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Your Ref:

Our Ref:

Ref: 16/25552-2
September 2016

81 AVENUE ROAD,

LONDON, NW8 6HR

BASEMENT IMPACT ASSESSMENT

Prepared for

B. K. Mirchandani

CONTENTS

1.0 INTRODUCTION

1.1 Project Objectives

The purpose of this assessment is to consider the effects of a proposed basement construction on the local slope stability, surface water and groundwater regime at the residential property at 81 Avenue Road, London, NW8 6HR.

The recommendations and comments given in this report are based on the information contained from the sources cited and may include information provided by the Client and other parties, including anecdotal information. It must be noted that there may be special conditions prevailing at the site which have not been disclosed by the investigation and which have not been taken into account in the report. No liability can be accepted for any such conditions.

This report does not constitute a full environmental audit of either the site or its immediate environs.

1.2 Planning Policy Context

The City of Westminster Council policies on basement development are set out in the Council's 'Basement Development in Westminster Supplementary Planning Document' (SPD), which was adopted by a Cabinet Member decision dated 20th October 2014.

The guidance set out in the SPD requires proposed subterranean developments to mitigate against the effects of ground and surface water flooding and to include drainage systems that do not impact neighbouring property of the site or the water environment by way of changing the groundwater regime.

This report is intended to address the issues set out in the SPD. It will review existing site investigation data and provide a preliminary assessment of the issues identified by the Site Analytical Services Limited screening process.

This report also provides an impact assessment of the geo-environmental impacts on adjacent structures and the surrounding area based on available site investigation data.

As part of this guidance a subterranean (groundwater) flow screening chart is provided. This chart follows current planning procedure for basements and lightwells adopted by other London Borough's including Camden, Kensington and Chelsea and Haringey. The completed chart in relation to this development is provided as Table 1, to this report.

1.3 Qualifications

The report has been prepared by Mr Tom Murray, a Fellow of the Geological Society (FGS) and Mr Andrew Garnham, a Fellow of the Geological Society (FGS) in coordination with Mr Mike Brice of Applied Geotechnical Engineering, a Chartered Geologist (CGEOL), Neil Smith of Applied Geotechnical Engineering, a Chartered Civil Engineer (CEng), Mr Ed Davenport of Elliott Wood Partnership Ltd and Ms Sarah Wadley of Elliott Wood Partnership Ltd.

2.0 SITE DETAILS

(National Grid Reference: TQ 270 837)

2.1 Site Location

81 Avenue Road is a residential property, located on the western side of Avenue Road, Westminster at approximate postcode NW8 6HR. The residential dwelling has two levels of accommodation; ground and first floor. The residential property comprises a front driveway, a single storey garage and a rear garden, which contains an outdoor swimming pool. The site covers an approximate area of 0.15 Hectares with the general area being under the authority of the City of Westminster Council.

The site is located on the western side of Avenue Road with residential properties to the north-west and south-east and roadways to the north-east, south-west.

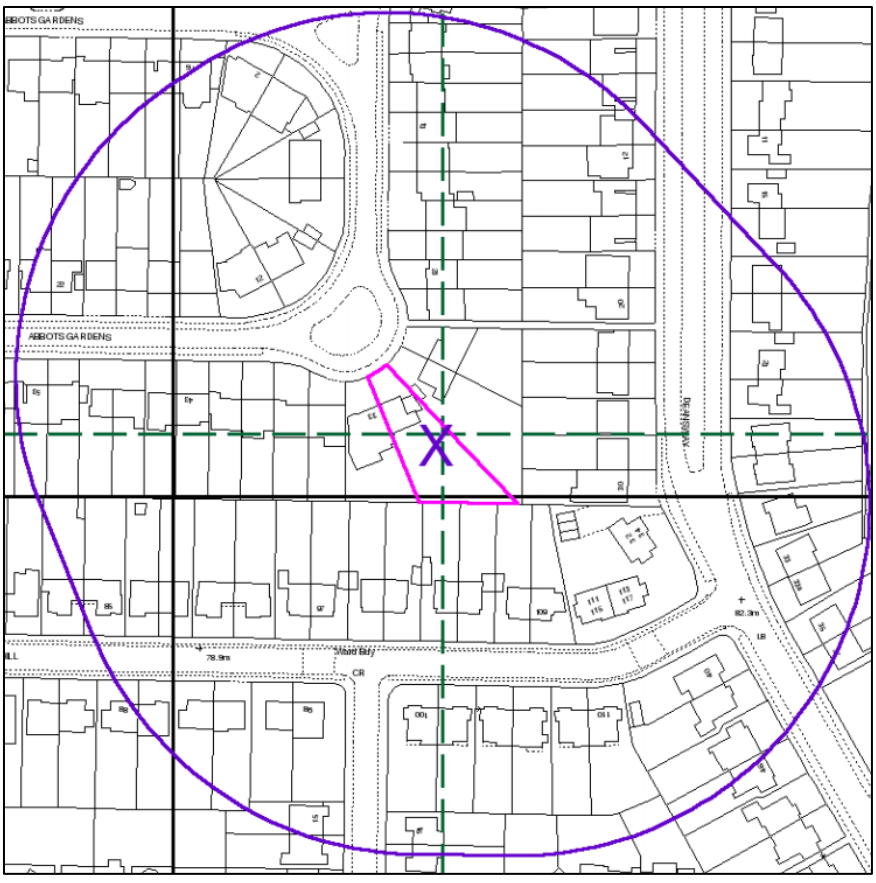


Figure 1. Site Location Plan

2.2 Site Layout and History

The site was attended on 16th August 2016 for the purposes of conducting the site walkover.

The site is accessed from Avenue Road and comprises a detached three storey residential property house with a driveway to the front and a large rear garden containing a swimming pool.

The front of the property is set mainly to paving slabs, with a small garden area between Avenue Road and the driveway.

The back garden consists of a large well-manicured lawn with flower beds and trees. There is also a large patio with a swimming pool to the rear of the house.

The existing ground level in the area of the site is believed to be broadly horizontal at an estimated level of approximately +46.4 mOD.

From the site walkover there were no obvious potentially contaminating activities on the site.

From historical map evidence it would appear that the site was first built on prior to 1871, with two periods of major changes taking place to the property between 1871-1896 and 1954-1960. The surrounding area has been residential throughout its history, though some industrial sites including a garages and electrical sub-stations have been present within the area.

2.3 Geology

The 1:50000 Geological Survey of Great Britain (England and Wales) covering the area (Sheet 256, 'North London', Solid and Drift Edition) indicates the site to be underlain the London Clay Formation.

The British Geological Survey maintains an archive of historical exploratory borehole logs throughout the UK. SAS has searched the database and have found that there are no boreholes located within 150m of the site.

- London Clay Formation: The London Clay Formation comprises clay, silt and sand and at this site location a thickness of between 70m and 100m is likely.

- Deeper strata is not of interest for this study.

Figure 2. Superficial and Bedrock geology of the Site (Ref. BGS Geoindex)

2.4 Hydrology and drainage

2.4.1 Rainfall and run-off

According to Mayes (1997) rainfall in the local area averages around 610mm and is significantly less than the national average of around 900mm.

Evapotranspiration is typically 450 mm/year resulting in about 160 mm per year as 'hydrologically effective' rainfall which is available to infiltrate into the ground or run-off as surface water flow.

According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011), the site is within 100m of a former river or watercourse, which is a tributary to The Tyburn approximately 40m east of the site. The closest surface water feature is a drain located 395m north of the site.

Figure 3. Location of site relative to the 'Lost Rivers' of London (Source: Barton, 1992)

The area located immediately around the site is highly developed with more than 80% of the surface covered with hardstanding. Most of the rainfall in the area will run-off hard surface areas and be collected by the local sewer network.

2.4.2 Drainage

Surface drainage from the site is assumed to be directed to drains flowing downhill north-west to south-east along Avenue Road.

2.4.3 Flood Risk

River or Tidal flooding

The site is currently not located within 1 kilometre of an area at risk from extreme flooding from rivers or sea without defences (Zone 2) or an area at risk from rivers or sea without defences (Zone 3). The EA's website also shows that this area does not fall within an area at risk of flooding from reservoirs.

Surface water flooding

According to Environment Agency Surface Water Flood maps of the area the site is at a low risk from surface water flooding, but there is an area of high risk approximate 50m north of the site.

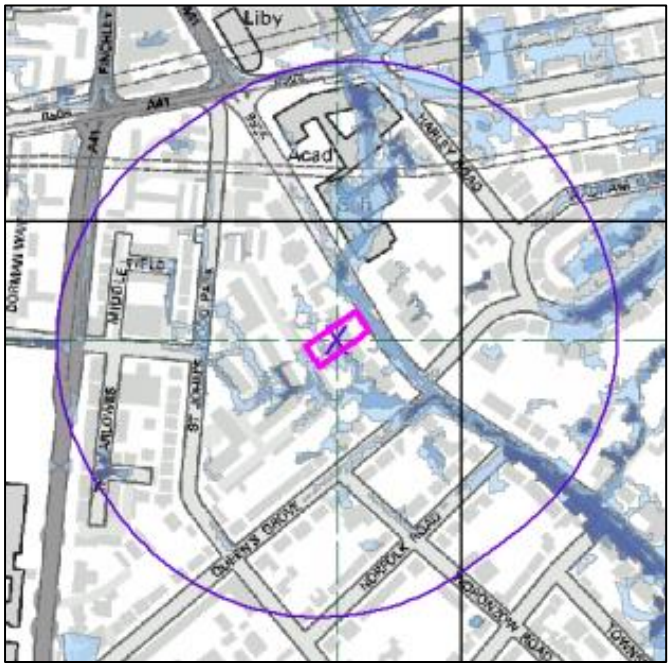


Figure 4. Extract from the Environment Agency's 'Risk of Flooding from Surface Water'. Ordnance Survey Crown copyright 2015. All rights reserved.

Sewer flooding

The London Regional Flood Risk Appraisal (2009) advises that foul sewer flooding is most likely to occur where properties are connected to the sewer system at a level below the hydraulic level of the sewage flow, which in general are often basement flats or premises in low lying areas. There is no record of sewer flooding having occurred at 81 Avenue Road and therefore the risk of sewer flooding is considered low.

2.5 Hydrogeology

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

The Bedrock geology underlying the site (London Clay) has been classified as Unproductive Strata; rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Groundwater levels within London Clay and across the site have been monitored as part of this study and the results are described in Section 4.0 below.

Other hydrogeological data obtained from the Phase 1 Preliminary Risk Assessment (PRA) (SAS Report Ref: 16/25552) for the site include:

- The underlying soil classification of the site is of high leaching potential.
- A Zone II (Outer Protection Zone) is present on-site.
- There are 4 non potable water abstraction licences within 1 kilometre of the site.
- There are 3 potable water abstraction licences within 1 kilometre of the site.
- The closest is located 381m to the north of the site with the abstraction of water for Municipal Grounds: Spray Irrigation- Direct. The permitted start date for this license is the 5th of December 2013.

2.6 Previous Reports

The results from a Phase 1 Preliminary Risk Assessment and Phase 2 Intrusive Investigation are presented under separate cover in Site Analytical Services Limited reports (Project No's. 16/25552 & 16/25552-1) dated September 2016. The findings from these reports are described in this basement impact assessment.

2.7 Proposed Development

At the time of reporting of September 2016, it is proposed to demolish the existing property and construct a new three storey dwelling with a single storey basement beneath the footprint of the property extending into the front and rear garden.

The proposed basement dig level is understood to be up to 6.95m below the garden level (39.45mOD).

2.8 Results of Basement Impact Assessment Screening

A screening process has been undertaken for the site and the results are summarised in Table 1 below:

Table 1: Summary of screening results

Item	Description	Response	Comment
Sub-terranean (Ground water Flow)	1a. Is the site located directly above an aquifer.	No	The site has been classified as being situated above an unproductive (negligibly permeable) formation (London Clay) that is generally regarded as containing insignificant quantities of groundwater.
	1b. Will the proposed basement extend beneath the water table surface.	Unknown – to be confirmed by Ground Investigation	Given the presence of a non-aquifer below the site it is unlikely that groundwater will be encountered during any excavations for the proposed basement, however this will be confirmed by the ground investigation.
	2. Is the site within 100m of a watercourse, well (used / disused) or potential spring line.	Yes	According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011), the site is within 100m of a former river or watercourse, which is a tributary to The Tyburn approximately 40m east of the site. The closest surface water feature is a drain located 395m north of the site. From the British Geological Society 'Geoindex' the nearest water well is located approximately 4550m east of the site.
	3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas.	No	The amount of hardstanding on-site is not expected to change.
	4. As part of site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS).	No	Existing drainage paths are to be utilised where possible. Whether soakaways/SUDS are used on the proposed development is to be confirmed (beyond the scope of this report). An appropriately qualified engineer should be engaged to ensure mandatory requirements are met.
	5. 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 or spring line.	Yes	According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011), the site is within 100m of a former river or watercourse, which is a tributary to The Tyburn approximately 40m east of the site. The closest surface water feature is a drain located 395m north of the site. From the British Geological Society 'Geoindex' the nearest water well is located approximately 4550m east of the site.

Item	Description	Response	Comment
Slope Stability	1. Does the existing site include slopes, natural or man-made greater than 7 degrees (approximately 1 in 8).	No	The site is essentially flat.
	2. Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7 degrees (approximately 1 in 8).	No	Re-profiling of landscaping at the site is not proposed.
	3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately 1 in 8).	No	The surrounding area is essentially flat.
	4. Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately 1 in 8).	No	There is a general slope across the surrounding area from north-west to south-east towards the Thames Basin, but this is less than 1 in 8.
	5. Is the London Clay the shallowest strata at the site.	Yes	With reference to available BGS records, the London Clay Formation is expected to be encountered from ground level.
	6. Will any trees be felled as part of the development and/or are any works proposed within any tree protection zones where trees are to be retained.	No	It is understood that no trees are to be felled as part of the development.
	7. Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site.	Yes	The site lies above the London Clay Formation well known as having a high tendency to shrink and swell.
	8. Is the site within 100m of a watercourse or a potential spring line.	Yes	According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011), the site is within 100m of a former river or watercourse, which is a tributary to The Tyburn approximately 40m east of the site. The closest surface water feature is a drain located 395m north of the site. From the British Geological Society 'Geoindex' the nearest water well is located approximately 4550m east of the site.
	9. Is the site within an area of previously worked ground.	No	According to the records held by the BGS the site is not underlain by any worked ground, made ground, infilled ground or landscaped ground
	10. Is the site within an aquifer. If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction.	No	The site has been classified as being situated above an unproductive (negligibly permeable) formation (London Clay) that is generally regarded as containing insignificant quantities of groundwater.

Item	Description	Response	Comment
	11. Is the site within 5m of a highway or pedestrian right of way.	Yes	The site lies within 5m of Avenue Road.
	12. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties.	Unknown – to be confirmed by Ground Investigation	The site is surrounded by No. 83 Avenue Road to the north and No.79 Avenue Road to the south. For the purposes of this assessment it is assumed that Nos. 83 and 79 has a basement structure much like that of No. 81.
	13. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines.	Unknown / outside scope of report	A full statutory service search was outside the scope of this report and must be completed prior to any excavations.
Surface Water and Flooding	1. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route.	No	The amount of hardstanding on-site is not changing therefore surface water will not be impacted by the development.
	2. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas.	No	The amount of hardstanding on-site is not expected to increase.
	3. 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	As no changes are occurring above the ground, surface water will not be impacted by the development.
	4. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses.	No	As no changes are occurring above the ground at the location of the basement, surface water will not be impacted by the development.
	5. Is the site in an area known to be at risk from surface water flooding.	Yes	According to Environment Agency Surface Water Flood Risk Assessment and Figure 4 from Westminster's SPD document (2014) the site is at low risk from surface water flooding.

The Screening Exercise has identified the following potential issues which will be carried forward to the Scoping Phase

Subterranean Groundwater Flow

- Will the proposed basement extend beneath the water table surface?
- Is the site within 100m of a watercourse, well (used / disused) or potential spring line?
- 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 or spring line?

Slope Stability

- Is the London Clay the shallowest strata at the site?
- Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?
- Is the site within 100m of a watercourse or a potential spring line?
- Is the site within 5m of a highway or pedestrian right of way?
- Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?

Surface water and flooding

- Is the site in an area known to be at risk from surface water flooding?

3.0 SCOPING PHASE

This purpose of the scoping phase is to assess in more detail the factors to be investigated in the impact assessment. Potential impacts are assessed for each of the identified impact factors and recommendations are stated.

A conceptual ground model is usually complied at the scoping stage however, because the ground investigation has already been undertaken for this project, the conceptual ground model including the findings of the ground investigation is described under Chapter 4.

Subterranean (Groundwater Flow)

Potential Issue (Screening Question)		**Potential impacts and actions**
1b	Will the proposed basement extend beneath the water table surface?	**Potential impact:** Local restriction of groundwater flows (perched groundwater or below groundwater table). **Action:** Ground investigation required, the review.
2	Is the site within 100m of a watercourse, well (used / disused) or potential spring line?	**Potential impact:** The flow from a spring, well or watercourse may increase or decrease if the groundwater flow regime is affected by the proposed basement **Action:** Review hydrogeology of the site and undertake a ground investigation.

Slope Stability

Potential Issue (Screening Question)		**Potential impacts and actions**
5	Is the London Clay the shallowest strata at the site?	**Potential impact:** The London Clay is prone to seasonal shrink-swell (subsidence and heave). **Action:** Ground investigation required, the review.
7	Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?	**Potential Impact:** Ground movements will occur during and after the basement construction. **Action:** Ground investigation required, then review.
8	Is the site within 100m of a watercourse or a potential spring line?	**Potential impact:** The flow from a spring, well or watercourse may increase or decrease if the groundwater flow regime is affected by the proposed basement **Action:** Review hydrogeology of the site and undertake a ground investigation.
11	Is the site within 5m of a highway or a pedestrian right of way?	**Potential impact:** Excavation of basement causes loss of support to footway/highway and damage to the services beneath them. **Action:** Ensure adequate temporary and permanent support by use of best practice working methods.

Potential Issue (Screening Question)		Potential impacts and actions
12	Will the proposed basement substantially increase the differential depth of foundations relative to neighbouring properties?	**Potential impact:** Loss of support to the ground beneath the new foundations to neighbouring properties if basement excavations are inadequately supported. **Action:** Ensure adequate temporary and permanent support by use of best practice methods.

Subterranean (Surface Water Flooding)

Potential Issue (Screening Question)		Potential impacts and actions
5	Is the site in an area known to be at risk from surface water flooding?	**Potential impact**: Flooding occurs during the excavation of the basement get flooded following construction **Action**: A groundwater exception test should be carried out prior to any construction works.

These potential impacts have been further assessed through the ground investigation, as detailed in Section 4 below.

4.0 EXISTING SITE INVESTIGATION DATA

4.1 Records of site investigations

Ground conditions at the site were investigated by Site Analytical Services Limited in August and September 2016 (Report Reference 16/25552-1). The ground conditions revealed by the investigation are summarised in the following table.

Strata	Depth to top of strata (mbgl)	Level to top of strata (mOD)	Depth to base of strata (mbgl)	Level to base of strata (mOD)	Description
Made Ground	0.00	46.43 to 46.35	0.60 to 1.60	45.83 to 44.80	Stone slabs and concrete over silty sandy clay containing brick and concrete fragments.
Superficial Head Deposits	0.60 to 1.60	45.83 to 44.80	3.20 to 3.50	43.20 to 42.93	Firm silty sandy gravelly clay.
London Clay Formation	3.20 to 3.50	43.20 to 42.93	15.00 (base of boreholes)	31.43 to 31.35	Stiff becoming very stiff silty sandy clay with gypsum crystals.

Table A: Summary of Ground Conditions in Exploratory Holes

Groundwater was not encountered in the boreholes and the soils remained essentially dry throughout.

It must be noted that the speed of excavation is such that there may well be insufficient time for further light seepages of groundwater to enter the borehole and hence be detected, particularly within more cohesive soils.

Isolated pockets of groundwater may also be present perched within any less permeable material found at shallower depth on other parts of the site especially within any Made Ground.

Groundwater was not subsequently encountered within the monitoring standpipes within Boreholes 1 and 2, but was encountered at a depth of 2.30mbgl (44.13mOD) within the standpipe in BH3 after a period of approximately three weeks.

It should be noted that the comments on groundwater conditions are based on observations made at the time of the investigation (August and September 2016) and that changes in the groundwater level could occur due to seasonal effects and also changes in drainage conditions.

5.0 FOUNDATION DESIGN

5.1 General

At the time of reporting, September 2016, it is proposed to demolish the existing property and construct a new three storey dwelling with a single storey basement beneath the footprint of the property extending into the front and rear garden.

The proposed basement dig level is understood to be up to 6.95m below the garden level (39.45mOD).

5.2 Site Preparation Works

The main contractor should be informed of the site conditions and risk assessments should be undertaken to comply with the Construction Design Management (CDM) regulations. Site personnel are to be made aware of the site conditions. It is recommended that extensive searches of existing man-made services are undertaken over the site prior to final design works.

5.3 Conventional Spread Foundations

A result of the inherent variability of uncontrolled fill, (Made Ground) is that it is usually unpredictable in terms of bearing capacity and settlement characteristics. Foundations should therefore, be taken through any Made Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.

Based on the ground and groundwater conditions encountered in the boreholes and trial pit, it should be possible to support the proposed new development on conventional strip or basement raft foundations taken down below the Made Ground and any weak superficial soils and placed in the natural firm sandy silty clay deposits which occur at depths of between approximately 3.20m (43.20mOD) and 3.50m (42.93mOD) below ground level over

the site. Foundations should be placed in the natural deposits at a minimum depth of 1.00m below final ground level in order to avoid the zone affected by seasonal moisture content changes.

Using theory from Terzaghi (1943), for the proposed depth of the basement, then strip foundations placed within natural soils may be designed to allowable net bearing pressures of approximately 295kN/m^2 at 5.00m depth increasing to 320kN/m^2 at 7.00m depth in order to allow for a factor of safety of 2.5 against general shear failure. The actual allowable bearing pressure applicable will depend on the form of foundation, its geometry and depth in accordance with classical analytical methods, details of which can be obtained from "Foundation Design and Construction", Seventh Edition, 2001 by M J Tomlinson (see references) or similar texts.

Any soft or loose pockets encountered within otherwise competent formations should be removed and replaced with well compacted granular fill.

In addition, foundations may need to be taken deeper should they be within the zones of influence of both existing or recently felled trees and any proposed tree planting. The depth of foundation required to avoid the zone likely to be affected by the root systems of trees is shown in the recommendations given in NHBC Standards, Chapter 4.2, April 2010, "Building near Trees" and it is considered that this document is relevant in this situation.

5.4 Piled Foundations

In the event that the use of conventional spread foundations proves either impracticable or uneconomical due to the size and depth of foundation required, then a piled foundation will be required. In these ground conditions, it is considered that some form of bored and in-situ cast concrete piled foundation with reinforced concrete ground beams should prove satisfactory.

The construction of a piled foundation is a specialist activity and the advice of a reputable contractor, familiar with the type of soil and groundwater conditions encountered at this site should be sought prior to finalising the foundation design. The actual pile working load will depend on the particular type of pile chosen and method of installation adopted.

To achieve the full bearing value a pile should penetrate the bearing stratum by at least five times the pile diameter.

Where piles are to be constructed in groups the bearing value of each individual pile should be reduced by a factor of about 0.8 and a calculation made to check the factor of safety against block failure.

Driven piles could also be used and would develop much higher working loads approximately 2.5 to 3 times higher than bored piles of a similar diameter at the same depth. However, the close proximity of adjacent buildings will in all probability preclude their use due to noise and vibration.

5.5 Retaining Walls

5.5.1 General

Several methods of retaining wall construction could be considered. These may include retaining structures cast in an underpinning sequence, or the use of temporary or sacrificial works to facilitate the retaining structure's construction. The excavation of the basement must not compromise the integrity of adjacent structures.

The full design of temporary and permanent retaining structures is beyond the scope of this report. However, the following design parameters for each element of soil recorded in the relevant exploratory holes are provided in Table B below to assist the design of these structures.

Stratum	**Depth to top (m)**	**Bulk Density (Mg/m3) (ɣ)**	**Effective Angle of Internal Friction (Φ)**
Superficial Head Deposits	0.60 to 1.60	2.00	28
London Clay Formation	3.20 to 3.50	2.00	21

Table B. Retaining Wall Design Parameters

The designer should use these parameters to derive the active and passive earth pressure coefficients ka and kp. The determination of appropriate earth pressure coefficients, together with factors such as the pattern of the earth pressure distribution, will depend upon the type/geometry of the wall and overall design factors.

5.6 Chemical Attack on Buried Concrete

The results show the soil samples tested to have water soluble sulphate contents up to 2.39g/litre associated with near neutral pH values.

In these conditions, it is considered that deterioration of buried concrete due to sulphate or acid attack is likely to occur. The final design of buried concrete according to Tables C1 and C2 of BRE Special Digest 1:2005 should be in accordance with Class DS-3 conditions.

In addition, segregations of gypsum were noted within the London Clay Formation. Consequently, it is considered that any buried concrete at depth may be attacked by such sulphates in solution and that it would be prudent to design any such concrete in accordance with full Class DS-3 conditions.

6.0 BASEMENT IMPACT ASSESSMENT

6.1 Summary

The screening identified a number of potential impacts. The table below summarises the previously identified potential impacts and the additional information that is now available from the site investigation in consideration of each impact.

Potential Impact	Site Investigation conclusions	Impact sufficiently addressed without further justification?
The proposed basement extends beneath the water table surface.	Groundwater was not subsequently encountered within the monitoring standpipes within Boreholes 1 and 2, but was encountered at a depth of 2.30mbgl (44.13mOD) within the standpipe in BH3 after a period of approximately three weeks. It is likely that the water encountered within the standpipe of BH2 is not representative of the true groundwater level and is likely caused by perched water from the Made Ground or surface water infiltration.	Yes
The site is within 100m of a watercourse, well (used / disused) or potential spring line	The site lies within 40m of the one of the tributaries of the former River Tyburn.	No – see below for further details.
The lowest point of the proposed excavation is close to, or lower than, the mean water level in any local pond or spring line		
There a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site.	The London Clay was proven below the site and was recorded as having a high susceptibility to shrinkage and shrinkage. However, the base of proposed basement will extend well below the potential depth of root action.	Yes
The site is within 5m of a highway or pedestrian right of way.	The proposed basement is not to be extended below Avenue Road and therefore it is suggested that the impact on these access roads is likely to be minimal. There is nothing unusual in the proposed development that would give rise to any concerns with regard to the stability of public highways.	Yes.
The proposed basement will significantly increase the differential depth of foundations relative to neighbouring properties.	The development will result in the extension of the foundation depth of the basement relative to neighbouring properties.	No – see below for further details.
The site is in an area known to be at risk from surface water flooding.	There is a potential risk of surface water following the construction.	No – see below for further details.

6.2 Outstanding Risks and Issues

The significant impacts which require further information have been described in detailed below in order to assess the likelihood of them occurring and the scope for reasonable engineering mitigation.

a. The site is within 100m of a watercourse, well (used / disused) or potential spring line & the lowest point of the proposed excavation is close to, or lower than, the mean water level in any local pond or spring line

As noted, there are no watercourses in the vicinity of the site.

The site is within a densely developed urban area, with a number of barriers to overland flow created by the existing residential development (i.e. the building footprint and the walls around the perimeter of the site).

Current information suggests that Fitzjohns Avenue marks the route of the River Tyburn, a former watercourse that has become lost through culverting and urban development of the catchment.

Assuming the watercourse exists in the area within a culverted section, this would flow southwards following the slope along Fitzjohns Avenue towards the River Thames. In an extreme flood event, the highway provides an open - and largely unobstructed - flow route.

The proposed basement development is located to the rear (west) side of the existing property and would be outside the extent of any such flow route. As such, no overland pathways to or from this feature exist across the site.

b. The proposed basement will significantly increase the differential depth of foundations relative to neighbouring properties.

The excavation and construction of the basement at the site has the potential to cause some movements in the surrounding ground if not properly managed. However, it is understood that ground movements and/or instability will be managed through the proper design and construction of mitigation measures during the works. This will require close collaboration with the appointed contractor's temporary works coordinator.

The Party Wall Act (1996) will apply to this development because neighbouring houses lie within a defined space around the proposed building works. The party wall process should be followed and adhered to during this development.

A monitoring plan should be set out at design stage and should include a monitoring strategy, instrumentation and monitoring plans and action plans. Trigger levels on movements will need to be defined. Precise levelling or reflective survey targets should be installed at the garden walls and neighbouring buildings. Monitoring should take place in advance of the proposed works as a base-line survey, during the works and for a period following the completion of the works, to understand the long term effects.

c. The site is in an area known to be at risk from surface water flooding.

Although the modelling of the site by the Environment Agency shows a 'Low' risk of flooding for No. 81, Westminster's SPD document (2014) indicates Avenue Road as a hotspot zone for surface water flooding.

In applying the Exception Test and assessing the risk associated with surface water and sewer flooding the following is considered:

- The proposed basement construction does not change the impermeable proportion at the site (this remains essentially the same). As such, the basement will not have an adverse impact on the site's surface water run-off.

- At the time of writing this report, the drainage details had not been finalised; however it is our understanding that the drainage details will incorporate a pumping device to protect the property from sewer flooding.

The proposed development will not increase flood risk at the site or the surrounding area. Also since the development is on already developed land, it will not adversely impact the Council's sustainability objectives.

7.0 BIA CONCLUSIONS

1. At the time of reporting of September 2016, it is proposed to demolish the existing property and construct a new 3 storey dwelling with a single storey basement beneath the footprint of the property extending into the front and rear garden.

   The proposed basement dig level is understood to be up to 6.95m below the garden level (39.45mOD).

2. Conditions at the site were investigated by Site Analytical Services Limited in August and September 2016 (SAS Report Reference 16/25552-1). The boreholes and trial pits revealed ground conditions that were generally consistent with the geological records and known history of the area and comprised up to 1.60m thickness of Made Ground, underlain by superficial Head Deposits with the London Clay Formation at depth.

3. As proven from the site investigation, the Bedrock geology underlying the site (solid permeable formations) has been classified as Unproductive Strata; rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

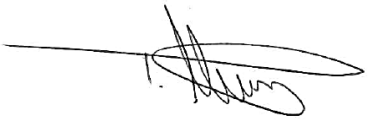
4. Groundwater levels in the immediate vicinity of the property have been recorded below the level of the proposed basement and therefore the impact on the groundwater is likely to be minimal.

5. A monitoring plan will be set out at design stage and will include a monitoring strategy, instrumentation and monitoring plans and action plans.

6. The excavation and construction of the basement at the site has the potential to cause some movements in the surrounding ground if not properly managed. However, it is understood that ground movements and/or instability will be managed through the proper design and construction of mitigation measures during the works.

p.p. SITE ANALYTICAL SERVICES LIMITED

A Garnham BSc (Hons) MSc FGS
Senior Engineer



T P Murray MSc BSc (Hons) FGS
Geotechnical Engineer

8.0 REFERENCES

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9.0 APPENDIX A – GROUND INVESTIGATION FACTUAL REPORT

Site Analytical Services Ltd.

Site Investigations, Analytical & Environmental Chemists, Laboratory Testing Services.

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F. J. Gibbs, F.I.B.M.S. F.I.F.S.T., F.R.S.H. K. J. Blanchette

Your Ref:

Our Ref: **Ref: 16/25552-1**
September 2016

81 AVENUE ROAD, LONDON, NW8 6HR

FACTUAL REPORT ON A GROUND INVESTIGATION

Prepared for

Elliott Wood Partnership Ltd

Working on behalf of

B. K. Mirchandani

CONTENTS

1.0 INTRODUCTION

1.1 Outline and Limitations of Report

At the request of B. K. Mirchandani, a ground investigation was carried out in connection with a proposed residential basement development at the above site. A Phase 1 Preliminary Risk Assessment (Desk Study) is presented under separate cover in Site Analytical Services Limited Report Reference 16/25552.

The information was required for the design and construction of foundations and infrastructure for the proposed development at the existing site which includes the demolition of the existing property and construction a new 3 storey dwelling with a single storey basement beneath the footprint of the property extending into the front and rear garden.

The recommendations and comments given in this report are based on the ground conditions encountered in the exploratory holes made during the investigation and the results of the tests made in the field and the laboratory. It must be noted that there may be special conditions prevailing at the site remote from the exploratory hole locations which have not been disclosed by the investigation and which have not been taken into account in the report. No liability can be accepted for any such conditions.

2.0 SITE DETAILS

(National Grid Reference: TQ 270 837)

2.1 Site Location

81 Avenue Road is a residential property, located on the western side of Avenue Road, Westminster at approximate postcode NW8 6HR. The residential dwelling has two levels of accommodation; ground and first floor. The residential property comprises a front driveway, a single storey garage and a rear garden, which contains an out-door swimming pool. The site covers an approximate area of 0.15 Hectares with the general area being under the authority of the City of Westminster Council.

The site is located on the western side of Avenue Road with residential properties to the north-west and south-east and roadways to the north-east, south-west.

2.2 Geology

The 1:50000 Geological Survey of Great Britain (England and Wales) covering the area (Sheet 256, ‘North London’, Solid and Drift Edition) indicates the site to be underlain the London Clay Formation at depth.

2.3 Previous Investigations

A Phase 1 Preliminary Risk Assessment (PRA) (SAS Report Ref: 16/25552 dated September 2016) has been undertaken across the site by Site Analytical Services Limited.

3.0 SCOPE OF WORK

3.1 Site Works

The proposed scope of works was agreed by the client prior to the commencement of the investigations. To achieve this, the following works were undertaken:-

- The drilling of two rotary percussive boreholes to 15.00m below ground level (Boreholes 1 and 2).
- The drilling of one continuous flight auger borehole to 15.00m below ground level (Borehole 3).
- Sampling and in-situ testing as appropriate to the ground conditions encountered in the boreholes and trial pits.
- Laboratory testing to determine the engineering properties of the soils encountered in the exploratory holes.
- Factual reporting on the results of the investigation.

3.2 Ground Conditions

The locations of the exploratory holes are shown on the site sketch plan, Figure 1.

The borehole and trial pits revealed ground conditions that were consistent with the geological records and known history of the area and comprised Made Ground up to 1.60m in thickness resting on superficial head deposits with the London Clay Formation at depth.

These ground conditions are summarised in the following table. For detailed information on the ground conditions encountered in the boreholes, reference should be made to the exploratory hole records presented in Appendix A.

Strata	Depth to top of strata (mbgl)	Level to top of strata (mOD)	Depth to base of strata (mbgl)	Level to base of strata (mOD)	Description
Made Ground	0.00	46.43 to 46.35	0.60 to 1.60	45.83 to 44.80	Stone slabs and concrete over silty sandy clay containing brick and concrete fragments.
Superficial Head Deposits	0.60 to 1.60	45.83 to 44.80	3.20 to 3.50	43.20 to 42.93	Firm silty sandy gravelly clay.
London Clay Formation	3.20 to 3.50	43.20 to 42.93	15.00 (base of boreholes)	31.43 to 31.35	Stiff becoming very stiff silty sandy clay with gypsum crystals.

Table A: Summary of Ground Conditions in Exploratory Holes

3.3 Groundwater

Groundwater was not encountered in the boreholes and the soils remained essentially dry throughout.

It must be noted that the speed of excavation is such that there may well be insufficient time for further light seepages of groundwater to enter the borehole and trial pits and hence be detected, particularly within more cohesive soils.

Isolated pockets of groundwater may also be present perched within any less permeable material found at shallower depth on other parts of the site especially within any Made Ground.

Groundwater was not subsequently encountered within the monitoring standpipes within Boreholes 1 and 2, but was encountered at a depth of 2.30mbgl (44.13mOD) within the standpipe in BH3 after a period of approximately three weeks.

It should be noted that the comments on groundwater conditions are based on observations made at the time of the investigation (August and September 2016) and that changes in the groundwater level could occur due to seasonal effects and also changes in drainage conditions.

4.0 IN-SITU TESTING AND LABORATORY TESTS

4.1 Standard Penetration Tests

The results of the Standard Penetration Tests carried out in the natural soils are shown on the exploratory hole records in Appendix A.

4.2 Undrained Triaxial Compression Test Results

Undrained Triaxial Compression tests were carried out on nine undisturbed 100mm diameter samples taken from within Boreholes 1 and 2.

The results of the tests are given within Table 1, contained in Appendix B

4.3 Hand Vane Tests

In the essentially cohesive natural soils encountered at the site, in-situ shear vane tests were made at regular depth increments in order to assess the undrained shear strength of the materials. The results indicate that the natural soils are of a generally high strength in accordance with BS 5930 (2015).

The results of the in-situ tests are shown on the appropriate exploratory hole records contained in Appendix A.

4.4 Classification Tests

Atterberg Limit tests were conducted on five samples taken at depth in Boreholes 1, 2 and 3 and showed the samples tested to fall into Classes CI and CH according to the British Soil Classification System.

The test results are given in Table 2, contained in Appendix B.

4.5 Sulphate and pH Analyses

The results of the sulphate and pH analyses made on four soil samples are presented on Table 3, contained in Appendix B.

p.p. SITE ANALYTICAL SERVICES LIMITED

T P Murray MSc BSc (Hons) FGS
Geotechnical Engineer

5.0 REFERENCES

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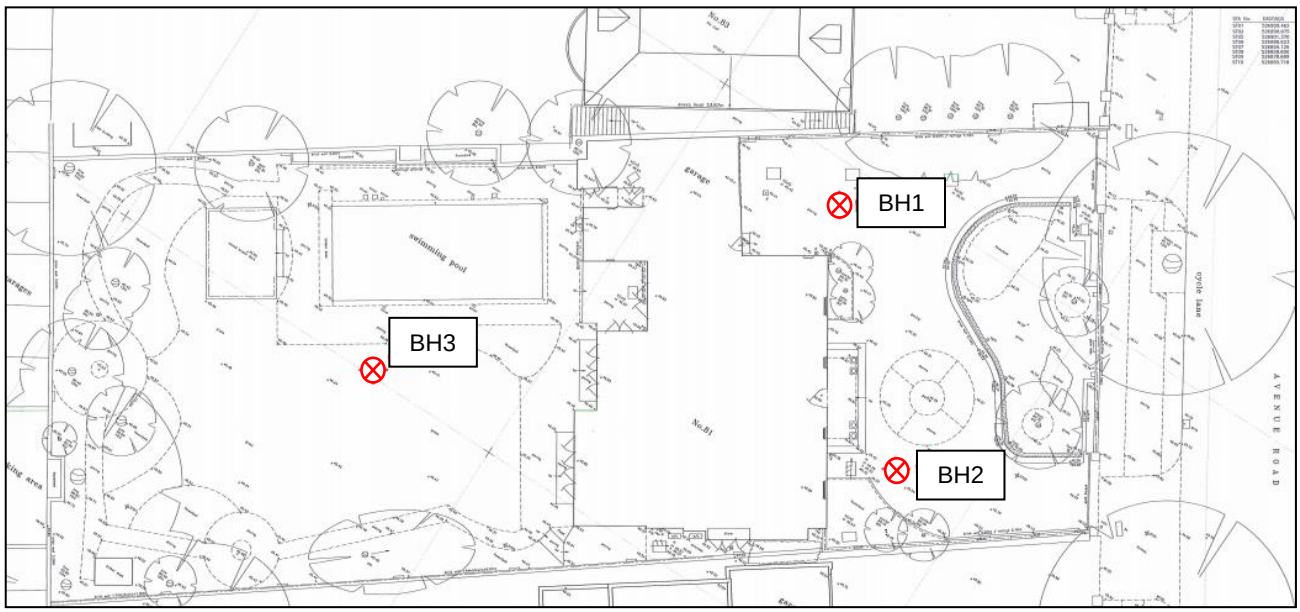
Site Analytical Services Ltd.		REF: 16/25552
LOCATION: 81 Avenue Road, London, NW8 6HR		FIG: 1
TITLE: Site Sketch Plan	DATE: Sept 2016	SCALE: NTS



A P P E N D I X `A'

Borehole / Trial Pit Logs

Site Analytical Services Ltd.

Site	Borehole Number
81 AVENUE ROAD, LONDON, NW8 6HR	BH1

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
ROTARTY PERCUSSIVE	128mm cased to 0.00m	46.40	B. K. MIRCHANDI	1625552

Location	Dates	Engineer	Sheet
TQ270837	26/07/2016-26/08/2016	ELLIOTT WOOD PARTNERSHIP LTD.	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					46.36	0.04	MADE GROUND: Stone paving slab.		
					46.30	0.10			
0.25	D1				46.20	(0.20)	MADE GROUND: Cement.		
					46.00	0.40			
0.50	D2					(0.20)	MADE GROUND: Reinforced concrete.		
					45.80	0.60			
0.75	D3						MADE GROUND: Grey concrete with fragments of brick rubble.		
1.00-1.45	SPT(C) N=12		DRY	2,3/3,3,3,3		(1.00)			
1.00	D4						MADE GROUND: Slightly pink sand and gravel with type 1 fill.		
					44.80	1.60	MADE GROUND: Light brown mottled silty sandy clay containing occassional fragments of brick and concrete rubble.		
1.75	D5					(0.40)			
					44.40	2.00	Firm brown mottled silty sandy CLAY.		
2.00-2.45	U1			50 blows			Firm brown gravelly CLAY. Gravels are fine to coarse grained sub-angular to sub-rounded flint.		
						(1.20)			
2.75	D6								
3.00-3.45	SPT(C) N=16		DRY	3,3/3,4,4,5					
3.00	D7				43.20	3.20	Firm becoming stiff then very stiff slightly silty sandy CLAY.		
3.75	D8								
4.00-4.45	U2			70 blows					
4.75	D9								
5.00-5.45	SPT N=32		DRY	7,8/7,8,8,9					
5.00	D10								
						(5.30)			
6.00	D11								
6.50-6.95	U3			110 blows					
7.50	D12								
8.00-8.45	SPT N=39		DRY	8,8/9,10,10,10					
8.00	D13						Claystones present at 8.30m depth.		
					37.90	8.50	Very stiff dark grey blue silty sandy CLAY, containing occassional gypsum crystals.		
9.00	D14								
						(1.50)			
9.50-9.95	U4			120 blows					

Remarks
D= Disturbed Sample
C= Standard Penetration Test- Cone
S= Standrad Penetration Test
Groundwater was not encountered during excavation
Excavating from 0.00m to 1.00m for 1 hour.

Scale (approx)	Logged By
1:50	MH

Figure No. 1625552.BH1

Site Analytical Services Ltd.

Site	Borehole Number
81 AVENUE ROAD, LONDON, NW8 6HR	BH1

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
ROTARTY PERCUSSIVE	128mm cased to 0.00m	46.40	B. K. MIRCHANDI	1625552

Location	Dates	Engineer	Sheet
TQ270837	26/07/2016-26/08/2016	ELLIOTT WOOD PARTNERSHIP LTD.	2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					36.40	10.00	Very stiff becoming hard dark grey blue silty sandy CLAY, containing occassional gypsum crystals.		
10.50	D15								
11.00-11.45 11.00	SPT N=50 D16		DRY	10,12/12,12,12,14					
12.00	D17								
12.50-12.95	U5			230 blows		(5.00)			
13.75	D18								
14.55-15.00 14.55	SPT N=80 D19		DRY	16,18/20,20,20,20					
				26/07/2016:DRY	31.40	15.00	Complete at 15.00m		

Remarks
D= Disturbed Sample
C= Standard Penetration Test- Cone
S= Standrad Penetration Test
Groundwater was not encountered during excavation

Scale (approx)	Logged By
1:50	MH

Figure No. 1625552.BH1

Site Analytical Services Ltd.

Site	Borehole Number
81 AVENUE ROAD, LONDON, NW8 6HR	BH1

Installation Type
Single Installation

Dimensions
Internal Diameter of Tube [A] = 50 mm
Diameter of Filter Zone = 128 mm

Client
B. K. MIRCHANDI

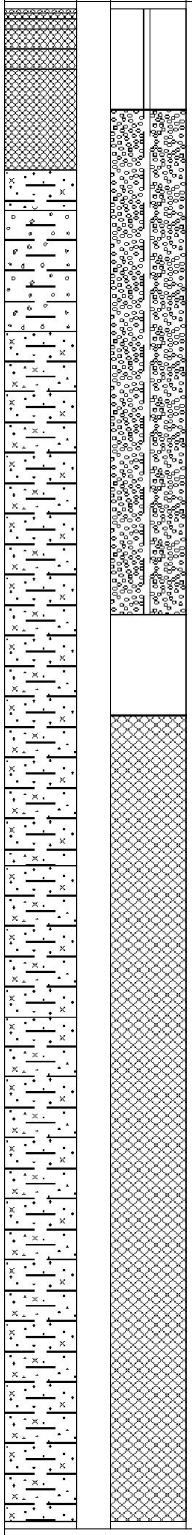
Job Number
1625552

Location
TQ270837

Ground Level (mOD)
46.40

Engineer
ELLIOTT WOOD PARTNERSHIP LTD.

Sheet
1/1



Legend	Water	Instr (A) (B)	Level (mOD)	Depth (m)	Description
			45.40	1.00	Bentonite Seal
					Slotted Standpipe
			40.40	6.00	Bentonite Seal
			39.40	7.00	
			31.40	15.00	General Backfill

Groundwater Strikes During Drilling

Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings 5 min	Readings 10 min	Readings 15 min	Readings 20 min	Depth Sealed (m)

Groundwater Observations During Drilling

Date	Start of Shift Time	Start of Shift Depth Hole (m)	Start of Shift Casing Depth (m)	Start of Shift Water Depth (m)	Start of Shift Water Level (mOD)	End of Shift Time	End of Shift Depth Hole (m)	End of Shift Casing Depth (m)	End of Shift Water Depth (m)	End of Shift Water Level (mOD)
26/07/16							15.00		DRY	

Instrument Groundwater Observations

Inst. [A] Type : **Inst. [B] Type :** Slotted Standpipe

Date	Instrument [A] Time	Instrument [A] Depth (m)	Instrument [A] Level (mOD)	Instrument [B] Time	Instrument [B] Depth (m)	Instrument [B] Level (mOD)	Remarks

Remarks

Site Analytical Services Ltd.

Site	Borehole Number
81 AVENUE ROAD, LONDON, NW8 6HR	BH2

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
ROTARTY PERCUSSIVE	128mm cased to 0.00m	46.35	B. K. MIRCHANDI	1625552
	Location	**Dates**	**Engineer**	**Sheet**
	TQ270837	27/07/2016	ELLIOTT WOOD PARTNERSHIP LTD.	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					46.31	0.04	MADE GROUND: Stone paving slab.		
					46.25	0.10			
0.25	D1				46.15	0.20 (0.30)	MADE GROUND: Cement.		
0.50	D2				45.85	0.50	MADE GROUND: Reinforced Concrete.		
0.75	D3					(0.70)	MADE GROUND: Grey sandy gravelly concrete crush containing frequent fragments of concrete rubble.		
1.00-1.45 1.00	SPT(C) N=12 D4		DRY	1,2/3,3,3,3	45.15	1.20	MADE GROUND: Brown molttled clay containing occassional fragments of brick and concrete rubble.		
						(0.70)	Firm brown mottled silty sandy CLAY.		
1.75	D5				44.45	1.90			
2.00-2.45 2.00	SPT(C) N=15 D6		DRY	3,4/3,4,4,4			Firm brown mottled very silty sandy gravelly CLAY. Gravels are fine to corase grained, sub-angular to sub-rounded flint.		
						(1.50)			
2.75	D7								
3.00	D8								
					42.95	3.40	Firm becoming stiff then very stiff brown mottled silty sandy CLAY.		
3.75	D9								
4.00-4.45	U1			80 blows					
4.75	D10					(2.80)			
5.00-5.45 5.00	SPT N=34 D11		DRY	7,7/8,8,9,9					
6.00	D12								
					40.15	6.20	Very stiff brown silty sandy CLAY.		
6.50-6.95	U2			100 blows					
						(2.50)			
7.50	D13								
8.00-8.45 8.00	SPT N=40 D14		DRY	9,9/10,10,10,10			Claystones present at 5.90m depth.		
					37.65	8.70	Very stiff dark grey blue silty sandy CLAY, containing occassional gypsum crystals.		
9.00	D15								
						(1.30)			
9.50-9.95	U3			130 blows					

Remarks
D= Disturbed Sample
C= Standard Penetration Test- Cone
S= Standrad Penetration Test
Groundwater was not encountered during excavation
Excavating from 0.00m to 1.00m for 1 hour.

Scale (approx)	Logged By
1:50	MH

Figure No. 1625552.BH2

Site Analytical Services Ltd.

Site	Borehole Number
81 AVENUE ROAD, LONDON, NW8 6HR	BH2

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
ROTARTY PERCUSSIVE	128mm cased to 0.00m	46.35	B. K. MIRCHANDI	1625552
	Location TQ270837	**Dates** 27/07/2016	**Engineer** ELLIOTT WOOD PARTNERSHIP LTD.	**Sheet** 2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					36.35	10.00	Very stiff becoming hard dark grey blue silty sandy CLAY, containing occassional gypsum crystals.		
10.50	D16								
11.00-11.45 11.00	SPT N=52 D17		DRY	11,12/12,12,14,14					
12.00	D18								
12.50-12.95	U4			220 blows		(5.00)			
13.75	D19								
14.55-15.00 14.55	SPT N=86 D20		DRY	20,20/20,22,22,22					
				27/07/2016:DRY	31.35	15.00	Complete at 15.00m		

Remarks

Scale (approx)	Logged By
1:50	MH

Figure No. 1625552.BH2

Site Analytical Services Ltd.

Site	Borehole Number
81 AVENUE ROAD, LONDON, NW8 6HR	BH2

Installation Type
Single Installation

Dimensions
Internal Diameter of Tube [A] = 50 mm
Diameter of Filter Zone = 128 mm

Client
B. K. MIRCHANDI

Job Number
1625552

Location
TQ270837

Ground Level (mOD)
46.35

Engineer
ELLIOTT WOOD PARTNERSHIP LTD.

Sheet
1/1

Legend	Water	Instr (A)	Level (mOD)	Depth (m)	Description
			45.35	1.00	Bentonite Seal
					Slotted Standpipe
			40.35	6.00	Bentonite Seal
			39.35	7.00	
					General Backfill
			31.35	15.00	

Groundwater Strikes During Drilling

Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings 5 min	Readings 10 min	Readings 15 min	Readings 20 min	Depth Sealed (m)

Groundwater Observations During Drilling

Date	Start of Shift Time	Start of Shift Depth Hole (m)	Start of Shift Casing Depth (m)	Start of Shift Water Depth (m)	Start of Shift Water Level (mOD)	End of Shift Time	End of Shift Depth Hole (m)	End of Shift Casing Depth (m)	End of Shift Water Depth (m)	End of Shift Water Level (mOD)
27/07/16							15.00		DRY	

Instrument Groundwater Observations

Inst. [A] Type : Slotted Standpipe

Date	Instrument [A] Time	Instrument [A] Depth (m)	Instrument [A] Level (mOD)	Remarks

Remarks

Site Analytical Services Ltd.

Site	Borehole Number
81 AVENUE ROAD, LONDON, NW8 6HR	BH3

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
CONTINUOUS FLIGHT AUGER	100mm cased to 0.00m	46.43	B. K. MIRCHANDI	1625552
	Location	**Dates**	**Engineer**	**Sheet**
	TQ270837	26/07/2016	ELLIOTT WOOD PARTNERSHIP LTD.	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.25	D1					(0.60)	MADE GROUND: Grass surface iver dark brown slightly sandy slightly gravelly clay, containing occassional fragments of brick and concrete rubble.		
0.50	D2				45.83	0.60	Stiff brown silty CLAY.		
0.75	D3					(0.80)			
1.00	D4								
1.00	V1 84				45.03	1.40	Stiff light brown silty CLAY.		
1.50	D5								
1.50	V2 81								
2.00	D6					(1.60)			
2.00	V3 100								
2.50	D7								
2.50	V4 130+								
3.00	D8				43.43	3.00	Stiff brown silty slightly gravelly CLAY. Gravels are fine grained, sub-angular to sub-rounded flint.		
3.00	V5 130+					(0.50)			
3.50	D9				42.93	3.50	Stiff brown silty sandy CLAY.		
3.50	V6 130+								
4.00	D10								
4.00	V7 130+								
4.50	D11								
4.50	V8 130+								
5.00	D12								
5.00	V9 130+					(3.50)			
6.00	D13								
6.00	V10 130+								
7.00	D14				39.43	7.00	Stiif dark grey blue silty sandy CLAY, containing occassional gypsum crystals.		
7.00	V11 130+								
8.00	D15								
8.00	V12 130+					(3.00)			
9.00	D16								
9.00	V13 130+								

Remarks
D= Disturbed Sample
V= Vane Test- Result in kPa
Groundwater was not encountered during boring
Excavating from 0.00m to 1.00m for 1 hour.

Scale (approx)	Logged By
1:50	MH

Figure No. 1625552.BH3

Site Analytical Services Ltd.

Site	Borehole Number
81 AVENUE ROAD, LONDON, NW8 6HR	BH3

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
CONTINUOUS FLIGHT AUGER	100mm cased to 0.00m	46.43	B. K. MIRCHANDI	1625552
	Location	**Dates**	**Engineer**	**Sheet**
	TQ270837	26/07/2016	ELLIOTT WOOD PARTNERSHIP LTD.	2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.00 10.00	D17 V14 130+				36.43	10.00	Stiif dark grey blue silty sandy CLAY, containing occassional gypsum crystals.		
11.00 11.00	D18 V15 130+								
12.00 12.00	D19 V16 130+					(5.00)			
13.00 13.00	D20 V17 130+								
14.00 14.00	D21 V18 130+								
15.00 15.00	D22 V19 130+			26/07/2016:DRY	31.43	15.00	Complete at 15.00m		

Remarks

Scale (approx)	Logged By
1:50	MH

Figure No. 1625552.BH3

Site Analytical Services Ltd.

Site	Borehole Number
81 AVENUE ROAD, LONDON, NW8 6HR	BH3

Installation Type
Single Installation

Dimensions
Internal Diameter of Tube [A] = 50 mm
Diameter of Filter Zone = 100 mm

Client
B. K. MIRCHANDI

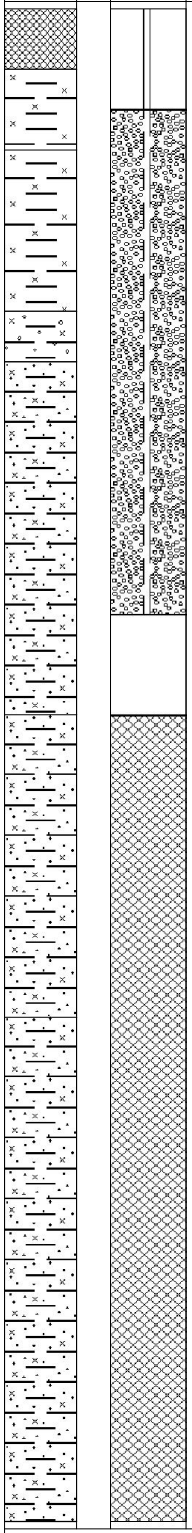
Job Number
1625552

Location
TQ270837

Ground Level (mOD)
46.43

Engineer
ELLIOTT WOOD PARTNERSHIP LTD.

Sheet
1/1



Legend	Water	Instr (A)	Level (mOD)	Depth (m)	Description
			45.43	1.00	Bentonite Seal
					Slotted Standpipe
			40.43	6.00	Bentonite Seal
			39.43	7.00	
					General Backfill
			31.43	15.00	

Groundwater Strikes During Drilling

Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings				Depth Sealed (m)
					5 min	10 min	15 min	20 min	

Groundwater Observations During Drilling

Date	Start of Shift					End of Shift				
	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)
26/07/16							15.00		DRY	

Instrument Groundwater Observations

Inst. [A] Type : Slotted Standpipe

Date	Instrument [A]			Remarks
	Time	Depth (m)	Level (mOD)	

Remarks

Site Analytical Services Ltd.

Standard Penetration Test Results

Site : 81 AVENUE ROAD, LONDON, NW8 6HR

Client : B. K. MIRCHANDI

Engineer : ELLIOTT WOOD PARTNERSHIP LTD.

Job Number 1625552

Sheet 1 / 1

Borehole Number	Base of Borehole (m)	End of Seating Drive (m)	End of Test Drive (m)	Test Type	Seating Blows per 75mm		Blows for each 75mm penetration				Result	Comments
					1	2	1	2	3	4		
BH1	1.00	1.15	1.45	CPT	2	3	3	3	3	3	N=12	
BH1	3.00	3.15	3.45	CPT	3	3	3	4	4	5	N=16	
BH1	5.00	5.15	5.45	SPT	7	8	7	8	8	9	N=32	
BH1	8.00	8.15	8.45	SPT	8	8	9	10	10	10	N=39	
BH1	11.00	11.15	11.45	SPT	10	12	12	12	12	14	N=50	
BH1	14.55	14.70	15.00	SPT	16	18	20	20	20	20	N=80	
BH2	1.00	1.15	1.45	CPT	1	2	3	3	3	3	N=12	
BH2	2.00	2.15	2.45	CPT	3	4	3	4	4	4	N=15	
BH2	5.00	5.15	5.45	SPT	7	7	8	8	9	9	N=34	
BH2	8.00	8.15	8.45	SPT	9	9	10	10	10	10	N=40	
BH2	11.00	11.15	11.45	SPT	11	12	12	12	14	14	N=52	
BH2	14.55	14.70	15.00	SPT	20	20	20	22	22	22	N=86	

A P P E N D I X `B'

Laboratory Test Data

Site Analytical Services Ltd.

Ref: 16/25552

UNDRAINED TRIAXIAL COMPRESSION TEST

LOCATION 81 Avenue Road, London, NW8 6HR

BH/TP No.	MOISTURE CONTENT %	BULK DENSITY Mg/m^3	LATERAL PRESSURE kN/m^2	COMPRESSIVE STRENGTH kN/m^2	COHESION kN/m^2	ANGLE OF SHEARING RESISTANCE degrees	DEPTH m
BH1	26	2.00	50	188	94		2.25
	5	2.01	80	190	95		4.25
	27	1.96	130	245	122		6.75
	27	2.00	190	226	113		9.75
	28	2.03	250	266	133		12.75
BH2	27	2.02	80	215	108		4.25
	24	2.00	130	248	124		6.75
	29						9.75
	27	2.03	250	269	135		12.75

Table 1

Site Analytical Services Ltd.

Ref: 16/25552

PLASTICITY INDEX & MOISTURE CONTENT DETERMINATIONS

LOCATION 81 Avenue Road, London, NW8 6HR

BH/TP No.	Depth m	Natural Moisture %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Passing 425 μm %	Class
BH1	3.75	26	57	22	35	100	CH
BH2	3.45	22	48	22	26	100	CI
BH3	3.50	26	59	23	36	100	CH
	4.00	26	58	25	33	100	CH

Table 2

Site Analytical Services Ltd.

Ref: 16/25552

SULPHATE & pH DETERMINATIONS

LOCATION 81 Avenue Road, London, NW8 6HR

BH/TP No.	DEPTH BELOW GL m	SOIL SULPHATES AS SO_4 TOTAL %	SOIL SULPHATES AS SO_4 WATER SOL g/l	WATER SULPHATES AS SO_4 g/l	pH	CLASS	SOIL - 2mm %
BH1	6.00		2.37		6.2	DS-3	100
	12.00		0.93		6.5	DS-2	100
BH2	8.00		2.39		6.4	DS-3	100
BH3	10.00		1.11		6.5	DS-2	100

Classification – Tables C1 and C2 : BRE Special Digest 1 : 2005

Table 3