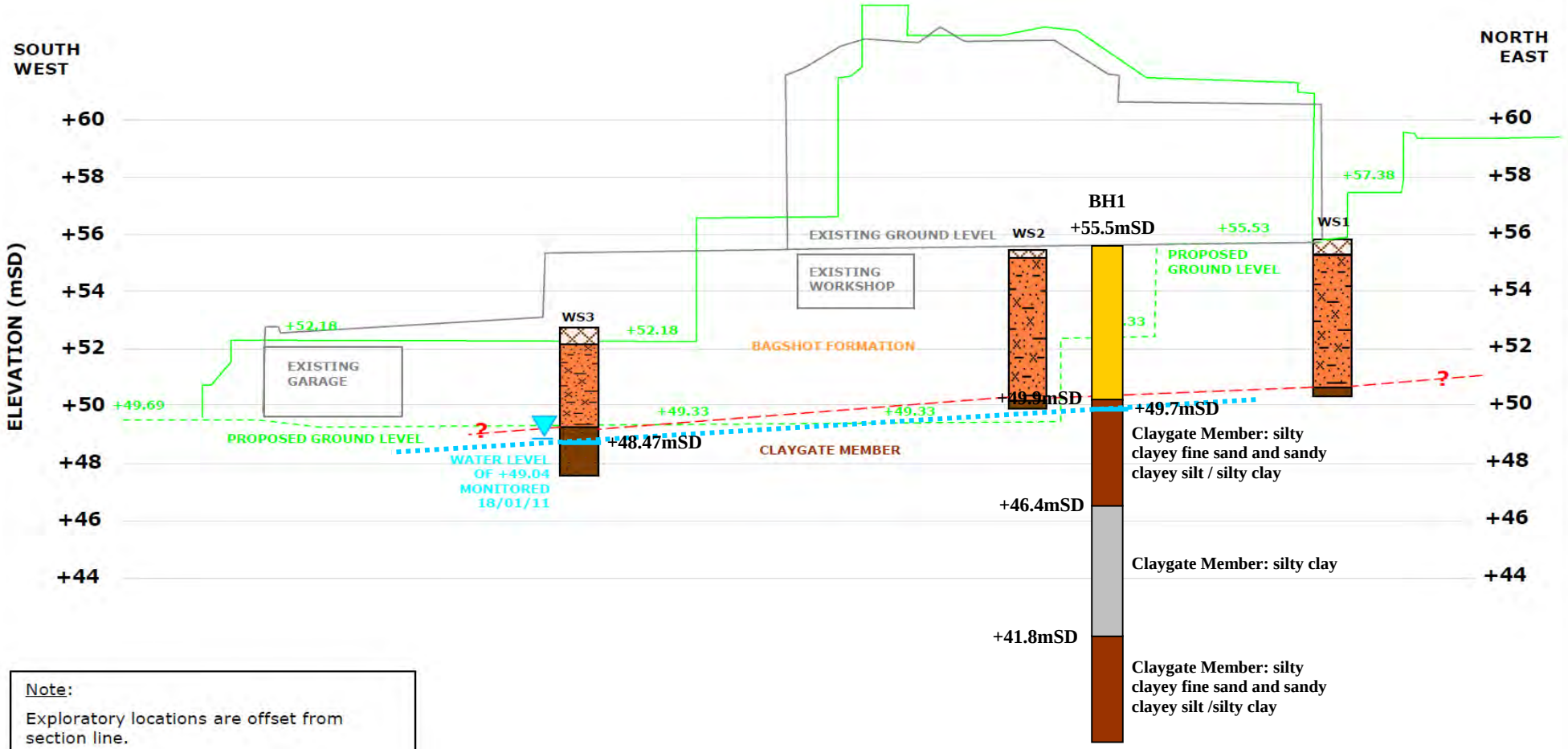
RSK	**Existing and Proposed Site Layout Section**	**Client:**	Alex Midgen	**Figure No:**	2
		Site:	18 Redington Road	**Job No:**	25250-01 (01)
		Scale:	See scale bar	**Source:**	Client



RSK	**Geology Map Extract**	**Client: Alex Midgen**	**Figure No: 3**
		Site: 18 Redington Road	**Job No: 25250-01 (01)**
		Scale: NTS	**Source: BGS**

Figure 4	18 REDINGTON ROAD, HAMPSTEAD, LONDON, W3 7RG	Report No	25250-01 (01)

INDICATIVE GEOLOGICAL CROSS SECTION



Note:

Exploratory locations are offset from section line.

Strata boundaries are indicative.

Green lines are proposed, grey existing

Approximate horizontal and vertical scale - 1:200

Topsoil / Made Ground

Bagshot Formation

Claygate Member

APPENDIX A

BH1 Borehole Log and Soil Test Certificates

BOREHOLE RECORD (Percussive)

Borehole Number: BH1

Site: 18 Redington Road

Location: 18 Redington Road

Client: Alex Midgen

Ground Level: 55.50mAOD

Date: 18 Nov 11

Job No: 25250-01

GROUND WATER | **SAMPLES/TESTS** | **STRATA RECORD** | Sheet 1 of 2

Strike	Well	Depth (m)	Depth/Type (m)	SPT 'N' or U Blows	Depth (m)	Level (mAOD)		Key	Description
			0.20 D D1				0.40		TOPSOIL: Dark-brown slightly sandy clay with roots.
			0.40-0.80 B B1		0.40	55.10			Orangey-brown mottled grey very sandy (fine) silty CLAY. (BAGSHOT FORMATION).
		1	1.10 D D2				0.90		
			1.20 SPTLSD3 S	N=20 [2,4](5,5,5,5)	1.30	54.20			Medium dense orangey-brown clayey SAND (fine) with laminae of grey and brown clay. (BAGSHOT FORMATION).
			1.80 D D4						
		2	2.20 SPTLSD5 S				2.10		
			2.40 D D6						
			2.50-3.00 B B2	N=14 [2,2](2,3,4,5)					
		3	3.20 SPTLSD7 S						
			3.40-4.00 B B3	N=12 [1,2](2,3,3,4)	3.40	52.10	0.60		Laminated orangey-brown clayey fine SAND and grey silty CLAY. (BAGSHOT FORMATION).
		4	4.00 SPTLSD8 S	N=13 [2,2](3,3,3,4)	4.00	51.50	0.50		Medium dense orangey-brown slightly clayey SAND (fine) with laminae of grey CLAY/SILT. (BAGSHOT FORMATION).
			4.50 D D9		4.50	51.00	0.40		Firm light-grey and brown sandy silty CLAY. (BAGSHOT FORMATION).
		5	5.00 SPTLSD10 S	N=10 [1,2](3,2,2,3)	4.90	50.60	0.70		Laminated light-grey and orange slightly sandy silty CLAY and silty SAND. (BAGSHOT FORMATION).
▽			5.50 D D11		5.60	49.90			Dark-brown silty very clayey fine SAND. (CLAYGATE MEMBER).
▼		6	6.20 D D12		6.20	49.30	0.60		
			6.60 SPTLSD13 S	N=11 [2,2](3,2,3,3)	6.50	49.00	0.30		Firm brown mottled orange sandy clayey SILT. (CLAYGATE MEMBER).
		7	7.00-7.50 B B4		7.00	48.50	0.50		Laminated dark-brown silty clayey SAND (fine) and sandy silty CLAY. (CLAYGATE MEMBER).
		8	8.10 SPTLSD14 S	N=13 [2,2](3,3,3,4)			2.10		Brown mottled orange very sandy silty CLAY / silty very clayey SAND. (CLAYGATE MEMBER). …becoming light-brown
			8.80 D D15						
		9	9.10 D D16		9.10	46.40			Stiff dark-grey, locally slightlysandy (fine), silty CLAY. (CLAYGATE MEMBER).
			9.50-9.95 U U1	U60					
			9.95 D D17						***Continued next sheet***

Remarks and Water Observations

Service inspection dug to 1.2m. Borehole cased with 150mm casing to 15m bgl. Water strike recorded at 5.6m bgl, rising to 4.8m, and 13.7m rising to 12.5m. Groundwater monitoring indicates water level at 5.8m bgl in upper strike and 10.6m in lower strike.

Scale: 1:50

Logged by: CG

Figure:

RSK Environment Ltd
18 Frogmore Road, Hemel Hempstead, HP3 9RT

BOREHOLE RECORD (Percussive)

Borehole Number: BH1

Site: 18 Redington Road

Location: 18 Redington Road

Client: Alex Midgen

Ground Level: 55.50mAOD

Date: 18 Nov 11

Job No: 25250-01

GROUND WATER		SAMPLES/TESTS			STRATA RECORD			
Strike	Well	Depth (m)	Depth/Type (m)	SPT 'N' or U Blows	Depth (m)	Level (mAOD)	Key	Description
			10.50 D D18					…becoming slightly sandy (fine)
		11	11.00 SPTLSD19	S N=17 [2,3](4,4,4,5)	11.20	44.30		Dark greenish-grey very sandy (fine) clayey SILT (glauconitic). (CLAYGATE MEMBER).
			11.60 D D20		11.70	43.80		Stiff dark-brownish grey, locally slightly sandy, silty CLAY. (CLAYGATE MEMBER).
		12	12.00 D D21					
			12.50-12.95U U2	U60				
		13	12.95 D D22					…becoming dark-brownish grey silty CLAY with partings of dark-green glauconitic fine sand
			13.50 D D23					
			13.80 D D24		13.70	41.80		Dark greenish-grey very sandy (fine) clayey SILT (glauconitic). (CLAYGATE MEMBER).
		14	14.00 SPTLSD25	S N=14 [1,2](2,3,4,5)	13.80	41.70		Dark-grey slightly silty very clayey SAND (fine) (CLAYGATE MEMBER).
		15	15.00 D D26		15.00	40.50		Dark-grey slightly sandy (fine) clayey SILT. (CLAYGATE MEMBER).
			15.50 SPTLSD27	S N=18 [2,2](3,4,5,6)				…becoming laminated dark-grey sandy clayey SILT with partings of pale-grey fine SAND
		16	16.20 D D28					
			16.50 SPTLSD29	S N=20 [2,2](4,5,5,6)				
		17			17.00	38.50		***End of Borehole at 17.00 m***
		18						
		19						

2.10 | 0.50 | 2.00 | 0.10 | 1.20 | 2.00

Remarks and Water Observations

Service inspection dug to 1.2m. Borehole cased with 150mm casing to 15m bgl. Water strike recorded at 5.6m bgl, rising to 4.8m, and 13.7m rising to 12.5m. Groundwater monitoring indicates water level at 5.8m bgl in upper strike and 10.6m in lower strike.

Scale: 1:50

Logged by: CG

Figure:

RSK Environment Ltd
18 Frogmore Road, Hemel Hempstead, HP3 9RT

UKAS TESTING
No 2652

Clive Geering
RSK ENVIRONMENT LIMITED
18 Frogmore Road
Hemel Hempstead
Herts
HP3 9RT

STRUCTURAL SOILS LTD

SITE INVESTIGATION

SOIL, ROCK & MATERIAL TESTING

GEOTECHNICAL CONSULTANCY

CONTAMINATED LAND ASSESSMENT

29th November 2011

TESTING REPORT

YOUR REF: 25250

SITE: 18 Redington Road

CERTIFICATE NUMBER: 581906

DATE SAMPLES RECEIVED: 23rd November 2011
DATE TESTING COMMENCED: 23rd November 2011

DATE OF SAMPLE DISPOSAL: 2nd January 2012

INSTRUCTIONS: Please carry out Moisture Content, Atterberg Limits Particle Size Distribution and Quick Undrained Triaxial tests on samples provided

I have pleasure in enclosing the test report for the above project that you submitted to us for testing.

Yours sincerely

D. Griffin

Derek Griffin
Laboratory Manager

Enc.

18 FROGMORE ROAD
HEMEL HEMPSTEAD
HERTS
HP3 9RT
TEL: 01442 416660
FAX: 01442 437550
hemel@soils.co.uk
www.soils.co.uk

HEAD OFFICE:
Bristol

BRANCH OFFICE:
Castleford
West Yorkshire

SUMMARY OF SOIL CLASSIFICATION TESTS

In accordance with clauses 3.2,4.3,4.4,5.3,5.4,7.2,8.2,8.3 of BS1377:Part 2:1990

Exploratory Position ID	Sample Ref	Sample Type	Depth (m)	Moisture Content %	Bulk Density Mg/m^3	Dry Density Mg/m^3	Particle Density Mg/m^3	Liquid Limit %	Plastic Limit %	Plasticity Index %	% <425um	Description of Sample
BH1		D	5.50	28				73	21	52	100	Yellowish brown mottled grey fine sandy CLAY
BH1		D	6.20									Dull yellowish brown mottled orangey brown sandy CLAY
BH1		D	7.00	39				49	23	26	100	Brown fine sandy CLAY
BH1		D	8.10	29				47	21	26	100	Dark yellowish brown mottled grey sandy CLAY
BH1		U	9.50	29				64	24	40	100	Brownish black CLAY
BH1		D	11.00	28				59	20	39	100	Grey CLAY
BH1		U	12.50	26				73	24	49	100	Brownish black CLAY
BH1		D	13.80									Grey mottled dark grey sandy CLAY

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Contract:

18 Reddington Road, NW3 7RG

Contract Ref:

581906

Page

of

SUMMARY OF SOIL CLASSIFICATION TESTS

In accordance with clauses 3.2,4.3,4.4,5.3,5.4,7.2,8.2,8.3 of BS1377:Part 2:1990

Exploratory Position ID	Sample Ref	Sample Type	Depth (m)	Moisture Content %	Bulk Density Mg/m^3	Dry Density Mg/m^3	Particle Density Mg/m^3	Liquid Limit %	Plastic Limit %	Plasticity Index %	% <425um	Description of Sample
BH1		D	15.00	31				51	21	30	100	Grey CLAY
BH1		D	16.20	31				55	19	36	100	Grey CLAY

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18 Reddington Road, NW3 7RG

Contract Ref:

581906

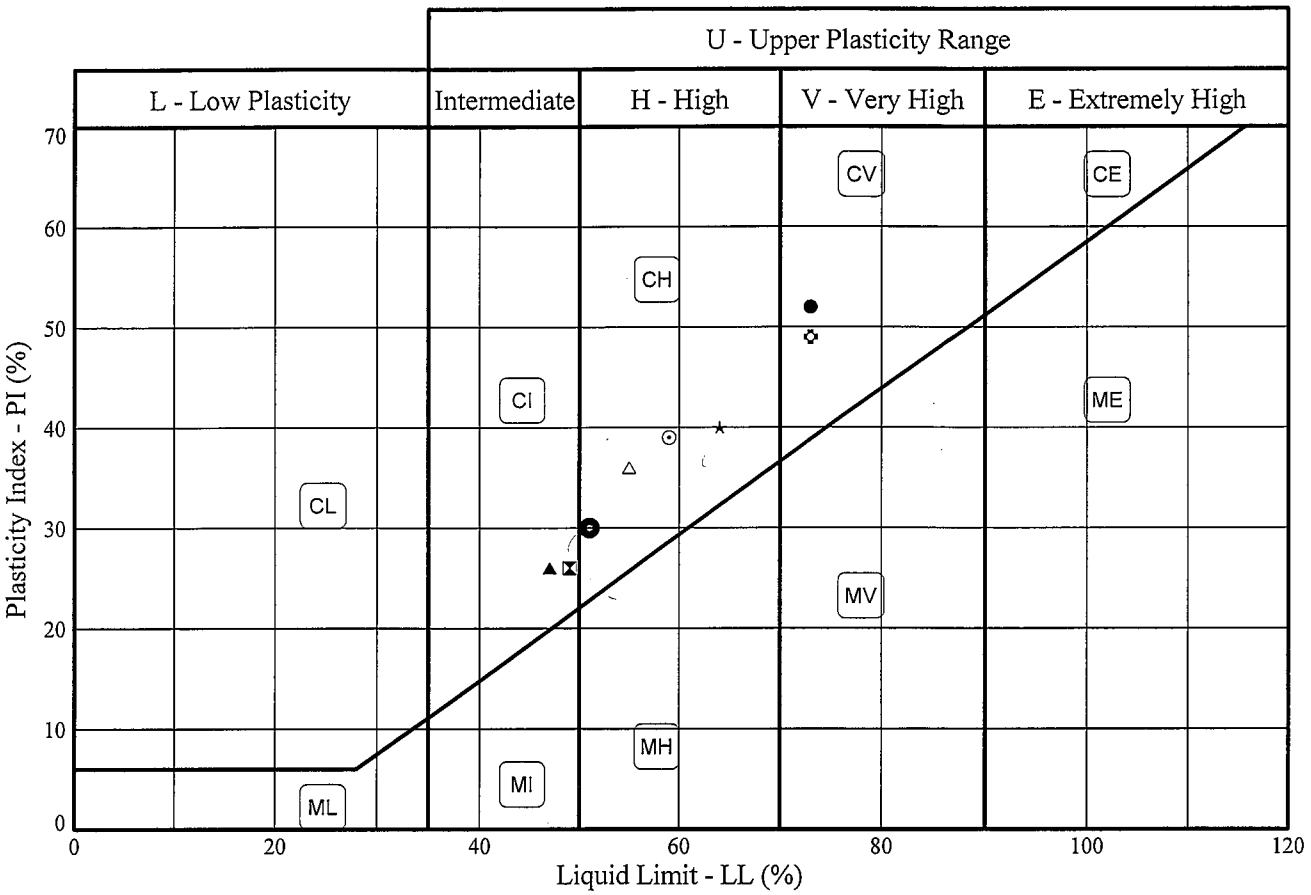
Page

of

AGS

PLASTICITY CHART - PI Vs LL

In accordance with clause 42.3 of BS5930:1981
Testing in accordance with BS1377-2:1990



Sample Identification				BS Test Method #	Preparation Method +	MC	LL	PL	PI	<425um
	Exploratory Position ID	Sample	Depth (m)			%	%	%	%	%
●	BH1	D	5.50	3.2/4.4/5.3/5.4	4.2.3	28	73	21	52	100
⧓	BH1	D	7.00	3.2/4.4/5.3/5.4	4.2.3	39	49	23	26	100
▲	BH1	D	8.10	3.2/4.4/5.3/5.4	4.2.3	29	47	21	26	100
★	BH1	U	9.50	3.2/4.4/5.3/5.4	4.2.3	29	64	24	40	100
⊙	BH1	D	11.00	3.2/4.4/5.3/5.4	4.2.3	28	59	20	39	100
✿	BH1	U	12.50	3.2/4.4/5.3/5.4	4.2.3	26	73	24	49	100
●	BH1	D	15.00	3.2/4.4/5.3/5.4	4.2.3	31	51	21	30	100
△	BH1	D	16.20	3.2/4.4/5.3/5.4	4.2.3	31	55	19	36	100

Tested in accordance with the following clauses of BS1377-2:1990.

3.2 - Moisture Content
4.3 - Cone Penetrometer Method
4.4 - One Point Cone Penetrometer Method
4.6 - One Point Casagrande Method
5.3 - Plastic Limit Method
5.4 - Plasticity Index

+ Tested in accordance with the following clauses of BS1377-2:1990.

4.2.3 - Natural State
4.2.4 - Wet Sieved

Key: * = Non standard test, NP = Non plastic.

Approved Signatories: D. GRIFFIN S. CAIRNS M. BROOKMAN

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By		Date
MBrookman	MELANIE BROOKMAN	29/11/11

Contract
18 Reddington Road, NW3 7RG

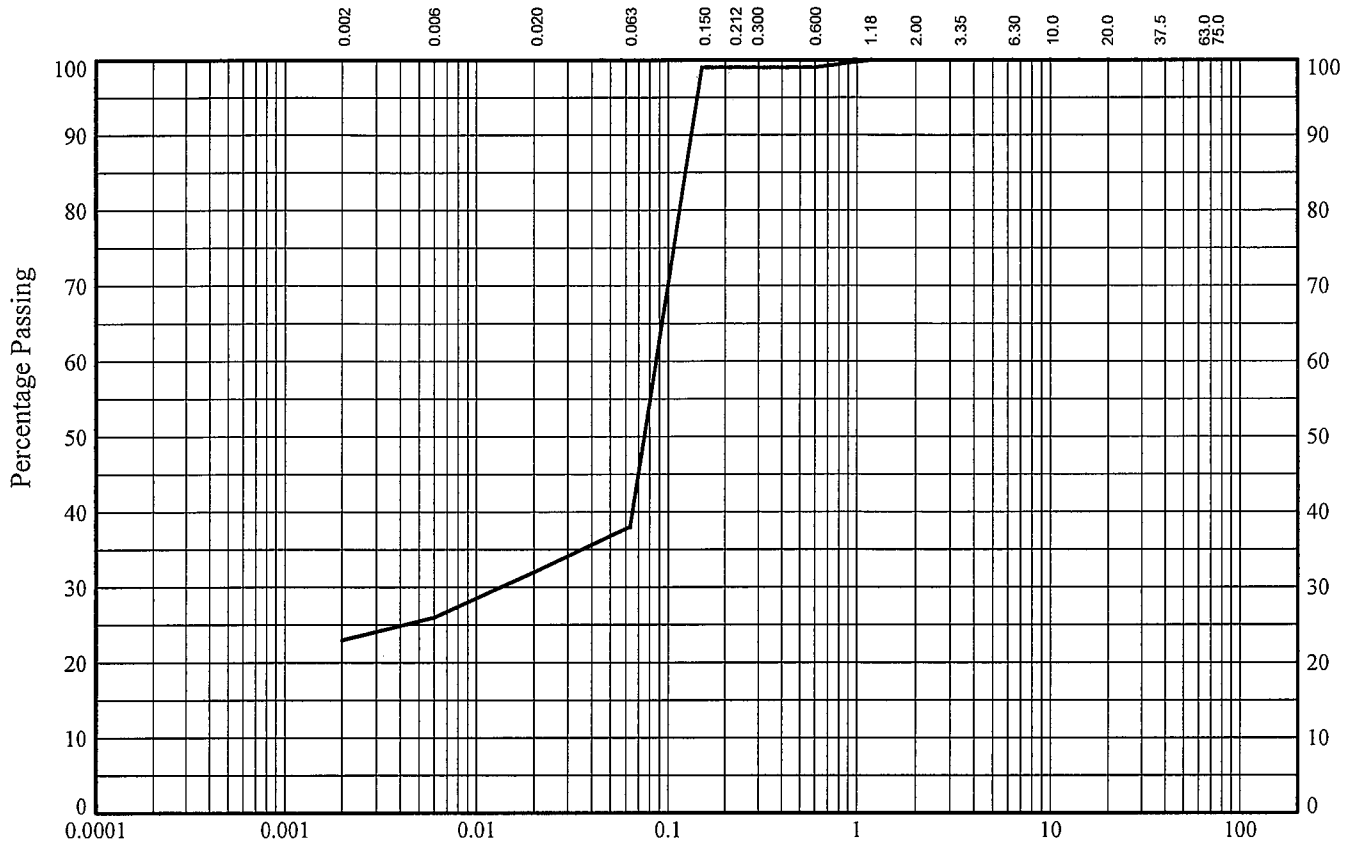
Contract Ref:
581906

Page of

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2,9.4 of BS1377:Part 2:1990

Borehole : **BH1** Sample Ref: Sample Type: **D** Depth (m): **6.20**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve (mm)	Percentage Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	99
0.425	99
0.3	99
0.212	99
0.15	99
0.063	38

Particle Diameter	Percentage Passing
0.02	**32**
0.006	**26**
0.002	**23**

Soil Fraction	Sieve Percentage
GRAVEL	**0**
SAND	**62**
SILT	**15**
CLAY	**23**

Soil Description:

Dull yellowish brown mottled orangey brown sandy CLAY

Approved Signatories: D. GRIFFIN S. CAIRNS M. BROOKMAN

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By		Date
	MELANIE BROOKMAN	29/11/11

Contract: **18 Reddington Road, NW3 7RG**

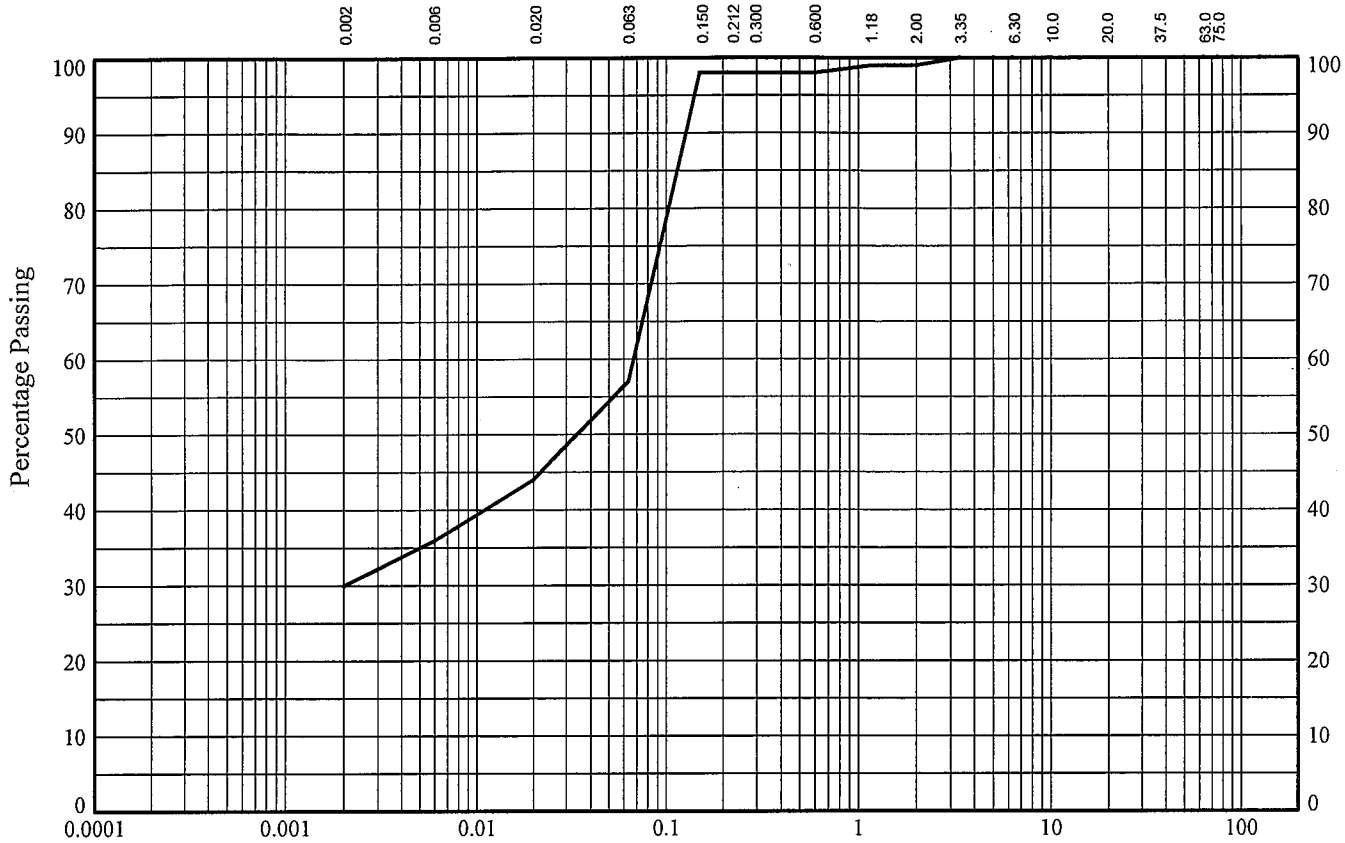
Contract Ref: **581906**

Page of

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2,9.4 of BS1377:Part 2:1990

Borehole : **BH1** Sample Ref: Sample Type: **D** Depth (m): **8.10**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve (mm)	Percentage Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	99
1.18	99
0.6	98
0.425	98
0.3	98
0.212	98
0.15	98
0.063	57

Particle Diameter	Percentage Passing
0.02	**44**
0.006	**36**
0.002	**30**

Soil Fraction	Sieve Percentage
GRAVEL	**1**
SAND	**42**
SILT	**27**
CLAY	**30**

Soil Description:
Dark yellowish brown mottled grey sandy CLAY

Approved Signatories: D. GRIFFIN S. CAIRNS M. BROOKMAN

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By		Date
	MELANIE BROOKMAN	29/11/11

Contract: **18 Reddington Road, NW3 7RG**

Contract Ref: **581906**

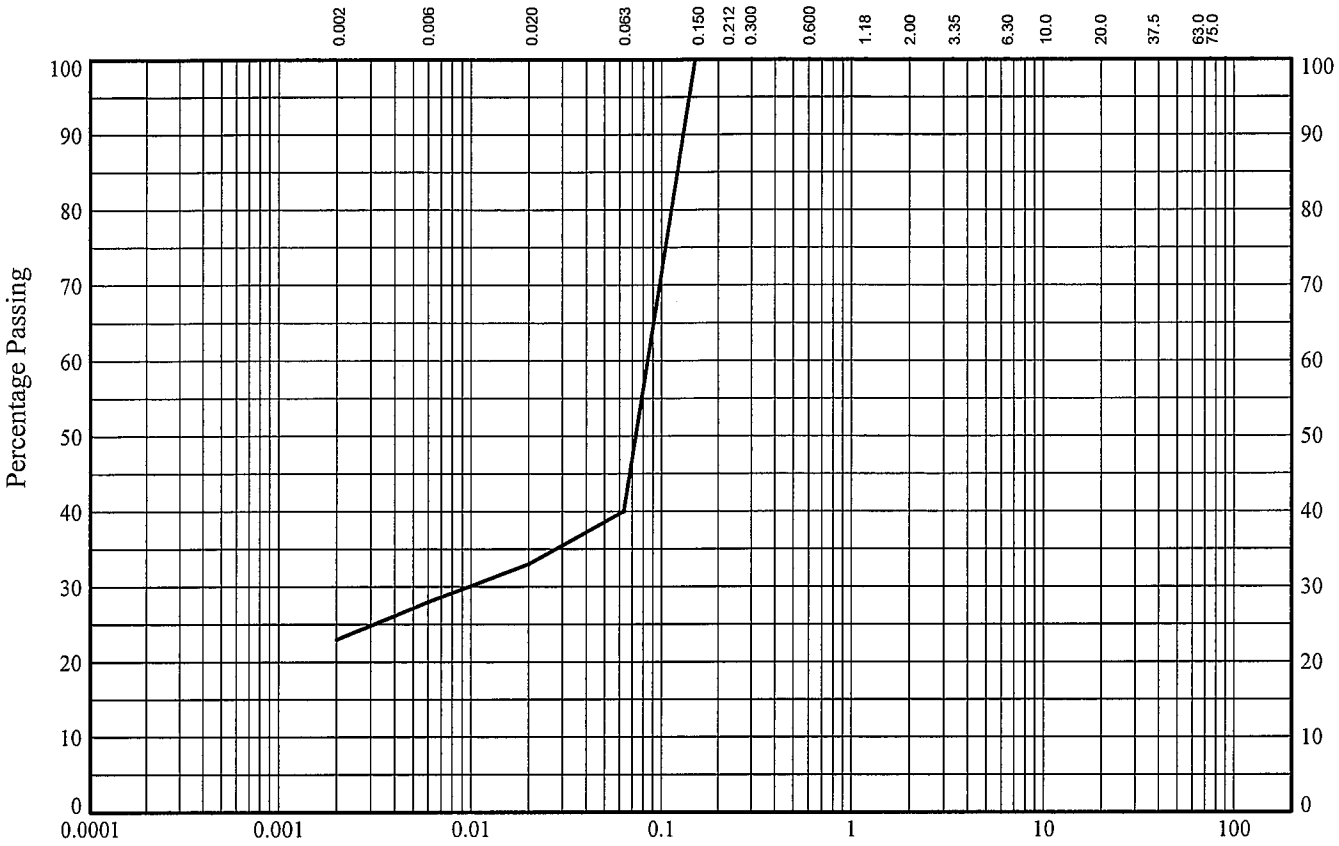
Page of

AGS

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2,9.4 of BS1377:Part 2:1990

Borehole : **BH1** Sample Ref: Sample Type: **D** Depth (m): **13.80**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve (mm)	Percentage Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	100
0.212	100
0.15	100
0.063	40

Particle Diameter	Percentage Passing
0.02	**33**
0.006	**28**
0.002	**23**

Soil Fraction	Sieve Percentage
GRAVEL	**0**
SAND	**60**
SILT	**17**
CLAY	**23**

Soil Description:
Grey mottled dark grey sandy CLAY

Approved Signatories: D. GRIFFIN S. CAIRNS M. BROOKMAN

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By		Date
MBrookman	MELANIE BROOKMAN	29/11/11

Contract: **18 Reddington Road, NW3 7RG**

Contract Ref: **581906**

Page of

AGS

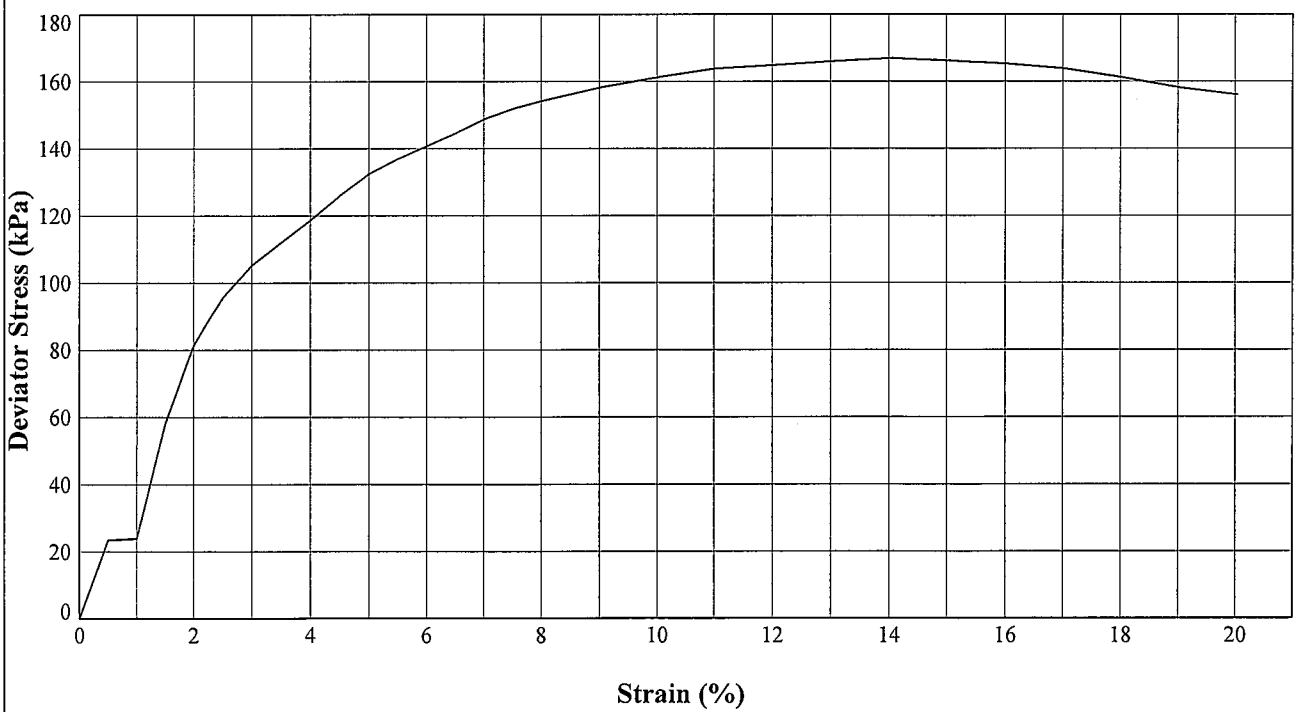
UNCONSOLIDATED QUICK UNDRAINED (SINGLE STAGE) TRIAXIAL COMPRESSION TEST

In accordance with BS1377:Part 7:1990, Clause 8

Borehole : **BH1** Sample Ref: Sample Type: **U** Depth (m): **9.50**

Description : **Brownish black CLAY**

STAGE NUMBER			1	2	3
SAMPLE DETAILS	Sample Condition		Undisturbed		
	Orientation of sample		Vertical		
	Diameter	(mm)	102.94		
	Height	(mm)	209.54		
	Moisture Content	(%)	28		
	Bulk Density	(Mg/m^3)	1.97		
	Dry Density	(Mg/m^3)	1.54		
TEST DETAILS	Membrane Thickness	(mm)	0.37		
	Rate of Axial Displacement	(%/min)	2.00		
	Cell Pressure	(kPa)	190		
	Membrane Correction	(kPa)	1.05		
	Corrected Deviator Stress	(kPa)	167		
	Undrained Shear Strength	(kPa)	84		
	Strain at Failure	(%)	14.0		
	Mode of Failure		Compound		



Approved Signatories: D. GRIFFIN S. CAIRNS M. BROOKMAN

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By		Date
	MELANIE BROOKMAN	29/11/11

Contract: **18 Reddington Road, NW3 7RG**

Contract Ref: **581906**

Page of

AGS

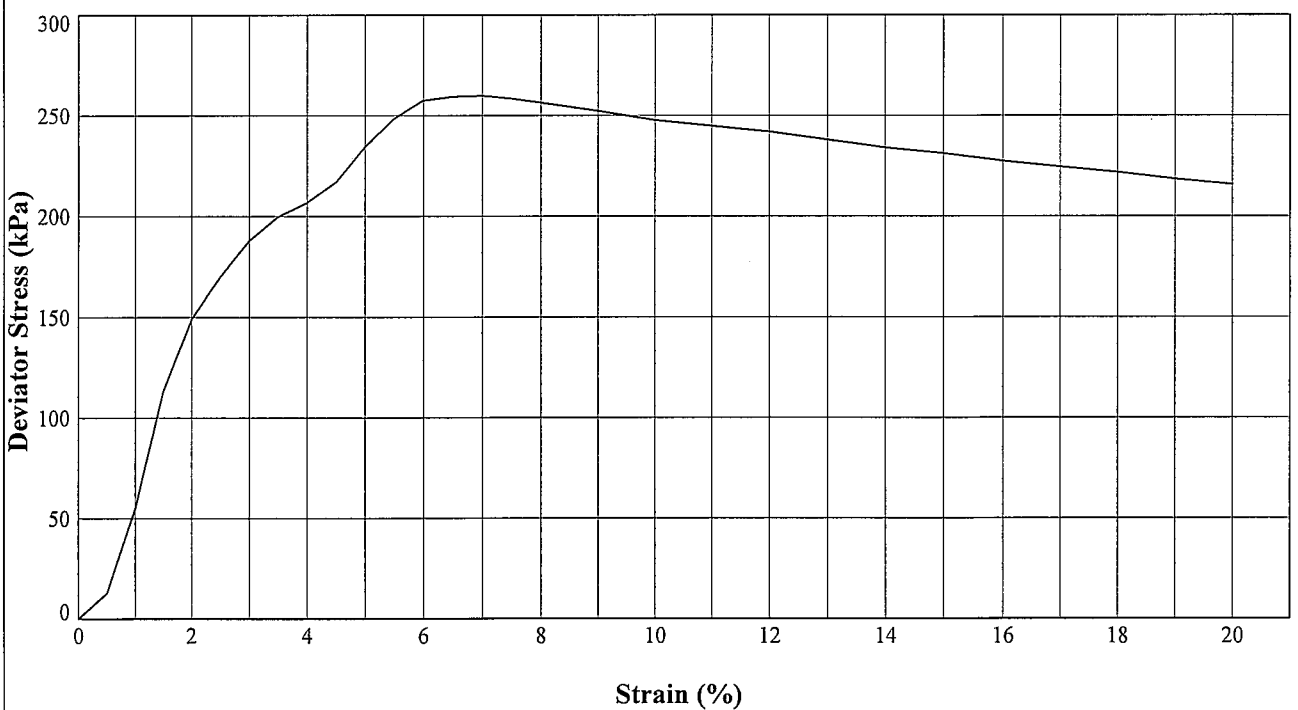
UNCONSOLIDATED QUICK UNDRAINED (SINGLE STAGE) TRIAXIAL COMPRESSION TEST

In accordance with BS1377:Part 7:1990, Clause 8

Borehole : **BH1** Sample Ref: Sample Type: **U** Depth (m): **12.50**

Description : **Brownish black CLAY**

STAGE NUMBER			1	2	3
SAMPLE DETAILS	Sample Condition		**Undisturbed**		
	Orientation of sample		**Vertical**		
	Diameter	(mm)	**102.43**		
	Height	(mm)	**210.02**		
	Moisture Content	(%)	**25**		
	Bulk Density	(Mg/m^3)	**2.00**		
	Dry Density	(Mg/m^3)	**1.60**		
TEST DETAILS	Membrane Thickness	(mm)	**0.29**		
	Rate of Axial Displacement	(%/min)	**2.00**		
	Cell Pressure	(kPa)	**250**		
	Membrane Correction	(kPa)	**0.49**		
	Corrected Deviator Stress	(kPa)	**260**		
	Undrained Shear Strength	(kPa)	**130**		
	Strain at Failure	(%)	**7.0**		
	Mode of Failure		**Brittle**		



Approved Signatories: D. GRIFFIN S. CAIRNS M. BROOKMAN

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By		Date
MBrookman	MELANIE BROOKMAN	29/11/11

Contract	Contract Ref:
18 Reddington Road, NW3 7RG	**581906**
	Page of

APPENDIX B

Summary Screening Flowcharts

Question	Answer	Evidence	Further Action Required?
Subterranean (ground water) screening flowchart			
Is the site located directly above an aquifer?	Yes	Sections 3.1.1	No (see below)
Will the proposed basement extend beneath the water table surface?	Yes	Section 3.1.2	No
Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	Yes	Section 3.1.3	No
Is the site within the catchment of the pond chains on Hampstead Heath?	No	Section 3.1.3	No
Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	No	Section 3.1.4	Engineer or consultant will be engaged as the design process develops.
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	Section 3.1.4	As above
Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath) or spring line?	No	Section 3.1.3	No

Question	Answer	Evidence	Further Action Required?
Slope stability screening flowchart			
Does the existing site include slopes, natural or manmade, greater than 7^{o}?	No	Section 3.3.1	No
Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7^{o}?	No	Section 3.3.1	No
Does the development neighbour land, including railway cuttings and the like, with a slope greater than	No	Section 3.3.1	No
Is the site within a wider hillside setting in which the general slope is greater than 7^{o}?	No	Section 3.3.1	No
Is the London Clay the shallowest stratum at the site?	No	Section 3.3.2	No
Will any tree/s 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?	Yes	Section 3.3.2	Check by structural engineer
Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	No	Section 3.3.2	No
Is the site within 100m of a watercourse or a potential spring line?	Yes	Section 3.3.1	No
Is the site within an area of previously worked ground?	No	Section 3.3.5	No
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?	Yes	Section 3.3.7	Design by structural engineer
Is the site within 50m of the Hampstead Heath ponds?	No	Section 3.3.1	No
Is the site within 5m of a highway or pedestrian right of way?	Yes	Section 3.3.8	No
Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes	Section 3.3.6	Design by structural engineer
Is the site over (or within the exclusion zone of) any tunnels?	No	Section 3.3.8	No

Question	Answer	Evidence	Further Action Required?
Surface flow and flooding screening flowchart			
Is the site within the catchment of the pond chains on Hampstead Heath?	No	Section 3.2.1	No
As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run off) be materially changed from the existing route?	No	Section 3.2.2	Engineer or consultant will be engaged as the design process develops.
Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No	Section 3.2.2	Engineer or consultant will be engaged as the design process develops.
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	Sections 3.2.1 & 3.2.2	Engineer or consultant will be engaged as the design process develops.
Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	Sections 3.2.1 & 3.2.2	No
Is the site in an area known to be at risk from surface water flooding, 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?	Yes	Section 3.2.3	Basement level intersects water table - design by structural engineer

APPENDIX C

Thames Water Information

Asset Location Search

Thames Water Property Searches
12 Vastern Road
READING
RG1 8DB

Search address supplied 18
Redington Road
London
NW3 7RG

Your reference 25250
Our reference ALS/ALS/24/2011_2132236

Search date 29 November 2011

You are now able to order your Asset Location Search requests online by visiting
www.thameswater-propertysearches.co.uk

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
F 0118 923 6655/57
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Asset Location Search

Search address supplied: 18, Redington Road, London, NW3 7RG

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

This search provides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0118 925 1504, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Tel: 0118 925 1504
Fax: 0118 923 6657

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

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Reading RG1 8DB

Asset Location Search

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0845 920 0800. The Customer Centre can

Thames Water Utilities Ltd

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Reading RG1 8DB

also arrange for a full flow and pressure test to be carried out for a fee.

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

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Asset Location Search

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clear Water Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Fax: 0118 923 6613
Email: developer.services@thameswater.co.uk

Should you require any further information regarding budget estimates, diversions or stopping up notices then please contact:

DevCon Team
Asset Investment
Thames Water
Maple Lodge STW
Denham Way
Rickmansworth
Hertfordshire
WD3 9SQ

Tel: 01923 898 072
Fax: 01923 898 106
Email: devcon.team@thameswater.co.uk

Thames Water Utilities Ltd

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No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Asset Location Search

Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact our Kew Service Desk by writing to:

Clean Water Design
Thames Water Utilities
1 Kew Bridge Road
Brentford
Middlesex
TW8 0EF

Tel: 0845 850 2777
Fax: 0208 213 8833
Email: developer.services@thameswater.co.uk

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PO Box 3189
Slough SL1 4WW

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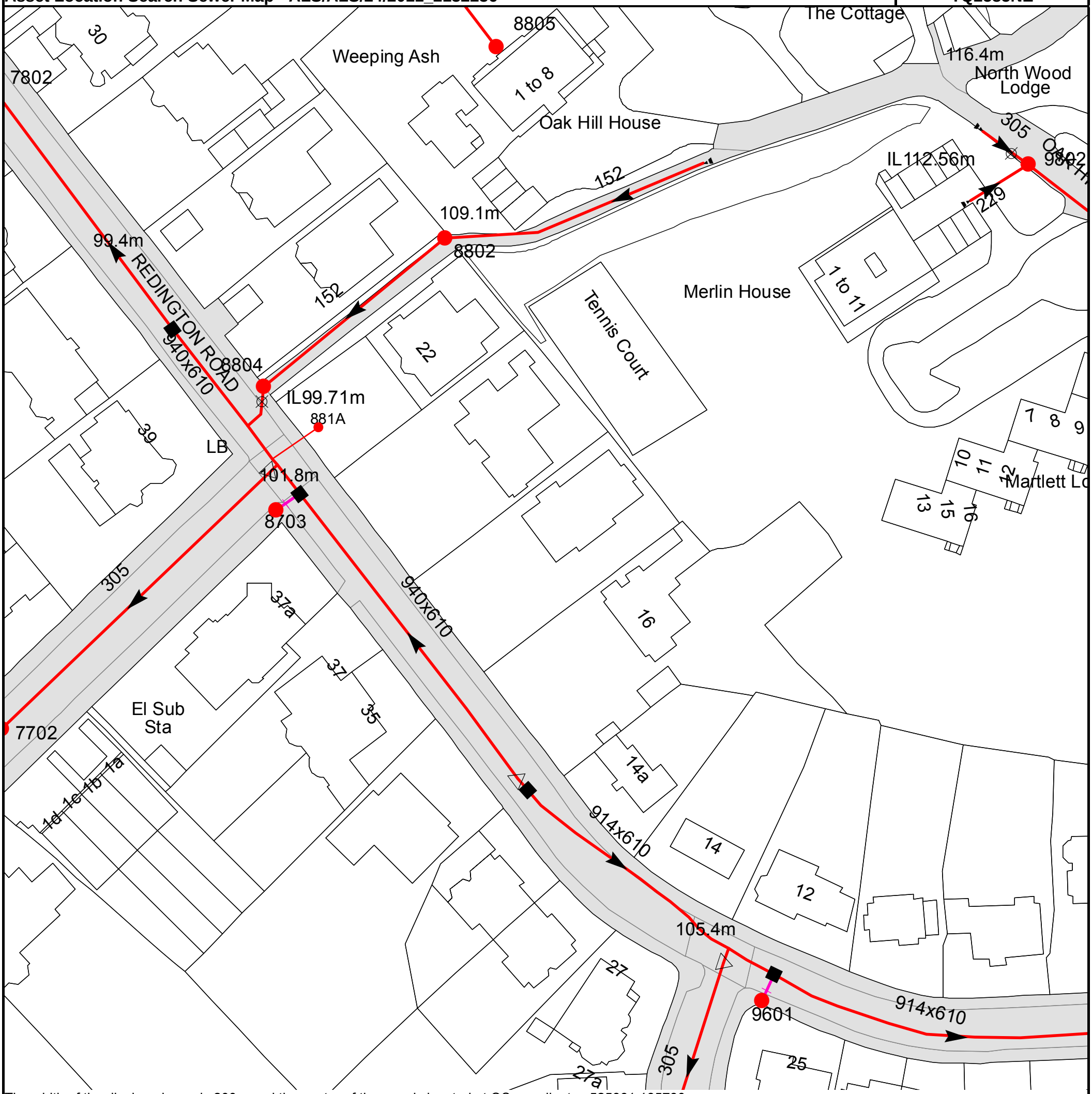
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Asset Location Search Sewer Map - ALS/ALS/24/2011_2132236	TQ2585NE



The width of the displayed area is 200m and the centre of the map is located at OS coordinates 525861,185780

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
881A	n/a	n/a
9802	116.4	112.34
8805	n/a	n/a
9601	n/a	n/a
8804	101.54	n/a
8703	n/a	n/a
-	-	-
8802	108.39	108.03

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

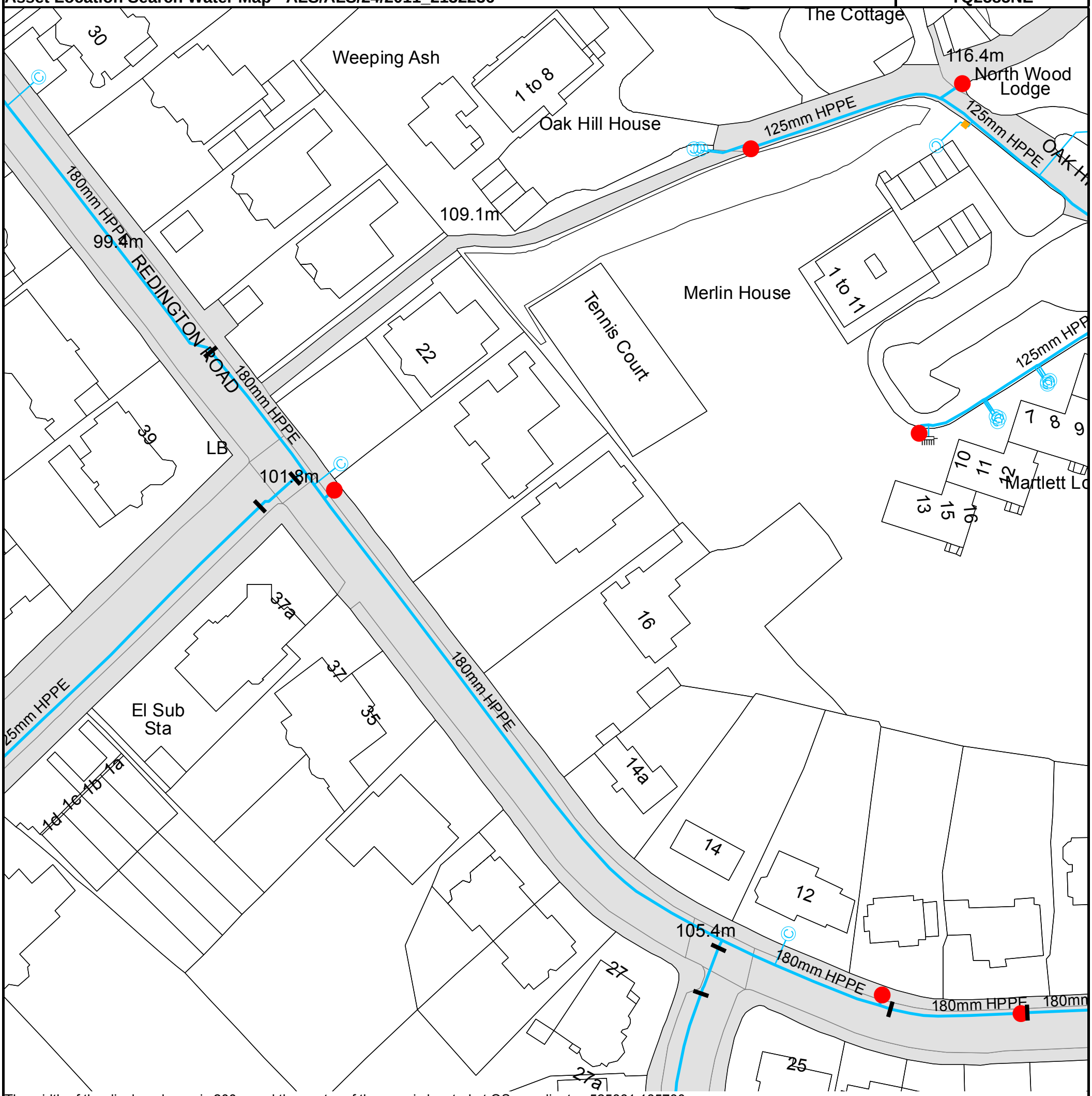
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Searches on 0118 925 1504.

Asset Location Search Water Map - ALS/ALS/24/2011_2132236	TQ2585NE



The width of the displayed area is 200m and the centre of the map is located at OS coordinates 525861,185780

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Sewer Flooding

History Enquiry

Thames Water Property Searches
12
Vastern Road
Reading
RG1 8DB

Search address supplied 18
Redington Road
London
NW3 7RG

Your reference 25250

Our reference SFH_SFH_Standard_2011_2132243

Search date **29 November 2011**

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
F 0118 923 6655/57
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

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No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Sewer Flooding

History Enquiry

Search address supplied: 18, Redington Road, London NW3 7RG

This search is recommended to check for any sewer flooding in a specific address or area

TWUL, trading as Property Searches, are responsible in respect of the following:-

(i) any negligent or incorrect entry in the records searched;

(ii) any negligent or incorrect interpretation of the records searched;

(iii) and any negligent or incorrect recording of that interpretation in the search report

(iv) compensation payments

Thames Water Utilities Ltd

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Sewer Flooding

History Enquiry

History of Sewer Flooding

Is the requested address or area at risk of flooding due to overloaded public sewers?

The flooding records held by Thames Water indicate that there have been no incidents of flooding in the requested area as a result of surcharging public sewers.

Although Thames Water does not have records of public sewer flooding within the vicinity, please be aware that property owners are not legally obliged to report this flooding to Thames Water. In addition flooding from private sewers, watercourses and highways drains are not the responsibility of Thames Water, and such incidents may not be noted in our records. We therefore strongly advise you to contact the current owners and occupiers of the premises and inquire about sewer flooding.

For your guidance:

- A sewer is “overloaded” when the flow from a storm is unable to pass through it due to a permanent problem (e.g. flat gradient, small diameter). Flooding as a result of temporary problems such as blockages, siltation, collapses and equipment or operational failures are excluded.
- “Internal flooding” from public sewers is defined as flooding, which enters a building or passes below a suspended floor. For reporting purposes, buildings are restricted to those normally occupied and used for residential, public, commercial, business or industrial purposes.
- “At Risk” properties are those that the water company is required to include in the Regulatory Register that is presented annually to the Director General of Water Services. These are defined as properties that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system more frequently than the relevant reference period (either once or twice in ten years) as determined by the Company’s reporting procedure.
- Flooding as a result of storm events proven to be exceptional and beyond the reference period of one in ten years are not included on the At Risk Register.
- Properties may be at risk of flooding but not included on the Register where flooding incidents have not been reported to the Company.
- Public Sewers are defined as those for which the Company holds statutory responsibility under the Water Industry Act 1991.
- It should be noted that flooding can occur from private sewers and drains which are not the responsibility of the Company. This report excludes flooding from private sewers and drains and the Company makes no comment upon this matter.
- For further information please contact Thames Water on Tel: 0845 9200 800 or website www.thameswater.co.uk

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
F 0118 923 6655/57
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

APPENDIX D

London Underground Information

Date 23 November 2011

Our Ref 20878-ND-8-231111

Your Ref

To Clive Gerring
RSK
CGerring@rsk.co.uk

London Underground Limited

Hello Clive,

18 Redington Road, London, NW3 7RG

Thank you for your communication of 17 November 2011.

I can confirm that London Underground has no assets within 50 metres of this area.

Should you have any further enquiries, please do not hesitate to contact me.

Nathan Darroch
Information Manager
LUL Infrastructure Protection
E-mail: nathan.darroch@tube.tfl.gov.uk
Tel: 020 7918 0016