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Your Ref:

Our Ref:

17/27399-2 April 2018

SOUTH LODGE, HEATHSIDE,

HAMPSTEAD, LONDON, NW3 1BL

BASEMENT IMPACT ASSESSMENT

Prepared for

Elliott Wood Partnership Limited

Acting on behalf of

Nick and Amanda Raphael





Reg Office: Units 14 +15, River Road Business Park, 33 River Road Barking, Essex IG11 0EA Business Reg. No. 2255616





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1.0 NON-TECHNICAL SUMMARY

1.1 **Project Objectives**

At the request of Elliott Wood Partnership Limited, working on behalf of Nick and Amanda Raphael, a Basement Impact Assessment has been carried out at South Lodge, Heathside, Hampstead, NW3 1BL in support of a planning application for a proposed development which includes the refurbishment to the west side of the property and the extension of the existing basement footprint.

The Finished Floor Level (FFL) of the proposed new basement steps down from 92.85m AOD below the footprint of the original property (which equates to an approximately 0.90m excavation) to 92.00m AOD below the existing rear extension (a 3.50m excavation).

The 0.90m excavation below the building is referred to as the new basement in this document whilst the 3.50m excavation below the rear extension is referred to as the new sub-basement.

1.2 Desk Study Findings

From historical map evidence it would appear that the site was first built on prior to 1879, with extensions being constructed to the existing property between 1973 and 1985. The surrounding area has been predominantly residential throughout its history and was partly urbanised during the early 20th century.

1.3 Ground Conditions

The boreholes 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 1.00m in thickness (unproven in TP6) resting on deposits of the Claygate Member. The Made Ground extended down to depths of between 0.70m and 0.90m in the boreholes and of between 0.20m and 1.00m below ground level in the trial pits (94.82 to 93.56mOD) and the material generally comprised a surface layer of grass/clay tiled floor / pea gravel overlying silty sandy gravelly clay with brick and concrete fragments. The Claygate Member was encountered below the Made Ground and consisted of soft becoming firm then stiff silty sandy clay with lenses of silty fine sand which extended to depths/levels between 6.70m (88.82mOD) in Borehole BH1 and 6.00m (88.46mOD) in Borehole WS1. This deposit extends down to the full depth of investigation of 6.00m below ground level in Borehole WS1. The London Clay Formation was encountered below the Claygate Member and consisted of stiff silty sandy clay with occasional pockets and partings of silty fine sand and scattered gypsum crystals. This deposit extends down to the full depths of investigation of 15.00m below ground level in Borehole 1 (80.524mOD). Following drilling operations groundwater monitoring piezometers were installed in Boreholes BH1 and WS1 to approximately 6.00m depth.

Groundwater was recorded at a depth of 2.51m (45.12mOD) within the standpipe located in Borehole BH1 and a depth of 3.62m (46.33mOD) within the standpipe in Borehole WS1 after a period of approximately three weeks.

1.4 Recommendations

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. It would be prudent to continue to monitor the standpipes for as long as possible in order to determine equilibrium level and the extent of any seasonal variations. The chosen contractor should also have a contingency plan in place to deal with any perched groundwater inflows as a precautionary measure.

2.0 INTRODUCTION

2.1 **Project Objectives**

At the request of Elliott Wood Partnership Limited, working on behalf of Nick and Amanda Raphael, a Basement Impact Assessment has been carried out at the above site in support of a planning application.

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 existing residential property.

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.

2.2 Planning Policy Context

The information contained within this BIA has been produced to meet the requirements set out by Camden Planning Guidance – Policy A5: Basements and CPG: Basements

As recommended by the Guidance for Subterranean Development (Ref 1) the BIA comprises the following steps



- 1. **Initial screening** to identify where there are matters of concern
- 2. **Scoping** to further define the matters of concern
- 3. Site Investigation and study to establish baseline conditions
- 4. **Impact Assessment** to determine the impact of the basement on baseline conditions
- 5. **Review and Decision Making** (to be undertaken by LBC)

3.0 SITE DETAILS

(National Grid Reference: TQ 268 860)

3.1 Site Location

South Lodge is a residential property, located on the north-western side of Heathside, Hampstead at approximate postcode NW3 1BL. The residential dwelling has five levels of accommodation; lower ground, upper ground, first, second and third floor. The site covers an approximate area of 0.19 Hectares with the general area being under the authority of the London Borough of Camden.

The site is located on the north-western side of Heathside with residential properties to the north-west, south-west and north-east and a roadway to the south-east.



Figure 1. Site Location Plan

3.2 Site Layout and History

The site is accessed from Heathside located to the south-east and comprises of a five storey residential property, including rooms at roof level with front and rear garden areas.

The property is bound by Heathside to the south-east, with residential properties to the north-east, north-west and south-west.

The property contains a gravel driveway running along the side of the property up to a single storey garage. The property contains a large front and rear lawn with a small greenhouse to the rear of the site. There are multiple trees of varying sizes found within the grounds of the site.

The site slopes very gently to the south-east with levels of 96.60mOD recorded in the rear garden and 94.15mOD recorded in the front garden area. The slope angle is less than 7 degrees. Also with reference to the Camden Geological, Hydrogeological and Hydrological Study, (Figure 2 below), the neighbouring properties also have slopes less than 7 degrees.



Figure 2. Exact from Figure 16 of the Camden CPG4 showing slope angles within the borough

The existing ground level in the area of the proposed basement is understood to be approximately 95.90mOD.

From historical map evidence it would appear that the site was first built on prior to 1879, with extensions being constructed to the existing property between 1973 and 1985. The surrounding area has been predominantly residential throughout its history and was partly urbanised during the early 20th century.

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3.3 **Previous Reports**

A Phase 1 Preliminary Risk Assessment (PRA) (SAS Report Ref: 17/27399) and Phase 2 Site Investigation (SAS Report Ref: 17/27399-1) was undertaken across the site by Site Analytical Services Limited in November 2017 and the results are discussed in this BIA.

3.4 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 Claygate Member.



Figure 3. Geology of the Site (Ref. BGS Geoindex)

The British Geological Survey's online records indicate there is one borehole located within 250m of the site. This is located 111m to the north-west of the site and reveals Made Ground to a depth of 1.20m underlain by the Claygate Member to a depth of 1.5m with the London Clay at depth.

3.5 Hydrology and drainage

3.5.1 Surface Water

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

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

With reference to Camden Geological, Hydrogeological and Hydrological Study (1999), Talling (2011) and Barton (1992) springs that sourced tributaries of the 'lost rivers' River Fleet were located approximately 300m east of the site respectively (Figure 5).



Figure 4. Location of site (circled) relative to the 'Lost Rivers' of London (Source: Barton, 1992)

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Figure 5. Location of River Westbourne with respect to the site from OS map dated 1879 (Purple boundary indicates >100m distance)

The River Fleet was the largest of London's lost rivers. The Fleet rises on Hampstead Heath by two heads separated by Parliament Hill. The Hampstead source (Western source) is near the Vale of Health and forms the Hampstead Ponds before going underground, near Hampstead Heath Station and running down Fleet Road towards Camden Town. The two main sources of the Fleet River unite just north of Camden Town, where it crosses Kentish Town Road, passes under Reagents Canals to Kings Cross. The river is then fed by two tributaries before feeding into the River Thames, close to Blackfriars Bridge.

The watercourses have since been largely lost through a culverting system as the urban extent of the borough has grown over time.

Envirocheck indicates that the closest surface water feature is the Hampstead Ponds located 305m east of the site.

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.

Surface drainage from the site is assumed to be directed to drains flowing downhill to the south-west along Heathside.

3.5.2 Flood Risk

3.5.2.1 River or Tidal flooding

According to Environment Agency Flood maps, the site lies within Flood Zone 1 which is defined as areas where flooding from rivers and the sea is very unlikely, with less than a 0.1 per cent (1 in 1000) chance of such flooding occurring each year. The EA's website also shows that this area does not fall within an area at risk of flooding from reservoirs. Based on this information a flood risk assessment will not be required.

3.5.2.2 Surface water flooding

Figure 6 shows that Heathside did not flood during either the 1975 or the 2002 flood events. The closest road to the property which flooded in either of these events is Willow Road located 155m to the east which flooded in 2002.



Figure 6. Exact from Figure 15 of the Camden CPG4 showing roads which flooded in 1975 (light blue), in 2002 (dark blue) and 'areas with potential to be at risk from surface water flooding' (wide light blue bands)

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Further modelling of surface water flooding has been undertaken by the Environment Agency and was published on its website in January 2014; an extract from their model is presented in Figure 7. Whilst this map identifies four levels of risk (high, medium, low and very low) it is understood that it is based at least in part on depths of flooding. This modelling shows a 'Very Low' risk of flooding (the lowest category for the national background level of risk) for South Lodge and the surrounding area.



Figure 7. Extract from the Environment Agency's 'Risk of Flooding from Surface Water'. Ordnance Survey Crown copyright 2015. All rights reserved.

As detailed in Table 1 below, the scheme will result in a small increase in impermeable areas by 28.0m².

Element	Existing (m ²)	Proposed (m ²)
Impermeable (hardstanding - building footprint, concrete areas)	332	360
Permeable (softscaping - grassed areas, (including green roof), permeable and porous paving)	1535	1507
Total (should be the site area and remain the same)	1867	1867

Table 1. Existing and Proposed Permeable Areas.

3.5.2.3 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 South Lodge and therefore the risk of sewer flooding is considered low.

3.6 Hydrogeological setting

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 Claygate Member is permeable, capable of storing and transmitting groundwater and is considered to be a Secondary A Aquifer; The underlying London Clay Formation is classed as unproductive strata or a non-aquifer. These are deposits with a low permeability that have negligible significance for water supply or river base flow.

Groundwater within the silty sandy clays of the Claygate Member is considered to be dominated by fissure flow. The absence of any significant sand bed horizons reduces the water bearing potential of the Claygate Member to that similar to the underlying London Clay. Due to the very low permeability of the London Clay, any groundwater flow will be at very low rates. Published data for the permeability of the London Clay indicates the horizontal permeability to generally range between 1×10^{-10} m/s and 1×10^{-8} m/s, with an even lower vertical permeability. However, the Claygate Member is sandier in composition and permeability is expected to be higher.

Local perched groundwater may occur near surface in Made Ground and possibly also in any Head deposits which overlie the Claygate Member, in at least the winter and early spring seasons.

The presence of interbedded sands, silts and clays of the Claygate Member gives rise to various springs. The River Fleet is located approximately 300m east of the site. The direction of groundwater flow within the Claygate Member beneath the site is likely to be controlled by the local topography and is therefore likely to be in a southerly direction, in the direction that the former river flowed.

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

Other hydrogeological data obtained from the Phase 1 Preliminary Risk Assessment (PRA) (SAS Report Ref: 17/27399) for the site include:

- The underlying soil classification of the site is of high leaching potential.
- There are no source protection zones within 1 kilometre of the site.
- There are no groundwater abstraction licences listed within one kilometre of the site.
- There are no surface water abstraction licences within 1km of the site.
- There are no public potable water supply abstraction licences within 1km of the site.

3.7 Proposed Development

It is proposed to refurbishment to the west side of the property and the extension of the existing basement footprint.

The Finished Floor Level (FFL) of the proposed new basement steps down from 92.85m AOD below the footprint of the original property (which equates to an approx. 0.90m excavation) to 92.00m AOD below the existing rear extension (a 3.50m excavation).



Existing

Sections showing the proposed developments are detailed in Figure 8 below.

Figure 8. Sections of the proposed North and South Elevations of the property.

3.8 Results of Basement Impact Assessment Screening

A screening process has been undertaken for the site and the results are summarised in Table 2 below:



Table 2: Summary of screening results

ltem	Description	Response	Comment
Sub- terranean (Ground water Flow)	1a. Is the site located directly above an aquifer.	Yes	The site lies above the Claygate Member. These deposits have been designated as Secondary A Class; permeable layers capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.
	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.	No	The nearest surface water feature from mapping evidence is the Hampstead Ponds within Hampstead Heath located 305m east of the site. According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011) and Stanford (1868) the site is 300m west from the River Fleet (Figures 5 and 6 of this report). From the British Geological Society 'Geoindex' the nearest water well is located approximately 420m south-east of the site.
	3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas.	Yes	The amount of hardstanding on-site is expected to increase.
	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.	No	The nearest surface water feature is recorded is located 305m east of the site.



Slope Stability	1. Does the existing site include slopes, natural or man-made greater than 7 degrees (approximately 1 in 8).	No	There is a slight slope from north to south across the site, but is below 7 degrees.
	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 drops to the south-east, but from survey information and with reference to Figure 16 from Camden CPG 4, this is at angles of less than 7 degrees.
	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 in the area towards the south down to the south-west, but this is at an angle of less than 7 degrees.
	5. Is the London Clay the shallowest strata at the site.	No	The 1:50000 Geological Survey of Great Britain (England and Wales) indicates the site is underlain by the Claygate Member with the London Clay Formation at depth. Deposits of the overlying Bagshot Formation are indicated to be approximately 315m to the north-west of the site, whilst the boundary to the underlying London Clay Formation is approximately 100m to the south-east.
	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.	Unknown – to be confirmed by Ground Investigation	The Claygate Beds do have cohesive layers which can be prone to shrinking and swelling.
	8. Is the site within 100m of a watercourse or a potential spring line.	No	The nearest surface water feature from mapping evidence is the Hampstead Ponds within Hampstead Heath located 305m east of the site. According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011) and Stanford (1868) the site is 300m west from the River Fleet (Figures 5 and 6 of this report).



	9. Is the site within an area of previously worked ground.	No	According to records from the BGS the site is not in the vicinity of any recorded areas of worked 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.	Yes	According to the results of the most recent ground investigation the site lies above a Secondary A Aquifer (Claygate Member). However, the depth to the groundwater level is unknown and will be determined by the site investigation.
	11. Is the site within 50m of the Hampstead Heath Ponds	No	With reference to the Camden Geological, Hydrogeological and Hydrological Study, the site is not within the catchment of the pond chains on Hampstead, nor the Golder's Hill Chain.
	12. Is the site within 5m of a highway or pedestrian right of way.	No	No, due to the nature of the site, the proposed development does not lie within 5m of Heathside.
	13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties.	Unknown – to be confirmed by Ground Investigation	It is unknown whether No. 1 to the north-east has a basement level, but for the purposes of this report it is assumed to have one.
	14. 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. It is understood there are no railway tunnels within 100m of the site
Surface Water and Flooding	1. Is the site within the catchment of the ponds chains on Hampstead Heath	No	With reference to the Camden Geological, Hydrogeological and Hydrological Study, the site is not within the catchment of the pond chains on Hampstead, nor the Golder's Hill Chain.
	2. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route.	No	No – any additional surface water generated from an increased hardstanding area will be attenuated to ensure they are not increased or altered. The basement will be beneath the footprint of the new dwelling therefore the 1m distance between the roof of the basement and ground surface as recommended by Chapter 5 of the Arup report, does not apply across these areas.
	3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas.	Yes	Yes, there will be a small change in the area of hard surfacing. The surface permeability will be affected with a slight increase in the footprint of the new building and a small increase in the amount of paved surface in relation to the total site.



4. Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses.	No	All surface water for the site will be contained within the site boundaries and collected as described above; hence there will be no change from the development on the quantity or quality of surface water being received by adjoining sites. The basement will be beneath the footprint of the dwelling therefore the 1m distance between the roof of the basement and ground surface as recommended by Chapter 5 of the Arup report does not apply across these areas.
5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses.	No	The surface water quality will not be affected by the development, as in the permanent condition collected surface water will be generally be from roofs, domestic hard landscaping or collected from beneath the landscaping layer over the basement.
6. Is the site in an area known to be at risk from surface water flooding, such as South Hampstead, West Hampstead, Gospel Oak and King's Cross, 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	No	South Lodge did not flood during either the 1975 or the 2002 flood events. Also, according to modelling by the Environment Agency, there is a 'Very Low' risk of surface water flooding (the lowest category for the national background level of risk) for South Lodge and the surrounding area. There are no surface water features within 100m of the site which could create a flood risk for the proposed basement.

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3.9 Non-Technical Summary of Chapter 3.0

The site is accessed from Heathside located to the south-east and comprises of a five storey residential property, including rooms at roof level with front and rear garden areas.

The site slopes very gently to the south-east with levels of 96.60mOD recorded in the rear garden and 94.15mOD recorded in the front garden area.

The 1:50000 Geological Survey of Great Britain (England and Wales) covering the area indicates the site to be underlain by the Claygate Member with the London Clay Formation at depth. The Claygate Member is permeable, capable of storing and transmitting groundwater and is considered to be a Secondary A Aquifer; The underlying London Clay Formation is classed as unproductive strata or a non-aquifer.

With reference to Camden Geological, Hydrogeological and Hydrological Study (1999), Talling (2011) and Barton (1992) springs that sourced tributaries of the 'lost rivers' River Fleet were located approximately 300m east of the site respectively (Figure 5).

The nearest surface water feature from mapping evidence is located 305m east of the site.

According to Environment Agency Flood maps there are no flood risk zones within 1 kilometre of the site. The EA's website also shows that this area does not fall within an area at risk of flooding from reservoirs.

According to Environment Agency Flood maps the site lies within Flood Zone 1, which is defined as areas where flooding from rivers and the sea is very unlikely, with less than a 0.1 per cent (1 in 1000) chance of such flooding occurring each year. South Lodge did not flood during either the 1975 or the 2002 flood events. Modelling of surface water flooding by the Environment Agency shows a 'Very Low' risk of flooding (the lowest category for the national background level of risk) for South Lodge and the surrounding area.

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

Subterranean Groundwater Flow

- Is the site located directly above an aquifer
- Will the proposed basement extend beneath the water table surface.



Slope Stability

- 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 5m of a highway or pedestrian right of way.
- Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties.
- Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines.

Surface Water and Flooding

• Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas.

4.0 SCOPING PHASE

4.1 Introduction

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.

Potential Issue (Screening Question)		Potential impacts and actions
1a	Is the site located directly above an aquifer	Potential impact: Infiltration could be reduced.Action:Ground Investigation required, then review.
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.

Subterranean (Groundwater Flow)



Slope Stability

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 occurduring and after the basement construction.Action:Ground investigation required, then
		review.
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.	Potential impact: Infiltration could be reduced. Action: Ground Investigation required, then review.
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.
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 support by use of best practice methods.

Surface Water and Flooding

Potential Issue (Screening Question)		Potential impacts and actions
3	Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas.	 Potential impact: May increase flow rates to sewer, and thus increase the risk of flooding Action: Assess net change in hard surfaced/paved areas and, if required, recommend appropriate types of SUDS for use as site-specific mitigation.

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

4.2 Non-Technical Summary of Chapter 4.0

The scoping exercise has reviewed the potential impacts for each of the items carried forward from Stage 1 screening, and has identified the following actions to be undertaken:

- A ground investigation is required (which has already been undertaken).
- Review of site's hydrogeology and groundwater control requirements.

All these actions are covered in Stage 3 or Stage 5 for the ground investigation.



5.0 SITE INVESTIGATION DATA

5.1 Records of site investigation

A site-specific ground investigation was undertaken by Site Analytical Services Limited (SAS) in October 2017 and included one rotary percussive borehole (Borehole BH1) one continuous flight auger borehole (WS1) and 7 trial pits (Trial Pits 1-7 inclusive) excavated to 1.5m depth.

The factual findings from the investigation are presented in Appendix A, including a site plan, exploratory hole logs, groundwater monitoring and laboratory test results.

5.2 Ground conditions

The boreholes 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 1.00m in thickness (unproven in TP6) resting on deposits of the Claygate Formation with the London Clay Formation at depth.

5.2.1 Made Ground

The Made Ground extended down to depths of between 0.70m and 0.90m in the boreholes and of between 0.20m and 1.00m below ground level in trial pits (94.82 to 93.56mOD) and the material generally comprised a surface layer of grass/clay tiled floor / pea gravel overlying silty sandy gravelly clay with brick and concrete fragments.

5.2.2 Claygate Member

The Claygate Member consisted of soft becoming firm then stiff silty sandy clay with lenses of silty fine sand which extended to depths/levels between 6.70m (88.82mOD) in Borehole BH1 and 6.00m (88.46mOD) in Borehole WS1. This deposit extends down to the full depth of investigation of 6.00m below ground level in Borehole WS1.

5.2.3 London Clay Formation

The London Clay Formation was encountered below the Claygate Member and consisted of stiff silty sandy clay with occasional pockets and partings of silty fine sand and scattered gypsum crystals. This deposit extends down to the full depth of investigation of 15.00m below ground level in Borehole BH1 (80.524mOD).

5.3 Groundwater

Groundwater was not encountered in any of the trial pits during site works and the material remained essentially dry throughout. Groundwater was encountered in Boreholes BH1 and WS1, as detailed in Table A below.

Exploratory Hole	Depth (m)	Notes	Stratum
BH1	4.00	Rose to 3.80m in 20 minutes	Claygate Member
WS1	5.80	Slight Seepage	Claygate Member

Table A: Groundwater Strike Summary

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 boreholes 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 encountered at a depth of 2.51m (93.01mOD) within the monitoring standpipe placed in Borehole BH1 and 3.62m (90.84mOD) below ground level within the monitoring standpipe placed in WS1 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 (October and November 2017) and that changes in the groundwater level could occur due to seasonal effects and also changes in drainage conditions.

5.4 Foundations

Trial Pits 1 to 7 inclusive were excavated adjacent to the wall of the existing property on the site in order to expose the foundations and founding soils. Trial Pits 1 to 7 inclusive showed the walls are supported on brick foundations resting on the Claygate at a depth of between 0.07m and over 1.50m.



5.5 In-Situ and Laboratory Testing

The results of the laboratory and in-situ tests are presented in the factual report contained in Appendix A.

5.5.1 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.

5.5.3 Undrained Triaxial Compression Test Results

Undrained Triaxial Compression tests were carried out on two undisturbed 100mm diameter samples taken from within Borehole 1.

The test results are given in Table 1, contained in Appendix A.

5.5.4 Vane Testing

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.

5.5.5 Classification Tests

Atterberg Limit tests were conducted on six samples taken at depth in Borehole 1 and Window Sampler 1 showed the samples tested to fall into Classes CI and CI/CH according to the British Soil Classification System.

These are fine grained silty clay soils of intermediate to high plasticity and as such generally have a low permeability and a medium susceptibility to shrinkage and swelling movements with changes in moisture content, as defined by the NHBC Standards, Chapter 4.2. The results indicated Plasticity Index values of between 21% and 25%, with all of the samples being below the higher 40% boundary between soils assessed as being of medium swelling and shrinkage potential and those assessed as being of high swelling and shrinkage potential.



5.5.6 Sulphate and pH Analyses

The results of the sulphate and pH analyses show the natural soil samples to have water soluble sulphate contents of up to 0.19g/litre associated with near neutral to slightly alkaline pH values.

5.6 Non-Technical Summary of Chapter 5.0

A site-specific ground investigation was undertaken by Site Analytical Services Limited (SAS) in October 2017 and included one rotary percussive borehole (Borehole BH1) one continuous flight auger borehole (Borehole WS1) and 7 trial pits (Trial Pits 1-7 inclusive) excavated to 1.5m depth.

The boreholes 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 1.00m in thickness (unproven in TP6) resting on deposits of the Claygate Formation with the London Clay Formation at depth.

Following drilling operations groundwater monitoring piezometers were installed in Boreholes BH1 and WS1 to approximately 6.00m depth.

Groundwater was encountered at a depth of 2.51m (93.01mOD) within the monitoring standpipe placed in Borehole BH1 and 3.62m (90.84mOD) below ground level within the monitoring standpipe placed in WS1 after a period of approximately three weeks.

6.0 FOUNDATION DESIGN

6.1 Introduction

It is proposed to refurbish the west side of the property and to extend the existing basement footprint.

The Finished Floor Level (FFL) of the proposed new basement steps down from 92.85mOD below the footprint of the original property (which equates to an approx. 0.90m excavation) to 92.00mOD below the existing rear extension (a 3.50m excavation).

6.2 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.



6.3 Ground Model

On the basis of the fieldwork, the ground conditions at the site can be characterised as follows:

- The Made Ground extended down to depths of between 0.70m and 0.90m in the boreholes and of between 0.20m and 1.00m below ground level in trial pits (94.82 to 93.56mOD).
- The Claygate Member consisted of soft becoming firm then stiff silty sandy clay with lenses of silty fine sand which extended to depths/levels between 6.70m (88.82mOD) in Borehole BH1 and 6.00m (88.46mOD) in Borehole WS1. This deposit extends down to the full depth of investigation of 6.00m below ground level in Borehole WS1.
- The London Clay Formation was encountered below the Claygate Member and consisted of stiff silty sandy clay with occasional pockets and partings of silty fine sand and scattered gypsum crystals. This deposit extends down to the full depth of investigation of 15.00m below ground level in Borehole BH1 (80.52mOD).
- Groundwater was encountered at a depth of 2.51m (93.01mOD) within the monitoring standpipe placed in Borehole BH1 and 3.62m (90.84mOD) below ground level within the monitoring standpipe placed in WS1 after a period of approximately three weeks.

6.4 Basement Excavation

Groundwater may be encountered in the basement excavation, but at a low rate of seepage and it would be prudent for the chosen contractor to have a contingency plan in place to deal with any perched groundwater inflows as a precautionary measure. Trial excavations to the proposed basement depth could be carried by the main contractor to confirm the stability of the soil and to further investigate the presence of any groundwater inflows.

6.5 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 pits, 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 0.20m and 1.00m 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), strip foundations placed within natural soils may be designed to allowable net bearing pressures of approximately 70kN/m² at 3.00m depth increasing to 90kN/m² at 5.00m 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.

6.6 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.





6.7 Retaining Walls

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 3 below to assist the design of these structures.

Stratum	Depth to top (mOD)	Bulk Density (Mg/m3) (γ)	Effective Angle of Internal Friction (Φ)
Made Ground	-	2.00	28
Claygate Member	94.82 to 93.56	2.00	23

Table 3. 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.

6.8 Chemical Attack on Buried Concrete

The results of the chemical analyses show the natural soil samples tested to have water soluble sulphate contents of up to 0.19g/litre associated with near neutral to slightly alkaline pH values.

In these conditions, it is considered that deterioration of buried concrete due to sulphate or acid attack is unlikely 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-1 conditions.

However, segregations of gypsum were noted within the London Clay and also are well known to occur within London Clay deposits. 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-2 conditions.



6.9 Non-Technical Summary of Chapter 6.0

On the basis of the fieldwork, the ground conditions at the site can be characterised as follows: Made Ground extends to depths of between 0.20m to 1.00m depth below ground level (94.82 to 93.56mOD). This rests upon the Claygate Member underlain by The London Clay Formation to the full depth of investigation of 15.00m below ground level (80.52mOD).

Groundwater may be encountered in the basement excavation, but at a low rate of seepage and it would be prudent for the chosen contractor to have a contingency plan in place to deal with any perched groundwater inflows as a precautionary measure.

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.

Based on the water-soluble sulphate tests carried out as part of these works, it is considered that deterioration of buried concrete due to sulphate or acid attack is unlikely 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-1 conditions.

However, segregations of gypsum were noted within the London Clay and also are well known to occur within London Clay deposits. 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-2 conditions.

7.0 BASEMENT IMPACT ASSESSMENT

7.1 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 site is directly above an aquifer.	The most recent soils investigation has proven that the site lies above the Claygate Member. These are generally aquifers formerly classified as minor aquifers.	No – see below for further details.
The proposed basement extends beneath the water table surface.	It is proposed to excavate to a maximum depth of approximately 3.50m (92.00mOD) through Made Ground into clay strata belonging to the Claygate Beds, which are underlain by a thick deposit of London Clay. Observations made in standpipe piezometers installed in these boreholes indicate a worst case groundwater level at approximately 90.84mOD. This is higher than the proposed dig level of 92.00mOD.	No – see below for further details.
There a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site.	The Claygate Member was proven below the site and was recorded as having a medium to high susceptibility to shrinkage and swelling. 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 Heathside 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.

7.2 Outstanding risks and issues

The Site is located directly above a Secondary A Aquifer/ The proposed basement extends beneath the water table surface.

The proposed founding depth for this basement is approximately 3.50m below ground level (92.00mSD). Thus, the basement is expected to be founded in the Claygate Member clays. Groundwater was recorded as being above the depth of the proposed basement at 93.01mOD although it would be recommended to continue to monitor the standpipes for as long as possible in order to determine equilibrium level and the extent of any seasonal variations. The chosen contractor should also have a contingency plan in place to deal with any perched groundwater inflows as a precautionary measure.



The Claygate Member underlying the site is able to transmit small to medium quantities of groundwater and recharge would be by leakage and vertical infiltration across the aquifer outcrop area. Groundwater will also be able to flow through the largely granular Made Ground. Groundwater gradients will follow the local topography and flows and will generally be from north-west to south-east. The groundwater will eventually discharge from the aquifer at a series of small springs and wells located to the edge of its outcrop area around 80m south-east of the site.

The presence of sandy lenses within the Claygate Member means the natural flow of groundwater below the site will be able to continue to flow around the new basement. This behaviour is acknowledged in the Camden GHHS which noted that even extensive excavations for basements in the City of London have not caused any serious problems in 'damming' groundwater flow, with groundwater simply finding an alternative route (Arup, 2010, paragraph 205). On this basis, it is not considered that the proposed basement would result in a significant change to the groundwater flow regime in the vicinity of the proposal.

The results of the in-situ rising head permeability test in the October 2017 investigation (Appendix A) indicates an apparent permeability or soil infiltration rates of between 1.34×10^{-6} m/sec and 3.23×10^{-7} m/sec within the Claygate Member. This soil infiltration rate lies within the range of published data for fissured and weathered clays and intact clays and is classed as being low to very low permeability material and therefore corresponding flow rates are also expected to be very low. As an added precaution, once heavy machinery is on-site, trial excavations to the proposed basement depth could be carried by the main contractor to confirm the stability of the soil and to further investigate the presence of any groundwater inflows.

The proposed basement will need to be fully waterproofed in order to provide adequate longterm control of moisture ingress from the groundwater. Detailed recommendations for the waterproofing system are beyond the scope of this report, although it is noted that, as a minimum, it would be prudent for the system to be designed in compliance with the requirements of BS8102:2009.

Due care and attention should be paid to ensure that no contamination incidents occur as a result of the development. No change to the existing drainage arrangements is proposed and therefore existing rates of rainfall infiltration and groundwater recharge will remain unchanged.

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.

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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 ground movement assessment was carried out at the site by Fairhurst under the instruction of Site Analytical Services Limited (Report Reference 125183/R0). The report is provided as Appendix B to this report and concludes that provided that appropriate consideration is given to the detailed design of party wall and return wall junctions with the basement in order to limit future movement, that good workmanship and construction sequences are used with appropriate support during excavations and that groundwater management is employed, then the proposed basement construction is unlikely to cause significant damage to the surrounding structures. Based on the predicted ground movements, the adjacent structures are expected to be within the CIRIA C760 Damage Category 1 (Very Slight).

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.

Change in paved surfacing and surface water runoff.

As identified in the initial screening and scoping stages there will be a small change in the amount of hard surfacing at the site where the property will be constructed and as a result total surface water flows may decrease.

Overall it is concluded that the surface water flows will not materially change in response to the small increase in hardstanding. On completion of the development the surface water flows will be routed in a similar way to the existing condition, with rainwater run-off collected in a surface water drainage system and discharged to a combined sewer. It will not be necessary to consider additional mitigation measures such as SUDS or soft landscaping over to reduce the rate of any surface water run-off.

7.3 Advice on Further Work and Monitoring

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.

It would be prudent to continue to monitor the standpipes for as long as possible in order to determine equilibrium level and the extent of any seasonal variations. The chosen contractor should also have a contingency plan in place to deal with any perched groundwater inflows as a precautionary measure.



7.4 Non-Technical Summary of Chapter 7.0

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. It is not considered that the proposed basement would result in a significant change to the groundwater flow regime in the vicinity of the proposal. Also, given limited scope of the scheme and limited increase in impermeable areas, the scheme is also considered compliant with the surface water management and flood risk elements of NPPF and Camden policy.

Given good workmanship, the basement to South Lodge can be constructed without imposing more than Very Slight damage on the adjoining properties. The development is not likely to significantly affect the existing local groundwater regime.

It would be prudent to continue to monitor the standpipes for as long as possible in order to determine equilibrium level and the extent of any seasonal variations.



8.0 REFERENCES

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8.0 APPENDIX A. GROUND INVESTIGATION FACTUAL REPORT

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Your Ref:

Our Ref:

Ref: 17/27399-1 April 2018

SOUTH LODGE, HEATHSIDE,

HAMPSTEAD, LONDON, NW3 1BL

FACTUAL REPORT ON A GROUND INVESTIGATION

Prepared for

Elliott Wood Partnership Limited

Acting on behalf of

Nick and Amanda Raphael





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1.0 INTRODUCTION

1.1 Outline and Limitations of Report

At the request of Elliott Wood Partnership Limited, acting on behalf of Nick and Amanda Raphael, a ground investigation was carried out in connection with a proposed residential basement development at the above site. A Phase 1 Preliminary Assessment (Desk Study) is presented under separate cover in Site Analytical Services Limited Report Reference 17/27399.

The information was required for the design and construction of foundations and infrastructure for the proposed development at the existing site.

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 268 860)

2.1 Site Location

South Lodge is a residential property, located on the north-western side of Heathside, Hampstead at approximate postcode NW3 1BL. The residential dwelling has five levels of accommodation; basement, ground, first, second and third floor. The site covers an approximate area of 0.19 Hectares with the general area being under the authority of the London Borough of Camden.

The site is located on the north-western side of Heathside with residential properties to the north-west, south-west and north-east and a roadway to the south-east.

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 Claygate Member.

The British Geological Survey maintains an archive of historical exploratory borehole logs throughout the UK. SAS Limited has searched the database and have found that there is one borehole located within 150m of the site. This is located 111m to the north-west of the site and reveals Made Ground to a depth of 1.20m underlain by the Claygate Member to a depth of 1.5m with the London Clay at depth.



2.3 **Previous Investigations**

A Phase 1 Preliminary Assessment (PRA) (SAS Report Ref: 17/27399, dated April 2018) 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 one rotary percussive borehole to a depth of 15.00m below ground level (Borehole 1).
- The drilling of one continuous flight auger borehole to a depth of 6.00m below ground level (WS1).
- The installation of a groundwater monitoring standpipes to a depth of approximately 6m below ground level in BH1 and WS1.
- The excavation by hand of seven trial pits to a maximum depth of 1.50m below ground level (Trial Pits 1 to 7 inclusive) to expose existing foundations on site.
- 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 boreholes 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 1.00m in thickness (unproven in TP6) resting on deposits of the Claygate Formation 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)	Level to Depth to top of base of strata strata (mOD) (mbgl)		Description
Made Ground	0.00	95.52 to 94.46	0.20 to 1.00	94.82 to 93.56	Grass / Clay tiled floor/ pea shingle over silty sandy gravelly clay
Claygate Formation	0.20 to 1.00	94.82 to 93.56	6.00-6.70	88.82	Soft becoming firm then stiff silty sandy CLAY.
London Clay Formation	6.00-6.70	88.82	15.00 (base of BH 1)	80.52(base of BH 1)	Stiff silty very sandy clay with gypsum crystals

Table A: Summary of Ground Conditions in Exploratory Holes

3.3 Groundwater

Groundwater was not encountered in any of the trial pits during site works and the material remained essentially dry throughout. Groundwater was encountered in Boreholes BH1 and WS1, as detailed in Table B below.

Exploratory Hole	Depth (m)	Notes	Stratum
BH1	4.00	Rose to 3.80m in 20 minutes	Claygate Member
WS1	5.80	Slight Seepage	Claygate Member

Table B: Groundwater Strike Summary

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 boreholes 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 encountered at a depth of 2.51m (93.01mOD) within the monitoring standpipe placed in Borehole BH1 and 3.62m (90.84mOD) below ground level within the monitoring standpipe placed in WS1 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 (October and November 2017) 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 two undisturbed 100mm diameter samples taken from within Borehole 1.

The test results are given in Table 1, contained in Appendix B.

4.3 In-situ 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 six samples taken at depth in Boreholes BH1 and WS1 showed the samples tested to fall into Classes CI and CI/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 six samples are presented on Table 3, contained in Appendix B.

5.0 WASTE ACCEPTANCE CRITERIA TESTING

5.1 Waste Acceptance Criteria Analysis

Sample were obtained from 1.75m depth below ground level in Borehole 1 and 0.75m in Borehole WS1 made at the locations indicated on the site sketch plan (Figure 1).

The samples selected for analysis were sub-contracted to QTS Environmental Limited (a UKAS and MCERTS accredited laboratory) and their report is contained in Appendix B.

The samples were analysed using the Catwastesoil assessment tool, which concluded that the samples were not hazardous in nature.

The samples were analysed for Waste Acceptance Criteria Testing in order to classify soils on site for disposal purposes.

For the purpose of waste disposal, the soil samples would be classified as:

BH1 @ 1.75m Inert Waste

WS1 @ 0.75m Inert Waste



6.0 REFERENCES

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٨	Site A	nalytical Ser	vices	s Ltd.	REF: 17	/27399-1
sAs	LOCATION:	South Lodge, Heathside, H	lampstead	, NW3 1BL	FIG:	1
*	TITLE:	Site Sketch Plan	DATE:	April 2018	SCALE:	NTS





APPENDIX `A'

Borehole / Trial Pit Logs

Site	e Analy	/tic	al	Servic	es Lt	d.	Site SOUTH LODGE, HEATHSIDE, HAMPSTEAD, NW3 1B	B N BL	orehole lumber BH1
Boring Metl ROTARY PE	hod ERCUSSIVE	Casing	Diamete 8mm cas	r ed to 0.00m	Ground Leve 95.52	l (mOD)	Client NICK AND AMANDA RAPHAEL	J N 1	ob lumber 727399
		Locatio TC	on 2268860		Dates 16/10/2	017	Engineer ELLIOTTWOOD PARTNERSHIP LTD	S	heet 1/2
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level D (mOD) (Thie	epth (m) ckness)	Description	Le	Kater Vater
0.25 0.50 0.75 1.00-1.45 1.00 1.75 2.00-2.45 2.75 3.00-3.45 3.00 3.75 4.00-4.45 4.75 5.00-5.45 5.00	D1 D2 D3 SPT(C) N=5 D4 D5 U1 D6 SPT N=8 D7 D8 U2 D9 SPT N=10 D10		DRY DRY 3.80	1,0/1,1,2,1 45 blows 1,2/2,2,2,2 Slight Seepage(1) at 4.00m, rose to 3.80m in 20 mins. 30 blows 2,2/3,2,2,3	95.22	(0.30) 0.30 (0.40) 0.70 (2.80) 3.50 (3.20)	MADE GROUND: Pea shingle over dark brown silty class sand with fragments of brick and concrete rubble MADE GROUND: Light brown silty sandy clay with fragments of brick and concrete rubble Soft becoming firm, mottled light brown orange grey silts sandy CLAY	nyey	
6.00 6.50-6.95 7.50	D11 U3 D12			55 blows	88.82	6.70	Stiff, brown orange very silty very sandy CLAY with part of silty find sand and occasional gypsum crystals	tings	
8.00-8.45 8.00	SPT N=14 D13		3.80	2,3/4,3,3,4		(3.30)		K K K	× × ×
9.00 9.50-9.95 9.50	D14 SPT N=16 D15		3.80	3,3/4,3,4,5				х х х х	<u>x</u> <u>x</u> <u>x</u> <u>x</u>
Remarks D= Disturbed U= Undistur C= Dynamic	d Sample bed 100mm Diamete Penetration Test - C	er Sample			I		Sc (app	cale L prox) B	ogged
S= Standard Excavating f	Fenetration lest - C from 0.00m to 1.00m	for 1 hou	r.				1: Fig	gure No. 1727399.	.BH1

Site		<i>itic</i>	al	Service	es I td	SOUTH LODGE HEATHSIDE HAMPSTEAD NW3	1BI	Borehole Number
							IDL	BH1
Boring Meth	od RCUSSIVE	Casing 12	Diamete 8mm cas	r ed to 0.00m	Ground Level (mOD) 95.52	Client NICK AND AMANDA RAPHAEL		Job Number 1727399
		Locatio TC	n 268860		Dates 16/10/2017	Engineer ELLIOTTWOOD PARTNERSHIP LTD		Sheet 2/2
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level Depth (mOD) (m) (Thickness)	Description		Kater Xater
					85.52 10.00	Stiff, brown orange very silty very sandy CLAY with pa of silty find sand and occasional gypsum crystals	artings	××
10.50	D16							× ×
11.00-11.45 11.00	SPT N=18 D17		3.80	3,4/4,4,5,5				х <u>х</u> х х х х х х
12.00	D18							××
12.50-12.95 12.50	SPT N=19 D19		3.80	4,3/4,5,5,5				
13.75	D20							<u>к</u> <u>к</u> <u>к</u> <u>к</u> <u>х</u>
14.55-15.00 14.55	SPT N=23 D21		3.80	4,5/5,6,6,6	80.52 15.00	Complete at 15.00m		ж. <u>ж.</u> ж. <u>ж.</u> ж. <u>ж</u>
Remarks D= Disturbed	Sample			l		(a	Scale approx)	Logged By
C= Dynamic S= Standard	Penetration Test - C Penetration Test - C	one one one					1:50	EW
						F	Figure N 17273	o. 99.BH1

Site Analytical Services Ltd.

Standard Penetration Test Results

Site : SOUTH LODGE, HEATHSIDE, HAMPSTEAD, NW3 1BL

Client : NICK AND AMANDA RAPHAEL

Engineer: ELLIOTTWOOD PARTNERSHIP LTD

			End of	Test	nor 7	Emm	Blows f	or each 7	5mm pen	etration		
Number	Borehole (m)	Seating Drive (m)	Test Drive (m)	Туре	1	2	1	2	3	4	Result	Comments
BH1	1.00	1.15	1.45	CPT	1	0	1	1	2	1	N=5	
BH1	3.00	3.15	3.45	SPT	1	2	2	2	2	2	N=8	
BH1	5.00	5.15	5.45	SPT	2	2	3	2	2	3	N=10	
BH1	8.00	8.15	8.45	SPT	2	3	4	3	3	4	N=14	
BH1	9.50	9.65	9.95	SPT	3	3	4	3	4	5	N=16	
BH1	11.00	11.15	11.45	SPT	3	4	4	4	5	5	N=18	
BH1	12.50	12.65	12.95	SPT	4	3	4	5	5	5	N=19	
BH1	14.55	14.70	15.00	SPT	4	5	5	6	6	6	N=23	

Job Number

1727399

1/1

Sheet

Sit	te	e A	nal	ytic	al Servi	ces	Lto	J.	Site SOUTH L	ODGE, H	IEATHSII	DE, HAM	PSTEAD	, NW3 1E	3L	Borehole Number BH1
Installat Single	tio: Insi	n Type tallation		Dimensi Intern Diame	ons al Diameter of Tube [A] = 5 ster of Filter Zone = 128 mr	0 mm n			Client NICK ANE) AMANE)A RAPH	AEL			;	Job Number 1727399
				Location TQ26	1 8860	Ground 9	Level (m 5.52	IOD)	Engineer ELLIOTTWOOD PARTNERSHIP LTD						:	Sheet 1/1
Legend	Vater	Instr	Level	Depth	Description				Groundwater Strikes During Drilling							
20gena	>		(1102)	(11)				Donth	Casing				Read	lings		Donth
					Bentonite Seal	Date	Time	Struck (m)	Casing Depth (m)	Inflo	w Rate	5 min	10 min	15 min	20 min	Sealed (m)
			94.52	1.00		16/10/17		4.00	0.00	Slight S	Seepage				3.80	
× × ×	 				Slotted Standpipe				Gr	oundwa	ter Obse	rvations	During E	Drilling		
× <u> </u>	7 1								Start of S	hift				End of Sl	nift	
×	Ž1					Date	Time	Depti Hole (m)	h Casing Depth (m)	Water Depth (m)	Water Level (mOD)	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)
			89.52 88.52	6.00 7.00	Bentonite Seal				Instru	ument G	roundwa	iter Obse	ervations			
×						Inst.	[A] Type	: Slotte	ed Standpip	e						
××							Ins	trumen	t [A]							
x x x x x x x x x x x x x x x x x x x						Date	Time	Depti (m)	h Level (mOD)				Rem	arks		
			80.52	15.00	General Backfill											
Remark Lockab	s le d	cover set	in cemen	t												

Site	e Analy	/tic	al	Servic	es l	Ltd.	Site SOUTH LODGE, HEATHSIDE, HAMPSTEAD, NW3 1BL	Borehole Number WS1
Boring Meth CONTINUO AUGER	nod US FLIGHT	Casing 12	Diamete 8mm cas	r ed to 0.00m	Ground	Level (mOD 94.46	Client NICK AND AMANDA RAPHAEL	Job Number 1727399
		Locatio TC	n 268860		Dates 16	6/10/2017	Engineer ELLIOTTWOOD PARTNERSHIP LTD	Sheet 1/1
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness	Description	Kater Vater
0.25 0.50 0.75 1.00 1.50 2.00 2.50 2.50 3.00 3.50 4.00 4.00 4.50 4.50 5.00 5.00 6.00 6.00	D1 D2 D3 D4 V1 113 D5 V2 115 D6 V3 130+ D7 V4 130+ D7 V4 130+ D8 V5 125 D9 V6 122 D10 V7 115 D11 V7 115 D11 V8 128 D12 V9 130+ D13 V10 130+			Slight Seepage(1) at 5.80m.	94.16 94.06 93.86 93.56 92.16 90.06 88.46		MADE GROUND: Grass over dark brown sandy clay with fragments of brick and concrete rubble and small roots MADE GROUND: Dark brown slightly gravelly sandy clay MADE GROUND: Dark brown slightly gravelly fine to coarse grained sand MADE GROUND: Brown fine to coarse grained sand with fragments of brick and concrete rubble Stiff, brown slightly gravelly slightly silty sandy CLAY with lenses of silty fine sand Stiff, mottled brown grey orange silty sandy CLAY with lenses of silty fine sand Stiff, dark grey blue silty sandy CLAY with lenses of silty fine sand Complete at 6.00m	
Remarks D= Disturbed V= Vane Tes	d Sample t - Results in kPa	for 4 h -	-	1	1	<u> </u>	Scal (appro	≩ Logged x) By
Excavating f	rom 0.00m to 1.00m	for 1 hou	r.				1:50	EW
							Figur 17.	27399.WS1

Site Anal	ytic	al Servic	es	Lto	1.	Site South Lo	ODGE, H	IEATHSII	DE, HAM	PSTEAD	, NW3 1E	SL.	Borehole Number WS1	
Installation Type Single Installation	Dimensi Interna Diame	ons al Diameter of Tube [A] = 50 ter of Filter Zone = 100 mm	mm		(Client NICK AND) AMANE)A RAPH	AEL				Job Number 1727399	
	Location TQ268	1 3860	Ground 9	Level (m 4.46	OD) E	Engineer Elliottv	WOOD PARTNERSHIP LTD						Sheet 1/1	
Legend ≥ (A) (mOD)	Depth (m)	Description			I	G	Groundwater Strikes During Drilling							
	. ,				Depth	Casing				Read	lings		Depth	
			Date	Time	Struck (m)	Depth (m)	Inflo	w Rate	5 min	10 min	15 min	20 min	Sealed (m)	
93.46	1 00	Bentonite Seal	16/10/17		5.80	0.00	Slight S	Seepage						
	1.00	1.00					Gr	oundwat	er Obse	rvations	During D	Drilling		
						Start of S	hift			E	End of St	nift		
			Date	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)	
						Instru	ument G	roundwa	ter Obse	ervations				
			Inst. [A] Type : Slotted Standpipe											
		Slotted Standpipe		Instrument [A]				Bomosko						
			Date	Time	Depth (m)	Level (mOD)				Rema	arks			
∑1 88.46 Remarks	6.00													

Site	Analy	/tica	al Servic	es	Ltd.	Site SOUTH LODGE, HEATHS	DIDE, HAMPSTEAD, NW3 1	Trial Pit Number 3L TP1A
Excavation HAND EXCA	Method AVATION	Dimension 0.30m(W)	ns) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD)	Client NICK AND AMANDA RAP	HAEL	Job Number 1727399
		Location TQ26	38860	Dates 16	6/10/2017	Engineer ELLIOTTWOOD PARTNE	RSHIP LTD	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend Safe
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Red cla MADE GROUND: Dark br fragments of brick Mottled brown very sandy Complete at 1.00m	y tiled floor over red brick own gravelly sandy clay with CLAY	
						D= Disturbed Sample Groundwater is not encount	ered during boring/excavatio	n
						Scale (approx) 1:50	Logged By	Figure No. 1727399.TP1A

Site)	Analy	vtical	Service	es Ltd.	Site SOUTH	LODGE, HEA	ATHSIDE, I	HAMPSTE	EAD, NW3 1BL	Trial Pit Number TP1A
Method Trial Pit			Dimensions 0.30m(W) x 0.3	30m(L) x 1.00m(D)	Ground Level (mOD	Client NICK AN	D AMANDA	RAPHAEL			Job Number 1727399
Orientation	[A D B C	Location TQ268860)	Dates 16/10/2017	Engineer ELLIOTT	WOOD PAR	TNERSHI	P LTD		Sheet 1/1
Depth 0.00	c	0.07m Brick	de was found a	t 0.07m depth					Level - 0.00 - - - 		
Strata							Samples	and Test	S		
Depth (m)	No.	Description					Depth (m)	Туре	Field Re	ecords	
0.00-0.07	1	MADE GROUNI	D: Red clay tiled	floor over red brick							
0.07-0.20	2 3	MADE GROUNI Mottled brown v	D: Dark brown gr ery sandy CLAY	avelly sandy clay with f	ragments of brick		0.25 0.50 0.75 1.00	D1 D2 D3 D4			
Remarks D= Disturbe Groundwate	d Sa	Imple not encountered (during boring/exc	cavation			HAND EXC Shoring / N/A Stability: GOOD Backfill: ARISINC	Support			
										Logged By : Checked By : Figure No. :	EW 1727399.TP1A

Site	e Analy	/tica	al Servic	es	Ltd.	Site SOUTH LODGE, HEATHS	DIDE, HAMPSTEAD, NW3 1	Trial Pit Number BL TP1B
Excavation HAND EXC	Method Avation	Dimension 0.30m(W)	ns) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD)	Client NICK AND AMANDA RAP	HAEL	Job Number 1727399
		Location		Dates	5/10/2017	Engineer		Sheet
		TQ26	38860			ELLIOTTWOOD PARTNE	RSHIP LTD	1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend S
0.25 0.50 0.75 1.00	D1 D2 D3 D4		·	-		MADE GROUND: Red cla MADE GROUND: Dark br fragments of brick Mottled brown very sandy Complete at 1.00m	y tiled floor over red brick own gravelly sandy clay with CLAY	
						Groundwater is not encount	ered during boring/excavation	n
								-
						асане (арргох) 1:50	EW	г ідиге No. 1727399.TP1B

Site	; А	naly	vtica	l Servic	es L	td.	South	LODGE, HEA	ATHSIDE, I	HAMPSTE	EAD, NW3 1BL	Trial Pit Number TP1B
Method Trial Pit			Dimensions 0.30m(W) x	0.30m(L) x 1.00m(D)	Ground Lev	rel (mOD)	Client NICK AN	d amanda i	RAPHAEL			Job Number 1727399
Orientation	D	A B C	Location TQ2688	360	Dates 16/10/	2017	Engineer ELLIOTT	WOOD PAR	TNERSHIF	PLTD		Sheet 1/1
Depth 0.00	0.07r	m <mark>€ Brick</mark> Unders	side was four	nd at 0.07m depth						Level 0.00 1.00		
Strata								Samples	and Test			
Depth (m)	No. D	escription						Depth (m)	Туре	Field Re	ecords	
0.00-0.07	1 M		D [.] Red clav tile	ed floor over red brick								
0.07-0.20	2 M	ADE GROUNI	D: Dark brown	gravelly sandy clay with	fragments of b	orick						
0.20-1.00	3 M	lottled brown v	ery sandy CLA	AY				0.25 0.50 0.75 1.00	D1 D2 D3 D4			
								Excavatio		d:		
								Shoring /	Support			
								N/A				
								Stability:				
								GOOD				
								ARISING	S			
									-			
Remarks												
D= Disturbed	d Samp	ple	during baring (

Site	Analy	/tica	al Servic	es	Ltd.	Site SOUTH LODGE, HEATHS	SIDE, HAMPSTEAD, NW3 1	Trial Pit Number 3L TP2
Excavation HAND EXCA	Method VATION	Dimension 0.30m(W)	ns) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD)	Client NICK AND AMANDA RAP	HAEL	Job Number 1727399
		Location	38860	Dates 1	6/10/2017	Engineer ELLIOTTWOOD PARTNE	RSHIP LTD	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Kater Kater
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Red cla MADE GROUND: Concret MADE GROUND: Hardcou Mottled brown very sandy Complete at 1.00m	y tiled floor te CLAY	
						D= Disturbed Sample Groundwater is not encount	ered during boring/excavatic	n
· ·		•		·	•••			
· ·	· ·				· · ·			
						Scale (approx)	Logged By	Figure No.

Site)	Analy	tical S	Servic	es Ltd.	South	LODGE, HEA	ATHSIDE, I	HAMPSTE	EAD, NW3 1BL	Trial Pit Number TP2
Method Trial Pit			Dimensions 0.30m(W) x 0.30m	i(L) x 1.00m(D)	Ground Level (mOD)	Client NICK AN	ID AMANDA	RAPHAEL			Job Number 1727399
Orientation		A D B C	Location TQ268860		Dates 16/10/2017	Engineer ELLIOTT	Wood Par	TNERSHIF	P LTD		Sheet 1/1
Depth 0.00		0.03m Pric 0.22m Bric	ck sk hardcore derside found at 0.	25m depth				-	Level - 0.00		
1.00									- 1.00		
Strata	No	Description					Samples	and Tests	S	cords	
	4						Deptil (iii)	iype			
0.07-0.16	1	MADE GROUN	D: Concrete	I			-				
0.16-0.20	3	MADE GROUN	D: Hardcore				-				
0.20-1.00	4	Mottled brown v	very sandy CLAY				0.25 0.50 0.75 1.00	D1 D2 D3 D4			
							Excavatio	on Metho	d:		
							Shoring /	Support			
							N/A	ouppoin			
							Stability:				
							GOOD				
							Backfill:	<u>`</u>			
							ARISING	50			
Remarks	d C.	ample					1				
Groundwate	er is	not encountered	during boring/excava	ation							
										Logged By	: EW
										Figure No.	: 1727399.TP2

Site	e Analy	/tica	al Servic	es	Ltd.	Site SOUTH LODGE, HEATHS	SIDE, HAMPSTEAD, NW3 1	BL Trial Pit Number TP3
Excavation HAND EXC/	Method AVATION	Dimensio 0.30m(W	ons /) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD) Client NICK AND AMANDA RAP	HAEL	Job Number 1727399
		Location TQ2	68860	Dates 10	6/10/2017	Engineer ELLIOTTWOOD PARTNE	RSHIP LTD	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness) D	escription	Legend S
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Red qua MADE GROUND: Dark bri fragments of brick and cor Mottled brown very sandy Complete at 1.00m	arry tiles over sand and cen own gravelly sandy clay with crete rubble and ash CLAY	
						D= Disturbed Sample Groundwater is not encount	ered during boring/excavati	on
				•	••••	Scale (approx) 1:50	Logged By EW	Figure No. 1727399.TP3

0:1-	A I.		4 -	Site					Trial Pit	
Site	Analy	tical Service	es Ltd.	SOUTH LODGE, HEATHSIDE, HAMPSTEAD, NW3 1BL					TP3	
Method Trial Pit		Dimensions 0.30m(W) x 0.30m(L) x 1.00m(D)	Ground Level (mOD)	Client NICK AN	ID AMANDA	RAPHAEL			Job Number 1727399	
Orientation	A	Location	Dates	Engineer	,				Sheet	
	D B	TQ268860	16/10/2017	/10/2017 ELLIOTTWOOD PARTNERSHIP LTD						
		·							·	
Depth							Level			
0.00	0.18m Brid 0.09m Brid 0.09m Brid 0.10m Brid 0.10m Brid	ck 0.07m 0.08m 0.06m 0.06m 0.06m ick, Lime mortar ck rubble Underside of foundation found at	t 0.56m depth			-	- 0.00 - -			
1.00							— 1.00			
Strata					Samples	and Tests	S			
Depth (m) N	lo. Description				Depth (m)	Туре	Field Rec	ords		
0.00-0.08 1	MADE GROUNI	D: Red quarry tiles over sand and ceme	nt							
0.08-0.72 2	2 MADE GROUNI rubble and ash	D: Dark brown gravelly sandy clay with f	fragments of brick and co	oncrete	0.25 0.50	D1 D2				
0.72-1.00 3	3 Mottled brown v	ery sandy CLAY			0.75	D3				
					Excavatio	on Metho	d:			
					Shoring /	Support				
					N/A	ouppoin	•			
					Stability:					
					GOOD					
					Backfill:	_				
					ARISING	iS				
Domente										
D= Disturbed Groundwater	Sample									
1	is not encountered	during boring/excavation								

Site	Analy	/tica	al Servic	es	Ltd.	Site SOUTH LODGE, HEATHS	SIDE, HAMPSTEAD, NW3 1	Trial Pit Number BL TP4
Excavation HAND EXCA	Method WATION	Dimension 0.30m(W)	ns) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD)	Client NICK AND AMANDA RAP	HAEL	Job Number 1727399
		Location	58860	Dates 10	6/10/2017	Engineer ELLIOTTWOOD PARTNE	RSHIP LTD	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	, D	escription	Legend S
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Red qu MADE GROUND: Dark br fragments of brick and con Mottled brown very sandy Complete at 1.00m	arry tiles over sand and cerr own gravelly sandy clay with crete rubble and ash CLAY	
						D= Disturbed Sample Groundwater is not encount	ered during boring/excavation	on
						Scale (approx)	Logged By	Figure No.

Site)	Analy	tical Se	rvice	es Ltd.	Site SOUTH I	LODGE, HE	ATHSIDE, I	HAMPSTE	AD, NW3 1BL	Trial Pit Number TP4
Method Trial Pit			Dimensions 0.30m(W) x 0.30m(L) x	1.00m(D)	Ground Level (mOD)	Client NICK AN	ID AMANDA	RAPHAEL			Job Number 1727399
Orientation		A D B C	Location TQ268860		Dates 16/10/2017	Engineer ELLIOTT	WOOD PAR	TNERSHIF	P LTD		Sheet 1/1
Depth 0.00		0.55m Brid	ck	n Black 4" c	0.39m .ast iron pipe 0.55m depth				Level 0.00 1.00		
Strata	No	Description					Samples	and Tests	S Field Bog	ordo	
	1		D: Pod guarry tiles over sa	and and come	nt		Depth (m)	туре	Field Rec	oras	
0.12-0.30	2	MADE GROUN	D: Dark brown gravelly sa	ndy clay with f	ragments of brick and c	oncrete	0.25	D1			
0.30-1.00	3	Mottled brown v	very sandy CLAY				0.50 0.75 1.00	D2 D3 D4			
Remarks							Excavation HAND EXC Shoring / N/A Stability: GOOD Backfill: ARISING	Savation Support	d: :		
D= Disturbe Groundwate	d Sa er is i	Imple not encountered	during boring/excavation							Logged By Checked By Figure No.	EW 1727399.TP3

Site	Analy	/tica	al Servic	es	Ltd.	Site SOUTH LODGE, HEATHS	DIDE, HAMPSTEAD, NW3 1	Trial Pit Number 3L TP5A
Excavation HAND EXCA	Method WATION	Dimension 0.30m(W)	1s) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD)	Client NICK AND AMANDA RAP	HAEL	Job Number 1727399
		Location TQ26	38860	Dates 16	6/10/2017	Engineer ELLIOTTWOOD PARTNE	RSHIP LTD	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend Safe
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Clay tile MADE GROUND: Concreito sub-angular flints MADE GROUND: Brick ru Mottled brown very sandy Complete at 1.00m	ed floor te containing course sub-rou bble CLAY	
						D= Disturbed Sample Groundwater is not encount	ered during boring/excavatio	n
		·			•			
		·		•	•••			
· ·	· ·		· · ·		· · ·			
					<mark>.</mark>	Scale (approx)	Logged By	Figure No.

Site)	Analy	vtica	I Servi	ice	es Ltd.	South	LODGE, HEA	ATHSIDE, I	HAMPSTI	EAD, NW3 1BL	Trial Pit Number TP5A
Method Trial Pit			Dimension 0.30m(W)	is x 0.30m(L) x 1.00m(E	D)	Ground Level (mOD)	Client NICK AN	id amanda i	RAPHAEL			Job Number 1727399
Orientation		A D B C	Location TQ26	8860		Dates 16/10/2017	Engineer ELLIOTT	Wood Par	TNERSHIF	P LTD		Sheet 1/1
Depth 0.00		0.21m Bric	ck Iderside of f	foundation found at	t 0.21m	n depth				Level - 0.00 - -		
1.00								1		- 1.00		
Strata		D						Samples	and Tests	S		
Deptn (m)	NO.	Description						Deptn (m)	туре	FIEID R	ecoras	
0.00-0.07	1	MADE GROUN	D: Clay tiled	floor	h			-				
0.07-0.20	2	MADE GROUNI	D: Concrete		b-round	led to sub-angular flint	\$	-				
0.23-1.00	4	Mottled brown v	ery sandy Cl	LAY				0.25 0.50 0.75 1.00	D1 D2 D3 D4			
								Excavatio	on Metho	d:		
								HAND EXC	AVATION			
								N/A	Support			
								Stability:				
								GOOD				
								Backfill:				
								ARISING	3S			
Remarks	d Sa	imple										
Groundwate	eris	not encountered	auring boring	g/excavation								
											Logged By Checked By	: EW :
											Figure No.	: 1727399.TP5A

Site	e Analy	/tica	al Servic	es	Ltd.	Site SOUTH LODGE, HEATHS	DIDE, HAMPSTEAD, NW3 1	Trial Pit Number BL TP5B
Excavation	Method AVATION	Dimension 0.30m(W)	ns) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD)	Client NICK AND AMANDA RAP	HAEL	Job Number 1727399
		Location TQ26	38860	Dates 16	6/10/2017	Engineer ELLIOTTWOOD PARTNE	RSHIP LTD	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend Safe
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Clay tile MADE GROUND: Concret to sub-angular flints MADE GROUND: Brick ru Mottled brown very sandy Complete at 1.00m	e containing course sub-rou bble CLAY	
						D= Disturbed Sample Groundwater is not encount	ered during boring/excavatic	n
	• •				•••			
	·	-				Scale (approx) 1:50	Logged By EW	Figure No. 1727399.TP5B

Site)	Analy	tical S	Service	es Ltd.	Site SOUTH	Trial Pit Number TP5B						
Method Trial Pit			Dimensions 0.30m(W) x 0.30r	n(L) x 1.00m(D)	Ground Level (mOD)	Client NICK AN	Job Number 1727399						
Orientation		A D B C	Location TQ268860		Dates 16/10/2017	Engineer Elliott	r Si TWOOD PARTNERSHIP LTD						
Depth 0.00		0.22m Brick	k Underside of fou	Indation found at (0.22m depth				Level - 0.00 - - - - 				
Strata						Samples and Tests							
Depth (m)	No.	Description					Depth (m)	Туре	Field Re	cords			
0.00-0.07	1	MADE GROUN	D: Clay tiled floor										
0.07-0.20	2	MADE GROUN	D: Concrete contain	ing course sub-roun	ded to sub-angular flints	5							
0.20-0.23	3	MADE GROUN	D: Brick rubble				0.25	D1					
0.23-1.00	4		ery sandy CLAF				0.25 0.50 0.75 1.00	D1 D2 D3 D4					
							Excavation Method:						
						HAND EXCAVATION							
						N/A							
							Stability:						
							GOOD						
							Backfill:						
							ARISING	S					
Remarks	d Sa	mple					1						
Groundwate	eris	not encountered	during boring/excav	ation									
										Logged By	: EW		
										Figure No.	: 1727399.TP5B		

Site	e Analy	/tica	al Servic	Site SOUTH LODGE, HEATHSIDE, HAMPSTEAD, NW3 1BL Trial F Numb				
Excavation HAND EXCA	Method AVATION	Dimensio 0.30m(W	ons /) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD)	Client NICK AND AMANDA RAP	Job Number 1727399	
Depth		Location TQ2	68860	Dates 16/10/2017		Engineer ELLIOTTWOOD PARTNE	Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	, D	Legend S	
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Timber MADE GROUND: Timber MADE GROUND: Concre MADE GROUND: Dark br fragments of brick and con MADE GROUND: Mottled of brick and concrete rubb Complete at 1.00m	floor boards joist te own gravelly sandy clay with crete rubble brown sandy clay with fragr le	nents
						Groundwater is not encount D= Disturbed Sample	ered during boring/excavatio	on
					· · ·	Scale (approx) 1:50	Logged By EW	Figure No.

Site)	Analy	tical Servi	ces Ltd.	Site SOUTH	LODGE, HEA	ATHSIDE, I	HAMPSTE	AD, NW3 1BL	Trial Pit Number TP6A	
Method Trial Pit			Dimensions 0.30m(W) x 0.30m(L) x 1.00m(D)	Ground Level (mOD)	Ground Level (mOD) Client NICK AND AMANDA RAPHAEL					Job Number 1727399	
Orientation		A D B C	Location TQ268860	Dates 16/10/2017	Engineer ELLIOTTWOOD PARTNERSHIP LTD					Sheet 1/1	
Depth 0.00		0.17m Bri	Id yellow stocks	Underside of fo	undation	was not four	nd	Level 0.00 			
Strata						Samples	and Test	S			
Depth (m)	No.	Description				Depth (m) Type Field Records					
0.00-0.07	1	MADE GROUN	ID: Timber floor boards			_					
0.07-0.31	2	MADE GROUN	ID: Timber joist			0.25	D1				
0.31-0.43	3	MADE GROUNI MADE GROUNI rubble	ID: Concrete ID: Dark brown gravelly sandy clay w	vith fragments of brick and c	oncrete	0.50	D2				
0.63-1.00	5	MADE GROUN	ID: Mottled brown sandy clay with fra	agments of brick and concre	te rubble	0.75	D3				
						Excavation Method:					
						HAND EXCAVATION					
						Shoring /	Support	:			
						Stability:					
						Backfill:					
Domostra											
Groundwate D= Disturbe	eris d Sa	not encountered	during boring/excavation								
									Logged By : I Checked By : Figure No. :	EW 1727399.TP6A	

Site	e Analy	/tica	al Servic	Site SOUTH LODGE, HEATHSIDE, HAMPSTEAD, NW3 1BL				
Excavation HAND EXC	Method AVATION	Dimension 0.30m(W)	ns) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD	Client NICK AND AMANDA RAP	Job Number 1727399	
Depth		Location TQ26	58860	Dates 16/10/2017		Engineer ELLIOTTWOOD PARTNE	Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Level Depth (mOD) (Thickness) Description		Legend S	
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Timber MADE GROUND: Timber MADE GROUND: Concrei MADE GROUND: Dark br fragments of brick and cor MADE GROUND: Mottled of brick and concrete rubb Complete at 1.00m	floor boards joist ie own gravelly sandy clay with crete rubble brown sandy clay with fragr le	nents
						D= Disturbed Sample Groundwater is not encount	ered during boring/excavation	on
· ·					 			
						Scale (approx)	Logged By	Figure No.
						1:50	EW	1727399.TP6B

Site		Analy	vtica	I Service	es Ltd.	Site SOUTH	LODGE, HE	ATHSIDE, I	HAMPSTE	EAD, NW3 1BL	Trial Pit Number TP6B	
Method Trial Pit			Dimensions 0.30m(W) x	s x 0.30m(L) x 1.00m(D)	Ground Level (mOD)	Ground Level (mOD) Client NICK AND AMANDA RAPHAE			EL Jo N 1'		Job Number 1727399	
Orientation		A	Location		Dates	Engineer	Engineer					
D B			TQ268	3860	16/10/2017	ELLIOTT	TWOOD PAR	TNERSHI	P LTD		1/1	
Depth 0.00 - - -		0.27m Brick	ellow	Underside o	f foundation was not	found			Level 0.00 			
1.00		¥							- 1.00			
Strata							Samples	and Test	5			
Depth (m)	No.	Description					Depth (m)	Туре	Field Re	cords		
0.00-0.07	1	MADE GROUN	D: Timber floo	or boards			_					
0.07-0.31	2	MADE GROUN	D: Timber jois	st			0.25	D1				
0.31-0.43	3	MADE GROUN	D: Concrete				0.50	DO				
0.43-0.63	4	rubble	D: Dark brow	n gravelly sandy clay with f	ragments of brick and c	oncrete	0.50	D2				
0.63-1.00	5	MADE GROUN	D: Mottled bro	own sandy clay with fragme	ents of brick and concret	e rubble	0.75	D3 D4	_			
ĺ							Shoring / Support:					
							N/A	oupport				
							Stability:					
							GOOD					
							Backfill:					
							ARISING	S				
Remarks D= Disturbe Groundwate	d Sa risi	mple not encountered	durina borina	/excavation								
			. <u>.</u>							Logged By Checked By	: EW :	
										Figure No.	: 1/27399.TP6E	

Site	Analy	/tica	al Servic	es	Ltd.	Site SOUTH LODGE, HEATHS	SIDE, HAMPSTEAD, NW3 1	Trial Pit Number 3L TP7A			
Excavation HAND EXCA	Method AVATION	Dimensio 0.30m(W	ns ') x 0.30m(L) x 1.00m(D)	Ground	l Level (mOD)	Client NICK AND AMANDA RAP	Job Number 1727399				
		Location TQ2	68860	Dates	6/10/2017	Engineer ELLIOTTWOOD PARTNE	Sheet 1/1				
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level Depth (mOD) (m) (Thickne		D	Description				
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Timber MADE GROUND: Timber MADE GROUND: Concret MADE GROUND: Dark br brick and concrete rubble Mottled brown sandy CLA Complete at 1.00m	floor boards joist te own sandy clay with fragmer and ash Y	its of			
						D= Disturbed Sample Groundwater is not encount	ered during boring/excavatio	n			
· ·	· ·	•	· · ·		· · ·						
					:	Scale (approx) 1:50	Logged By EW	Figure No. 1727399.TP7A			


Site	e Analy	/tica	al Servic	es	Ltd.	Site SOUTH LODGE, HEATHS	SIDE, HAMPSTEAD, NW3 1	Trial Pit Number 3L TP7B
Excavation HAND EXC/	Method Avation	Dimensio 0.30m(W	ons /) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD)	Client NICK AND AMANDA RAP	HAEL	Job Number 1727399
		Location TQ2	68860	Dates 10	6/10/2017	Engineer ELLIOTTWOOD PARTNE	RSHIP LTD	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness	D	escription	Legend Safet
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Timber MADE GROUND: Timber MADE GROUND: Concret MADE GROUND: Dark bri brick and concrete rubble Mottled brown sandy CLA Complete at 1.00m	floor boards joist ie own sandy clay with fragmer and ash Y	Its of
						D= Disturbed Sample Groundwater is not encount	ered during boring/excavatic	'n
· ·								
· ·		•		·	· · · -			
						Scale (approx) 1:50	Logged By EW	Figure No. 1727399.TP7B

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APPENDIX `B'

In-situ, Laboratory Test & Groundwater Monitoring Data

	ytical	Servio	es Ltd	SOU	TH LODGE, H	EATHSIDE, HAN	MPSTEAD, NW3 1BL	Borehole Number WS1
Situ Permeability Type ling Head	Test No.	1	Ground Level (m	OD) Client	t K AND AMAND	A RAPHAEL		Job Number 1727399
	Location		Dates	Engin	neer			Sheet
	TQ26886	60	16/10/2017	ELLI	OTTWOOD PA	ARTNERSHIP L	TD	1/2
Height of casing above g	ground level:	0.00 m	PERM	IEABILITY ((after Hvorsle	v, 1951)		
Depth to Base of Boreho	ole:	6.00 m bgl	Gene	ral Approac	ch			
Depth to Base of Casing	:	1.00 m bgl	H1 se	lected at t=	= 5.49 mins (=t	1 = 60.6 secs)		
Depth to equilibrium wat	ter level:	5.80 m btoc	H2 se	lected at t=	= 3.937 mins (=	=t2 = 3610.2 sec	cs)	
Test Length L:		5.00 m	k =	1.34E-06	6 ms-1			
Diameter of Test Length	D:	0.05 m						
Area of Test Section:		0.0020 m2						
Intake Factor F:		0.1375						
(after condition B, figure 6,	, BS 5930)							
Elapsed Depth to time water (mins) (m btoc)	Head of Water, H (m)	Ht / Ho	5.8 *					
Elapsed time (mins)Depth to water (m btoc)0.00.000 0.300	Head of Water, H (m) 5.800 5.500	Ht / Ho 1.000 0.948	5.8					
Elapsed time (mins) Depth to water (m btoc) 0.0 0.000 1.0 0.300 2.0 0.360 3.0 0.400	Head of Water, H (m) 5.800 5.500 5.440 5.400	Ht / Ho 1.000 0.948 0.938 0.931	5.8					
Elapsed time (mins) Depth to water (m btoc) 0.0 0.000 1.0 0.300 2.0 0.360 3.0 0.400 4.0 0.450 5.0 0.470	Head of Water, H (m) 5.800 5.500 5.440 5.440 5.400 5.350 5.330	Ht / Ho 1.000 0.948 0.938 0.931 0.922 0.919	5.8					
Elapsed time (mins) Depth to water (m btoc) 0.0 0.000 1.0 0.300 2.0 0.360 3.0 0.400 4.0 0.450 5.0 0.470 10.0 0.580	Head of Water, H (m) 5.800 5.500 5.440 5.400 5.350 5.330 5.330 5.220 5.140	Ht / Ho 1.000 0.948 0.938 0.931 0.922 0.919 0.900 0.886	5.8 5.6 5.3					
Elapsed time (mins) Depth to water (m btoc) 0.0 0.000 1.0 0.300 2.0 0.360 3.0 0.400 4.0 0.450 5.0 0.470 10.0 0.580 15.0 0.660 20.0 0.840 30.0 1.160	Head of Water, H (m) 5.800 5.500 5.440 5.350 5.350 5.330 5.330 5.220 5.140 4.960 4.640	Ht / Ho 1.000 0.948 0.938 0.931 0.922 0.919 0.900 0.886 0.855 0.800	5.8 5.6 5.3 (E) 5.1					
Elapsed time (mins) Depth to water (m btoc) 0.0 0.000 1.0 0.300 2.0 0.360 3.0 0.400 4.0 0.450 5.0 0.470 10.0 0.580 15.0 0.660 20.0 0.840 30.0 1.160 45.0 1.600 60.0 1.850	Head of Water, H (m) 5.800 5.500 5.440 5.400 5.350 5.330 5.220 5.140 4.960 4.640 4.200 3.950	Ht / Ho 1.000 0.948 0.938 0.931 0.922 0.919 0.900 0.886 0.855 0.800 0.724 0.681	5.8 5.6 5.3 5.1					
Elapsed time (mins) Depth to water (m btoc) 0.0 0.000 1.0 0.300 2.0 0.360 3.0 0.400 4.0 0.450 5.0 0.470 10.0 0.580 15.0 0.660 20.0 0.840 30.0 1.160 45.0 1.600 60.0 1.850	Head of Water, H (m) 5.800 5.500 5.440 5.400 5.350 5.330 5.220 5.140 4.960 4.640 4.200 3.950	Ht / Ho 1.000 0.948 0.938 0.931 0.922 0.919 0.900 0.886 0.855 0.800 0.724 0.681	5.8 5.6 5.3 5.1 5.1 5.1 5.1 5.1 5.1 5.1 5.1 5.1 5.1					
Elapsed time (mins) Depth to water (m btoc) 0.0 0.000 1.0 0.300 2.0 0.360 3.0 0.400 4.0 0.450 5.0 0.470 15.0 0.660 20.0 0.840 30.0 1.160 45.0 1.600 60.0 1.850	Head of Water, H (m) 5.800 5.500 5.440 5.350 5.330 5.220 5.140 4.960 4.960 4.640 4.200 3.950	Ht / Ho 1.000 0.948 0.938 0.931 0.922 0.919 0.900 0.886 0.855 0.800 0.724 0.681	5.8 5.6 5.3 5.1 5.1 4.8 4.8					
Elapsed time (mins) Depth to water (m btoc) 0.0 0.000 1.0 0.300 2.0 0.360 3.0 0.400 4.0 0.450 5.0 0.470 10.0 0.580 15.0 0.660 20.0 0.840 30.0 1.160 45.0 1.600 60.0 1.850	Head of Water, H (m) 5.800 5.500 5.440 5.350 5.340 5.350 5.330 5.220 5.140 4.960 4.640 4.200 3.950	Ht / Ho 1.000 0.948 0.938 0.931 0.922 0.919 0.900 0.886 0.855 0.800 0.724 0.681	5.8 5.6 5.3 5.1 4.8 4.8 4.6					
Elapsed time (mins) Depth to water (m btoc) 0.0 0.000 1.0 0.300 2.0 0.360 3.0 0.400 4.0 0.450 5.0 0.470 10.0 0.580 15.0 0.660 20.0 0.840 30.0 1.160 45.0 1.600 60.0 1.850	Head of Water, H (m) 5.800 5.500 5.440 5.350 5.330 5.220 5.140 4.960 4.640 4.200 3.950	Ht / Ho 1.000 0.948 0.938 0.931 0.922 0.919 0.900 0.886 0.855 0.855 0.800 0.724 0.681	5.8 5.6 5.3 5.1 4.8 4.6 4.6					
Elapsed time (mins) Depth to water (m btoc) 0.0 0.000 1.0 0.300 2.0 0.360 3.0 0.400 4.0 0.450 5.0 0.470 10.0 0.580 15.0 0.660 20.0 0.840 30.0 1.160 45.0 1.600 60.0 1.850	Head of Water, H (m) 5.800 5.500 5.440 5.400 5.350 5.330 5.220 5.140 4.960 4.960 4.640 4.200 3.950	Ht / Ho 1.000 0.948 0.938 0.931 0.922 0.919 0.900 0.886 0.855 0.800 0.724 0.681	5.8 5.6 5.3 5.1 5.1 4.8 4.6 4.6					
Elapsed time (mins) Depth to water (m btoc) 0.0 0.000 1.0 0.300 2.0 0.360 3.0 0.400 4.0 0.450 5.0 0.470 10.0 0.580 15.0 0.660 20.0 0.840 30.0 1.160 45.0 1.600 60.0 1.850	Head of Water, H (m) 5.800 5.500 5.440 5.350 5.330 5.220 5.140 4.960 4.640 4.200 3.950	Ht / Ho 1.000 0.948 0.938 0.931 0.922 0.919 0.900 0.886 0.855 0.800 0.724 0.681	5.8 5.6 5.3 5.1 5.1 4.8 4.6 4.3					

0

7.5

15

Remarks

30

Elapsed time (mins)

22.5

45

37.5

₩ 60

52.5

ite /	Analy	/tical	Ser	vice	es l	_td.	SOL	JTH LODO	GE, HEA	THSIDE, I	HAMPS	STEAD, I	NW3 1	BL	Num W
tu Permeabi l ng Head	lity Type	Test No.	2		Ground	Level (mOD) Clien	it K AND AN	IANDA F	RAPHAEL					Job Num 172
		Location			Dates		Engi	neer							She
		TQ2688	60		16	/10/2017	ELLI	IOTTWOC	DD PART	INERSHI	P LTD				2
Height of ca	ising above g	round level:	0.00 r	n		PERMEA	BILITY	(after Hvo	orslev, 1	951)]			
Depth to Ba	se of Boreho	le:	6.00 n	n bgl		General	Approa	ch							
Depth to Ba	se of Casing		1.00 m	n bgl		H1 selec	ted at t	= 5.74 miı	ns (=t1 =	55.2 sec	s)				
Depth to eq	uilibrium wate	er level:	5.80 n	n btoc		H2 selec	ted at t	= 5.298 m	ins (=t2	= 3599.4	secs)				
Test Length	L:		5.00 m	n		k =	3.23E-0	7 ms-1							
Diameter of	Test Length	D:	0.05 m	n											
Area of Test	t Section:		0.0020 m	m2											
Intake Facto	on B figure 6	BS 5930)	0.1375												
Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho		5.8 🗧	X									
Elapsed time (mins) 0.0 1.0 2.0	Depth to water (m btoc) 0.000 0.040 0.020	Head of Water, H (m) 5.800 5.760 5.760	Ht / Ho 0.993 0.993		5.8 ;	X X									
Elapsed time (mins) 0.0 1.0 2.0 3.0 4.0	Depth to water (m btoc) 0.040 0.070 0.080 0.090	Head of Water, H (m) 5.800 5.760 5.730 5.720 5.710	Ht / Ho 1.000 0.993 0.988 0.986 0.984		5.8 3	×.									
Elapsed time (mins) 0.0 1.0 2.0 3.0 4.0 5.0 10.0	Depth to water (m btoc) 0.040 0.070 0.080 0.090 0.120 0.200	Head of Water, H (m) 5.800 5.760 5.730 5.720 5.720 5.710 5.680 5.600	Ht / Ho 0.993 0.988 0.986 0.984 0.979 0.966		5.8 3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX									
Elapsed time (mins) 0.0 1.0 2.0 3.0 4.0 5.0 10.0 15.0 20.0	Depth to water (m btoc) 0.040 0.070 0.080 0.090 0.120 0.200 0.260 0.300	Head of Water, H (m) 5.800 5.760 5.720 5.710 5.720 5.710 5.680 5.680 5.540 5.540 5.5500	Ht / Ho 1.000 0.993 0.988 0.986 0.984 0.979 0.966 0.955 0.948		5.8 \$ 5.7 • (E)	× ×									
Elapsed time (mins) 0.0 1.0 2.0 3.0 4.0 5.0 10.0 15.0 20.0 30.0 45.0 30.0	Depth to water (m btoc) 0.040 0.070 0.080 0.120 0.200 0.260 0.300 0.400 0.440	Head of Water, H (m) 5.800 5.760 5.720 5.720 5.710 5.680 5.600 5.540 5.500 5.540 5.500 5.400 5.360	Ht / Ho 1.000 0.993 0.988 0.988 0.988 0.988 0.988 0.986 0.985 0.948 0.955 0.948 0.931 0.924 0.924		ater (m)	×××	 								
Elapsed time (mins) 0.0 1.0 2.0 3.0 4.0 5.0 10.0 15.0 20.0 30.0 45.0 60.0	Depth to water (m btoc) 0.040 0.070 0.080 0.090 0.120 0.200 0.260 0.300 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.760 5.720 5.710 5.720 5.710 5.680 5.540 5.540 5.540 5.5500 5.400 5.360 5.330	Ht / Ho 1.000 0.993 0.988 0.986 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919		t Mater (m)	×,									
Elapsed time (mins) 0.0 1.0 2.0 3.0 4.0 5.0 10.0 15.0 20.0 30.0 45.0 60.0	Depth to water (m btoc) 0.040 0.070 0.080 0.120 0.200 0.260 0.300 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.760 5.730 5.720 5.710 5.680 5.570 5.540 5.500 5.540 5.500 5.400 5.360 5.330	Ht / Ho 1.000 0.993 0.988 0.988 0.988 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919		ad of Water (m)	×××									
Elapsed time (mins) 0.0 1.0 2.0 3.0 4.0 5.0 10.0 15.0 20.0 30.0 45.0 60.0	Depth to water (m btoc) 0.040 0.070 0.080 0.090 0.120 0.200 0.260 0.300 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.760 5.720 5.710 5.680 5.5710 5.680 5.540 5.540 5.5500 5.400 5.360 5.330	Ht / Ho 1.000 0.993 0.988 0.986 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919		Head of Water (m)	× ×	*								
Elapsed time (mins) 0.0 1.0 2.0 3.0 4.0 5.0 10.0 15.0 20.0 30.0 45.0 60.0	Depth to water (m btoc) 0.040 0.070 0.080 0.120 0.200 0.260 0.300 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.760 5.730 5.720 5.710 5.680 5.570 5.540 5.500 5.540 5.500 5.400 5.360 5.330	Ht / Ho 0.993 0.988 0.986 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919		Fead of Water (m)	×××		*							
Elapsed time (mins) 0.0 1.0 2.0 3.0 4.0 5.0 10.0 15.0 20.0 30.0 45.0 60.0	Depth to water (m btoc) 0.040 0.070 0.080 0.120 0.200 0.260 0.300 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.760 5.730 5.710 5.710 5.680 5.540 5.540 5.540 5.540 5.360 5.330	Ht / Ho 0.993 0.988 0.986 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919		5.8 5.7 • • • • • • • • • • • • • • • • • • •	×××	*								
Elapsed time (mins) 0.0 1.0 2.0 3.0 4.0 5.0 10.0 15.0 20.0 30.0 45.0 60.0	Depth to water (m btoc) 0.040 0.070 0.080 0.120 0.200 0.260 0.300 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.760 5.730 5.720 5.710 5.680 5.500 5.540 5.500 5.400 5.360 5.330	Ht / Ho 0.993 0.988 0.986 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919		5.8 5 5.7 - 5.7 5.6 5.6 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4		*								
Elapsed time (mins) 0.0 1.0 2.0 3.0 4.0 5.0 10.0 15.0 15.0 20.0 30.0 45.0 60.0	Depth to water (m btoc) 0.000 0.040 0.070 0.080 0.120 0.200 0.260 0.300 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.730 5.730 5.720 5.710 5.680 5.540 5.540 5.5500 5.400 5.360 5.330	Ht / Ho 1.000 0.993 0.988 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919		Head of Water (m)		*					*			
Elapsed time (mins) 0.0 1.0 2.0 3.0 4.0 5.0 10.0 15.0 20.0 30.0 45.0 60.0	Depth to water (m btoc) 0.040 0.070 0.080 0.120 0.200 0.200 0.260 0.300 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.760 5.730 5.720 5.710 5.680 5.500 5.540 5.500 5.400 5.360 5.330	Ht / Ho 0.993 0.988 0.984 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919		5.8 ⁵ 5.7 - 5.6 - 5.6 - 5.6 - 5.6 - 5.6 - 5.6 - 5.6 - 5.4 - 5.6 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4 - 5.4										
Elapsed time (mins) 0.0 1.0 2.0 3.0 4.0 5.0 10.0 15.0 15.0 20.0 30.0 45.0 60.0	Depth to water (m btoc) 0.000 0.040 0.070 0.080 0.120 0.200 0.200 0.260 0.300 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.760 5.730 5.720 5.710 5.680 5.540 5.540 5.5500 5.400 5.360 5.330	Ht / Ho 1.000 0.993 0.988 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919		Head of Water (m)	0 7.5			2.5	30	37.5	45		52.5	60
Elapsed time (mins) 0.0 1.0 2.0 3.0 4.0 5.0 10.0 15.0 20.0 30.0 45.0 60.0	Depth to water (m btoc) 0.000 0.040 0.090 0.120 0.200 0.200 0.200 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.760 5.720 5.710 5.680 5.600 5.600 5.540 5.540 5.540 5.330	Ht / Ho 0.993 0.988 0.986 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919		5.8 5	0 7.5		15 2 Ela	2.5 apsed	30 time (37.5 mins	45		52.5	60
Elapsed time (mins) 0.0 1.0 2.0 3.0 4.0 5.0 10.0 15.0 20.0 30.0 45.0 60.0	Depth to water (m btoc) 0.000 0.040 0.070 0.080 0.120 0.200 0.260 0.300 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.730 5.730 5.720 5.710 5.680 5.540 5.540 5.5500 5.400 5.360 5.330	Ht / Ho 1.000 0.993 0.988 0.986 0.955 0.948 0.931 0.924 0.919		5.8 5 5.7 Head of Mater (m)	0 7.5		15 2 Ela	2.5 apsed	30 time (37.5 mins	45		52.5	÷60
Elapsed time (mins) 0.0 1.0 2.0 3.0 4.0 5.0 10.0 15.0 20.0 30.0 45.0 60.0	Depth to water (m btoc) 0.040 0.070 0.080 0.120 0.200 0.260 0.300 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.760 5.720 5.710 5.680 5.540 5.540 5.540 5.5500 5.400 5.360 5.330	Ht / Ho 1.000 0.993 0.988 0.986 0.984 0.979 0.965 0.948 0.931 0.924 0.919		5.8 5.7 • • • • • • • • • • • • • • • • • • •	0 7.5		15 2 Elá	2.5 apsed	30 1 time (37.5 mins	45		52.5	60



UNDRAINED TRIAXIAL COMPRESSION TEST

LUUA		South Lot	ige, neath	side, Hampstead			
BH/TP No.	MOISTURE CONTENT	BULK DENSITY	LATERAL PRESSURI	COMPRESSIVE E STRENGTH	COHESION	ANGLE OF SHEARING RESISTANCE	DEPTH
	%	Mg/m ³	kN/m²	kN/m ²	kN/m²	degrees	m
BH1	27	1.89	50	116	58		2.25
BH1	28	2.00	80	98	49		4.25

LOCATION South Lodge, Heathside, Hampstead, London NW3 1BL



PLASTICITY INDEX & MOISTURE CONTENT DETERMINATIONS

LOCATION South Lodge, Heathside, Hampstead, London NW3 1BL

BH/TP No.	Depth	Natural Moisture	Liquid Limit	Plastic Limit	Plasticity Index	Passing 425 μm	Class
	m	%	%	%	%	%	
BH1	3.00	28	50	26	24	100	CI/CH
	3.75	32	49	28	21	100	CI
	4.75	27	48	23	25	100	CI
WS1	3.00	26	44	23	21	100	CI
	3.50	25	45	20	25	100	CI
	4.00	25	45	20	25	100	CI



SULPHATE & pH DETERMINATIONS

BH/TP No.	DEPTH BELOW	SOIL S A	ULPHATES S SO4 WATER SOL	WATER SULPHATES AS SO4	рН	CLASS	SOIL - 2mm
	m	%	g/l	g/l			%
BH1	5.00		0.18		8.2	DS-1	100
	9.00		0.19		7.7	DS-1	100
W/S1	4 50		0 14		71	DS-1	100
WOT	4.00		0.14		7.1	00-1	100
	6.00		0.19		7.2	DS-1	100

LOCATION South Lodge, Heathside, Hampstead, NW3 1BL

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



GROUNDWATER MONITORING

South Lodge, Heathside, Hampstead, NW3 1BL LOCATION

	GROUNDWATER MONITORING RECORD										
Date	Weather Conditions	Temperature (°C)									
07/11/2017	Light Rain	Light Rain Wet									
Monitoring Point Location	Depth to wate	Depth to water (mBGL)									
WS1	3.91	3.91									
BH1	2.72		6.00								



GROUNDWATER MONITORING

South Lodge, Heathside, Hampstead, NW3 1BL LOCATION

	GROUNDWATER MONITORING RECORD										
Date	Weather Conditions	Temperature (°C)									
07/11/2017	Light Rain	Light Rain Wet									
Monitoring Point Location	Depth to wate	Depth to water (mBGL)									
WS1	3.62	5.42									
BH1	2.51		6.00								



Aubrey Davidson Site Analytical Services Ltd Units 14 & 15 River Road Business Park 33 River Road Barking Essex IG11 0EA



QTS Environmental Ltd Unit 1 Rose Lane Industrial Estate Rose Lane Lenham Heath Kent ME17 2JN t: 01622 850410 russell.jarvis@gtsenvironmental.com

QTS Environmental Report No: 17-66298

Site Reference:	South Lodge, Heathside
Project / Job Ref:	17/27399
Order No:	1525
Sample Receipt Date:	30/10/2017
Sample Scheduled Date:	30/10/2017
Report Issue Number:	1
Reporting Date:	03/11/2017

Russell Jarvis Associate Director of Client Services

Dave Ashworth Deputy Quality Manager

QTSE is the trading name of DETS Ltd, company registration number 03705645





Soil Analysis Certificate							
QTS Environmental Report No: 17-66298		1	Date Sampled	27/10/17	27/10/17		
Site Analytical Services Ltd		Т	ime Sampled	None Supplied	None Supplied		
Site Reference: South Lodge, Heathside			TP / BH No	BH1	WS1		
Project / Job Ref: 17/27399		Ac	Iditional Refs	None Supplied	None Supplied		
Order No: 1525			Depth (m)	1.75	0.75		
Reporting Date: 03/11/2017		QT	SE Sample No	298633	298634		
			·				
Determinand	Unit	RL	Accreditation				
Ashestos Screen ^(S)	N/a	N/a	IS017025	Not Detected	Not Detected		

Asbestos Screen (S)	N/a	N/a	ISO17025	Not Detected	Not Detected		
pH	pH Units	N/a	MCERTS	8.0	7.3		
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2		
Complex Cyanide	mg/kg	< 2	NONE	< 2	< 2		
Free Cyanide	mg/kg	< 2	NONE	< 2	< 2		
Total Sulphate as SO ₄	mg/kg	< 200	NONE	256	294		
Total Sulphate as SO ₄	%	< 0.02	NONE	0.03	0.03		
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	61	43		
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.06	0.04		
Sulphide	mg/kg	< 5	NONE	< 5	< 5		
Organic Matter	%	< 0.1	MCERTS	0.7	0.2		
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	0.4	0.1		
Arsenic (As)	mg/kg	< 2	MCERTS	5	6		
W/S Boron	mg/kg	< 1	NONE	< 1	< 1		
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	< 0.2		
Chromium (Cr)	mg/kg	< 2	MCERTS	20	25		
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2		
Copper (Cu)	mg/kg	< 4	MCERTS	6	9		
Lead (Pb)	mg/kg	< 3	MCERTS	17	10		
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1		
Nickel (Ni)	mg/kg	< 3	MCERTS	6	8		
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3		
Zinc (Zn)	mg/kg	< 3	MCERTS	39	32		
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2		

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

Subcontracted analysis (S)





Soil Analysis Certificate	- Speciated PAHs					
QTS Environmental Repor	t No: 17-66298		Date Sampled	27/10/17	27/10/17	
Site Analytical Services Lt	:d		Time Sampled	None Supplied	None Supplied	
Site Reference: South Lo	dge, Heathside		TP / BH No	BH1	WS1	
Project / Job Ref: 17/273	399		Additional Refs	None Supplied	None Supplied	
Order No: 1525			Depth (m)	1.75	0.75	
Reporting Date: 03/11/2	.017	Q	TSE Sample No	298633	298634	
Determinand	Unit	RL	Accreditation			
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	
Coronene	mg/kg	< 0.1	NONE	< 0.1	< 0.1	
Total Oily Waste PAHs	mg/kg	< 1	MCERTS	< 1	< 1	
Total Dutch 10 PAHs	mg/kg	< 1	MCERTS	< 1	< 1	
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	
Total WAC-17 PAHs	mg/kg	< 1.7	NONE	< 1.7	< 1.7	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C





Soil Analysis Certificate	- TPH CWG Bande	d					
QTS Environmental Repor	t No: 17-66298		Date Sampled	27/10/17	27/10/17		
Site Analytical Services Lt	:d	Time Sampled		None Supplied	None Supplied		
Site Reference: South Lo	dge, Heathside		TP / BH No	BH1	WS1		
Project / Job Ref: 17/273	399		Additional Refs	None Supplied	None Supplied		
Order No: 1525			Depth (m)	1.75	0.75		
Reporting Date: 03/11/2	.017	Q	TSE Sample No	298633	298634		
Determinand	Unit	RL	Accreditation				
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01		ļ
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05		
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2		
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2		
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3		
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3		
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10		
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21		
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01		
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05		
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2		
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2		
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2		
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3		
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10		1
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	< 21		1
Total >C5 - C35	mg/kg	< 42	NONE	< 42	< 42		

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C





Soil Analysis Certificate	- BTEX / MTBE					
QTS Environmental Report No: 17-66298		Date Sampled		27/10/17	27/10/17	
Site Analytical Services Lt	d		Time Sampled	None Supplied	None Supplied	
Site Reference: South Lo	dge, Heathside	TP / BH No		BH1	WS1	
Project / Job Ref: 17/27399		Additional Refs		None Supplied	None Supplied	
Order No: 1525			Depth (m)	1.75	0.75	
Reporting Date: 03/11/2017		QTSE Sample No		298633	298634	
Determinand	Unit	RL	Accreditation			
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	
Ethylbenzene	ug/kg	< 2	MCERTS	< 2	< 2	
p & m-xylene	ug/kg	< 2	MCERTS	< 2	< 2	
o-xylene	ug/kg	< 2	MCERTS	< 2	< 2	
MTBF	ua/ka	< 5	MCERTS	< 5	< 5	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C





Waste Acceptance Criteria	Analytical Ce	ertificate - BS EN	12457/3					
QTS Environmental Report No: 17-66298 Date Sampled			27/10/17			Landfill Wast	e Acceptance (Criteria Limits
Site Analytical Services Ltd Time Sampled		None Supplied						
Site Reference: South Lodge,	Heathside	TP / BH No	BH1				Stable Non-	
Project / Job Ref: 17/27399		Additional Refs	None			Inert Waste	reactive HAZARDOUS	Hazardous Waste
Order No: 1525		Depth (m)	1.75			Landfill	waste in non- hazardous	Landfill
Reporting Date: 03/11/2017		QTSE Sample No	298633				Landfill	
Determinand	Unit	MDI						
	Unit 0/4	MDL	0.4			20/-	50/-	60/-
Loss on Ignition	-70	< 0.1	1.70			570	J-70	10%
	70 70	< 0.01	1.70					10%
BIEX S	mg/kg	< 0.05	< 0.05			6		
	mg/kg	< 0.1	< 0.1			1		
	mg/kg	< 10	< 10			500		
	mg/kg	< 1.7	< 1.7			100		
pH ^{MO}	pH Units	N/a	8.0				>6	
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	< 1				To be	To be
. ,	,				Cumulative	Limit values	evaluated	evaluated
Eluste Analysis			2:1	8:1	10.1		N 12457-2 of 1	/S 10 I/kg
Liudte Analysis			ma/l	ma/l	10.1 ma/ka	using b5 b	(ma/ka)	-/3 IU I/Kg
A	-		< 0.01	(1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	111 9/ Kg	0.5		25
Arsenic	_		< 0.01	< 0.01	 < 0.2	0.5	100	20
Barium ⁻	_		< 0.02	< 0.02	< 0.1	20	100	500
	_		< 0.0005	< 0.0005	< 0.02	0.04	1	5
Chromium	_		< 0.005	< 0.005	 < 0.20	0.5	10	70
Copper ^o	_		< 0.01	< 0.01	 < 0.5	2	50	100
Mercury	_		< 0.005	< 0.005	 < 0.01	0.01	0.2	2
Molybdenum	_		0.004	0.002	 < 0.1	0.5	10	30
Nickel	_		< 0.007	< 0.007	 < 0.2	0.4	10	40
Lead			< 0.005	< 0.005	 < 0.2	0.5	10	50
Antimony			< 0.005	< 0.005	 < 0.06	0.06	0.7	5
Selenium			< 0.005	< 0.005	< 0.1	0.1	0.5	7
Zinc			< 0.005	< 0.005	< 0.2	4	50	200
Chloride			4	3	27	800	15000	25000
Fluoride	_		< 0.5	< 0.5	< 1	10	150	500
Sulphate ^U	_		25	5	65	1000	20000	50000
TDS	_		74	29	330	4000	60000	100000
Phenol Index	_		< 0.01	< 0.01	< 0.5	1	-	-
DOC			9.6	8.6	86.6	500	800	1000
Leach Test Information								
Sample Mass (kg)			0.19					
Dry Matter (%)			93					
Moisture (%)			7.6					
Stage 1								
Volume Eluate L2 (litres)			0.34					
Filtered Eluate VE1 (litres)			0.15					
	-							
	haria afi		at the second	de la				
EVENUTS are everessed on a dry weight	made attor corror	www.tor.moisture.conte	www.wnoro.annlica	11 M L				

Stated limits are expressed on a dry weight basis, after correction for moisture content where applicable Stated limits are for guidance only and QTS Environmental cannot be held responsible for any discrepencies with current legislation M Denotes MCERTS accredited test U Denotes ISO17025 accredited test





Waste Acceptance Criteria	Analytical Ce	ertificate - BS EN	12457/3					
QTS Environmental Report No:	17-66298	Date Sampled	27/10/17			Landfill Wast	te Acceptance	Criteria Limits
Site Analytical Services Ltd Time Sampled		None Supplied						
Site Reference: South Lodge,	Heathside	TP / BH No	WS1				Stable Non-	
Project / Job Ref: 17/27399		Additional Refs	None Supplied			Inert Waste	reactive HAZARDOUS	Hazardous Waste
Order No: 1525		Depth (m)	0.75			Landfill	hazardous	Landfill
Reporting Date: 03/11/2017		QTSE Sample No	298634				Lunum	
Determinand	Unit	MDL		I				
TOC ^{MU}	%	< 0.1	0.1	I		3%	5%	6%
Loss on Ignition	%	< 0.01	1.70					10%
BTEX ^{MU}	mg/kg	< 0.05	< 0.05			6		
Sum of PCBs	mg/kg	< 0.1	< 0.1]		1		
Mineral Oil ^{MU}	mg/kg	< 10	< 10			500		
Total PAH ^{MU}	mg/kg	< 1.7	< 1.7			100		
рН ^{MU}	pH Units	N/a	7.3				>6	
Acid Noutralization Canacity	mol/kg () ()	- 1	z 1				To be	To be
Actu Neutralisation Capacity	11101/Kg (+/-)	< 1	< 1				evaluated	evaluated
			2:1	8:1	Cumulative	Limit values	for compliance	leaching test
Eluate Analysis				0.1	10:1	using BS E	N 12457-3 at l	L/S 10 l/kg
			mg/l	mg/l	mg/kg		(mg/kg)	
Arsenic ^U			< 0.01	< 0.01	< 0.2	0.5	2	25
Barium ^U			< 0.02	< 0.02	< 0.1	20	100	300
Cadmium ^u			< 0.0005	< 0.0005	< 0.02	0.04	1	5
Chromium ^U			< 0.005	< 0.005	< 0.20	0.5	10	70
Copper ^U			< 0.01	< 0.01	< 0.5	2	50	100
Mercury ^U			< 0.005	< 0.005	< 0.01	0.01	0.2	2
Molybdenum ^U			< 0.001	< 0.001	< 0.1	0.5	10	30
Nickel ^u			< 0.007	< 0.007	< 0.2	0.4	10	40
Lead ^U			< 0.005	< 0.005	< 0.2	0.5	10	50
Antimony ^u			< 0.005	< 0.005	< 0.06	0.06	0.7	5
Selenium ^u			< 0.005	< 0.005	< 0.1	0.1	0.5	7
Zinc ^U			< 0.005	< 0.005	< 0.2	4	50	200
Chloride ^U			4	3	28	800	15000	25000
Fluoride ^U			< 0.5	< 0.5	< 1	10	150	500
Sulphate ^U			13	4	42	1000	20000	50000
TDS			58	26	276	4000	60000	100000
Phenol Index			< 0.01	< 0.01	< 0.5	1	-	-
DOC	_		11.6	8.1	82.8	500	800	1000
Leach Test Information	8		11.0	011	02.0			1000
Comple Mana (las)			0.21					
			0.21	l	 			
Dry Matter (%)			83.9					
Moisture (%)			19.2		 			
Stage 1			0.00					
Volume Eluate L2 (litres)			0.32	l				
Filtered Eluate VE1 (litres)			0.09	l				
Bosulta are expressed on a dry weight	hacic after correc	tion for maisture conto	nt whore applies		 			

Stated limits are for guidance only and QTS Environmental cannot be held responsible for any discrepencies with current legislation M Denotes MCERTS accredited test U Denotes ISO17025 accredited test





Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 17-66298	
Site Analytical Services Ltd	
Site Reference: South Lodge, Heathside	
Project / Job Ref: 17/27399	
Order No: 1525	
Reporting Date: 03/11/2017	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
298633	BH1	None Supplied	1.75	7	Light brown sandy clay
298634	WS1	None Supplied	0.75	16.1	Brown sandy clay

Moisture content is part of procedure E003 & is not an accredited test Insufficient Sample $^{\rm VS}$ Unsuitable Sample $^{\rm VS}$

Page 8 of 9





Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 17-66298
Site Analytical Services Ltd
Site Reference: South Lodge, Heathside
Project / Job Ref: 17/27399
Order No: 1525
Reporting Date: 03/11/2017

Matrix	Analysed	Determinand	Brief Method Description	Method
Call	Un	Bauan Watau Calubla		
Soli	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soll	AR	BIEX	Determination of BTEX by headspace GC-MS	E001
Soll	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	F020
Soil		EPH (C10 - C40)	Determination of actione/basing extractable budgestone by GC-ETD	E020
Soil		EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-TD	E004
3011	AL		Determination of acctone/hexaric extractable hydrocarbons by GC+1D	LUUT
Soil	AR			E004
Call	D	C12-C16, C16-C21, C21-C40)		5000
Soli	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content: determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TFM)	Gravimetrically determined through extraction with toluene	E011
	-		Determination of organic matter by oxidising with potassium dichromate followed by titration with	
Soil	D	Total Organic Carbon (TOC)	iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried



9.0 APPENDIX B. GROUND MOVEMENT ASSESSMENT

Ground Movement Assessment

South Lodge, Heathside, NW3 1BL

April 2018



CONTROL SHEET

CLIENT:	SITE ANALYTICAL SERVICES LIMITED (SASL)
PROJECT TITLE:	SOUTH LODGE, HEATHSIDE, HAMPSTEAD NW3 1BL
REPORT TITLE:	GROUND MOVEMENT ASSESSMENT
DOCUMENT NUMBER:	125183/R0
STATUS:	FINAL

lule	ISSU	E 1	Name				Signature	•	Date
oval Sched	Prepar	ed by	Joh	n Thuysbaer	t				24/04/2018
le & Appro	Check	ed by	And	drew Smith					25/04/2018
ıssl	Approv	ed by	And	drew Penrose	è				25/04/2018
	Rev.	Date	•	Status	Descrip	otion		Signature	
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This document has been prepared in accordance with procedure OP/P02 of the Fairhurst Quality and Environmental Management System.

This document has been prepared in accordance with the instructions of the client, Site Analytical Services Limited, for the client's sole and specific use. Any other persons who use any information contained herein do so at their own risk.

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2.0	BASELINE CONDITIONS	.4
3.0	GROUD INVESTIGATION AND MONITORING	.5
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FIGURES

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FIGURE 2 – Undrained Shear Strength Versus Depth Plot
FIGURE 3 – Young's Modulus Versus Depth Plot
FIGURE 4 – Modulus of Volume Compressibility (Mv) Vs Depth

FIGURE 5 – Ground Movement Assessment Wall Location Plan

APPENDICES

- APPENDIX A Proposed Development Plans and Topographical Survey
- APPENDIX B SASL Ground Investigation Records
- APPENDIX C Structural Loadings and Proposed Basement Plan
- APPENDIX D Settle3D Stage 1 (Undrained Unloading)
- APPENDIX E Settle3D Stage 2 (Undrained Reloading)
- APPENDIX F Settle3D Stage 3 (Drained Reloading)
- APPENDIX G XDISP Analysis

1.0 INTRODUCTION

1.1 Background

Fairhurst have been commissioned by Site Analytical Services Limited (SASL) to complete a Ground Movement Assessment (GMA) in connection with a proposed residential development at South Lodge, Heathside, Hampstead at approximate postcode NW3 1BL. The location of the site is detailed on Figure 1. The purpose of this assessment is to determine what effects the proposed permanent construction may have upon nearby structures.

A site specific Ground Investigation has previously been carried out by SASL in October 2017 at the site. The ground investigation was designed by SASL and the results have been used in the derivation of parameters utilised in this assessment. Fairhurst cannot be held responsible for any inaccuracy in the factual data provided. It is understood that this report will be included as part of a Basement Impact Assessment (BIA) to be submitted to Camden Council by the client.

1.2 Proposed Development

The development proposal at the site involves the extension of the existing lower ground floor (basement level) below the existing property and rear extension.

In accordance with the topographical survey and drawings provided by the Architects (Appendix A) the existing ground level of the existing property is at 95.50m AOD. The Finished Floor Level (FFL) of the proposed new basement steps down from 92.85m AOD below the footprint of the original property (which equates to an approx. 0.90m excavation) to 92.00m AOD below the existing rear extension (a 3.50m excavation).

The 0.90m excavation below the building is referred to as the new basement in this document whilst the 3.50m excavation below the rear extension is referred to as the new sub-basement.

Further information on the proposed construction is detailed on the architect drawings, presented in Appendix A whilst the existing and proposed structural loads determined by Elliot Wood are presented in Appendix C.

1.3 Limitations

The conclusions and recommendations made in this report are made on the basis of the site specific ground investigations undertaken by SASL undertaken in October 2017. The ground investigation was designed by SASL and the results of the work should be viewed in the context of the range of data sources consulted and the information provided along with the number of locations where the ground was sampled. No liability can be accepted for inaccuracies in the factual data, information in other data sources or conditions not revealed by the sampling or testing.

In addition to this SASL have recommended the use of third party data where appropriate, it is assumed that reliance on that data used in this report has been agreed by SASL.

The effect of the proposed construction on existing subterranean assets (including services and tunnels) is outside the scope of this report.

1.4 Qualifications

The report has been written by Mr Andrew Smith, a Chartered Geologist (CGeol) and Member of the Chartered Institute of Water and Environmental Management (MCIWEM) and approved by Mr Andrew Penrose, a Chartered Structural Engineer (CEng) and Member of the Institution of Structural Engineers (MIStructE).

2.0 BASELINE CONDITIONS

2.1 Site Description

The site is located at South Lodge, Heathside, Hampstead, NW3 1BL (National Grid Ref: 526895, 186040). A site location plan is included in this report as Figure 1.

The site is located on the western side of Heathside, covers an approximate area of 0.19 hectares and is under the authority of the London Borough of Camden. The semi-detached residential building comprises five levels of accommodation arranged over basement, ground, first, second and third floors. Details of the buildings located in close proximity to the property which have been considered in the analysis are described in Table 2-1 below and detailed on Figure 5.

From the topographical information provided by the Architects, the front (south eastern) garden of the property is at level of 94.46m AOD whilst the rear (north western) garden is at level 95.8m AOD. The driveway slopes north-westwards from 94.02m AOD from the entrance of the property located southeast of the site, to 94.93m AOD at South Lodge.

Building Name	Name Description		Distance from the site
No.1 E Heath Road	3 storey semi-detached residential dwelling with roof space.	12m	Immediately Adjacent to the northeast
No.2 E Heath Road	1 storey detached residential outbuilding.	2.5m	Adjacent 1.5m to the Northeast

2.2 Geology

The British Geological Survey (BGS) map of the area (North London, Sheet 256) indicates that the site is underlain directly by the Claygate Member (ClgB) which is in turn underlain by the London Clay Formation. The site is also detailed by the BGS to be in an area locally likely to be covered by Superficial Head Deposits (Head Propensity). These deposits have not been formally mapped by the BGS and have been interpreted from slope analyses and borehole data only.

Superficial Head Deposits generally comprise clays, silts, sands and gravels and were formed up to 3 million years ago in the Quaternary Period in a local environment previously dominated by subaerial slopes.

According to the BGS Lexicon, the underlying London Clay (LC) Formation comprises "bioturbated or poorly laminated, blue-grey or grey brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. The Claygate Member (ClgB) comprises dark grey clays with sand laminae, passing up into thin alternations of clays, silts and fine-grained sand, with beds of bioturbated silt.

There are no available BGS historical boreholes within 100m of the site.

3.0 GROUD INVESTIGATION AND MONITORING

A site specific Ground Investigation (GI) was undertaken by SASL from the October to November 2017. The works undertaken at the site comprised of the following:

- One rotary percussive borehole (BH1) down to a depth of 15.0m bgl inclusive of Standard Penetration Testing (SPT) and U100 sampling;
- One continuous flight auger borehole (WS1) to a depth of 6.0m bgl. Shear vane testing was undertaken at regular intervals to enable in-situ testing for geotechnical purposes;
- Seven hand excavated Trial Pits (TP1 to TP7) to a depth of 1.0m bgl to determine existing foundation constructions and founding materials;
- Collection of disturbed soil samples for geotechnical and geo-environmental laboratory testing;
- Installation of two 50mm internal diameter groundwater monitoring wells to depths of 6m bgl in both boreholes;
- Two rounds of groundwater level monitoring following completion of the site works.

Full factual records of the ground investigation works, including the results of all laboratory analysis, groundwater monitoring and exploratory logs, are presented in the SASL Factual Report (refer Appendix B).

3.1 Ground Conditions

The boreholes and trial pits revealed ground conditions that were generally consistent with the geological records and known history of the area. A summary of the ground conditions encountered is presented below in Table 3-1.

Strata	Depth (m Elevation	bgl) and (m AOD)	Maximum Thickness	Description	
	Тор	Base	(m)		
Made Ground	GL (95.52) to GL (94.46)	0.7 (94.82) to 0.9 (93.56)	0.9	MADE GROUND - Grass, over gravelly sandy CLAY with fragments of brick and concrete rubble.	
Claygate Member (ClgB)	0.7 (94.82) to 0.9 (93.56)	6.7 (88.82) to 6.0 (88.46)	6.0	Soft silty sandy CLAY / stiff silty sandy CLAY with lenses of silty fine sand.	
London Clay (LC)*	6.7 (88.82) to 6.0 (88.46)	15.0 (80.52) Base of BH1	8.3 (Base of BH1	Stiff very silty very sandy CLAY with lenses of silty fine sand.	

Table 3-1: Summary of the SASL Ground Investigation

*Maximum thickness of London Clay Formation not proven

3.2 Foundation Inspection Pits

Seven number of foundation inspection pits (TP1 – TP7) were undertaken within the ground floor and within the basement floor of the existing building at positions shown in the SASL exploratory layout plan (refer Appendix B). The foundation pit schematics are presented within the SASL GI records as shown in Appendix B and the findings are summarised in Table 3-2.

Trial Pit No.	Founding Depth m bgl	TP limit of excavation m bgl	Comments
TP1	0.07	1.0	Located in existing basement. Tiled floor over brick foundation founded in MADE GROUND (Gravelly sandy clay with fragments of brick).
TP2	0.25	1.0	Located in existing basement. Tiled floor over brick and concrete foundation founded in the ClgB (very sandy CLAY).
TP3	0.56	1.0	Located in existing basement. Tiled floor over stepped brick and lime mortar foundation founded in MADE GROUND (gravelly sandy clay with fragments of brick and concrete rubble and ash).
TP4	0.55	1.0	Located in existing basement. Tiled floor over brick foundation founded in the ClgB (very sandy CLAY). 4" Cast iron pipe located 0.53m from the foundation at a depth of 0.39m bgl.
TP5	0.22	1.0	Located in existing basement. Tiled floor over brick foundation founded in MADE GROUND (Brick rubble).
TP6	*NP	1.0	Located in Ground Floor directly above the footprint of the proposed basement extension. Brick and old yellow stocks foundation proven to limit of excavation only. Underside of foundation was not found (assumed founded in the ClgB).
TP7	*NP	1.0	Located in Ground Floor directly above the footprint of the proposed basement extension. Brick and old yellow stocks foundation proven to limit of excavation only.

Table 3-2: Summary of foundation inspection pits

*GF = Ground Floor *NP: Denotes that the foundation depth was not proven during the foundation inspection

3.3 Groundwater

Groundwater was encountered during the drilling works at approx. 4.0m and 5.8m bgl in BH1 and WS1 respectively within the Claygate Member. Groundwater was not encountered in any of the trial pits during the site works and the material remained essentially dry throughout.

founded in the ClgB) ...

Underside of foundation was not found (assumed

Following completion of ground investigation works the monitoring well installed in BH1 and WS1 was monitored on 2 No. occasions in November 2017 with the results summarised in Table 3-3 below.

Date	Borehole ID	Ground Level		Response Zone	Groundwater Level		
		m AOD	m bgl	m AOD	m bgl	m AOD	
7/11/2018	BH1	95.52	1.0 – 6.0	94.52 - 89.52	ClgB	3.91	91.61
7/11/2018	BH1	95.52	1.0 – 6.0	94.52 - 89.52	ClgB	3.62	91.90
16/11/2018	WS1	94.46	1.0 – 5.42	93.46 - 89.04	ClgB	2.72	91.74
16/11/2018	WS1	94.46	1.0 – 5.42	93.46 - 89.04	ClgB	2.51	91.95

*ClgB Claygate Member

The water monitoring undertaken indicates that the groundwater level in BH1 and WS1 was recorded slightly below the maximum excavation depth of 92.0m AOD.

The above interpretation is based on two monitoring visits and it would be prudent to continue monitoring of the existing standpipe for as long as possible in order to determine equilibrium level and the extent of any seasonal variations.

3.4 In-situ and Laboratory Testing

A summary of laboratory and in-situ test results undertaken within the geological strata encountered during the SASL GI is presented below. Detailed results are available in the SASL Geotechnical Investigation records as shown in Appendix D and Figure 2 to 4.

In-situ Strength Testing

Eight in-situ SPTs were undertaken within BH1. The results are summarised in Table 3-4.

Table 3-4: Summary of SPTs

Lithology	No.	Depth of testing	SPT N Value	Correlated Parameters*
	Tests	(m bgl)		Undrained Shear Strength, Cu (kN/m ²)
Claygate Member (ClgB)	3	1.0 to 5.0	5 to 10 (Avg. 8)	23 to 45 (Avg. 35)
London Clay (LC)	5	8.0 to 14.6	14 to 23 (Avg. 18)	63 to 104 (Avg.81)

*Values of undrained shear strength (Cu) have been correlated from the results of SPTs using the following relationship: $Cu = f_1 \times N$ (Stroud and Butler, 1975). Based on the Plasticity Index results from the Atterberg Limit Testing of this material, an f_1 value of 4.5 has been used for the correlation.

In accordance with BS5930:2015, the ClgB is representative of a low to medium strength material. The LC is representative of a medium to high strength cohesive material.

The results of the in-situ strength testing have been plotted as undrained shear strength (Cu) against depth and are presented graphically as Figure 3. A trend of increasing strength with depth is observed within the ClgB and LC.

Shear Vane Testing

Ten Situ Borehole Shear Vane Tests were undertaken within WS1 in order to assess the undrained shear strength of the cohesive materials below the site. The results are summarised in Table 3-5 below.

Table 3-5: Summary of Shear Vane test results

Strata	No. Tests	Depth of testing (m bgl)	Undrained Shear Strength, Cu (kPa)
Claygate Member (ClgB)	10	1.0 to 6.0	113 to 130+* (Avg.124)

*130 kPa is the upper limit of the shear of the Hand Shear Vane apparatus

Figure 2 shows a comparative plot of laboratory (Triaxial) Cu and in-situ (SPT & Shear Vane) converted Cu results against depth. The hand vane shear testing does not correlate with the strengths indicated by the standard penetration testing or triaxial testing with the shear vane test values being on average 50-70% higher than the corresponding values.

Triaxial testing has been performed on undisturbed samples collected from site and considers anisotropy and the fabric of the in-situ material during testing thus providing a more reliable determination of Cu than the vane testing. Emphasis on these results combined with those calculated indirectly from the standard penetration testing has therefore been used in this report rather than those from the shear vane testing.

Atterberg Limits and Moisture Contents

Six Atterberg Limit and Moisture Content determinations were undertaken on samples collected from BH1 and WS1. The results are summarised in Table 3-6.

Table 3-6: Summary of Atterberg Limits and Moisture Content

Lithology	No.	Depth of	Moisture	Liquid Limit	Plastic	Plasticity
	Tests	testing (m bgl)	Content (MC)	(LL)	Limit (PL)	Index (PI)
Claygate Member (ClgB)	6	3.0 to 4.75	25 to 32% (Avg. 27%)	44 to 50% (Avg. 47%)	20 to 28% (Avg. 23%)	21 to 25% (Avg. 24%)

*NP – Denotes the material as Non-Plastic

According to Plasticity Chart (BS 1377-2:1990) the sample tested in the ClgB is representative of a Clay of Intermediate Plasticity (CI).

In accordance with the NHBC Standards (2018), a Modified Plasticity Index of 24% has been determined in the ClgB assuming 100% of particles are less than 425µm (worst case), representative of medium volume change potential.

Laboratory Strength Testing

A direct measurement of undrained shear strength (Cu) was undertaken in the laboratory via an Unconsolidated Undrained (UU) tri-axial compression test on two undisturbed samples from BH1. The results are summarised in Table 3-7.

Table 3-7: Summary of Tri-axial test results

Lithology	No. Tests	Depth of testing (m bgl)	Undrained Shear Strength, Cu (kN/m²)
Claygate Member (ClgB)	2	2.25 to 4.25	49 to 58 (Avg. 54)

In accordance with BS5930:2015, the ClgB is representative of a medium strength material. Figure 2 shows a comparative plot of laboratory (Triaxial) Cu and in-situ (SPT & Shear Vane) converted Cu results against depth.

4.0 PREDICTION OF GROUND MOVEMENT AND DAMAGE ASSESSMENT

4.1 Introduction

In connection with the proposed basement construction, a ground movement and damage assessment has been undertaken at the site. The purpose of this assessment is to determine the effects of the proposed basement and sub-basement excavation upon the existing building and the neighbouring structures.

The soil behaviour over the footprint of the excavated area is different from the behaviour outside and the associated ground movements require assessment using different approaches.

In the area of the new basement the soil will tend to move as a result of change in vertical load on the ground due to excavation and demolition. Movements in the long term would also be expected as a result of changes in the pore pressure in the clay layer/cohesive band under the basement.

Around the site the construction activities that may result in ground movements during and after the works are mainly related to the excavation, which would induce a reduction of vertical and lateral stresses in the ground along the excavation boundaries.

The magnitude and distribution of ground movements inside and outside the excavated area are a function of changes of load in the ground and also, critically, are a function of workmanship.

Ground movements within the area of the proposed excavation have been estimated using Geotechnical Software (Settle3D by Rocscience) whilst the expected movements and impact assessment of the area around the site and surrounding structures have been estimated using Geotechnical Software (XDISP by OASYS). The latter software relies on CIRIA report C580 Embedded Retaining Walls - Guidance for Economic Design (superseded by C760, 2017) which is based on field measurements of movements from a number of basement constructions across London.

The calculations provided are specific to the proposed development and the advice herein should be reviewed if the development proposals are amended.

4.2 Adjacent Properties

The properties or structures more likely to be affected by the ground movements associated with the proposed basement construction are shown in Figure 5, summarised in Table 2-1 and include the following:

- No.1 E Heath Road (Immediately adjacent to the northeast);
- No.2 E Heath Road (adjacent 1.5m to the northeast).

4.3 Ground Model

The ground model utilised for this assessment is based on the site specific ground investigation undertaken by SASL at the site (October 2017). It should be noted that Fairhurst can take no liability for inaccuracies in the factual data from the SASL investigation and that reliance on this data has been sought by the client.

The ground conditions adopted within the model and analysis are in accordance with the results of borehole (BH1) located closed to the new basement extension at South Lodge, Hearthside and comprises:

- Made Ground to a depth of 0.7m bgl (94.82m AOD);
- Claygate Member to a depth of 6.7m bgl (88.826m AOD);
- London Clay to a depth of 15.00m bgl (80.52m AOD).

The method of Ground Movement Analyses undertaken requires soils stiffness parameters to be used. In accordance with BS8004:2015 section 4.3.1.6 'Soil Stiffness' it is acknowledged that both the drained and undrained stiffness moduli of soils (E', E_u) are highly dependent on

the strain level applicable to the engineering problem considered. The change in axial strain will directly influence the resultant stiffness of the soil, and in turn the stiffness of the soil will influence the strain exhibited.

Therefore in order to define stiffness modulus applicable to the engineering problem considered, it is necessary to assess the magnitude of axial strain which the soil will be subjected to. In accordance with the recommendations made in BS8004:2015 the strain generally applicable to foundations design is in the range of 0.075 to 0.2%. The material stiffness values used for the analysis of the ground movements have been interpreted as follows:

Made Ground

Case history values were consulted where estimating the linear elastic parameters for Made Ground. Specifically values for the drained case were adopted from:

'Burland, Standing, Jardine (2001). Volume 1 – Projects and Methods. Building response to Tunnelling – Case Studies from construction of the Jubilee Line Extension, London. CIRIA Special Publication 200, Section 12.2.3, page 180'

Using the results of this paper it has been assumed that the Poisson's Ratio (v) would slightly increase for the undrained case (v) from 0.2 to 0.3 and the Shear Stiffness / modulus (G) would be the same in the Made Ground for both the drained and undrained cases (as the water would not add any shear stiffness, only compressional). It has also been assumed that the material is isotropic and therefore the shear modulus is related to the Young's Modulus (E') via the equation 2G/(1+v) = E. Using equation 17.19 of ICE manual of geotechnical engineering (2012), Volume II, chapter 17.8.8, $E_u = 1.25.E'$.

Table 4-1 below shows the values for Made Ground adopted for this analysis.

Claygate Member (ClgB) / London Clay (LC)

Based on the maximum (i.e. most conservative) axial strain of 0.2% prescribed in BS8004:2015, the following correlation has been used to determine the Young's Modulus (*Eu*) of the cohesive Claygate member and London Clay. The relation has been taken from ICE manual of geotechnical engineering (2012), Volume II, chapter 53.7.2 (Page 792) and matches ratio of *Eu/Cu* at 0.2% axial strain recommended in Tomlinson (7th,2001) based on works by Jardine et al. (1986):

$$E_u = 330C_u (kN/m^2)$$

The ratio of end of construction (Undrained) settlement to total settlement (fully drained) was taken as 60% as specified in ICE manual of geotechnical engineering (2012), Volume II, chapter 53.6 (Page 783). Therefore:

$$E^{-} = 220C_{u} (kN/m^{2})$$

In addition a drained (υ) and undrained (υ) Poisson's ratio of 0.2 and 0.5 respectively were utilised as specified in Tomlinson 7th ed (page 74). Figure 3 shows SPT derived *E*' and *Eu* values plotted against depth.

Modulus of volume compressibility (m_v) parameters have been used for the calculation of primary consolidation settlements for the long term (drained) loading case. This is the process in which a reduction in soil volume occurs by the expulsion of water under static loads in the long term. These were determined with depth using the recommendations in Skempton and Bjerrum (1957) where the following relationship between m_v and E' is described:

$$M_v = \frac{1}{E'}$$

Figure 4 shows the corresponding SPT derived m_v values plotted against depth. Due to the transitional boundary between the ClgB and underlying LC, the same parameters have been used for these soil types.

A table summary of the stiffness and m_v values utilised in this analysis is presented in Table 4-1 below.

	Level at	Short-term (un	drained)	Lo	Long-term (drained)		
Lithology	top (m bgl) E _u kPa Poisson's Ratio (υ) E' kPa		mv (m²/MN)	Poisson's Ratio (ʋ')			
Made Ground	GL	3000	0.3	3000	N/A	0.2	
Claygate Member (ClgB)	0.7	7425+1848z	0.5	4500+1050z	2.2E-4 – 1.45E-5z	0.2	
London Clay (LC)	6.7	7425+1848z	0.5	4500+1050z	2.2E-4 – 1.45E-5z	0.2	

Table 4-1: Soil stratigraphy and stiffness parameters adopted

4.4 Construction and load cases

With reference to the proposed drawings presented within Appendix A, the existing lower ground floor is expected to be extended as follows:

- 1. Design of Temporary Works:
 - All temporary works should be designed by an appropriately qualified structural engineer. It is likely that the designs may require checking by a party wall surveyor on the neighbouring properties;
 - The chosen contractor should have a plan in place to deal with groundwater inflows;
- 2. Excavation for underpins & temporary foundations & installation of temporary works:
 - Excavate down and underpin/construct to proposed foundations formation level (approximately 92.0m AOD);
 - Insert temporary bases and propping as and where required during the excavation process.
 - Installation of appropriate temporary works and propping should occur simultaneously as excavation progresses;
- 3. Excavation down to underside of basement level and associated temporary works;
- 4. Reloading:
 - Construction of foundation slab to proposed basement FFL. Construct load-bearing external RC walls & internal walls/columns.
 - Construct new ground floor slab to provide permanent horizontal support to underpins as required
 - Removal of any temporary props once permanent supports are in place.

Structural Loading at foundation level for use in the ground movement analysis has been calculated by Elliot Wood as shown in Appendix C. This assessment is specific to the construction sequence and load case described above. If any changes are made to the proposed development then this assessment should be updated.

4.5 Ground movement inside the proposed basement

Following excavation to the proposed foundation formation levels the soil at this level and along the boundary of the excavation will tend to heave as a result of the change in the soil stress conditions. The magnitude and distribution of ground movements inside the excavated area are a function of the excavation size and shape.

The stress conditions and resultant settlement/heave have been assessed using the Boussinesq's method and geotechnical software Settle3D by Rocscience. This approach assumes linear elastic behaviour of the soil. Elastic vertical strains are calculated on the basis of the calculated stress changes and then integrated to obtain vertical movements.

Three stages have been set up to create a simplified model of the redevelopment. These are as follows:

1. **Stage 1:** A first stage has been analysed to simulate excavation across the site with unloading due to the removal of soil. Assuming that no delays occur during the construction process, this stage has been simulated using short term soil parameters only (i.e. undrained conditions).

It is proposed to excavate down to a maximum depth of 3.50m bgl for the sub-basement and 0.90m bgl for the basement (although it should be noted that foundations may need to have deeper excavations locally due to additional excavations for temporary works). The undrained removal of the overburden, calculated using assumed unit weights ($16kN/m^3$ for Made Ground, $17kN/m^2$ for the Claygate Member and $19kN/m^2$ for the London Clay) and thickness of strata, will therefore cause a maximum unloading pressure of approximately - $60kN/m^2$ for the new sub-basement and - $15kN/m^2$ for the new basement. The Settle3D analysis outputs at ground level are presented in Appendix D.

2. **Stage 2:** A second stage has been analysed to simulate the conditions at the end of the construction phase when the site is to be re-loaded with the pressures from the proposed structures at the new formation level.

Structural Loading at foundation level for use in the ground movement analysis has been calculated internally by the structural engineer (Elliot Wood) as shown in Appendix C.

The Settle3D analysis outputs for this stage are presented in Appendix E.

3. **Stage 3:** A final third stage simulates a long term condition after construction, when the stress conditions within the soil have been allowed to equilibrate under the new pressures and pore pressures in the soil have stabilized (i.e. fully drained conditions). The model and tabular outputs for this stage are presented in Appendix F.

The elastic parameters for the soil have been chosen as appropriate for the short and long term conditions. A short term analysis has used undrained parameters and for long term assessments fully drained parameters were used. The vertical boundary of the model was fixed at 10m bgl where the effective vertical stress due to foundation unloading decreases to 20% of the effective overburden as required in EC7.

The results of the Settle3D analysis are based on an unrestrained excavation as the model is unable to take account of the mitigating effect of the temporary works bounding the excavation, which in reality will combine to restrict these movements within the basement excavation. The movements predicted at or just beyond the site boundaries are unlikely to be realised and should not therefore have a detrimental impact upon any nearby structures. It should be noted that the heave movements detailed below are not cumulative.

Settle 3D results

The results for each stage of the analysis are summarised in Table 4-2 below with the results detailed in Appendix D to Appendix F. The outputs have been represented at the level of the new sub-basement (92.00m AOD) where the magnitudes of movements are the greatest and therefore worst case.

Table 4-2: Settle 3D results

	Maximum <u>Settlement</u> /Heave (mm)*					
Stage	New Sub-B (3.50m exc	asement avation)	New Basement (0.90m excavation)			
	Centre	Edges	Centre	Edges		
Stage 1 – Excavation (Unloading)	-5.5	-3.0	-1.0	-2.0		
Stage 2 – Reloading (Undrained)	-6.0	<u>1.5</u>	<u>1.0</u>	-1.5		
Stage 3 – Reloading (Drained)	-45.0	<u>3.0</u>	-8.0	-21.2		

*Heave is denoted by -vet sign convention

Conclusions and recommendations

The results show that initially upon excavation and before construction the ground is expected to heave upwards by a maximum of -5.5mm and -2.0mm for the sub-basement and basement respectively.

Immediately after construction, heave movements are expected to increase to -6.0mm underneath the centre of sub-basement whilst settlements of up to 1.5mm are evident around the edges of this area underneath the location of the external walls. Settlements of up to 1.0mm are evident directly underneath the ground floor slabs of the new basement, whilst heave movements of up to 1.5mm are evident.

In the long term, heave is expected to increase to -45.00mm with settlement increasing to 3.0mm for the sub-basement. For the new basement, heave is expected to increase to -8.0mm in the centre of the lowered floor slab with heave increasing to -21.0mm in close proximity to the proposed sub-basement.

Final designs for the basement retaining walls, basement slabs and internal RC load-bearing basement walls and columns should be designed to support the heave and settlement movements predicted as indicated in Table 4-2 above. These movements should be taken into account particularly at party walls where additional loadings are proposed (party wall with No. 1). Further to this, the Elliot Wood basement plan (Appendix C) shows an assumed doweled joint at the junction between the new sub-basement and basement. To ensure the stability of both structures it is important that the magnitude of movements at this junction be taken into account in detailed design.

Proposed drainage system or pipe works underlying the ground floor should be designed to accommodate the predicted movements.

4.6 Ground Movements outside the Area of the New Basement

Excavations and Assessment Methodology

Ground movements due to basement excavations are typically estimated based on guidance given in the CIRIA publications and C760. These documents are based on the behaviour of deep excavations supported by embedded walls at numerous sites in the London area.

As detailed in the Elliott Wood proposed basement plan presented in Appendix C, a suspended floor slab is proposed as part of the new construction. It is understood that a reinforced concrete thickening will occur directly underneath the perimeter walls in the permanent case. Given that propping will generally be included in the temporary and permanent cases over the proposed structure, a low stiffness approach would not apply to this situation.

With this in mind, the XDISP analysis considers both 'installation of contiguous bored pile wall in stiff clay' (CIRIA 580 Fig. 2.8(b)) and 'excavation in front of a high stiffness wall in stiff clay' (CIRIA C760 Fig. 6.15(a)) to simulate the effects from the underpinning and excavation respectively on neighbouring structures. The combined cumulative movements resulting from

both the wall installation (underpinning) and basement excavation have been used to carry out an assessment of the likely damage to adjacent properties.

Ground movements have been analysed using XDISP by Oasys and a building damage assessment has been undertaken based on the results of the analysis. Contours of vertical and horizontal ground movement and tabular output of the analysis are presented in Appendix G. Summary tables are provided below.

Building Damage Assessment

The building damage assessment was carried out on the relevant adjacent structures, as detailed in Figure 5 and summarised below in Table 4-3.

Property	Structure (Refer Figure 5)	Structure ID (Shown in Appendix G)	Assumed Structural Height (m)	Approximate Line Length (m)
No. 2 E Heath Road	W1	Wall 1	2.5	4.6
	W2	Wall 2	2.5	2.4
	W3	Wall 3	2.5	4.5
	W4	Wall 4	2.5	0.8
	W5	Wall 5	2.5	4.5
	W6	Wall 6	2.5	4.03
	W7	Wall 7	2.5	4.5
	W8	Wall 8	2.5	0.7
No. 1 E Heath Road	W9	Wall 9	12.0	8.9
	W10	Wall 10	12.0	5.9
	W11	Wall 11	12.0	1.4
	W12	Wall 12	12.0	3.8
	W13	Wall 13	12.0	1.6
	W14	Wall 14	12.0	2.8
	W15	Wall 15	12.0	8.8
	W16	Wall 16	12.0	12.1

Table 4-3: Summary of structures

<u>Results</u>

Table 4-4 presents the damage assessments for the structures listed above. The table also presents the CIRIA C760 approximate crack widths corresponding to the damage categories. The tabular XDisp program output for the basement is presented as Appendix G.

 Table 4-4: Ground movement / Building Damage Summary

Property	Structure (Refer Figure 5)	Maximum settlement (mm)	Highest Average Horizontal Strain (%)	Maximum Tensile Strain (%)	Damage Category*	Approximate Crack Width (mm) (CIRIA C760)
2 E Heath Road	W1	3.4751	0.055295	0.069553	Very Slight	<1mm
	W2	3.4751	705.78E-6	831.16E-6	Negligible	<0.1mm
	W3	3.4970	0.057270	0.073246	Very Slight	<1mm
	W4	2.0316	959.08E-6	961.70E-6	Negligible	<0.1mm
	W5	2.0318	0.036753	0.044361	Negligible	<0.1mm
	W6	0.29210	427.90E-6	474.68E-6	Negligible	<0.1mm
	W7	1.7451	0.037055	0.043812	Negligible	<0.1mm

Property	Structure (Refer Figure 5)	Maximum settlement (mm)	Highest Average Horizontal Strain (%)	Maximum Tensile Strain (%)	Damage Category*	Approximate Crack Width (mm) (CIRIA C760)	
	W8	1.7913	407.21E-6	407.30E-6	Negligible	<0.1mm	
	W9	All settlements are less than the settlement Trough limit sensitivity.					
1 E Heath	W10	0.59214	0.015669	0.015967	Negligible	<0.1mm	
Road							
	W11	1.3954	-0.0050136	0.026759	Negligible	<0.1mm	
1 E Heath Road	W12	3.3668	0.049596	0.051440	Very Slight	<1mm	
	W13	3.3818	-0.012950	0.056622	Very Slight	<1mm	
	W14	1.5026	-0.051594	0.026252	Negligible	<0.1mm	
	W15	1.6983	0.015321	0.029241	Negligible	<0.1mm	
	W16	0.59718	0.0027776	0.0067185	Negligible	<0.1mm	

Based on these predicted ground movements, the properties surrounding the site are expected to be predominantly within CIRIA C760 Damage Category 0 (Negligible) although there are four instances where this is exceeded to a Damage Category 1 (Very Slight).

The results indicate that the greatest potential for damage (Category 1 – Very Slight) may be recorded at the following structures shown on Figure 5:

- W12 & W13 of No.1 E Heath Road;
- W1 & W3 of No.2 E Heath Road.

It should be noted however that these movements are likely to be affected by the quality of the workmanship and propping of the basement excavations. The construction details adopted at the junctions with the party walls and at return walls will also have a significant influence on the likelihood of any future movement at these locations. Extra care should be taken in these sections to provide appropriate support to the existing walls to prevent any excessive deflection.

Based on these results it is considered that appropriate consideration to the support & stability of neighbouring walls (especially party walls and party wall junctions/return walls) will be needed in the detailed structural design of the basement. Movement monitoring of these walls is recommended during the construction stage and trigger levels should be set in order to protect the neighbouring properties as a precautionary measure.
5.0 CONCLUSIONS

A Ground Movement Assessment has been carried out for South Lodge, Heathside, Hampstead, NW3 1BL to assist with pre-planning document submissions to the Camden Council.

Providing that appropriate consideration is given to the detailed design of party wall and return wall junctions with the basement in order to limit future movement, that good workmanship and construction sequences are used with appropriate support during excavations and that groundwater management is employed, then the proposed basement construction is unlikely to cause significant damage to the surrounding structures. Based on the predicted ground movements, the adjacent structures are expected to be within the CIRIA C760 Damage Category 1 (Very Slight).

Groundwater has been recorded approximately 0.50m below the proposed basement level and therefore groundwater may be encountered during the proposed excavations. The contractor should therefore demonstrate adequate control measures to ensure this risk is mitigated. It would also be prudent to continue to monitor the existing installed standpipe for as long as possible in order to determine equilibrium level and the extent of any seasonal groundwater variations. Trial excavations to the proposed basement depth could be carried by the main contractor to confirm the stability of the soil and to further investigate the presence of groundwater inflows.

Early movement monitoring of the boundary walls to the neighbouring buildings is recommended during the construction stage and trigger levels should be set in order to protect the neighbouring properties as a precautionary measure (especially at the junctions between the property's). A specification for movement monitoring should be incorporated into the final construction scheme for the proposed development to monitor the adjacent properties and establish the extent of any future potential movement to the building. Any temporary and permanent works should be designed to limit eventual movement.

FIGURES







Young's Modulus, E'/Eu (kN/m²) 15,000 5,000 10,000 20,000 25,000 30,000 0 96.0 95.0 ۱ ۵ 94.0 93.0 92.0 91.0 Drained Design Line Undrained Design Line 90.0 (7425 + 1848 x Z) Elevation (m AOD) 0.68 M OD 0.28 M OD faimed Des. 59 line 1 Drained Design Line (4500 + 1050 x Z) 86.0 85.0 84.0 83.0 Eu ClgB 82.0 `, ▲ Eu London Clay ■E' ClgB 81.0 • E' London Clay 80.0 FAIRHURST PROJECT TITLE:-**ORIGINATOR:-**South Lodge, Heathside, Hampstead, FIG No .:-FIG TITLE:-3 **Ground Investigation** Young's Modulus (E'/Eu) versus Depth REPORT 125836

FAIRHURST

DATE: April 2018





Figure 5: Ground Movement Assessment Wall Location Plan

APPENDIX A
DEVELOPMENT PLANS AND TOPOGRAPHICAL SURVEY







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<u> </u>	Existing basement level
	Estation becaused to be the state of the sta
(4/4,	Existing basement slab to be lowered to increase
	ceiling heights in the existing basement while
	retaining the hierarchy of the different floors.

PLANNING ISSUE	Proj South Lodge, Heatl	^{ect:} nside, London NW3				
Il dimensions must be confirmed on site and verified with the Architect. Any discrepencies on the drawing must be reported to the Architect prior to any works being carried out on site	Drawin Proposed s	ections F-F				
DO NOT SCALE OFF THIS DRAWING, only use stated dimensions for setting out purposes.	Drawing No.: 1938 - 223					
The copyright of this schedule / drawing remains with he Architect. No part of this schedule / drawing may be reproduced in any form or by any means without the written permission of Greenway Architects.	Date 19/06/2017	_{Scale} 1:100 @ A3 1:50 @ A1				
	greenwayarchitects					
	Branch Hill Mews, London NW3 7LT Tel +44 (0)20 7435 6091 www.greenwayarchitects.co.uk					



	1	
No	Revision	Date
1.00.		Bato.



 - New stair from ground floor to basement level

-- New steps to suit new ground slab level

PLANNING ISSUE	Project: South Lodge, Heathside, London NW3					
All dimensions must be confirmed on site and verified with the Architect. Any discrepencies on the drawing must be reported to the Architect prior to any works being carried out on site	Drawin Proposed ba	^{g Title:} sement level				
DO NOT SCALE OFF THIS DRAWING, only use stated dimensions for setting out purposes.	Drawing No.: 1938 - 206					
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	greenway	architects				
	Branch Hill Mews, London NW3 7LT Tel +44 (0)20 7435 6091 www.greenwayarchitects.co.uk					

APPENDIX B SASL GROUND INVESTIGATION RECORDS

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Your Ref;

Our Ref:

Ref: 17/27399-1 April 2018

SOUTH LODGE, HEATHSIDE,

HAMPSTEAD, LONDON, NW3 1BL

FACTUAL REPORT ON A GROUND INVESTIGATION

Prepared for

Elliott Wood Partnership Limited





Reg. Office: Units 14 +15, River Road Business Park, 33 River Road, Barking, Essex IG11 0EA Business Reg. No. 2255616





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4.4	Classification Tests4	
4.5	Sulphate and pH Analyses5	,
5.0 Re	ferences	j



1.0 INTRODUCTION

1.1 Outline and Limitations of Report

At the request of Elliott Wood Partnership Limited, a ground investigation was carried out in connection with a proposed residential basement development at the above site. A Phase 1 Preliminary Assessment (Desk Study) is presented under separate cover in Site Analytical Services Limited Report Reference 17/27399.

The information was required for the design and construction of foundations and infrastructure for the proposed development at the existing site.

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 268 860)

2.1 Site Location

South Lodge is a residential property, located on the north-western side of Heathside, Hampstead at approximate postcode NW3 1BL. The residential dwelling has five levels of accommodation; basement, ground, first, second and third floor. The site covers an approximate area of 0.19 Hectares with the general area being under the authority of the London Borough of Camden.

The site is located on the north-western side of Heathside with residential properties to the north-west, south-west and north-east and a roadway to the south-east.

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 Claygate Member.

The British Geological Survey maintains an archive of historical exploratory borehole logs throughout the UK. SAS Limited has searched the database and have found that there is one borehole located within 150m of the site. This is located 111m to the north-west of the site and reveals Made Ground to a depth of 1.20m underlain by the Claygate Member to a depth of 1.5m with the London Clay at depth.



2.3 **Previous Investigations**

A Phase 1 Preliminary Assessment (PRA) (SAS Report Ref: 17/27399, dated November 2017) 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 one rotary percussive borehole to a depth of 15.00m below ground level (Borehole 1).
- The drilling of one continuous flight auger borehole to a depth of 6.00m below ground level (WS1).
- The excavation by hand of seven trial pits to a maximum depth of 1.50m below ground level (Trial Pits 1 to 7) to expose existing foundations on site.
- Sampling and in-situ testing as appropriate to the ground conditions encountered in the boreholes.
- 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 boreholes 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 1.00m in thickness (unproven in TP6) resting on deposits of the Claygate Formation 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 (mSD)		Depth to base of strata (mbgl)	Level to base of strata (mSD)	Description
Made Ground	0.00	95.52 to 94.46	0.20 to 1.00	94.82 to 93.56	Grass / Clay tiled floor/ pea shingle over silty sandy gravelly clay.
Claygate Formation	0.20 to 1.00	94.82 to 93.56	6.00-6.70	88.82	Soft becoming firm then stiff silty sandy CLAY.
London Clay Formation	6.00-6.70	88.82	15.00 (base of BH 1)	80.52(base of BH 1)	Stiff silty very sandy clay with gypsum crystals

Table A: Summary of Ground Conditions in Exploratory Holes

3.3 Groundwater

Groundwater was not encountered in any of the Trial pits during site works and the material remained essentially dry throughout. Groundwater was encountered in Borehole 1 & Window Sampler 1, as detailed in Table B below.

Exploratory Hole	Depth (m)	Notes	Stratum
BH1	4.00	Rose to 3.80m in 20 minutes	Claygate Member
WS1	5.80	Slight Seepage	Claygate Member

Table B: Groundwater Strike Summary

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 boreholes 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 encountered at a depth of 2.51m (93.01mSD) within the monitoring standpipe placed in Borehole 1 and WS1 after a period of approximately four weeks and 3.62m (90.84mSD) below ground level within the monitoring standpipe placed in Window Sampler 1 after a period of approximately four weeks.

It should be noted that the comments on groundwater conditions are based on observations made at the time of the investigation (October, November 2017) 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 three undisturbed 100mm diameter samples taken from within Borehole 1.

The test results are given in Table 1, contained in Appendix B.

4.3 In-situ 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 six samples taken at depth in Borehole 1 and Window Sampler 1 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 six 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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Λ	Site A	REF: 17	/27399-1			
sAs	LOCATION:	South Lodge, Heathside, H	lampstead	, NW3 1BL	FIG:	1
*	TITLE:	Site Sketch Plan	DATE:	April 2018	SCALE:	NTS





APPENDIX `A'

Borehole / Trial Pit Logs

Site	e Analy	/tic	al	Servic	es L	.td.	Site SOUTH LODGE, HEATHSIDE, HAMPSTEAD, NW3 18	BL	Borehole Number BH1
Boring Meth ROTARY PE	hod ERCUSSIVE	Casing 12	Diamete 8mm cas	r ed to 0.00m	Ground Lo 95	evel (mOD) 5.52	Client ELLIOTTWOOD PARTNERSHIP LTD		Job Number 1727399
		Locatio TC	on 2268860		Dates 16/1	0/2017	Engineer		Sheet 1/2
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) Thickness)	Description		Kater Vater
0.25 0.50 0.75 1.00-1.45 1.00 1.75 2.00-2.45 2.75 3.00-3.45 3.00 3.75 4.00-4.45 4.75 5.00-5.45 5.00	D1 D2 D3 SPT(C) N=5 D4 D5 U1 D6 SPT N=8 D7 D8 U2 D9 SPT N=10 D10 D11		DRY DRY 3.80	1,0/1,1,2,1 45 blows 1,2/2,2,2,2 Slight Seepage(1) at 4.00m, rose to 3.80m in 20 mins. 30 blows 2,2/3,2,2,3	95.22 94.82 92.02	(0.30) 0.30 (0.40) 0.70 (2.80) (2.80) (3.20) (3.20)	MADE GROUND: Pea shingle over dark brown silty classed with fragments of brick and concrete rubble MADE GROUND: Light brown silty sandy clay with fragments of brick and concrete rubble Soft becoming firm, mottled light brown orange grey siles and y CLAY	layey	
6.50-6.95	U3			55 blows	88.82	6.70	Stiff, brown orange very silty very sandy CLAY with par of silty find sand and occasional gypsum crystals	urtings	х х х х х х х х х х х х х х
7.50 8.00-8.45 8.00	D12 SPT N=14 D13		3.80	2,3/4,3,3,4		(3.30)			
9.00 9.50-9.95 9.50	D14 SPT N=16 D15		3.80	3,3/4,3,4,5		- 			ж К К К К К К К К К К К К К К К К К К К
Remarks D= Disturber U= Undistur C= Dynamic	d Sample bed 100mm Diamete Penetration Test - C	er Sample	-		. I		S (ap	Scale oprox)	Logged By
S= Standard Excavating f	Penetration Test - C rom 0.00m to 1.00m	Cone for 1 hou	r.				1 Fi	1:50 igure N 17273	EW o. 99.BH1

Cito	Analy	<i>(</i> 1 :0		Somia	Site		Borehole Number		
Sile	Analy	/liC		Service	es Lia.	SOUTH LODGE, HEATHSIDE, HAMPSTEAD, NW3 1	IBL	BH1	
Boring Meth ROTARY PE	nod RCUSSIVE	Casing 12	Diamete 8mm cas	r ed to 0.00m	Ground Level (mOD) 95.52	Client ELLIOTTWOOD PARTNERSHIP LTD		Job Number 1727399	
		Locatio	n 268860		Dates 16/10/2017	Engineer		Sheet 2/2	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level Depth (mOD) (m) (Thickness)	Description	L	Vater V	
					85.52 10.00	Stiff, brown orange very silty very sandy CLAY with pa of silty find sand and occasional gypsum crystals	artings	×	
10.50	D16						×	*	
11.00-11.45 11.00	SPT N=18 D17		3.80	3,4/4,4,5,5			· · · · · · · · · · · · · · · · · · ·		
12.00	D18						, x.		
12.50-12.95 12.50	SPT N=19 D19		3.80	4,3/4,5,5,5					
13.75	D20								
14.55-15.00 14.55	SPT N=23 D21		3.80	4,5/5,6,6,6	80.52 15.00	Complete at 15.00m	, X.,	×	
Remarks D= Disturbed U= Undisturb	I Sample bed 100mm Diamete	r Sample				s (ar	Scale pprox)	Logged By	
C= Dynamic S= Standard	Penetration Test - C Penetration Test - C	one Sone					1:50	EW	
						F	igure No 172739	9.BH1	

Site Analytical Services Ltd.

Standard Penetration Test Results

Site

: SOUTH LODGE, HEATHSIDE, HAMPSTEAD, NW3 1BL

Client : ELLIOTTWOOD PARTNERSHIP LTD

Engineer:

Borehole	Base of	End of	d of End of Test Seating Blows Blows for each 75mm penetrati		etration	Desult	Commonto					
Number	(m)	Drive (m)	Drive (m)	туре	1	2	1	2	3	4	Result	Comments
BH1	1.00	1.15	1.45	CPT	1	0	1	1	2	1	N=5	
BH1	3.00	3.15	3.45	SPT	1	2	2	2	2	2	N=8	
BH1	5.00	5.15	5.45	SPT	2	2	3	2	2	3	N=10	
BH1	8.00	8.15	8.45	SPT	2	3	4	3	3	4	N=14	
BH1	9.50	9.65	9.95	SPT	3	3	4	3	4	5	N=16	
BH1	11.00	11.15	11.45	SPT	3	4	4	4	5	5	N=18	
BH1	12.50	12.65	12.95	SPT	4	3	4	5	5	5	N=19	
BH1	14.55	14.70	15.00	SPT	4	5	5	6	6	6	N=23	
	1	1		1	1							

Job Number

1727399

Sheet

1/1

Site	e Al	nal	ytic	al Servi	ces	Lto	d.	SOUTH L	ODGE, H	IEATHSI	DE, HAM	PSTEAD	, NW3 1E	BL	Borehole Number BH1	
Single Ins	stallation		Intern Diame	al Diameter of Tube [A] = 5 eter of Filter Zone = 128 mr	ELLIOTTWOOD PARTNERSHIP LTD							Number 1727399				
			Location	n 8860	Ground 9	Level (m 5.52	IOD) E	Engineer						;	Sheet 1/1	
≷ Predeng	Instr (A)	Level (mOD)	Depth (m)	Description				Gi	roundwa	ter Strik	es Durin	ıg Drilling)			
					Data	Time	Depth	Casing	Inflo	v Doto		Readings			Depth	
				Bentonite Seal	Date	Time	(m)	(m)	Intio	w Rate	5 min	10 min	15 min	20 min	(m)	
ж ж ж ж ж ж ж ж ж ж ж ж ж ж ж ж ж ж ж	× 94.52	1.00		16/10/17		4.00	0.00	Slight S	Seepage				3.80			
x <u>x</u>				Slotted Standpipe				Gro	oundwat	ter Obse	rvations	During D	Drilling	I	I	
<u>₹</u> 1							1	Start of S	hift	1		ļ	End of SI	nift	1	
××1					Date	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)	
х х х х х х х х х х х х х х		89.52	6.00	Bentonite Seal												
×	******	88.52	7.00					lu etu								
x x								Instru	iment G	roundwa		ervations				
× <u>*</u>					Inst.	[A] Type	: Slotted	d Standpip	e							
x						Ins	trument	[A]				Pom	arke			
x					Date	Time	Depth (m)	Level (mOD)				Rem	arks			
		80.52	15.00	General Backfill												

Site	Site Analytical Servio					td.	Site SOUTH LODGE, HEATHSIDE, HAMPSTEAD, NV	V3 1BL	Borehole Number WS1
Boring Meth CONTINUO AUGER	hod US FLIGHT	Casing 12	Diamete 8mm cas	r ed to 0.00m	Ground Le 94	e vel (mOD) .46	Client ELLIOTTWOOD PARTNERSHIP LTD		Job Number 1727399
		Locatio TC	n 268860		Dates 16/1	0/2017	Engineer		Sheet 1/1
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) Thickness)	Description		Kate Sate
0.25 0.50 0.75 1.00 1.50 2.00 2.50 2.50 3.00 3.50 4.00 4.50 4.50 5.00 5.00 6.00 6.00	D1 D2 D3 D4 V1 113 D5 V2 115 D6 V3 130+ D7 V4 130+ D7 V4 130+ D8 V5 125 D9 V6 122 D10 V7 115 D11 V7 115 D11 V8 128 D12 V9 130+ D13 V10 130+			Slight Seepage(1) at 5.80m.	94.16 94.06 93.86 93.56 93.56 93.56 93.66 93.66 93.66 93.66 93.66	(0.30) 0.30 (0.20) 0.60 (0.30) 0.90 (1.40) (1.40) (2.30 (2.10) (1.60) (1.60) (1.60) (1.60) (1.60) (1.60)	MADE GROUND: Grass over dark brown sandy of fragments of brick and concrete rubble and small MADE GROUND: Dark brown slightly gravelly sard Coarse grained sand MADE GROUND: Brown fine to coarse grained sat fragments of brick and concrete rubble Stiff, brown slightly gravelly slightly slity sandy CL lenses of slity fine sand Stiff, mottled brown grey orange slity sandy CLAY lenses of slity fine sand Stiff, dark grey blue slity sandy CLAY with lenses of fine sand Complete at 6.00m	clay with roots indy clay e to and with AY with with of silty	
Remarks D= Disturber V= Vane Tes	d Sample t - Results in kPa							Scale (approx)	Logged By
Excavating f	rom 0.00m to 1.00m	for 1 hou	r.					1:50	EW
								Figure N 17273	o. 99.WS1

/	Α	۱n	al	ytic	al Servi	ces	Lto	.	SOUTH LO	ODGE, H	IEATHSI	DE, HAM	PSTEAD,	NW3 1B	۶L	Borehole Number WS1
ype atic	ype ation	ו		Dimension Interna Diame	ons al Diameter of Tube [A] = 5 ter of Filter Zone = 100 mn	0 mm n		•	Client ELLIOTTV	VOOD P/	ARTNER	SHIP LTI	D			Job Number 1727399
			-	Location TQ268	1 3860	Ground 9	Level (m 4.46	IOD) I	Engineer							Sheet 1/1
ist	nstr (A)	l	Level mOD)	Depth (m)	Description			I	G	roundwa	ter Strik	es Durin	g Drilling	J	I	
T	, I	-		(,				Depth	Casing				Read	ings		Depth
						Date	Time	Struck (m)	Depth (m)	Inflo	w Rate	5 min	10 min	15 min	20 min	Sealed (m)
93.46			02.46	1 00	Bentonite Seal	16/10/17		5.80	0.00	Slight S	Seepage					
Contra Contrast on the	No. No.		33.40	Groundwater C							ter Obse	rvations	During D	rilling		
Techool In									Start of S	hift			E	End of Sh	nift	
and a straight of the second s						Date	Time	Depth Hole (m)	n Casing Depth (m)	Water Depth (m)	Water Level (mOD)	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)
							Instru	ument G	roundwa	ter Obse	ervations					
South and the second se						Inst.	[A] Type	: Slotte	d Standpip	e						
and a grad a g					Slotted Standpipe		Ins	trument	t [A]				Bom	orko		
مقتوه المكتمرة م الم طريقة مطامع الم						Date	Time	Depth (m)	n Level (mOD)				Rema	11K5		
یده سیدیه در ساید و سیده میکده استانیه است. در سیدیه در شده و شکل به میکند و شکلیه و شکل و شکلیه و شکل و فیک و شهر به همان این طرح همانم این طرح شواستان طرح های طرح به این طرح شمانه این طرح شمانه این طرح شهمانه این طرح ساله			88.46	6.00												
نيون <u>مواليد من المار م</u>	ver set	et in o	88.46 cement	6.00												

Site Analytical Service				es	Ltd.	Site SOUTH LODGE, HEATHS	SIDE, HAMPSTEAD, NW3 1	BL Trial Pit Number TP1A
Excavation HAND EXC/	Method Avation	Dimensio 0.30m(W	ons /) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD)	Client ELLIOTTWOOD PARTNE	RSHIP LTD	Job Number 1727399
		Location	268860	Dates 16	6/10/2017	Engineer		Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Kater Kater
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Red cla MADE GROUND: Dark br fragments of brick Mottled brown very sandy Complete at 1.00m	y tiled floor over red brick own gravelly sandy clay with CLAY	
						D= Disturbed Sample Groundwater is not encount	ered during boring/excavati	on
· ·	· ·				· ·			
			-			Scale (approx) 1:50	Logged By EW	Figure No. 1727399.TP1A

Site)	Analy	tical S	ervice	es Ltd.	Site SOUTH	LODGE, HEA	ATHSIDE, I	HAMPSTE	EAD, NW3 1BL	Trial Pit Number TP1A
Method Trial Pit			Dimensions 0.30m(W) x 0.30m	(L) x 1.00m(D)	Ground Level (mOD)	Client ELLIOTT	WOOD PAR	TNERSHI	P LTD		Job Number 1727399
Orientation	[A D B C	Location TQ268860		Dates 16/10/2017	Engineer					Sheet 1/1
Depth 0.00	c	.07m Brick Undersid	de was found at 0.0	07m depth					Level 0.00 		
Strata							Samples	and Tests	S		
Depth (m)	No.	Description					Depth (m)	Туре	Field Re	ecords	
0.00-0.07	1	MADE GROUNI	D: Red clay tiled floor	over red brick							
0.07-0.20	3	MADE GROUNI	D: Dark brown gravel ery sandy CLAY	ly sandy clay with f	ragments of brick		0.25 0.50 0.75 1.00	D1 D2 D3 D4			
Remarks							Excavation HAND EXC Shoring / N/A Stability: GOOD Backfill: ARISING	Support	d: :		
D= Disturbe Groundwate	d Sa r is i	mpie not encountered (during boring/excava	tion						Logged By Checked By Figure No.	: EW : : 1727399.TP1A

Site Analytical Service				es	Ltd.	Site SOUTH LODGE, HEATHS	SIDE, HAMPSTEAD, NW3 1	BL Trial Pit Number TP1B
Excavation HAND EXC/	Method Avation	Dimensio 0.30m(V	ons /) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD)	Client ELLIOTTWOOD PARTNE	RSHIP LTD	Job Number 1727399
		Location TQ2	268860	Dates	6/10/2017	Engineer		Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend S
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Red cla MADE GROUND: Dark br fragments of brick Mottled brown very sandy Complete at 1.00m	y tiled floor over red brick own gravelly sandy clay with CLAY	h
						D= Disturbed Sample Groundwater is not encount	ered during boring/excavati	on
					· · ·	Scale (approx) 1:50	Logged By EW	Figure No. 1727399.TP1B

Site)	Analy	vtical	Servic	es Ltd.	SOUTH LODGE, HEATHSIDE, HAMPSTEAD, NW3					Trial Pit Number TP1B
Method Trial Pit			Dimensions 0.30m(W) x	0.30m(L) x 1.00m(D)	Ground Level (mOD)	Client ELLIOTT	WOOD PAR	TNERSHI	P LTD		Job Number 1727399
Orientation	1	A D B C	Location TQ2688	60	Dates 16/10/2017	Engineer					Sheet 1/1
Depth 0.00	0.	07m Brick	ide was foun	d at 0.07m depth					Level - 0.00 - - -		
Strata							Samples	and Tests	5		
Depth (m)	No.	Description					Depth (m)	Туре	Field Re	ecords	
0.00-0.07	1		D: Red clay tile	d floor over red brick							
0.07-0.20	2	MADE GROUNE	D: Dark brown	gravelly sandy clay with	fragments of brick						
0.20-1.00	3	Mottled brown v	ery sandy CLA	Y			0.25 0.50 0.75 1.00	D1 D2 D3 D4			
							Excavatio	ON Metho	d:		
							Shoring /	Support	:		
							N/A				
							Stability:				
							GOOD Backfill				
							ARISING	S			
Remarks D= Disturbe Groundwate	d Sa	imple	durina borina/e	excavation			1				
										Logged By :	EW
										Checked By Figure No.	1727399.TP1B

Site Analytical Service				es	Ltd.	Site SOUTH LODGE, HEATHS	SIDE, HAMPSTEAD, NW3 1	BL Trial Pit Number TP2
Excavation HAND EXC/	Method Avation	Dimension 0.30m(V	ons V) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD)	Client ELLIOTTWOOD PARTNE	RSHIP LTD	Job Number 1727399
		Location TQ2	268860	Dates 16	6/10/2017	Engineer		Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend S
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Red cla MADE GROUND: Concrei MADE GROUND: Hardco Mottled brown very sandy Complete at 1.00m	y tiled floor te CLAY	
						D= Disturbed Sample Groundwater is not encount	ered during boring/excavati	on
					•••			
					· · ·	Scale (approx) 1:50	Logged By EW	Figure No. 1727399.TP2

Site)	Analy	vtical	Service	es Ltd.	Site SOUTH	LODGE, HEA	ATHSIDE, I	HAMPSTE	EAD, NW3 1BL	Trial Pit Number TP2
Method Trial Pit			Dimensions 0.30m(W) x	0.30m(L) x 1.00m(D)	Ground Level (mOD)	Client ELLIOTT	WOOD PAR	TNERSHI	P LTD		Job Number 1727399
Orientation	1	A D B C	Location TQ2688	60	Dates 16/10/2017	Engineer					Sheet 1/1
Depth 0.00		0.03m Pric 0.22m Bric	ck sk hardcore derside found	at 0.25m depth					Level 0.00 		
Strata							Samples a	and Tests	S		
Depth (m)	No.	Description					Depth (m)	Туре	Field Re	ecords	
0.00-0.07	1	MADE GROUN	D: Red clay tile	d floor							
0.07-0.16	2	MADE GROUN	D: Concrete								
0.16-0.20	3	MADE GROUN	D: Hardcore rery sandy CLA	Y			0.25 0.50 0.75 1.00	D1 D2 D3 D4			
							Excavatio	n Metho AVATION	d:		
							Shoring /	Support	:		
							N/A				
							Stability:				
							Backfill:				
							ARISING	S			
Remarke											
D= Disturbe Groundwate	ed Sa er is	ample not encountered	during boring/e	excavation							
										Logged By Checked By	: EW :
										Figure No.	: 1727399.TP2

Site	Site Analytical Servic				Ltd.	Site SOUTH LODGE, HEATHS	BL Trial Pit Number TP3	
Excavation HAND EXCA	Method Avation	Dimension 0.30m(W)	n s) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD)	Client ELLIOTTWOOD PARTNE	RSHIP LTD	Job Number 1727399
		Location	38860	Dates 16	6/10/2017	Engineer		Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	, D	escription	Legend S
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Red qu MADE GROUND: Dark br fragments of brick and con Mottled brown very sandy Complete at 1.00m	arry tiles over sand and cen own gravelly sandy clay with crete rubble and ash CLAY	
						D= Disturbed Sample Groundwater is not encount	ered during boring/excavati	on
						Scale (approx) 1:50	Logged By EW	Figure No. 1727399.TP3

0:1	_	A I	-411		Site					Trial Pit
Site		Analy	tical Service	es Ltd.	SOUTH	LODGE, HEA	ATHSIDE, H	HAMPSTE	EAD, NW3 1BL	TP3
Method Trial Pit			Dimensions 0.30m(W) x 0.30m(L) x 1.00m(D)	Ground Level (mOD)	Client ELLIOTT	WOOD PAR	TNERSHIF	P LTD		Job Number 1727399
Orientation	[A D C B	Location TQ268860	Dates 16/10/2017	Engineer					Sheet 1/1
Depth 0.00		0.18m Brid 0.09m Brid 0.09m Brid 0.10m Brid 0.10m Brid	ick 0.07m 0.08m 0.06m 0.06m 0.06m rick, Lime mortar ck rubble Underside of foundation found at	: 0.56m depth				Level - 0.00		
Strata						Samples	and Tests	5		
Depth (m)	No.	Description				Depth (m)	Туре	Field Re	ecords	
0.00-0.08	1	MADE GROUN	D: Red quarry tiles over sand and cemer	nt						
0.08-0.72	2	rubble and ash	D: Dark brown gravelly sandy clay with t	ragments of brick and c	oncrete	0.25	D1 D2			
0.72-1.00	3	Mottled brown v	very sandy CLAY			0.75 1.00 Excavatio	D3 D4 D4			
						HAND EXC Shoring / N/A Stability: GOOD Backfill: ARISING	AVATION Support:			
Remarks D= Disturber Groundwate	d Sa r is i	mple not encountered	during boring/excavation							
									Logged By Checked By Figure No.	: EW : : 1727399.TP3

Site Analytical Service				es	Ltd.	Site SOUTH LODGE, HEATHS	IBL Trial Pit Number			
Excavation HAND EXC/	Method Avation	Dimensio 0.30m(W	ons /) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD)	Client ELLIOTTWOOD PARTNE	RSHIP LTD	Job Number 1727399		
		Location TQ2	68860	Dates 16	6/10/2017	Engineer		Sheet 1/1		
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Kater Kater		
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Red qua MADE GROUND: Dark br fragments of brick and cor Mottled brown very sandy Complete at 1.00m	arry tiles over sand and cen own gravelly sandy clay with crete rubble and ash CLAY	h		
						D= Disturbed Sample Groundwater is not encount	ered during boring/excavati	on		
						Scale (approx) 1:50	Logged By EW	Figure No. 1727399.TP3		
Site)	Analy	tical Servic	es Ltd.	SOUTH LODGE, HEATHSIDE, HAMPSTEAD, NW3 1BL					Trial Pit Number TP4
----------------------------	-----------------	--------------------------	----------------------------------------------------------------------------	----------------------------	--------------------------------------------	------------------------------------------------------------------------------------------	-----------------------------------------	-----------------------------------	-----------------------------------------------	-----------------------------------
Method Trial Pit			Dimensions 0.30m(W) x 0.30m(L) x 1.00m(D)	Ground Level (mOD)	Client ELLIOTT	WOOD PAR	TNERSHI	P LTD		Job Number 1727399
Orientation	I	A D B C	Location TQ268860	Dates 16/10/2017	Engineer	,				Sheet 1/1
Depth 0.00		0.55m Brid	ick $\underbrace{0.53m}_{Black 4'}$ Underside of foundation found at	0.39m				Level 0.00 1.00		
Strata	No	Description				Samples	and Test	S Field Rec	ords	
0.00-0.12	1	MADE GROUN	ID: Red quarry tiles over sand and cerr	nent			.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
0.12-0.30	2	MADE GROUN	ID: Dark brown gravelly sandy clay with	n fragments of brick and c	oncrete	0.25	D1			
0.30-1.00	3	Mottled brown v	very sandy CLAY			0.50 0.75 1.00	D2 D3 D4			
Remarks						Excavation HAND EXC Shoring / N/A Stability: GOOD Backfill: ARISING	Support	a: :		
D= Disturbe Groundwate	d Sa er is i	Imple not encountered	during boring/excavation					L (Logged By :E Checked By : Figure No. :1	:W 727399.TP3

Site	Analy	/tica	al Servic	es	Ltd.	Site SOUTH LODGE, HEATHS	DIDE, HAMPSTEAD, NW3 1	Trial Pit Number BL TP5A
Excavation HAND EXCA	Method AVATION	Dimensio 0.30m(W	ons /) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD)	Client ELLIOTTWOOD PARTNE	RSHIP LTD	Job Number 1727399
		Location TQ2	68860	Dates 16	6/10/2017	Engineer		Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Kater Sater
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Clay tile MADE GROUND: Concrei to sub-angular flints MADE GROUND: Brick ru Mottled brown very sandy Complete at 1.00m	et floor te containing course sub-rou bble CLAY	
						D= Disturbed Sample Groundwater is not encount	ered during boring/excavatio	n
					· · ·	Scale (approx) 1:50	Logged By EW	Figure No. 1727399.TP5A

Site	Analy	tical Serv	ices Ltd.	SOUTH I	LODGE, HEA	ATHSIDE, I	HAMPSTE	EAD, NW3 1BL	Trial Pit Number TP5A
Method Trial Pit		Dimensions 0.30m(W) x 0.30m(L) x 1.00m((D) Ground Level (mOD)	Client ELLIOTT	WOOD PAR	TNERSHI	P LTD		Job Number 1727399
Orientation	A D B C	Location TQ268860	Dates 16/10/2017	Engineer					Sheet 1/1
Depth 0.00	0.21m Bric	sk Iderside of foundation found a	at 0.21m depth				Level 0.00 		
Strata					Samples	and Tost			
Depth (m) No.	Description				Depth (m)	Туре	Field Re	cords	
0 00-0 07 1		D [.] Clay tiled floor							
0.07-0.20 2	MADE GROUNE	D: Concrete containing course su	ub-rounded to sub-angular flint	s					
0.20-0.23 3	MADE GROUNE	D: Brick rubble							
0.23-1.00 4	Mottled brown ve	rery sandy CLAY			0.25 0.50 0.75 1.00	D1 D2 D3 D4			
						on Metho	d:		
					Shoring /	Sunnort			
					N/A		-		
					Stability:				
					GOOD				
					Backfill:				
					ARISING	55			
Remarks	ample				1				
Groundwater is	not encountered of	during boring/excavation							
								Logged By	: EW
								Figure No.	: 1727399.TP5A

Site	Analy	/tica	al Servic	es	Ltd.	Site SOUTH LODGE, HEATHS	IDE, HAMPSTEAD, NW3 1	Trial Pit Number 3L TP5B
Excavation HAND EXCA	Method Avation	Dimensio 0.30m(W	ons /) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD)	Client ELLIOTTWOOD PARTNE	RSHIP LTD	Job Number 1727399
		Location	268860	Dates	6/10/2017	Engineer		Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend S
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Clay tile MADE GROUND: Concret to sub-angular flints MADE GROUND: Brick ru Mottled brown very sandy Complete at 1.00m	d floor e containing course sub-rou bble CLAY	nded
						Groundwater is not encount	ered during boring/excavatio	n
 	· ·		· · ·		 			
· ·						Scale (approx)	Logged By	Figure No.

Site)	Analy	tical Se	rvice	es Ltd.	Site SOUTH	LODGE, HEA	ATHSIDE, H	HAMPSTE	EAD, NW3 1BL	Trial Pit Number TP5B
Method Trial Pit			Dimensions 0.30m(W) x 0.30m(L) x 7	1.00m(D)	Ground Level (mOD)	Client ELLIOTT	WOOD PAR	TNERSHIF	P LTD		Job Number 1727399
Orientation		A D B C	Location TQ268860		Dates 16/10/2017	Engineer					Sheet 1/1
Depth 0.00		0.22m Brick	k Underside of foundatio	on found at (0.22m depth				Level - 0.00 - - - -		
Strata							Samples	and Tests	5		
Depth (m)	No.	Description					Depth (m)	Туре	Field Re	ecords	
0.00-0.07	1		D: Clay tiled floor		ded to sub angular flints						
0.20-0.23	3	MADE GROUNI	D: Brick rubble			•					
0.23-1.00	4	Mottled brown v	very sandy CLAY				0.25 0.50 0.75 1.00	D1 D2 D3 D4			
							Excavatio		d:		
							Shoring /	Support			
							N/A				
							Stability:				
							Backfill:				
							ARISING	S			
Remarks											
D= Disturbe Groundwate	d Sa eris	mple not encountered (during boring/excavation								
										Logged By Checked By Figure No.	: EW : : 1727399.TP5B

Site Analytical Servic					Ltd.	Site SOUTH LODGE, HEATHS	DIDE, HAMPSTEAD, NW3 1	Trial Pit Number 3L TP6A
Excavation HAND EXCA	Method AVATION	Dimension 0.30m(W)	ns) x 0.30m(L) x 1.00m(D)	Ground	l Level (mOD)	Client ELLIOTTWOOD PARTNE	RSHIP LTD	Job Number 1727399
		Location	68860	Dates 1	6/10/2017	Engineer		Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend S
0.25 0.50 0.75 1.00	D1 D2 D3 D4				0.07 0.24) 0.31 0.43 0.37) 1.00 1.00 1.00	MADE GROUND: Timber MADE GROUND: Timber MADE GROUND: Concrei MADE GROUND: Dark br fragments of brick and con MADE GROUND: Mottled of brick and concrete rubb Complete at 1.00m	floor boards joist ie own gravelly sandy clay with crete rubble brown sandy clay with fragme le	eents
						Groundwater is not encount D= Disturbed Sample	ered during boring/excavatio	n
		·		·	· · ·	Scale (approx)	Logged By	Figure No.

Site)	Analy	tical S	ervice	es Ltd.	Site SOUTH	LODGE, HEA	ATHSIDE, I	HAMPSTE	EAD, NW3 1BL	Trial Pit Number TP6A
Method Trial Pit			Dimensions 0.30m(W) x 0.30m(L) x 1.00m(D)	Ground Level (mOD)	Client ELLIOTT	WOOD PAR	TNERSHI	P LTD		Job Number 1727399
Orientation	1	A D B C	Location TQ268860		Dates 16/10/2017	Engineer					Sheet 1/1
Depth 0.00		0.17m Brid	ck d yellow stocks	0.12m	Underside of fou	Indation v	was not four	nd	Level - 0.00 - - - - 		
Strata							Samples	and Tests	S		
Depth (m)	No.	Description					Depth (m)	Туре	Field Re	ecords	
0.00-0.07	1	MADE GROUNI	D: Timber floor boards	8			-				
0.07-0.31	2		D: Timber joist				0.25	D1			
0.31-0.43	3	MADE GROUNI MADE GROUNI rubble	D: Dark brown gravel	y sandy clay with f	ragments of brick and co	oncrete	0.50	D2			
0.63-1.00	5	MADE GROUNI	D: Mottled brown san	dy clay with fragme	ents of brick and concret	e rubble	0.75	D3			
							Excavatio	n Metho	d:		
							HAND EXC	AVATION			
							Shoring /	Support	:		
							Stability:				
							Backfill:				
Remarks Groundwate	er is i	not encountered	during boring/excavat	ion							
וט - טווגנערפּנעראנעראני	u 38									Logged By : Checked By : Figure No. :	EW 1727399.TP6A

Site	Site Analytical Servic				Ltd.	Site SOUTH LODGE, HEATHS	BL Trial Pit Number TP6B	
Excavation	Method Avation	Dimensio 0.30m(W	ns) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD	Client	RSHIP LTD	Job Number 1727399
		Location	68860	Dates 16	6/10/2017	Engineer		Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness	D	escription	Legend Safe
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Timber MADE GROUND: Timber MADE GROUND: Concret MADE GROUND: Dark br fragments of brick and cor MADE GROUND: Mottled of brick and concrete rubb Complete at 1.00m	floor boards joist ie own gravelly sandy clay with crete rubble brown sandy clay with fragr le	
						D= Disturbed Sample Groundwater is not encount	ered during boring/excavation	on
						Scale (approx)	Logged By	Figure No.
						1:50	EW	1727399.TP6B

Site)	Analy	vtica	al Service	es Ltd.	Site SOUTH	LODGE, HE	ATHSIDE, I	HAMPSTE	AD, NW3 1B	Trial Pit Number TP6B	
Method Trial Pit			Dimensio 0.30m(W	ons V) x 0.30m(L) x 1.00m(D)	Ground Level (mOD)	Client ELLIOTT	WOOD PAR	TNERSHI	P LTD		Job Number 1727399	
Orientation	l	A D B C	Location TQ2	268860	Dates 16/10/2017	Engineer					Sheet 1/1	
Depth 0.00		0.27m Brick	ellow	Underside o	of foundation was not	found			Level 0.00 			
Strata							Samples	and Test	S			
Depth (m)	No.	Description					Depth (m)	Туре	Field Re	cords		
0.00-0.07	1	MADE GROUN	D: Timber f	floor boards								
0.07-0.31	2	MADE GROUNI	D: Timber j	joist			0.25	D1				
0.43-0.63	4	MADE GROUNI rubble	D: Dark bro	own gravelly sandy clay with f	ragments of brick and c	oncrete	0.50	D2				
0.63-1.00	5	MADE GROUN	D: Mottled	brown sandy clay with fragme	ents of brick and concret	e rubble	0.75 1.00	D3 D4				
							Excavatio	on Metho	d:			
Remarks D= Disturbe Groundwate	Remarks Excavation Method: HAND EXCAVATION Shoring / Support: N/A Stability: GOOD Backfill: ARISINGS ARISINGS											
										Logged By Checked By Figure No.	: EW ; : : 1727399.TP6B	

Site Analytical Servic				es	Ltd.	Site SOUTH LODGE, HEATHS	Trial Pit Number BL TP7A	
Excavation HAND EXC	Method AVATION	Dimensio 0.30m(W	ons /) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD)	Client ELLIOTTWOOD PARTNE	RSHIP LTD	Job Number 1727399
		Location TQ2	68860	Dates 16	6/10/2017	Engineer		Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness	D	escription	Legend Safe
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Timber MADE GROUND: Timber MADE GROUND: Concre MADE GROUND: Dark br brick and concrete rubble Mottled brown sandy CLA Complete at 1.00m	floor boards joist te own sandy clay with fragmen and ash Y	nts of
						D= Disturbed Sample Groundwater is not encount	ered during boring/excavatio	on
· ·	· ·	•	· · ·		· · ·	Scale (approx)	Logged By	Figure No.
						1:50	EW	- 1727399.TP7A

Site)	Analy	vtic	al Service	es Ltd.	Site SOUTH	LODGE, HE	ATHSIDE, I	HAMPSTE	EAD, NW3 1BL	Trial Pit Number TP7A
Method Trial Pit			Dimens 0.30m(ions W) x 0.30m(L) x 1.00m(D)	Ground Level (mOD)	Client ELLIOTT	WOOD PAR	TNERSHI	P LTD		Job Number 1727399
Orientation		A D B C	Locatio TC	n 0268860	Dates 16/10/2017	Engineer					Sheet 1/1
Depth 0.00		0.30m Brick 0.70m Old yel stocks	low	Undersio	de of foundation was	not found			Level 0.00 		
1.00							Semulas		- 1.00		
Strata	No	Description					Samples		S Field Re	acords	
	4		D. Timber	flaan kaanda			Doptii (iii)	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
0.00-0.07	1	MADE GROUN	D: Timber	rioist			-				
0.18-0.30	3	MADE GROUN	D: Concre	ete			0.25	D1			
0.30-0.42	4	MADE GROUN	D: Dark b	rown sandy clay with fragments	s of brick and concrete r	ubble and	-				
0.42-1.00	5	ash Mottled brown s	andy CLA	ΑY			0.50 0.75 1.00	D2 D3			
							Excavatio	n Metho	d:		
							HAND EXC	AVATION			
							Shoring /	Support	:		
							N/A Stability:				
							GOOD				
							Backfill:				
							ARISING	S			
Remarks											
D= Disturbe Groundwate	d Sa eris	ample not encountered	during bo	ring/excavation							
			-							Logged By : E Checked By :	ΞW
										Figure No. 1	1727399.TP7A

Site Analytical Servic				es	Ltd.	Site SOUTH LODGE, HEATHS	Trial Pit Number BL TP7B	
Excavation HAND EXC	Method AVATION	Dimensio 0.30m(W	ons /) x 0.30m(L) x 1.00m(D)	Ground	Level (mOD)	Client ELLIOTTWOOD PARTNE	RSHIP LTD	Job Number 1727399
		Location TQ2	68860	Dates 16	6/10/2017	Engineer		Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend Safe
0.25 0.50 0.75 1.00	D1 D2 D3 D4					MADE GROUND: Timber MADE GROUND: Timber MADE GROUND: Concret MADE GROUND: Dark br brick and concrete rubble Mottled brown sandy CLA Complete at 1.00m	floor boards joist te own sandy clay with fragmen and ash Y	nts of
						D= Disturbed Sample Groundwater is not encount	ered during boring/excavatio	on
· ·								
· ·	· ·		· · ·		· · · -	Scale (approx)	Logged By	Figure No.
						1:50	EW	1727399.TP7B



APPENDIX 'B'

Laboratory Test & Gas Monitoring Data



UNDRAINED TRIAXIAL COMPRESSION TEST

LUUA			ige, neath		, NVVO TDE		
BH/TP No.	MOISTURE CONTENT	BULK DENSITY	LATERAL PRESSURI	COMPRESSIVE E STRENGTH	COHESION	ANGLE OF SHEARING RESISTANCE	DEPTH
	%	Mg/m ³	kN/m ²	kN/m ²	kN/m ²	degrees	m
BH1	27	1.89	50	116	58		2.25
BH1	28	2.00	80	98	49		4.25

LOCATION South Lodge, Heathside, Hampstead, NW3 1BL



PLASTICITY INDEX & MOISTURE CONTENT DETERMINATIONS

LOCATION South Lodge, Heathside, Hampstead, NW3 1BL

BH/TP No.	Depth	Natural Moisture	Liquid Limit	Plastic Limit	Plasticity Index	Passing 425 μm	Class
	m	%	%	%	%	%	
BH1	3.00	28	50	26	24	100	CI/CH
	3.75	32	49	28	21	100	CI
	4.75	27	48	23	25	100	CI
WS1	3.00	26	44	23	21	100	CI
	3.50	25	45	20	25	100	CI
	4.00	25	45	20	25	100	CI



SULPHATE & pH DETERMINATIONS

BH/TP No.	DEPTH BELOW	SOIL S A	ULPHATES S SO4 WATER SOL	WATER SULPHATES AS SO4	рН	CLASS	SOIL - 2mm
	m	%	g/l	g/l			%
BH1	5.00		0.18		8.2	DS-1	100
	9.00		0.19		7.7	DS-1	100
WS1	4.50		0.14		7.1	DS-1	100
	6.00		0.19		7.2	DS-1	100

LOCATION South Lodge, Heathside, Hampstead, NW3 1BL

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



GROUNDWATER MONITORING

LOCATION South Lodge, Heathside, Hampstead, NW3 1BL

	GROUNDWATER MONITORING RECORD							
Date	Weather Conditions	Temperature (°C)						
07/11/2017	Light Rain	Wet	9.4					
Monitoring Point Location	Depth to wate	r (mBGL)	Depth to Base of well (mBGL)					
WS1	3.91		5.42					
BH1	2.72		6.00					



GROUNDWATER MONITORING

LOCATION South Lodge, Heathside, Hampstead, NW3 1BL

	GROUNDWATER MONITORING RECORD							
Date	Weather Conditions	Temperature (°C)						
07/11/2017	Light Rain	Wet	9.4					
Monitoring Point Location	Depth to wate	r (mBGL)	Depth to Base of well (mBGL)					
WS1	3.62		5.42					
BH1	2.51		6.00					

ing Head Test No. Image: Constraint of the second sec	ite Analy	ytical	Servio	es L	.td.	SOUTH LODGE, HEATHSIDE, HAMPSTEAD,	NW3 1BL
Location TQ268860 Dates 16/10/2017 Engineer Shee 1/ Height of casing above ground level: 0.00 m 6.00 m bgl 6.00 m bgl General Approach Depth to Base of Casing: 1.00 m bgl General Approach Height L: 5.80 m btoc H1 selected at I= 5.49 mins (=t1 = 60.6 secs) H2 selected at I= 3.937 mins (=t2 = 3610.2 secs) k = 1.34E-06 ms-1	tu Permeability Type ng Head	Test No.	1	Ground L	.evel (mOD)	Client ELLIOTTWOOD PARTNERSHIP LTD	Jok Nur 17:
Height of casing above ground level: 0.00 m Depth to Base of Borehole: 6.00 m bgl Depth to Base of Casing: 1.00 m bgl Depth to equilibrium water level: 5.80 m btoc Test Length L: 5.00 m Diameter of Test Length D: 0.05 m Area of Test Section: 0.0020 m2 Intake Factor F: 0.1375 (after condition B, figure 6, BS 5930) 0.1375		Location TQ2688	60	Dates 16/*	10/2017	Engineer	She
Height of casing above ground level:0.00mPERMEABILITY (after Hvorslev, 1951)Depth to Base of Casing:1.00m bglGeneral ApproachDepth to equilibrium water level:5.80m btocH2 selected at t= 5.49 mins (=t1 = 60.6 secs)Test Length L:5.00mH2 selected at t= 3.937 mins (=t2 = 3610.2 secs)Diameter of Test Length D:0.05m0.0020m2Intake Factor F: (after condition B, figure 6, BS 5930)0.1375			1				
Depth to Base of Borehole:6.00m bglDepth to Base of Casing:1.00m bglDepth to equilibrium water level:5.80m btocTest Length L:5.00mDiameter of Test Length D:0.05mArea of Test Section:0.0020m2Intake Factor F: (after condition B, figure 6, BS 5930)0.1375	Height of casing above g	round level:	0.00 m		PERMEAB	ILITY (after Hvorslev, 1951)	
Depth to Base of Casing:1.00 m bglDepth to equilibrium water level:5.80 m btocTest Length L:5.00 mDiameter of Test Length D:0.05 mArea of Test Section:0.0020 m2Intake Factor F:0.1375(after condition B, figure 6, BS 5930)	Depth to Base of Boreho	le:	6.00 m bgl		General A	oproach	
Depth to equilibrium water level: 5.80 m btoc Test Length L: 5.00 m Diameter of Test Length D: 0.05 m Area of Test Section: 0.0020 m2 Intake Factor F: 0.1375 (after condition B, figure 6, BS 5930)	Depth to Base of Casing	:	1.00 m bgl		H1 selecte	d at t= 5.49 mins (=t1 = 60.6 secs)	
Test Length L: 5.00 m Diameter of Test Length D: 0.05 m Area of Test Section: 0.0020 m2 Intake Factor F: 0.1375 (after condition B, figure 6, BS 5930)	Depth to equilibrium wate	er level:	5.80 m btoc		H2 selecte	d at t= 3.937 mins (=t2 = 3610.2 secs)	
Diameter of Test Length D: 0.05 m Area of Test Section: 0.0020 m2 Intake Factor F: 0.1375 (after condition B, figure 6, BS 5930) 0.1375	Test Length L:		5.00 m		k = 1.	34E-06 ms-1	
Area of Test Section: 0.0020 m2 Intake Factor F: 0.1375 (after condition B, figure 6, BS 5930) 0	Diameter of Test Length	D:	0.05 m				
Intake Factor F: 0.1375 (after condition B, figure 6, BS 5930)	Area of Test Section:		0.0020 m2				
	Intake Factor F: (after condition B. figure 6.	BS 5930)	0.1375				

time (mins)	water (m btoc)	Water, H (m)	/ Ho
(mins) 0.0 1.0 2.0 3.0 4.0 5.0 10.0 15.0 20.0 30.0 45.0 60.0	(m btoc) 0.000 0.300 0.400 0.450 0.470 0.580 0.660 0.840 1.160 1.850	(m) 5.800 5.500 5.440 5.350 5.330 5.220 5.140 4.960 4.640 4.200 3.950	Ho 1.000 0.948 0.938 0.922 0.919 0.900 0.886 0.855 0.800 0.724 0.681



Remarks

	ype	Test No.		Groun	d Level (mOI								Jo
g Head			2			ELLIO	TTWOOI	D PARTN	ERSHIP I	TD			Nu 17
	F	Location		Dates	16/10/2017	Engine	er						Sh
		TQ26886	60										
Height of casing	above gro	und level:	0.00 m		PERME	ABILITY (a	after Hvo	rslev, 19	51)				
Depth to Base of	f Borehole:		6.00 m bgl		General	Approach	h						
Depth to Base of	f Casing:		1.00 m bgl		H1 selec	ted at t=	5.74 mins	s (=t1 = 5	5.2 secs)				
Depth to equilibr	rium water	level:	5.80 m btoc	-	H2 selec	ted at t=	5.298 mir	ns (=t2 =	3599.4 se	ecs)			
Test Length L:			5.00 m		k =	3.23E-07	ms-1						
Diameter of Test	Length D:		0.05 m										
Area of Test Sect	tion:		0.0020 m2										
Intake Factor F: (after condition B	figure 6 B	\$ 5930)	0.1375										
Elapsed	Depth to	Head of	₩t	5.8	3 *;		;						7
Elapsed time (mins) D 0.0 (r	Depth to water m btoc) 0.000 0.070 0.080 0.090 0.120 0.200 0.200 0.200 0.200 0.300 0.400	Head of Water, H (m) 5.800 5.760 5.730 5.720 5.710 5.680 5.600 5.540 5.500 5.540 5.500	Ht / Ho 1.000 0.993 0.988 0.986 0.984 0.979 0.966 0.955 0.948 0.931	5.8 5.7 (U)	3 X X X X X X X	×							
Elapsed time (mins) D 0.0 (r 10.0 (r 15.0 (r 20.0 (r 30.0 (r 45.0 (r 60.0 (r	Depth to water m btoc) 0.000 0.040 0.070 0.080 0.090 0.120 0.200 0.200 0.200 0.200 0.200 0.200 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.760 5.730 5.720 5.710 5.680 5.600 5.540 5.500 5.540 5.500 5.400 5.330	Ht / Ho 1.000 0.993 0.988 0.986 0.986 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919	5.7 5.7		×							
Elapsed time (mins) D 0.0 (r 15.0 (r 20.0 (r 30.0 (r 45.0 (r 60.0 (r	Depth to water m btoc) 0.000 0.040 0.070 0.080 0.200 0.200 0.200 0.200 0.200 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.760 5.720 5.710 5.680 5.600 5.540 5.500 5.540 5.500 5.400 5.360 5.330	Ht / Ho 1.000 0.993 0.988 0.986 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919	d of Water (m) 2.5 2.6	3 X								
Elapsed time (mins) D 0.0 (r 30.0 45.0 60.0 (r	Depth to water m btoc) 0.000 0.040 0.090 0.120 0.200 0.200 0.200 0.200 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.760 5.720 5.710 5.680 5.600 5.540 5.500 5.540 5.500 5.400 5.360 5.330	Ht / Ho 1.000 0.993 0.988 0.986 0.984 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919	Head of Water (m)	3	×							
Elapsed time (mins) D 0.0 (r 2.0 3.0 4.0 5.0 10.0 15.0 20.0 30.0 45.0 60.0	Depth to water m btoc) 0.000 0.040 0.090 0.120 0.200 0.260 0.300 0.400 0.440 0.440	Head of Water, H (m) 5.800 5.760 5.730 5.720 5.720 5.720 5.720 5.730 5.720 5.730 5.730 5.720 5.730 5.720 5.730 5.720 5.750 5.730 5.750 5.680 5.540 5.5500 5.400 5.360 5.330	Ht / Ho 1.000 0.993 0.988 0.986 0.984 0.979 0.965 0.948 0.931 0.924 0.919	Head of Water (m)	3 *	×							
Elapsed time (mins) D 0.0 (r 10.0 (r 15.0 (r 20.0 (r 30.0 45.0 60.0 (r	Depth to water m btoc) 0.000 0.040 0.090 0.120 0.200 0.200 0.200 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.760 5.720 5.710 5.680 5.500 5.540 5.500 5.540 5.500 5.400 5.360 5.330	Ht / Ho 1.000 0.993 0.988 0.986 0.984 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919	5.7 Head of Water (m) 5.6 5.4	3 X	×							
Elapsed time (mins) D 0.0 (r 2.0 3.0 4.0 5.0 5.0 20.0 30.0 45.0 60.0 60.0	Depth to water m btoc) 0.000 0.040 0.070 0.080 0.090 0.120 0.200 0.200 0.200 0.200 0.200 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.730 5.720 5.710 5.680 5.600 5.540 5.500 5.540 5.500 5.400 5.330	Ht / Ho 1.000 0.993 0.988 0.988 0.986 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919	5.7 Head of Water (m) 5.4	3 X X X X X X X X X X X X X X X X X X X								
Elapsed time (mins) D 0.0 (r 0.0 (r 2.0 3.0 4.0 5.0 10.0 15.0 20.0 30.0 45.0 60.0	Depth to water m btoc) 0.000 0.040 0.090 0.120 0.200 0.200 0.200 0.200 0.400 0.440 0.440 0.470	Head of Water, H (m) 5.800 5.760 5.730 5.720 5.710 5.680 5.500 5.540 5.500 5.540 5.500 5.400 5.360 5.330	Ht / Ho 1.000 0.993 0.988 0.986 0.986 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919	5.7 5.7 5.6 5.4	8 *	×					*		
Elapsed time (mins) D 0.0 (r 2.0 3.0 4.0 5.0 5.0 20.0 30.0 45.0 60.0 60.0	Depth to water m btoc) 0.000 0.070 0.080 0.090 0.120 0.200 0.200 0.200 0.200 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.730 5.720 5.710 5.680 5.600 5.540 5.500 5.400 5.360 5.330	Ht / Ho 1.000 0.993 0.988 0.988 0.988 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919	5.5 Head of Water (m) 5.6 5.4									
Elapsed time (mins) D 0.0 (r 0.0 (r 2.0 3.0 4.0 5.0 10.0 15.0 20.0 30.0 45.0 60.0	Depth to water m btoc) 0.000 0.040 0.090 0.120 0.200 0.200 0.200 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.760 5.720 5.710 5.680 5.500 5.540 5.500 5.540 5.500 5.330	Ht / Ho 1.000 0.993 0.988 0.986 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919	5.7 5.7 5.6 5.4		5 15	5 22 Ela		30 3 ime (n	97.5 hins)	45	52.5	
Elapsed time (mins) D 0.0 (r 1.0 2.0 3.0 4.0 5.0 10.0 15.0 20.0 30.0 45.0 60.0 60.0	Depth to water m btoc) 0.000 0.040 0.070 0.200 0.200 0.200 0.200 0.200 0.400 0.440 0.470	Head of Water, H (m) 5.800 5.730 5.720 5.710 5.680 5.540 5.540 5.500 5.400 5.360 5.330	Ht / Ho 1.000 0.993 0.988 0.988 0.984 0.979 0.966 0.955 0.948 0.931 0.924 0.919	5.5 Head of Water (m) 5.4		5 15		.5 psed t	30 3 ime (n	37.5 hins)	45	52.5	60

FAIRHURST

APPENDIX C STRUCTURAL LOADINGS AND PROPOSED BASEMENT PLAN





					BASEMENT	PROPOSED LOAD TAKEDO	DWN	elliottwo
					SKETC	CH		Elliott Wood Partnersh Wimbledon • Central London
					scale (s) 1·100@Δ3	date	drawn STh	Consulting Structural and C tel: (020) 7499 5888. www.elli
rev	date	by d	hk descriptio	n	1.100@//0	23/00/10	5111	

NOTE: ALL LOAD RUNS ARE SLS

project SOUTH LODGE, HEATHSIDE, LONDON

boc

ship Ltd **n • Nottingham** Civil Engineers Iliottwood.co.uk

Project no. 2170605

Sketch no. SK/02

revision P1

FAIRHURST

APPENDIX D SETTLE 3D – STAGE 1 (UNDRAINED UNLOADING)

Stage 1 - Undrained Unloading



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APPENDIX E SETTLE 3D – STAGE 2 (UNDRAINED RELOADING)

Stage 2 - Undrained Reloading



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APPENDIX F SETTLE 3D – STAGE 3 (DRAINED RELOADING)







Settle3D Analysis Information South Lodge, Heathside Ground Movement Assessment

Project Settings

 Document Name
 Settle 3D - Stage 1,2 &3

 Project Title
 South Lodge, Heathside Ground Movement Assessment

 Analysis
 Ground Movement Assessment

 Author
 JT

 Company
 Fairhurst

 Date Created
 10/04/2018, 11:00:30

 Stress Computation Method
 Boussinesq

 Minimum settlement ratio for subgrade modulus
 0.9

Calculate settlement with mean stress

Use average properties to calculate layered stresses

Ignore negative effective stresses in settlement calculations

Stage Settings

Stage #	Name
1	Status Quo
2	Stage 1 - Undrained Unloading
3	Stage 2 & 3 - Undrained and Drained Reloading

Results (relative to Stage: Status Quo)

Time taken to compute: 4.1781 seconds

Stage: Status Quo

Data Type	Minimum	Maximum
Total Settlement [mm]	0	0
Total Consolidation Settlement [mm]	0	0
Virgin Consolidation Settlement [mm]	0	0
Recompression Consolidation Settlement [mm]	0	0
Immediate Settlement [mm]	0	0
Loading Stress ZZ [kPa]	0	0
Loading Stress XX [kPa]	0	0
Loading Stress YY [kPa]	0	0
Effective Stress ZZ [kPa]	0	0
Effective Stress XX [kPa]	0	0
Effective Stress YY [kPa]	0	0
Mean Stress [kPa]	0	0
Total Stress ZZ [kPa]	0	0
Total Stress XX [kPa]	0	0
Total Stress YY [kPa]	0	0
Modulus of Subgrade Reaction (Total) [kPa/m]	0	0
Modulus of Subgrade Reaction (Immediate) [kPa/m]	0	0
Modulus of Subgrade Reaction (Consolidation) [kPa/m]	0	0
Total Strain	0	0
Pore Water Pressure [kPa]	0	0
Degree of Consolidation [%]	0	0
Pre-consolidation Stress [kPa]	0	0
Over-consolidation Ratio	0	0
Void Ratio	0	0
Hydroconsolidation Settlement [mm]	0	0
Undrained Shear Strength	0	0

Stage: Stage 1 - Undrained Unloading

Data Type	Minimum	Maximum
Total Settlement [mm]	-50.85	0.449708
Total Consolidation Settlement [mm]	-45.5775	0
Virgin Consolidation Settlement [mm]	0	0.000948272
Recompression Consolidation Settlement [mm]	-45.5775	0
Immediate Settlement [mm]	-6.01194	1.52935
Loading Stress ZZ [kPa]	-65.416	8.74558
Loading Stress XX [kPa]	-69.5262	5.21162
Loading Stress YY [kPa]	-63.2756	7.14398
Effective Stress ZZ [kPa]	-65.416	8.74558
Effective Stress XX [kPa]	-69.5262	5.21162
Effective Stress YY [kPa]	-63.2756	7.14398
Mean Stress [kPa]	-81.4758	6.19525
Total Stress ZZ [kPa]	-65.416	8.74558
Total Stress XX [kPa]	-69.5262	5.21162
Total Stress YY [kPa]	-63.2756	7.14398
Modulus of Subgrade Reaction (Total) [kPa/m]	0	0
Modulus of Subgrade Reaction (Immediate) [kPa/m]	0	0
Modulus of Subgrade Reaction (Consolidation) [kPa/m]	0	0
Total Strain	-0.0104347	0.00188989
Pore Water Pressure [kPa]	0	0
Degree of Consolidation [%]	-1.42109e-014	100
Pre-consolidation Stress [kPa]	0	0.00263321
Over-consolidation Ratio	-0.506096	2823.71
Void Ratio	0	0
Hydroconsolidation Settlement [mm]	0	0
Undrained Shear Strength	-0.000147341	0.000282014

Stage: Stage 2 & 3 - Undrained and Drained Reloading

Data Type	Minimum	Maximum
Total Settlement [mm]	-44.7323	3.02477
Total Consolidation Settlement [mm]	-39.0706	1.48069
Virgin Consolidation Settlement [mm]	0	3.73294
Recompression Consolidation Settlement [mm]	-39.0706	0.37742
Immediate Settlement [mm]	-6.20627	1.82062
Loading Stress ZZ [kPa]	-59.4119	27.2964
Loading Stress XX [kPa]	-63.9346	22.3547
Loading Stress YY [kPa]	-59.0847	21.857
Effective Stress ZZ [kPa]	-59.4119	27.2964
Effective Stress XX [kPa]	-63.9346	22.3547
Effective Stress YY [kPa]	-59.0847	21.857
Mean Stress [kPa]	-74.9755	26.9578
Total Stress ZZ [kPa]	-59.4119	27.2964
Total Stress XX [kPa]	-63.9346	22.3547
Total Stress YY [kPa]	-59.0847	21.857
Modulus of Subgrade Reaction (Total) [kPa/m]	-1.10342e+006	28570.3
Modulus of Subgrade Reaction (Immediate) [kPa/m]	-94412.4	575804
Modulus of Subgrade Reaction (Consolidation) [kPa/m]	-98442.6	62731.4
Total Strain	-0.0106994	0.00438399
Pore Water Pressure [kPa]	0	0
Degree of Consolidation [%]	-1.42109e-014	100
Pre-consolidation Stress [kPa]	0	21.185
Over-consolidation Ratio	-0.351711	125.595
Void Ratio	0	0
Hydroconsolidation Settlement [mm]	0	0
Undrained Shear Strength	-0.0936249	0.747717

Loads

1. Polygonal Load: "New Basement Load (80nKN/m2)"

Label	New Basement Load (80nKN/m2)
Load Type	Flexible
Area of Load	34.3907 m ²
Load	80 kPa
Depth	3.5 m
Installation Stage	Stage 2 & 3 - Undrained and Drained Reloading

Coordinates

X [m]	Y [m]
526890	186048
526887	186050
526886	186050
526880	186055
526875	186050
526884	186042
526885	186043
526877	186050
526880	186054
526887	186048
526887	186049
526890	186047
526890	186048
526890	186048

2. Polygonal Load: "Basement New Load (20kN/m2)"



 Label
 Basement New Load (20kN/m2)

 Load Type
 Flexible

 Area of Load
 4.65865 m²

 Load
 20 kPa

 Depth
 2.55 m

 Installation Stage
 Stage 2 & 3 - Undrained and Drained Reloading

Coordinates

X [m]	Y [m]
526882	186041
526883	186040
526886	186043
526885	186044

3. Polygonal Load: "Ground Bearing slab (10kN/m2)"

	3 1 1 1
Label	Ground Bearing slab (10kN/m2)
Load Type	Flexible
Area of Load	121.352 m ²
Load	10 kPa
Depth	2.55 m
Installation Stage	Stage 2 & 3 - Undrained and Drained Reloading

Coordinates

X [m]	Y [m]
526883	186040
526886	186037
526887	186038
526894	186032
526896	186035
526899	186035
526900	186036
526900	186039
526900	186040
526893	186045
526892	186044
526891	186044
526890	186043
526889	186044
526887	186042
526886	186043

Excavations

1. Excavation: "New Basement"

Advanced Staging

Stage	Depth [m]
Status Quo	1.95
Stage 1 - Undrained Unloading	2.85
Stage 2 $_{\&}$ 3 - Undrained and Drained Reloading	2.85

Coordinates

X [m]	Y [m]
526882	186041
526886	186037
526887	186038
526894	186032
526896	186035
526899	186035
526900	186036
526900	186039
526900	186040
526893	186045
526892	186044
526891	186044
526890	186043
526889	186044
526887	186042
526885	186044
526884	186042



2. Excavation: "New sub-basement "

Depth 3.5 m Installation Stage Stage 1 - Undrained Unloading

Coordinates

X [m]	Y [m]
526875	186050
526884	186042
526885	186044
526887	186042
526889	186044
526890	186043
526891	186044
526892	186044
526893	186045
526890	186048
526887	186050
526886	186050
526880	186055

Soil Layers

Layer #	Туре	Thickness [m]	Depth [m]
1	Made Ground	0.7	0
2	Claygate Member	6	0.7
3	London Clay	3.3	6.7



Soil Properties

Propert	ty .	Made Ground	Claygate Member	London Clay
Color				
Unit Weight [kN/m	3]	16	17	19
Saturated Unit We	ight [kN/m ³]	16*	18*	20*
Poisson's Ratio		0.3*	0.49999*	0.49999*
K0		1	1	1
Immediate Cattlen	ant	Enchlad	Enchlad	Enchlad
	top	Enabled 2000	Enableu 6971	17056
E[KFa]	lop	3000	17056	24052
Eur [kDa]	bollom	-	6974	24055
Eur [KPa]	lop	3000	17056	24052
	DOLIOITI	-	17950	24055
Primary Consolida	tion	Disabled	Enabled	Enabled
Material Type			Linear	Linear
mv [m ² /kN]	top	-	0.000224*	0.000142*
	bottom	-	0.000142	9.8e-005
mvur [m ² /kN]	top	-	0.000224*	0.000142*
	bottom	-	0.000142	9.8e-005
Underside and Ory A. D.	NI/ 01	0	0	0
Undrained Su A [k	N/m2j	0	0	0
Undrained SU S		0.2	0.2	0.2
Undrained Su m		0.8	0.8	0.8
Piezo Line ID		1	1	1

* Base value only. Refer to Stage Factor section.



Groundwater

Groundwater method Piezometric Lines Water Unit Weight 9.81 kN/m³

Piezometric Line Entities

ID Depth (m) 1 5.42 m

Query Points

Point #	Query Point Name	(X,Y) Location	Number of Divisions
1	Query Point 1	526891, 186041	Auto: 75
2	Query Point 2	526885, 186047	Auto: 63
3	Query Point 3	526881, 186049	Auto: 63
4	Query Point 4	526888, 186050	Auto: 63
5	Query Point 5	526880, 186055	Auto: 63
6	Query Point 6	526876, 186050	Auto: 63
7	Query Point 7	526884, 186043	Auto: 63
8	Query Point 8	526883, 186041	Auto: 75
9	Query Point 9	526894, 186041	Auto: 75
10	Query Point 10	526899, 186040	Auto: 75
11	Query Point 11	526893, 186033	Auto: 75
12	Query Point 12	526888, 186043	Auto: 75
13	Query Point 13	526889, 186043	Auto: 75
14	Query Point 14	526894, 186036	Auto: 75

Field Point Grid

Number of points 506 Expansion Factor 2

Grid Coordinates

X [m]	Y [m]
526909	186064
526909	186023
526866	186023
526866	186064

FAIRHURST

APPENDIX G XDISP ANALYSIS


Oasys Southside Lodge Ground Movement Assessment	Job No.	Sheet No.	Rev.
	125836		
Southside Lodge	Drg. Ref.		
Ground Movement Assessment	Made by	Date	Checked

Problem Type

Problem Type : Tunnelling and Embedded Wall Excavations

Prote point Record point Prote point	Type Name	Direction of extrusion		Point	/Line/Line	e for extrus	ion		No. of intervals across	Extrusion depth	No. of intervals along	Calculate	Surface type for
Note: Note: <th< th=""><th></th><th></th><th>x</th><th>First point Y</th><th>Z(level)</th><th>x</th><th>Second point Y</th><th>Z(level)</th><th>extrusion/line</th><th></th><th>extrusion</th><th></th><th>cunners</th></th<>			x	First point Y	Z(level)	x	Second point Y	Z(level)	extrusion/line		extrusion		cunners
	ine Line 1	-	[m] 526886.700	[m] 00 186057.90000	[m] 0.00000	[m] 526883.7000	[m] 0 186054.45000	[m] 0.00000	5	[m] _	-	Yes	Surface
	ine Line 2 ine Line 3	-	526883.700 526885.550	00 186054.45000 00 186052.95000	0.00000	526885.5500 526888.5000	0 186052.95000 0 186056.40000	0.00000	3	-	-	Yes Yes	Surface
	ine Line 4 ine Line 5	-	526888.500 526889.100	00 186056.40000 00 186055.85000	0.00000	526889.1000 526892.1000	0 186055.85000 0 186059.25000	0.00000	2	-	-	Yes Yes	Surface
	ine Line 6 ine Line 7	-	526892.100 526889.000	00 186059.25000 00 186061.80000	0.00000	526889.0000 526886.1500) 186061.80000) 186058.35000	0.00000	4	-	-	Yes Yes	Surface
	ine Line 8 ine Line 9	-	526886.150 526908.300	00 186058.35000 00 186048.55000	0.00000	526886.7000 526901.7000	0 186057.90000 0 186054.55000	0.00000	2	-	-	Yes Yes	Surface
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<pre>prov Fitting Folymonial</pre>		depth (z)(%)] [0.000,0.000,0.	040][2.000	,0.000,0.0001									
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Intermetation: invertion: Recorrection in front of high stiffness wall in stiff clay (CIRIA 580 Fig. 2.11b) inverting Distance from seal / wall depth or max. excavation depth (y), Depth / wall depth (1)(8) Distance from seal / wall depth or max. excavation depth (y), Depth / wall (1,000, 0.000, 0.033) [0.100, 0.000, 0.043] [0.200, 0.000, 0.055] [0.300, 0.000, 0.052] Distance from seal / wall depth or max. excavation (1,000, 0.000, 0.033) [0.100, 0.000, 0.043] [0.200, 0.000, 0.072] [0.000, 0.000, 0.073] Distance from seal / wall depth or max. excavation (1,000, 0.000, 0.033) [0.100, 0.000, 0.045] [0.200, 0.000, 0.072] [0.300, 0.000, 0.038] Distance from seal / wall depth or max. excavation (1,000, 0.000, 0.033) [0.100, 0.000, 0.045] [0.200, 0.000, 0.022] [0.300, 0.000, 0.023] Distance from seal / wall depth or max. (1,000, 0.000, 0.001] [0.100, 0.000, 0.008] [0.000, 0.000] [0.300, 0.000] [0.300, 0.000] Distance from seal / wall depth or max. (1,000, 0.000, 0.002) [0.200, 0.000, 0.008] [0.000, 0.001] [0.300, 0.000, 0.001] Distance from seal / wall depth or max. (1,000, 0.000, 0.003) [0.100, 0.000, 0.001] [0.100, 0.000, 0.001] [0.100, 0.000, 0.001] Distance from seal / wall depth or max. (1,000, 0.000, 0.001] [0.100, 0.000, 0.001] [0.100, 0.000, 0.001] [0.100, 0.000, 0.001] Distance from seal / wall depth or max. (1,000, 0.000, 0.001] [0.100, 0.000, 0.001] [0.1000, 0.000, 0.001] [0.10	Polynomial: z = Coeff. of	-2.0E-2x + 4.0H 1.0	5-2										
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<pre>depth or max. excavation depth (y), Settlement / wall depth or max. excavation</pre>	curve Name:	Excavation in f	wall / wal	gh stiffness wa l depth or max.	<pre>11 in stif excavatio</pre>	ff clay (CIR on depth (x)	IA 580 Fig. 2. , Depth / wall	11 (b)					
<pre>bit bit bit bit bit bit bit bit bit bit</pre>		depth or max. e depth (z)(%)]	excavation	depth (y), Sett	lement / v	wall depth o	r max. excavat	ion					
<pre></pre>		[0.400,0.000,0.	067][0.500	,0.000,0.049][0	.600,0.000),0.072][0.7	0,0.000,0.073]					
<pre></pre>			065] [1.300	,0.000,0.061][1	.400,0.000	0,0.058][1.5]					
<pre> [2.800,0.000,0.001][2.900,0.000,0004][3.000,0.000][3.100,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.001] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003] [3.200,0.000,0.003</pre>			034] [2.100	,0.000,0.030][2	.200,0.000	0, 0.042 [1.5]]					
<pre>[3.600,0.000,0.000,0.000][3.700,0.000][3.800,0.000,0.001][3.900,0.000,0.001] [4.000,0.000,0.000,0.000] promal order: 4 order: 0 lynomial: z = -2.6455E-3x⁴ + 2.8495E-2x³ - 1.0051E-1x² + 1.0569E-1x + 3.8990E-2 9.9991E-1 termination:</pre>			010] [2.900	,0.000,0.008][3	.000,0.000	0, 0.007 [3.1]					
rrve Fitting Folynomial Order: 4 Order: 0 Ilynomial: z = -2.6455E-3x ⁴ + 2.8495E-2x ³ - 1.0051E-1x ² + 1.0569E-1x + 3.8990E-2 9:ff. of 9.9991E-1 termination: 5 ordinates: Installation of contiguous bored pile wall in stiff clay (CIRIA 580 Fig. 2.8(a)) iordinates: Installation of contiguous bored pile wall in stiff clay (CIRIA 580 Fig. 2.8(a)) 10.000, 0.000, 0.001 / 0.000, 0.0039 [0.100, 0.000, 0.036] [0.150, 0.000, 0.034] 10.200, 0.000, 0.001 / 0.000, 0.0039 [0.100, 0.000, 0.036] [0.150, 0.000, 0.034] 10.200, 0.000, 0.001 [0.250, 0.000, 0.039] [0.100, 0.000, 0.036] [0.150, 0.000, 0.034] 10.200, 0.000, 0.001 [0.050, 0.000, 0.039] [0.100, 0.000, 0.036] [0.150, 0.000, 0.034] 10.200, 0.000, 0.002 [0.250, 0.000, 0.039] [0.100, 0.000, 0.036] [0.150, 0.000, 0.034] 10.200, 0.000, 0.002 [0.250, 0.000, 0.038] [0.100, 0.000, 0.026] [0.150, 0.000, 0.034] 10.200, 0.000, 0.003 [0.100, 0.000, 0.003] [0.100, 0.000, 0.003] 10.200, 0.000, 0.001 [0.100, 0.000, 0.002] [0.150, 0.000, 0.013] 11.200, 0.000, 0.005 [1.150, 0.000, 0.008] [1.1500, 0.000, 0.007] [1.1500, 0.000, 0.003] 11.200, 0.000, 0.005 [1.1250, 0.000, 0.004] [1.1300, 0.000, 0.006] 11.200, 0.000, 0.005 [1.1250, 0.0000, 0.004] [1.1300, 0.000, 0.003] 11.200, 0.000, 0.005 [1.1250, 0.000,		[3.600,0.000,0	002][3.700	,0.000,0.002][3	.800,0.000	0.001][3.9	00,0.000,0.001]					
Order: 0 order: 0 slynomial: z seff. -2.6455E-3x ⁴ + 2.8495E-2x ³ - 1.0051E-1x ² + 1.0569E-1x + 3.8990E-2 seff. of point Installation of contiguous bored pile wall in stiff clay (CIRIS 580 Fig. 2.8(a)) point Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Horizontal movement / wall depth or max. excavation depth (y), Horizontal movement / wall depth or max. excavation depth (y) 10.000,0.000,0.039] [0.100,0.000,0.036] [0.1550,0.000,0.034] [0.200,0.000,0.039] [0.350,0.000,0.032] [0.350,0.000,0.034] [0.200,0.000,0.033] [0.500,0.000,0.032] [0.350,0.000,0.022] [0.450,0.000,0.033] [0.400,0.003,0.0161 [0.750,0.000,0.022] [0.450,0.000,0.034] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.013] [0.400,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.000,0.003] [0.450,0.	urve Fitting Wethod:	Polynomial											
<pre>olynomial: z = -2.6455E-3x⁴ + 2.8495E-2x³ - 1.0051E-1x² + 1.0569E-1x + 3.8990E-2</pre>	Order: Order:	4 0											
starnination: orizontal Ground Movement Curves (Excavations) irre Name: Installation of contiguous bored pile wall in stiff clay (CIRIA 580 Fig. 2.8(a)) jordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Horizontal movement / wall depth or max. excavation depth (y), Borizontal movement / wall depth or max. excavation depth (y), Borizontal movement / wall depth or max. excavation depth (y), Borizontal movement / wall depth or max. excavation depth (y), Borizontal movement / wall depth or max. (0.200, 0.000, 0.001 [0.250, 0.000, 0.039] [0.100, 0.000, 0.036] [0.1550, 0.000, 0.034] [0.250, 0.000, 0.039] [0.350, 0.000, 0.022] [0.350, 0.000, 0.022] [0.350, 0.000, 0.022] [0.350, 0.000, 0.022] [0.350, 0.000, 0.022] [0.450, 0.000, 0.033] [0.000, 0.003] [0.750, 0.000, 0.022] [0.350, 0.000, 0.022] [0.450, 0.000, 0.003] [0.650, 0.000, 0.033] [0.700, 0.000, 0.0015] [0.450, 0.000, 0.013] [0.900, 0.000, 0.013] [0.750, 0.000, 0.015] [0.450, 0.000, 0.013] [0.900, 0.000, 0.012] [0.750, 0.000, 0.003] [1.1500, 0.000, 0.003] [1.1500, 0.000, 0.003] [1.1500, 0.000, 0.003] [1.1500, 0.000, 0.003] [1.1500, 0.000, 0.003] [1.1500, 0.000, 0.003] [1.1500, 0.000, 0.003] [1.1500, 0.000, 0.003] [1.1500, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.350, 0.000, 0.003] [1.350, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.003] [1.300, 0.000, 0.	olynomial: z =	-2.6455E-3x ⁴ +	2.8495E-2x	³ - 1.0051E-1x ²	+ 1.05698	E-1x + 3.899	0E-2						
orizontal Ground Movement Curves (Excavations) inve Name: bordinates: Installation of contiguous bored pile vall in stiff clay (CIRIA 580 Fig. 2.8(a)) (Distance from wall / wall depth or max. excavation depth (%). Pepth / wall depth or max. excavation depth (y) (1) (0.000, 0.000, 0.001) (0.000, 0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.000, 0.001) (0.0000, 0.001) (0.0000, 0.001) <	etermination:												
Irve Name: Installation of contiguous bored pile wall in stirr clay (CIRLA 500 Fig. 2.8(3)) Dordinates: [Distance from wall / wall depth or max. excavation depth (y), Horizontal movement / wall depth or max. excavation depth (2) (%)] [0.000, 0.004, 0.004, 0.003] [0.100, 0.000, 0.036] [0.150, 0.000, 0.034] [0.200, 0.000, 0.025] [0.250, 0.000, 0.039] [0.100, 0.000, 0.029] [0.350, 0.000, 0.034] [0.200, 0.000, 0.025] [0.450, 0.000, 0.039] [0.100, 0.000, 0.029] [0.350, 0.000, 0.027] [0.400, 0.000, 0.005] [0.150, 0.000, 0.033] [0.500, 0.000, 0.029] [0.350, 0.000, 0.027] [0.400, 0.000, 0.005] [0.450, 0.000, 0.038] [0.750, 0.000, 0.029] [0.600, 0.000, 0.000] [0.650, 0.000, 0.033] [0.700, 0.000, 0.016] [0.750, 0.000, 0.020] [0.600, 0.000, 0.001] [1.650, 0.000, 0.013] [0.700, 0.000, 0.016] [0.750, 0.000, 0.015] [0.600, 0.000, 0.000] [1.050, 0.000, 0.003] [1.100, 0.000, 0.007] [1.150, 0.000, 0.006] [1.200, 0.000, 0.005] [1.250, 0.000, 0.004] [1.300, 0.000, 0.004] [1.350, 0.000, 0.003] [1.400, 0.000, 0.000] [1.650, 0.000, 0.001] [1.500, 0.000, 0.004] [1.350, 0.000, 0.003] [1.400, 0.000, 0.002] [1.450, 0.000, 0.001] [1.500, 0.000, 0.004] rve Fitting Folynomial [1.400, 0.000, 0.002] [1.450, 0.000, 0.001] [1.500, 0.000, 0.000] rvder: 3 3 3	lorizontal Ground	Movement Curve	s (Excavatio	ns)									
<pre>ive Fitting rely for 0 = 0 = 0</pre>	cordinates:	Distance from	wall / wal	l depth or max.	excavation excavation	on depth (x)	Depth / wall	o (a.))					
<pre>ive Fitting relynomial</pre>		excavation dept	h (z)(%)]	0 000 0 0201/0	100 0 001) O OBELIO S	50 0 000 0 000	.1					
<pre>ivade:: 0</pre>		[0.200,0.000,0.	032] [0.250		.300,0.000	0,0.029][0.3	50,0.000,0.027]					
<pre>(1.000, 0.000) (0.009) (1.050, 0.000, 0.008) (1.100, 0.000, 0.007) (1.150, 0.000, 0.006) (1.200, 0.000, 0.005) (1.250, 0.000, 0.004) (1.300, 0.000, 0.004) (1.350, 0.000, 0.003) (1.400, 0.000, 0.002) (1.450, 0.000, 0.001) (1.500, 0.000, 0.000) rvve Fitting Polynomial thod: Order: 3 Order: 0</pre>		[0.600,0.000,0	019][0.650	,0.000,0.018][0	.700,0.000	0,0.016][0.7	50,0.000,0.015	j					
[1.400,0.000,0.002][1.450,0.000,0.001][1.500,0.000] ruve Fitting Polynomial tthod: Order: 3 Order: 0		[1.000,0.000,0.	009][1.050	,0.000,0.008][1	.100,0.000	0,0.007][1.1 0,0.004][1 3	50,0.000,0.006	1					
nthod: Order: 3 Order: 0	urve Fitting	[1.400,0.000,0. Polynomial	002][1.450	,0.000,0.001][1	.500,0.000	0,0.000]		-					
order: 0	ethod: Order:	3											
3 2													

\bigcap asa	Job No.	Sheet No.	Rev.
Ousys	125836		
outhside Lodge	Drg. Ref.		
Ground Movement Assessment	Made by	Date	Checked
Name Coordinates	JT	16-Apr-2018	
x y z [m] [m] [m]			
etermination:			
<pre>coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall</pre>			
depth or max. excavation depth (y), Horizontal movement / wall depth or max. excavation depth (z) (8)] [0 000 0 000 0 15014 000 0 000 0 000]			
urve Fitting Polynomial ethod:			
. Order: 1 Order: 0 O'unomia: z = -3.75E-2x + 1.50E-1			
eff. of 1.00 etermination:			
Polygonal Excavations			
xcavation Name: New Basement (Excavation) urface level [m]: 0.0			
ontribution: Positive nabled: Yes			
corner x y Base Stiffened Previous Side Next Side Level d pl p2* d pl p2*			
[m] [m] [m] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] <td></td> <td></td> <td></td>			
3 526890. 1860503.5000 Yes 0.0 67.000 25.000 0.0 67.000 25.000 4 526890. 1860503.5000 Yes 0.0 67.000 25.000 0.0 67.000 25.000			
5 528880. 1880803.5000 Yes 0.0 67.000 25.000 0.0 67.000 25.000			
x y x y Vertical Horizontal [m] [m] </td <td></td> <td></td> <td></td>			
stiffness will in stiff clay stiffness wall in stiff clay (CIRIA 580 Fig. 2.11(b) (CIRIA 580 Fig. 2.11(a))			
2 526880. 186040. 526890. 186050. Excavation in front of high stiffness wall in stiff clay (CIRIA 580 Fig. 2.11(b) (CIRIA 580 Fig. 2.11(a))			
3 526890. 186050. 526890. 186050. Excavation in front of high stiffness wall in stiff clay stiffness wall in stiff clay (CTRL 580 Fig. 2 11(a)). (CTRL 580 Fig. 2 11(a))			
4 526890. 186050. 526880. 186060. Excavation in front of high stiffness wall in stiff clay stiffness wall in stiff clay			
(CIRIA 580 Fig. 2.11(a)) 5 526880. 186060. 526870. 186050. Excavation in front of high stiffness wall in stiff clay stiffness wall in stiff clay			
(CIRIA 580 Fig. 2.11(b) (CIRIA 580 Fig. 2.11(a))			
xcavation Name: New Basement (Underpin) urface level [m]: 0.0 ontribution: Positive			
nabled: Yes Corner x v Base Stiffened Previous Side Next Side			
Level d p1 p2* d p1 p2* [m] [m] [m] [m] [%] [%] [%]			
2 52680. 1860503.5000 Yes 0.0 67.000 25.000 0.0 67.000 25.000 3 526890. 1860503.5000 Yes 0.0 67.000 25.000 0.0 67.000 25.000			
4 526890. 1860503.5000 Yes 0.0 67.000 25.000 0.0 67.000 25.000 5 526880. 1860603.5000 Yes 0.0 67.000 25.000 0.0 67.000 25.000			
Side Corner 1 Corner 2 Ground Movement Curve x y x Y Vertical Horizontal			
رسا اسا اسا استار است bored pile wall in stiff clay bored pile wall in stiff clay			
(CIRIA 580 Fig. 2.8(b)) (CIRIA 580 Fig. 2.8(c)) 2 526880. 186040. 526890. 186050. Installation of contiguous Installation of contiguous bord pile wall in stiff clay bord pile wall in stiff clay			
(CIRIA 580 Fig. 2.8(b)) (CIRIA 580 Fig. 2.8(a)) (CIRIA 580 Fig. 2.8(a)) 3 526890. 186050. 526890. 186050. Installation of contiguous Installation of contiguous			
bored pile wall in stiff clay bored pile wall in stiff clay (CIRIA 580 Fig. 2.8(b)) (CIRIA 580 Fig. 2.8(a)) 4 526890. 186050. 526880. 186060. Installation of continuous Installation of continuous			
(CIRIA 580 Fig. 2.8(b)) (CIRIA 580 Fig. 2.8(a))			
5 526880. 186060. 526870. 1860500. installation of contiguous bored pile wall in stiff clay bored pile wall in stiff clay (CIRIA 580 Fig. 2.8(b)) (CIRIA 580 Fig. 2.8(a))			
xcavation Name: Exsiting Basement (Excavation)			
urface level [m]: -1.9500 ontribution: Positive nabled: Yes			
former x y Base Stiffened Previous Side Next Side Level d pl p2* d pl p2*			
[m] [m] [m] [m] [m] [%] [%] [m] [%] [%] 1 526880. 1860402.5500 Yes. 0.0 67.000 25.000 0 502000 100040 0.0 57.000 25.000 0 502000 100040 0.0 57.000 0 50200 0.0 57.000 0 50200 0 50200			
2 526800. 1860402.5500 Yes 0.0 67.000 25.000 0.0 67.000 25.000 3 526890. 1860402.5500 Yes 0.0 67.000 25.000 0.0 67.000 25.000 4 526890. 1860302.5500 Yes 0.0 67.000 25.000 0.0 67.000 25.000			
5 526900. 1860302.5500 Yes 0.0 67.000 25.000 0.0 67.000 25.000 6 526900. 1860402.5500 Yes 0.0 67.000 25.000 0.0 67.000 25.000 7 526900. 1860402.5500 Yes 0.0 67.000 25.000 0.0 67.000 25.000			
8 526890. 1860502.5500 Yes 0.0 67.000 25.000 0.0 67.000 25.000			
x y x y Vertical Movement Curve			
1 526880. 186040. 526880. 186040. Installation of contiguous Installation of contiguous bored pile wall in stiff clay bored pile wall in stiff clay (CTRT 520 Fin 520 Fin 2 8(b)) (CTRT 520 Fin 2 9(c))			
2 526880. 186040. 526890. 186040. Installation of contiguous bored pile wall in stiff clay bored pile wall in stiff clay			
(CLRLA 580 Fig. 2.8(a)) 3 526890. 186040. 526890. 186030. Installation of contiguous bored pile wall in stiff clay bored pile wall in stiff clay			
(CIRIA 580 Fig. 2.8(b)) (CIRIA 580 Fig. 2.8(a)) 4 526890. 186030. 526900. 186030. Installation of contiguous Installation of contiguous bored pile wall on stiff show bord pile wall on stiff show			
(CIRIA 580 Fig. 2.8(b)) 5 526900. 186030. 526900. 186040. Installation of contiguous Installation of contiguous			
bored pile wall in stiff clay (CIRIA 580 Fig. 2.8(h)) (CIRIA 580 Fig. 2.8(h)) 6 526900. 186040. 526900. 186040. Installation of continuous			
bored pile wall in stiff clay bored pile wall in stiff clay (CIRIA 580 Fig. 2.8(b)) (CIRIA 580 Fig. 2.8(a))			
, J20300. 100040. J20030. Instalation of contiguous Installation of contiguous bored pile wall in stiff clay bored pile wall in stiff clay (CIRIA 580 Fig. 2.8(b)) (CIRIA 580 Fig. 2.8(a))			
8 526890. 186050. 526880. 186040. Installation of contiguous Installation of contiguous bored pile wall in stiff clay bored pile wall in stiff clay (CIRIA 580 Fic. 2.8(b)) (CIRIA 580 Fic. 2.8(c))			
(unit douring, 200(0), (Units douring, 200(0))			
tcavacuon txisting Basement (Underpin) inface level [m]: -1.9500 ontribution: Positive			
nabled: Yes			
There we we was a stattened Browieve Side Newt Side			

\frown	Job No.	Sheet No.	Rev.
Oasys	125836		
Southside Lodge	Drg. Ref.		
Ground movement Assessment	Made by JT	Date 16-Apr-2018	Checked

	1 2 3 4 5 6 7 8	[m] 526880. 526890. 526890. 526900. 526900. 526900. 526900.	[m] 186040. 186040. 186030. 186030. 186040. 186040. 186050.	Level [m] -2.5500 -2.5500 -2.5500 -2.5500 -2.5500 -2.5500 -2.5500 -2.5500	Yes Yes Yes Yes Yes Yes Yes Yes	d p1 [m] [%] 0.0 67.000 0.0 67.000 0.0 67.000 0.0 67.000 0.0 67.000 0.0 67.000 0.0 67.000 0.0 67.000 0.0 67.000 0.0 67.000 0.0 67.000	p2* [%] 25.000 25.000 25.000 25.000 25.000 25.000 25.000 25.000 25.000 25.000	d [m] 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0	p1 [%] 67.000 67.000 67.000 67.000 67.000 67.000 67.000	p2 ★ [%] 25.000 25.000 25.000 25.000 25.000 25.000 25.000			
ide		Corne x	er 1 Y	Corne x	r 2 y		Vertic	Gro	ound Mo	vement Cu	rve Horizo	ontal	
	1	526880.	186040.	526880.	186040.	Installati bored pile (CIRIA 580	on of o wall : Fig. 2	contigu in stif 2.8(b))	ious Ef clay	Install bored p (CIRIA	ation of ile wall 580 Fig.	contiguo in stiff 2.8(a))	us clay
	2	526880.	186040.	526890.	186040.	Installati	on of a	contigu	ious ff clav	Install bored p	ation of	contiguo	us clav
	3	526890.	186040.	526890.	186030.	(CIRIA 580 Installati bored pile (CIRIA 580	Fig. 2 on of o wall : Fig. 2	2.8(b)) contigu in stif 2.8(b))	ious ff clay	(CIRIA Install bored p (CIRIA	580 Fig. ation of ile wall 580 Fig.	2.8(a)) contiguo in stiff 2.8(a))	us clay
	4	526890.	186030.	526900.	186030.	Installati	on of o	contigu	lous	Install	ation of	contiguo	us
	5	526900.	186030.	526900.	186040.	CIRIA 580 Installati bored pile (CIRIA 580	wall : Fig. 2 on of o wall : Fig. 2	in stif 2.8(b)) contigu in stif 2.8(b))	ff clay nous ff clay	CIRIA (CIRIA Install bored p (CIRIA	580 Fig. ation of ile wall 580 Fig.	in stiff 2.8(a)) contiguo in stiff 2.8(a))	clay us clay
	6	526900.	186040.	526900.	186040.	Installati	on of o	contigu in stif	ious ff clav	Install bored p	ation of	contiguo in stiff	us clav
	7	526900.	186040.	526890.	186050.	(CIRIA 580 Installati bored pile (CIRIA 580	Fig. 2 on of o wall 2 Fig. 2	2.8(b)) contigu in stif 2.8(b))	ious ff clay	(CIRIA Install bored p (CIRIA	580 Fig. ation of ile wall 580 Fig.	2.8(a)) contiguo in stiff 2.8(a))	us clay
	8	526890.	186050.	526880.	186040.	Installati bored pile (CIRIA 580	on of o wall : Fig. 2	contigu in stif 2.8(b))	f clay	install bored p (CIRIA	ation of ile wall 580 Fig.	in stiff 2.8(a))	clay

Damage Category Strains

Name	0	(Negligible)	1	(Very Slight)	2	(Slight)	3	(Moderate)
		to		to		to		to
	1	(Very Slight)		2 (Slight)	3	(Moderate)	4	(Severe)
Burland Strain Timite		0 0		500 008-6		750 008-6		0 0015000

Specific Structures - Geometry

	;
[m] [m] [m] [mm]	
2 E Heath Road Wall 1 Line 1 0.00000 4.57000 0.0 0.10000 Burland Strain Limits 0.20000 2.600	100
2 E Heath Road Wall 2 Line 2 0.00000 2.38000 0.0 0.10000 Burland Strain Limits 0.20000 2.600	000
2 E Heath Road Wall 3 Line 3 0.00000 4.53800 0.0 0.10000 Burland Strain Limits 0.20000 2.600	000
2 E Heath Road Wall 4 Line 4 0.00000 0.81200 0.0 0.10000 Burland Strain Limits 0.20000 2.600	000
2 E Heath Road Wall 5 Line 5 0.00000 4.53300 0.0 0.10000 Burland Strain Limits 0.20000 2.600	000
2 E Heath Road Wall 6 Line 6 0.00000 4.01300 0.0 0.10000 Burland Strain Limits 0.20000 2.600	000
2 E Heath Road Wall 7 Line 7 0.00000 4.47300 0.0 0.10000 Burland Strain Limits 0.20000 2.600	000
2 E Heath Road Wall 8 Line 8 0.00000 0.70900 0.0 0.10000 Burland Strain Limits 0.20000 2.600	0.01
1 E Heath Road Wall 9 Line 9 0.00000 8.91800 0.0 0.10000 Burland Strain Limits 0.20000 2.600	0.00
1 E Heath Boad Wall 10 Line 10 0.00000 5.87400 0.0 0.10000 Burland Strain Limits 0.20000 2.600	0.00
1 E Heath Road Wall 11 Line 11 0 00000 1 41400 0 0 0 10000 Burland Strain Limits 0 20000 2 600	0.0
1 E Heath Road Wall 12 Line 12 0.0000 3.91900 0.0 0.0 0.10000 Eurland Strain Limite 0.20000.2.600	10.0
1 E Heath Road Wall 12 Dine 12 0.0000 J. 5000 0.0 0.0000 Dilland Stalin Hints 0.20000 2.000	000
1 E Heath Road Wall 13 Line 13 0.00000 1.35000 0.0 0.10000 Billand Stath Lintts 0.20000 2.000	100
i neath Road Wall 14 blue 14 0.00000 2.70000 0.0 0.10000 Birland Strain Limits 0.20000 2.800	00
I E Heath Road Wall 15 Line 15 0.00000 8.76900 0.0 0.10000 Burland Strain Limits 0.20000 2.600	100

Specific Structures - Bending Parameters

Structure Name	Sub-Structure Name	Height	Default Properties		Hogging			Sagging	
				2nd Moment of Area (per unit width)	Distance of Bending Strain from N.A.	Distance of N.A. from Edge of Beam in Tension	2nd Moment of Area (per unit width)	Distance of Bending Strain from N.A.	Distance of N.A. from Edge of Beam in Tension
		[m]		[m 3]	[m]	[m]	[m ³]	[m]	[m]
2 E Heath Road	Wall 1	2.5000	Yes	5.2083	2.5000	2.5000	1.3021	1.2500	1.2500
2 E Heath Road	Wall 2	2.5000	Yes	5.2083	2.5000	2.5000	1.3021	1.2500	1.2500
2 E Heath Road	Wall 3	2.5000	Yes	5.2083	2.5000	2.5000	1.3021	1.2500	1.2500
2 E Heath Road	Wall 4	2.5000	Yes	5.2083	2.5000	2.5000	1.3021	1.2500	1.2500
2 E Heath Road	Wall 5	2.5000	Yes	5.2083	2.5000	2.5000	1.3021	1.2500	1.2500
2 E Heath Road	Wall 6	2.5000	Yes	5.2083	2.5000	2.5000	1.3021	1.2500	1.2500
2 E Heath Road	Wall 7	2.5000	Yes	5.2083	2.5000	2.5000	1.3021	1.2500	1.2500
2 E Heath Road	Wall 8	2.5000	Yes	5.2083	2.5000	2.5000	1.3021	1.2500	1.2500
1 E Heath Road	Wall 9	12.000	Yes	576.00	12.000	12.000	144.00	6.0000	6.0000
1 E Heath Road	Wall 10	12.000	Yes	576.00	12.000	12.000	144.00	6.0000	6.0000
1 E Heath Road	Wall 11	12.000	Yes	576.00	12.000	12.000	144.00	6.0000	6.0000
1 E Heath Road	Wall 12	12.000	Yes	576.00	12.000	12.000	144.00	6.0000	6.0000
1 E Heath Road	Wall 13	12.000	Yes	576.00	12.000	12.000	144.00	6.0000	6.0000
1 E Heath Road	Wall 14	12.000	Yes	576.00	12.000	12.000	144.00	6.0000	6.0000
1 E Heath Road	Wall 15	12.000	Yes	576.00	12.000	12.000	144.00	6.0000	6.0000
1 E Heath Road	Wall 16	12.000	Yes	576.00	12.000	12.000	144.00	6.0000	6.0000

Building Segment Combinations

Structure Nam	e Si	ub-Structu Name	Tre Vertical Offset from Line for Vertical Movement	Segment	Start	Length	Curvature	Combined Segment
			Calculations					
			[m]		[m]	[m]		
No structures	have	segments	combined.					

Utility Strain Calculation Options

Neglect beneficial contribution of axial strains : No

Warnings

- Multiple excavations have been specified. The displacements resulting from these excavations are calculated by summing the displacements resulting from each individual excavation. No account has been taken of the interactions between excavations (e.g. overlapping zones of influence or 'shielding' of one excavation by another). 1
- 2
- 3
- 4
- 5
- Excavations (e.g. overlapping zones of influence of 'shielding' of one excavation by another). Embedded Wall Excavation PEI : New Basement (Excavation) intersects PE3 : Exsiting Basement (Excavation), and PE4 : Existing Basement (Underpin). Embedded Wall Excavation PE2 : New Basement (Underpin) intersects PE3 : Exsiting Basement (Excavation), and PE4 : Existing Basement (Underpin). Embedded Wall Excavation PE3 : Exsiting Basement (Underpin). Embedded Wall Excavation, and PE4 : Existing Basement (Underpin). Embedded Wall Excavation PE3 : Existing Basement (Underpin). Embedded Wall Excavation, and PE2 : New Basement (Underpin). Embedded Wall Excavation, and PE2 : New Basement (Underpin). If an embedded wall excavation is assigned a 'surface' ground movement curve then displacements induced by it can only be calculated for those points that are level with the embedded wall excavation's 'surface level'. Others are ignored. An example 6

\frown	Job No.	Sheet No.	Rev.
Oasys	125836		
Southside Lodge	Drg. Ref.		
Ground Movement Assessment	Mada hu		he alve d
	JT 1	16-Apr-2018	пескеа

 Structure Name
 Sub-Structure
 Vertical
 Segment Start Length Curvature Combined

 Name
 Offset from
 Segment

 Line for
 Segment

 Vertical
 Vertical

 of such a combination, for which displacements will not be calculated is Excavation

 XP3/Side 1/Grid 1/Vertical. This is an example only. There are 543 others.

Errors

None

Displacement and Strain Results

Туре	e/No.		Coordinates				Displacem	ents		Angle of
Name	Dist.	x	У	z	x	У	z	Horizontal displacement along Line	Horizontal displacement perpendicular to Line	Line to x Axis
	[m]	[m]	[m]	[m]	[mm]	[mm]	[mm]	[mm]	[mm]	[°]
Line 1	0.91439	526886.10000	186057.90000	0.00000	-1.8487	-2.5063	2.3361	2.9719	0.40188	228.99
	1.8288	526885.50000	186056.52000	0.00000	-2.1252	-3.2343	2.8344	3.8351	0.51861	228.99
	2.7432	526884.90000	186055.83000	0.00000	-2.4115	-3.6701	3.2338	4.3519	0.58848	228.99
	4.5719	526883.70000	186054.45000	0.00000	-3.0479	-4.6385	3.4751	5.5002	0.74376	228.99
Line 2	0.79390	526883.70000	186053.95000	0.00000	-3.04/9	-4.6385	3.4/51 3.4617	0.55390	-5.5225	320.96
	1.5878	526884.93333	186053.45000	0.00000	-3.1092	-4.7319	3.4457	0.56506	-5.6337	320.96
Line 3	2.381/ Line 3	526885.55000	186052.95000	0.00000	-3.1403	-4.7793	3.4272	-5.6733	-0.71920	49.467
	0.90785	526886.14000	186053.64000	0.00000	-2.8022	-4.2647	3.4988	-5.0625	-0.64177	49.467
	2.7236	526887.32000	186055.02000	0.00000	-2.2041	-3.3545	2.9589	-3.9819	-0.50479	49.467
	3.6314	526887.91000	186055.71000	0.00000	-1.9274	-2.9334	2.4857	-3.4821	-0.44142	49.467
Line 4	Line 4	526888.50000	186056.40000	0.00000	-1.7014	-2.5894	1.9529	0.49551	-3.0585	317.49
	0.40697	526888.80000 526889.10000	186056.12500 186055.85000	0.00000	-1.7148	-2.6098	1.9924	0.49941 0.50331	-3.0826	317.49
Line 5	Line 5	526889.10000	186055.85000	0.00000	-1.7283	-2.6302	2.0318	-3.1157	-0.44430	48.576
	1.8137	526890.30000	186057.21000	0.00000	-1.3585	-2.0675	1.0356	-2.4491	-0.34924	48.576
	2.7206	526890.90000	186057.89000	0.00000	-1.1736	-1.7861	0.72647	-2.1158	-0.30171	48.576
	4.5343	526892.10000	186059.25000	0.00000	-0.80387	-1.2234	0.29210	-1.4492	-0.20666	48.576
Line 6	Line 6	526892.10000	186059.25000	0.00000	-0.80387	-1.2234	0.29210	-0.15637	1.4555	140.56
	2.0070	526890.55000	186060.52500	0.00000	-0.75972	-1.1562	0.25784	-0.14778	1.3756	140.56
	3.0105	526889.77500 526889.00000	186061.16250	0.00000	-0.73764	-1.1226	0.24205	-0.14349	1.3356	140.56
Line 7	Line 7	526889.00000	186061.80000	0.00000	-0.71557	-1.0890	0.22714	1.2953	0.14190	230.44
	1.7900	526887.86000	186060.42000	0.00000	-1.0820	-1.6467	0.59440	1.9586	0.21456	230.44
	2.6850	526887.29000	186059.73000	0.00000	-1.2652	-1.9255	0.87302	2.2902	0.25089	230.44
	4.4749	526886.15000	186058.35000	0.00000	-1.6316	-2.4831	1.7463	2.9535	0.32355	230.44
Line 8	Line 8 0.35532	526886.15000 526886.42500	186058.35000 186058.12500	0.00000	-1.6316	-2.4831	1.7463	0.30962	-2.9550	320.71
- 1 - 0	0.71063	526886.70000	186057.90000	0.00000	-1.6468	-2.5063	1.7915	0.31251	-2.9826	320.71
Line 9	0.99107	526908.30000	186048.55000	0.00000	0.0	0.0	0.0	0.0	0.0	137.73
	1.9821	526906.83333	186049.88333	0.00000	0.0	0.0	0.0	0.0	0.0	137.73
	3.9643	526905.36667	186051.21667	0.00000	-0.050683	-0.043004	0.015180	0.0085746	0.065914	137.73
	4.9554	526904.63333	186051.88333	0.00000	-0.080535	-0.074029	0.020799	0.0097936	0.10895	137.73
	6.9375	526903.16667	186053.21667	0.00000	-0.12718	-0.13407	0.028200	0.0039199	0.14550	137.73
	7.9286 8.9196	526902.43333 526901.70000	186053.88333 186054.55000	0.00000	-0.14197	-0.15861	0.030391 0.031420	-0.0016426	0.21287	137.73
Line 10	Line 10	526901.70000	186054.55000	0.00000	-0.14975	-0.17619	0.031420	0.23111	0.0075799	227.76
	1.9586	526900.38333	186053.82500	0.00000	-0.34591	-0.29169	0.052788	0.38251	0.012657	227.76
	2.9379	526899.72500	186052.37500	0.00000	-0.44417	-0.52371	0.16470	0.68631	0.023230	227.76
	4.8965	526898.40833	186050.92500	0.00000	-0.64135	-0.75794	0.40307	0.99227	0.028821	227.76
Line 11	5.8758 Line 11	526897.75000	186050.20000	0.00000	-0.74043	-0.87650	0.59248	1.1466	0.041063	227.76
	0.70799	526897.22500	186050.67500	0.00000	-1.7648	-2.1150	1.3956	-0.11031	2.7524	137.86
Line 12	1.4160 Line 12	526896.70000	186051.15000	0.00000	-1.7580	-2.1069	1.3785	-0.10989 2.7401	0.14535	227.12
	0.95525	526896.05000	186050.45000	0.00000	-1.9872	-2.3815	1.9583	3.0973	0.16430	227.12
	2.8657	526894.75000	186049.05000	0.00000	-2.6137	-3.1324	3.0125	4.0739	0.21610	227.12
Line 13	3.8210 Line 13	526894.10000	186048.35000	0.00000	-2.9740	-3.5641	3.3675	4.6354	0.24589	227.12
	0.79569	526894.67500	186047.80000	0.00000	-2.9951	-3.5894	3.3820	0.31670	-4.6641	316.27
Line 14	Line 14	526895.25000	186047.25000	0.00000	-1.2507	-1.4641	1.4187	1.9248	0.052375	227.94
	0.92045	526894.63333	186046.56667	0.00000	-1.4077	-1.6479	1.4655	2.1665	0.058950	227.94
	2.7613	526893.40000	186045.20000	0.00000	-1.2528	0.081226	1.3562	0.77901	-0.98447	227.94
Line 15	0.97451	526893.40000	186045.20000	0.00000	-1.2528	0.081226	1.3562	-1.0160	-0.086831	320.32
	1.9490	526894.90000	186043.95556	0.00000	-0.70637	1.0479	1.2752	-1.2127	0.35546	320.32
	3.8980	526896.40000	186042.71111	0.00000	-0.85760	0.43315	1.5623	-0.93660	-0.21422	320.32
	4.8725	526897.15000	186042.08889	0.00000	-0.47182	0.69994	0.89639	-0.81004	0.23743	320.32
	6.8215	526898.65000	186040.84444	0.00000	-0.67596	0.16369	0.95094	-0.62475	-0.30562	320.32
	8.7705	526900.15000	186039.60000	0.00000	-0.31450	0.46655	0.32499	-0.53994	-0.17448	320.32
Line 16	Line 16	526900.15000	186039.60000	0.00000	-0.58447	0.25818	0.59718	-0.20262	0.60598	47.679
	2.0175	526901.50833	186041.09167	0.00000	-0.25824	0.22627	0.17174	-0.0065680	0.34328	47.679
	3.0262	526902.18750 526902.86667	186041.83750 186042.58333	0.00000	-0.24549	0.14966	0.14140	-0.054631	0.28228	47.679
	5.0436	526903.54583	186043.32917	0.00000	-0.20505	0.032704	0.081331	-0.11388	0.17363	47.679
	7.0611	526904.90417	186044.82083	0.00000	-0.15465	-0.023713	0.042083	-0.12166	0.098383	47.679
	8.0698	526905.58333	186045.56667	0.00000	-0.11744	-0.031315	0.029760	-0.10222	0.065746	47.679
	10.087	526906.94167	186047.05833	0.00000	-0.023010	-0.010070	0.0088758	-0.022937	0.010233	47.679
	12.105	526908.30000	186048.55000	0.00000	0.0	0.0	0.0	0.0	0.0	47.679
Grid 1	Grid 1	526865.00000	186025.00000	0.00000	0.0	0.0	0.0	-	-	-
		526867.50000	186025.00000	0.00000	0.0	0.0	0.0	-	-	-
		526872.50000	186025.00000	0.00000	0.0	0.0	0.0	-	-	-
		526877.50000	186025.00000	0.00000	0.0	0.0	0.0	-	-	-
		526880.00000 526882.50000	186025.00000 186025.00000	0.00000	0.0	0.0	0.0	-	-	-
		526885.00000	186025.00000	0.00000	0.0	0.0	0.0	-	-	-
		526890.00000	186025.00000	0.00000	0.0	0.0	0.0	-	-	-
		526892.50000	186025.00000	0.00000	0.0	0.0	0.0	-	-	-
		526897.50000	186025.00000	0.00000	0.0	0.0	0.0	-	-	-
		526900.00000 526902.50000	186025.00000 186025.00000	0.00000	0.0	0.0	0.0	-	-	-
		526905.00000	186025.00000	0.00000	0.0	0.0	0.0	-	-	-
		526910.00000	186025.00000	0.00000	0.0	0.0	0.0	-	-	-
		526912.50000	186025.00000	0.00000	0.0	0.0	0.0	-	-	-
		526865.00000	186029.00000	0.00000	0.0	0.0	0.0	-	-	-
		526867.50000 526870.00000	186029.00000	0.00000	0.0	0.0	0.0	-	-	-
		526872.50000	186029.00000	0.00000	0.0	0.0	0.0	-	-	-
		520075.00000	100020.00000	0.00000	0.0	0.0	0.0		_	

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asvs		105006		
side Lodge				
d Movement Assessment		Made by	Date	Checke
pe/No. Coordinates	Displacements	JT Angle of	16-Apr-2018	
Dist. x y z	x y z Horizontal displacement d	Line Horizontal to x Axis isplacement		
52687.50000 186029.00000 0.0 526880.00000 186029.00000 0.0 526882.50000 186029.00000 0.0	0000 0.010651 0.03482 0.010148 - 0000 0.011651 0.034820 0.010148 - 0000 0.011215 0.14720 0.028897 -			
52685.00000 186029.00000 0.0 526887.50000 186029.00000 0.0 526890.00000 186029.00000 0.0	0000 -0.020326 0.16550 0.030993 - 0000 -0.015448 0.054534 0.013338 - 0000 0.0 0.0 -	 		
526892.50000 186029.00000 0.0 526895.00000 186029.00000 0.0 526897.50000 186029.00000 0.0	0000 0.0 0.0 0.0 - 0000 0.0 0.0 0.0 -			
526900.00000 186029.00000 0.0 526902.50000 186029.00000 0.0 526905.00000 186029.00000 0.0	0000 0.0 0.0 0.0 - 0000 0.0 0.0 0.0 - 0000 0.0 0.0 0.0 -			
526907.50000 186029.00000 0.0 526910.00000 186029.00000 0.0 526912.50000 186029.00000 0.0	0000 0.0 0.0 0.0 - 0000 0.0 0.0 0.0 - 0000 0.0 0.0 -			
526915.00000 186029.00000 0.0 526865.00000 186033.00000 0.0 526867.50000 186033.00000 0.0	0000 0.0 0.0 0.0 - 0000 0.0 0.0 0.0 - 0000 0.0 0.0 0.0 -			
526870.00000 186033.00000 0.0 526872.50000 186033.00000 0.0 526875.00000 186033.00000 0.0	0000 0.0 0.0 0.0 - 0000 0.0 0.0 0.0 - 0000 0.29048 0.34420 0.063889 -			
526877.50000 186033.00000 0.0 526880.00000 186033.00000 0.0 526882.50000 186033.00000 0.0	0000 0.44224 0.62042 0.11353 - 0000 0.39407 0.87852 0.21601 - 0000 0.13306 1.0522 0.29936 -			
526885.00000 186033.00000 0.0 526887.50000 186033.00000 0.0 526890.00000 186033.00000 0.0	0000 -0.19239 1.2136 0.32727 - 0000 -0.43663 1.4456 0.31347 - 0.35825 1.1861 0.20515 -			
526892.50000 186033.00000 0.0 526895.00000 186033.00000 0.0 526897.50000 186033.00000 0.0	0000 Point lies within an excavat 0000 Point lies within an excavat 0000 -0.051942 0.16645 0.048345 -	ion. 		
526900.00000 186033.00000 0.0 526902.50000 186033.00000 0.0 526905.00000 186033.00000 0.0	0000 -0.0061284 0.016146 0.0050478 - 0000 0.0 0.0 0.0 -			
526907.50000 186033.00000 0.0 526910.00000 186033.00000 0.0	0000 0.0 0.0 0.0 - 0000 0.0 0.0 0.0 -			
526912.50000 186033.00000 0.0 526915.00000 186033.00000 0.0 526865.00000 186037.00000 0.0	0000 0.0 0.0 0.0 - 0000 0.0 0.0 0.0 - 0000 0.0 0.0 0.0 -			
52687.50000 186037.00000 0.0 526870.00000 186037.00000 0.0 526872.50000 186037.00000 0.0	0000 0.24988 0.29609 0.057616 - 0000 0.63984 0.75817 0.13885 -			
526875.00000 186037.00000 0.0 526877.50000 186037.00000 0.0 526880.00000 186037.00000 0.0	0000 1.2298 1.2203 0.35881 - 0000 1.4198 1.6823 0.78122 - 0000 1.2591 1.6850 1.1357 -	 		
526882.50000 186037.00000 0.0 526885.00000 186037.00000 0.0 526887.50000 186037.00000 0.0	0000 0.48830 1.8867 1.4647 - 0000 -0.56683 2.3512 1.7600 - Point lies within an excavat	 		
526890.00000 186037.00000 0.0 526892.50000 186037.00000 0.0 526895.00000 186037.00000 0.0	0000 Point lies within an excavat 0000 Point lies within an excavat 0000 Point lies within an excavat	ion. ion. ion.		
526897.50000 186037.00000 0.0 526900.00000 186037.00000 0.0 526902.50000 186037.00000 0.0	0000 Point lies within an excavat 0000 -0.61038 0.38637 0.54587 - 0000 -0.088131 0.14096 0.031408 -	ion		
526905.00000 186037.00000 0.0 526907.50000 186037.00000 0.0 526910.00000 186037.00000 0.0	0000 0.0 0.0 0.0 - 0000 0.0 0.0 0.0 - 0000 0.0 0.0 0.0 -			
526912.50000 186037.00000 0.0 526915.00000 186037.00000 0.0 526865.00000 186041.00000 0.0	0000 0.0 0.0 0.0 - 0000 0.0 0.0 0.0 - 0000 0.11070 0.11155 0.028302 -			
526867.50000 186041.00000 0.0 526870.00000 186041.00000 0.0 526872 50000 186041.00000 0.0	0000 0.39695 0.46730 0.083496 - 0000 0.98921 1.1721 0.32487 - 1.3722 1.6342 0.72749 -			
526875.00000 186041.00000 0.0 526877.50000 186041.00000 0.0 526877.50000 186041.00000 0.0	0000 1.7691 2.0963 1.3770 - 0000 2.1798 2.5829 2.3500 -			
526882.50000 186041.00000 0.0 526882.50000 186041.00000 0.0 526885.00000 186041.00000 0.0	0000 2.7636 3.2770 3.1607 - 0000 3.6943 3.8011 3.9315 - 0000 Point lies within an excavat			
526890.00000 186041.00000 0.0 526890.00000 186041.00000 0.0 526892.50000 186041.00000 0.0	0000 Point lies within an excavat 0000 Point lies within an excavat	ion. ion.		
526895.00000 186041.00000 0.0 526897.50000 186041.00000 0.0 526900.00000 186041.00000 0.0	J000 Point lies within an excavat 0000 -0.31973 0.36329 0.39783 0000 -0.4002 -0.4002 -	ion. 		
526902.50000 186041.00000 0.0 526905.00000 186041.00000 0.0 526907.50000 186041.00000 0.0	0000 -0.21042 0.16434 0.10292 - 0000 -0.089181 0.050298 0.026901 - 0000 0.0 0.0 -			
526910.00000 186041.00000 0.0 526912.50000 186041.00000 0.0 526915.00000 186041.00000 0.0	0000 0.0 0.0 0.0 - 0000 0.0 0.0 0.0 - 0000 0.0 0.0 0.0 -			
526865.00000 186045.00000 0.0 526867.50000 186045.00000 0.0 526870.00000 186045.00000 0.0	0000 0.42289 0.27431 0.094331 - 0000 0.76273 0.62059 0.33515 - 0000 1.1107 1.1760 0.80211 -			
526872.50000 186045.00000 0.0 526875.00000 186045.00000 0.0 526877.50000 186045.00000 0.0	0000 2.1201 2.5122 2.2514 - 0000 2.7026 3.2024 3.0976 - 0000 3.3415 3.9595 3.5055 -			
526880.00000 186045.00000 0.0 526882.50000 186045.00000 0.0 526885.00000 186045.00000 0.0	0000 4.0931 4.8500 3.0652 - 0000 Point lies within an excavat 0000 Point lies within an excavat	 ion. ion.		
526887.50000 186045.00000 0.0 526890.00000 186045.00000 0.0 526892.50000 186045.00000 0.0	0000 Point lies within an excavat 0000 Point lies within an excavat 0000 Point lies within an excavat	ion. ion.		
526895.00000 186045.00000 0.0 526897.50000 186045.00000 0.0 526900.00000 186045.00000 0.0	0000 -0.85339 0.016249 1.2589 - 0000 -0.64197 -0.079193 0.94908 - 0000 -0.46035 -0.072873 0.47315 -			
526902.50000 186045.00000 0.0 526905.00000 186045.00000 0.0 526907.50000 186045.00000 0.0	0000 -0.30657 -0.053271 0.16625 - 0000 -0.15061 -0.027484 0.040160 - 0000 -0.0			
526910.00000 186045.00000 0.0 526912.50000 186045.00000 0.0 526915.00000 186045.00000 0.0	0000 0.0 0.0 0.0 - 0000 0.0 0.0 0.0 -			
526871.00000 106043.00000 0.0 526865.00000 186049.00000 0.0 526867.50000 186049.00000 0.0	0000 0.51760 0.038571 0.15125 - 0000 0.84665 0.099417 0.49476 - 0000 1.2013 0.24110 1.2026			
526872.50000 186049.00000 0.0 526875.00000 186049.00000 0.0 526875.00000 186049.00000 0.0	0000 1.7721 0.76114 1.8577 - 0000 4.0079 4.7491 3.1648 -			
526877.50000 186049.00000 0.0 526880.00000 186049.00000 0.0 526882.50000 186049.00000 0.0	Point lies within an excavat 0000 Point lies within an excavat 0000 Point lies within an excavat 0000 Point lies within an excavat	ion.		
526885.00000 186049.00000 0.0 526887.50000 186049.00000 0.0 526890.00000 186049.00000 0.0	JUUU Point lies within an excavat 0000 Point lies within an excavat 0000 -3.8985 -4.6721 3.2505	ion.		
526892.50000 186049.00000 0.0 526895.00000 186049.00000 0.0 526897.50000 186049.00000 0.0	0000 -3.1842 -3.8161 3.4769 - 0000 -2.5692 -3.0790 2.9559 - 0000 -0.80564 -0.88858 0.83526 -			
526900.00000 186049.00000 0.0 526902.50000 186049.00000 0.0 526905.00000 186049.00000 0.0	0000 -0.54959 -0.49757 0.37028 - 0000 -0.33361 -0.25788 0.12486 - 0000 -0.13846 -0.094302 0.031978 -			
526907.50000 186049.00000 0.0 526910.00000 186049.00000 0.0 526912.50000 186049.00000 0.0	0000 0.0 0.0 0.0 - 0000 0.0 0.0 0.0 - 0000 0.0 0.0 0.0 -			
526915.00000 186049.00000 0.0 526865.00000 186053.00000 0.0 526867.50000 186053.00000 0.0	0000 0.0 0.0 0.0 - 0000 0.55372 -0.26371 0.13292 - 0000 0.96492 -0.56123 0.46080 -			
526870.00000 186053.00000 0.0 526872.50000 186053.00000 0.0 526875.00000 186053.00000 0.0	0000 1.4288 -1.0688 1.1548 - 0000 2.9968 -2.6074 2.9240 - 0000 3.8556 -3.3546 3.4997 -			
526877.50000 186053.00000 0.0 526880.00000 186053.00000 0.0 526882.50000 186053.00000 0.0	0000 4.8886 -4.2534 2.9521 - 0000 Point lies within an excavat	ion.		
526885.0000 186053.00000 0.0 526887.50000 186053.00000 0.0 526887.50000 186053.00000 0.0	0000 -3.2446 -4.9379 3.3479 - 0000 -2.7272 -4.1505 3.4761 - 0000 -2.6175 -2.1262 -2.0122			
526892.50000 186053.00000 0.0 526892.50000 186053.00000 0.0 526895.00000 186053.00000 0.0	7000 -2.01/5 -3.1309 3.0173 - 0000 -2.0632 -2.4726 2.1492 - 0000 -1.6784 -2.0115 1.1839 -			
526897.50000 186053.00000 0.0 526900.00000 186053.00000 0.0 526902.50000 186053.00000 0.0				
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Uus ys								125836			
Southside Lodge								Drg. Ref.			
round Move	ement Ass	essment							Made by	Date 16-Apr-2018	Checke
Type/No.	×	Coordinates	~	×	v	Displacem	Horizontal	Horizonta	Angle of Line		
	526915.0000	- 0 186053.00000 0 186057 00000	0.00000	0.0	-0.23876	0.0	displacement	displaceme -	ent -		
	526867.50000 526870.00000	0 186057.00000 0 186057.00000	0.00000	1.0165	-0.88441 -1.3487	0.24362 0.65922	-	-	-		
	526872.50000 526875.00000 526877.50000	0 186057.00000 0 186057.00000 0 186057.00000	0.00000	2.0836 2.6847 3.5039	-2.3359 -3.0486	2.5354 3.3687	-	-	-		
	526880.00000 526882.50000 526885.00000	0 186057.00000 0 186057.00000 0 186057.00000	0.00000	-0.55684 -2.5233 -2.0862	-2.5179 -3.8402 -3.1749	2.1001 3.3457 2.7694	-	-	-		
	526887.50000 526890.00000	0 186057.00000 0 186057.00000	0.00000	-1.7113	-2.6044	1.9818	-	-	-		
	526892.50000 526895.00000 526897.50000	0 186057.00000 0 186057.00000 0 186057.00000	0.00000	-0.94054	-1.1272	0.29398	-	-	-		
	526900.00000 526902.50000 526905.00000	0 186057.00000 0 186057.00000 0 186057.00000	0.00000	-0.17091 0.0 0.0	-0.20482 0.0 0.0	0.044621 0.0 0.0	-	-	-		
	526907.50000 526910.00000	0 186057.00000 0 186057.00000	0.00000	0.0	0.0	0.0	-	-	-		
	526912.50000 526915.00000 526865.00000	D 186057.00000 D 186057.00000 D 186061.00000	0.00000	0.0	0.0	0.0	-	-	-		
	526867.50000 526870.00000	0 186061.00000 0 186061.00000	0.00000	0.27369	-0.23813 -0.70237	0.055100 0.15682	-	-	-		
	526875.0000 526877.50000	0 186061.00000 0 186061.00000	0.00000	1.0332 0.62931	-1.0934	0.67093	-	-	-		
	526880.00000 526882.50000 526885.00000	0 186061.00000 0 186061.00000 0 186061.00000	0.00000	-0.15804 -0.85623 -1.3056	-1.3887 -1.5753 -1.9869	1.1325 1.0563 0.94188	-	-	-		
	526887.50000 526890.00000	0 186061.00000 0 186061.00000	0.00000	-1.0229	-1.5567	0.51755	-	-	-		
	526892.50000 526895.00000 526897.50000	D 186061.00000 D 186061.00000 D 186061.00000	0.00000	-0.45746 -0.17823 0.0	-0.69620 -0.23850 0.0	0.10939 0.047660 0.0	-	-	-		
	526900.00000 526902.50000	0 186061.00000 0 186061.00000	0.00000	0.0	0.0	0.0	-	-	-		
	526905.00000 526907.50000 526910.00000	D 186061.00000 D 186061.00000 D 186061.00000	0.00000	0.0	0.0	0.0	-	-	-		
	526912.50000 526915.00000	0 186061.00000 0 186061.00000	0.00000	0.0	0.0	0.0	-	-	-		
	526865.00000 526867.50000 526870.00000	D 186065.00000 D 186065.00000 D 186065.00000	0.00000	0.0	0.0	0.0	-	-	-		
	526872.50000 526875.00000	0 186065.00000 0 186065.00000	0.00000	0.26728 0.31381 0.17559	-0.30540	0.058347 0.11459	-	-	-		
	526880.0000 526882.5000	0 186065.00000 0 186065.00000	0.00000	-0.066351	-0.71018	0.20622 0.18302	-	-	-		
	526885.0000 526887.50000	0 186065.00000 0 186065.00000 0 186065.00000	0.00000	-0.36401 -0.33447	-0.62158	0.11293	-	-	-		
	526892.50000 526895.00000	0 186065.00000 0 186065.00000	0.00000	0.0	0.0	0.020048	-	-	-		
	526897.50000	0 186065.00000	0 00000								
	526900.00000	0 186065.00000	0.00000	0.0	0.0	0.0	-	-	-		
	526900.00000 526902.50000 526905.00000 526907.50000	D 186065.00000 D 186065.00000 D 186065.00000 D 186065.00000	0.00000 0.00000 0.00000 0.00000	0.0 0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0 0.0	-				
ecific Building Dan ructure: 2 E Heat Lat.	526902.5000 526902.5000 526907.5000 526907.5000 526917.0000 526915.00000 526915.00000 mage Results - H th Road Sub-: Coordinates	D 186065.00000 D 186065.00000 D 186065.00000 D 186065.00000 D 186065.00000 D 186065.00000 D 186065.00000 D 186065.00000 Horizontal Displace structure: Wall	0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0 0.0 0.0 0.0		-	-			
<pre>xcific Building Dan ucture: 2 E Heat st. x m] [m] 0.0 526886.7000 8288 52685.500 8288 52685.500 6575 52684.3000 5719 526883.7000</pre>	526900.00001 526902.50001 526905.00001 526915.00001 526915.00001 526915.00001 526915.00001 526915.00001 526915.00001 526915.00001 526915.00001 526915.00001 526915.00001 526915.00001 526915.00001 52695.21000 186055.21000 001 186055.83000 001 186055.83000 001 186055.83000 001 186055.83000 001 186055.83000	0 186065.00000 186065.00000 186065.00000 186065.00000 186065.00000 186065.00000 186065.00000 186065.00000 186065.00000 186065.00000 0 186065.00000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0					
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Southside Lodge Ground Movement Assessment

Job No.	Sheet No.	Rev.		
125836				
Drg. Ref.				
Made by JT	Date 16-Apr-2018	Checked		

Dist.	x	C	oordina y	tes	z	x	У	Horizonta	s L Horizontal
								along the	perpendicular
1.8137 52 2.7206 52	6890 6890	.30000	186057 186057	.21000	0.00000	-1.3585	-2.067	5 -2.44	91 -0.34924 58 -0.30171
3.6275 52 4.5343 52	6891 6892	.50000	186058	.57000	0.00000	-0.98874	-1.504	8 -1.782 4 -1.449	25 -0.25419 92 -0.20666
Structure:	2 E	Heath	Road	Sub-s	tructure	: Wall 6			
Dist.	x	Co	ordinate y	es	z	×	D Y	isplacements Horizontal	Horizontal
								displacement	t displacement
[m]	[m]		[m]		[m]	[mm]	[mm]	Line	to Line
0.0 526	892.	10000	186059.2	25000	0.00000	-0.80387	-1.2234	-0.1563	7 1.4555
2.0070 526	890.	55000	186060.	52500	0.00000	-0.75972	-1.1562	-0.1477	1.3756
4.0140 526	889.	00000	186061.8	80000	0.00000	-0.71557	-1.0890	-0.1391	9 1.3356
	0.5		D						
Diet	2 5	neath	Roau	sub-s	cruccure	: Wall /		Dienlesseet	_
Dist.	x	C	oordina Y	ces	z	x	У	Horizonta	s L Horizontal
								displacement along the	nt displacement perpendicular
[m]	[m	1	[m]]	[m]	[mm]	[mm]	Line [mm]	to Line [mm]
0.0 52	6889 6888	.00000	186061 186061	.80000	0.00000	-0.71557	-1.089	0 1.295	53 0.14190 70 0.17823
1.7900 52	6887 6887	.86000	186060	.42000	0.00000	-1.0820	-1.646	7 1.95	36 0.21456 0.25089
3.5799 52	6886	.72000	186059	.04000	0.00000	-1.4484	-2.204	3 2.62	0.28722
	0000	.15000	100000		0.00000	2.0010	2.105	1 2.00	0.02000
Structure:	2 E	Heath	Road	Sub-s	tructure	: Wall 8			
Dist.		C	oordina	tes	_		D	isplacements	Weni sente l
	x		У		z	x	У	displacement	t displacement
								along the Line	perpendicular to Line
[m] 0.0 52	[m] 6886] .15000	[m] 186058] .35000	[m] 0.00000	[mm] -1.6316	[mm] -2.4831	[mm] 0.30962	[mm] 2 -2.9550
0.35532 52	6886 6886	.42500	186058 186057	.12500	0.00000	-1.6392	-2.4947	0.3110	6 -2.9688 L -2.9826
0.71000 02	0000	.,	100007		0.00000	1.0100	2.0000	0.0120	2.5020
Structure:	1 E	Heath	Road	Sub-s	tructure	: Wall 9			
Dist.		C	oordina	tes	_	_		Displacement	ts
	x		У		2	*	У	displace	ement displacement
								along t Line	the perpendicular e to Line
[m] 0.0 52	[m 6908] .30000	[m] 186048] .55000	[m] 0.00000	[mm] 0.	[mm 0	[mm] 0.0	[mm] 0.0 0.0
0.99107 52	6907 6906	.56667	186049 186049	.21667	0.00000	0.	0	0.0	0.0 0.0
2.9732 52	6906	.10000	186050	.55000	0.00000	-0.01769	4 -0.01	3739 0.003	38507 0.022068 35746 0.065914
4.9554 52	6904	. 63333	186051	.88333	0.00000	-0.08053	5 -0.07	4029 0.00	97936 0.10895
6.9375 52	6903	.16667	186053	.21667	0.00000	-0.1271	8 -0.1	3407 0.003	39199 0.18475
7.9286 52 8.9196 52	6902 6901	.43333	186053	.88333	0.00000	-0.1419	7 -0.1 5 -0.1	5861 -0.00 7619 -0.00	16426 0.21287 77122 0.23110
	1		D						
Structure:	ΙE	Heath	Road	Sub-s	tructure	: Wall 10			
Dist.	x	C	oordina y	ces	z	x	У	Horizonta	al Horizontal
								displaceme along the	ent displacement e perpendicular
[m]	[m	1	[m]]	[m]	[mm]	[mm]	Line [mm]	to Line [mm]
0.0 52	6901 6901	.70000	186054 186053	.55000	0.00000	-0.14975	-0.176	19 0.23 69 0.382	0.0075799 0.012657
1.9586 52	6900	.38333	186053	.10000	0.00000	-0.34591	-0.407	50 0.53 71 0.68	422 0.017861 531 0.023230
3.9172 52	6899	40833	186051	.65000	0.00000	-0.54263	-0.640	45 0.83	0.028821 0.034720
5.8758 52	6897	.75000	186050	.20000	0.00000	-0.74043	-0.876	50 1.1	466 0.041063
Chanadarana	1 12	Ileeth	Deed	Cub a	******	. Mell 11			
Bist	ΤĿ	neath	Road	Sub-s	cruccure	: Wali ii			
Dist.	x	C	oordina y	tes	z	x	У	Horizonta	al Horizontal
								displaceme along the	ent displacement e perpendicular
[m]	ſm	1	ſm	1	[m]	[mm]	[mm]	Line [mm]	to Line
0.0 52	6897 6897	.75000	186050	20000	0.00000	-0.74043	-0.876	50 -0.038 50 -0.110	996 1.1467 031 2.7524
1.4160 52	6896	.70000	186051	.15000	0.00000	-1.7580	-2.10	69 -0.10	2.7418
Chanadarana	1 12	Ileeth	Deed	Cub a	******	. Mell 10			
Structure:	ΙĽ	neath	Road	Sub-s	cructure	: Wali iz			
Dist.	x	C	oordina y	tes	z	x	у	Horizontal	Horizontal
								displacement along the	t displacement perpendicular
[m]	ſm	1	ſm	1	[m]	[mm]	[mm]	Line	to Line
0.0 52	6896	.70000	186051	15000	0.00000	-1.7580	-2.1069	2.740	L 0.14535
1.9105 52	6895	.40000	186049	.75000	0.00000	-2.2707	-2.7213	3.539	0.18774
3.8210 52	6894 6894	.10000	186048	.35000	0.00000	-2.9740	-3.5641	4.0/3	4 0.24589
Structure:	1 E	Heath	Road	Sub-s	tructure	: Wall 13			
Dist.	×	C	oordina v	tes	z	x	D V	isplacements Horizontal	Horizontal
	Â		Y		-		4	displacement	t displacement
			-		<i>,</i> .	, .		Line	to Line
[m] 0.0 52	[m 6894	10000	[m] 186048	J .35000	[m] 0.00000	[mm] -2.9740	[mm] -3.5641	[mm] 0.3144	[mm] 7 -4.6312
0.79569 52 1.5914 52	6894 6895	.67500	186047 186047	.80000	0.00000	-2.9951 -1.2507	-3.5894 -1.4641	0.31670	-4.6641 -1.9225
Structure:	1 E	Heath	Road	Sub-s	tructure	: Wall 14			
Dist.		C	oordina	tes	-	*		Displacement:	B Horizontal
	x		Ŷ		z	~	¥	displacemen	nt displacement
								along the Line	perpendicular to Line
[m] 0.0 52	[m 6895	25000	[m] 186047] .25000	[m] 0.00000	[mm] -1.2507	[mm] -1.464	[mm] 1 1.924	[mm] 48 0.052375
0 02045 50	COO 4	60000	106046	56667	0 00000	1 4077	1 640	0 0 1 6	0 050050

Oasys

Southside Lodge

Dist.

Ground Movement Assessment

Coordinates

Displacements

Job No.	Sheet No.	Rev.
125836		
Drg. Ref.		
Made by JT	Date 16-Apr-2018	Checked

	* C	v	z	×	Dis	placements Horizontal	Horizontal
		1			d	isplacement	displacement
1.8409	526894.01667	186045.88333	0.00000	-1.5806	-1.8503	2.4326	0.066193
2.7613	526893.40000	186045.20000	0.00000	-1.2528 0	.081226	0.77901	-0.98447
2 .	. 1 5 5						
Structur	e: I E Heath	Road Sub-S	tructure	: Wall 15			
Dist.	c x	oordinates v	z	x	Dis V	placements Horizontal	Horizontal
	-	1	-		1	displacement	displacement
						along the Line	perpendicular to Line
[m]	[m] 526893 40000	[m] 186045 20000	[m]	[mm] -1 2528	[mm] 0.081226	[mm] -1 0160	[mm] -0.73738
0.97451	526894.15000	186044.57778	0.00000	-1.1107	0.80868	-1.3712	-0.086831
1.9490	526894.90000 526895.65000	186043.95556 186043.33333	0.00000	-0.93492	1.0479	-1.2127	-0.17531
3.8980	526896.40000	186042.71111	0.00000	-0.85760	0.43315	-0.93660	-0.21422
5.8470	526897.90000	186041.46667	0.00000	-0.72536	0.23697	-0.70956	-0.28077
6.8215 7.7960	526898.65000 526899.40000	186040.84444	0.00000	-0.87596	0.16369	-0.62475	-0.30562
8.7705	526900.15000	186039.60000	0.00000	-0.58447	0.25818	-0.61467	-0.17448
Structur	o, 1 E Hosth	Road Sub-e	tructuro	- Wall 16			
Structur	e. i E neach	Road Sub 3	cruccure.	. Wall 10			
Dist.	Co x	ordinates y	z	x	Di Y	splacements Horizonta	1 Horizontal
						displaceme	nt displacement
						along the Line	to Line
[m]	[m] 26900 15000	[m] 186039 60000 1	[m]	[mm] -0 58447	[mm] 0 2581	[mm] 8 -0.202	[mm] 62 0.60598
1.0087 5	26900.82917	186040.34583	0.00000	-0.26478	0.3094	8 0.0505	51 0.40415
3.0262 5	26902.18750	186041.83750	0.00000	-0.23824	0.2262	6 -0.0546	31 0.28228
4.0349 5	26902.86667	186042.58333	0.00000	-0.22682	0.08407	8 -0.0905	50 0.22431 88 0.17363
6.0524 5	26904.22500	186044.07500	0.00000	-0.18412	-0.002577	0 -0.125	87 0.13440
7.0611 5 8.0698 5	26905.58333	186045.56667	0.00000	-0.15465	-0.023/1	5 -0.102	22 0.065746
9.0786 5	26906.26250	186046.31250	0.00000 -	-0.073285	-0.02637	8 -0.0688	45 0.036425
11.096 5	26907.62083	186047.80417	0.00000	0.0	0.	0 0	.0 0.0
12.105 5	26908.30000	186048.55000	0.00000	0.0	υ.	υ ι	.0 0.0
Specific I	Building Dama	nge Results - Ve	rtical Disp	olacements	;		
Charlest	. 0 E	Deed 1 Cub		Mell 1			
Structur	e: 2 E Heath	Road Sub-s	tructure:	: Wall I			
Dist.	c x	oordinates v	z	Displ	acements		
[m]	[m]	[m]	[m]	[mm]			
Vertical	Offset 1						
0.0	526886.70000 526886.10000	186057.90000	0.00000	1.7915			
1.8288	526885.50000	186056.52000	0.00000	2.8344			
3.6575	526884.90000 526884.30000	186055.14000	0.00000	3.4716			
4.5719	526883.70000	186054.45000	0.00000	3.4751			
Chruchur		Road Sub-e		Mell 0			
	о• и нозто			·			
Structur	e: 2 E Heath	Road Sub 3	cructure.	Wall 2			
Dist.	e: 2 E Heath C	oordinates Y	z	Displ	acements		
Dist.	e: 2 E Heath C x [m]	oordinates Y [m]	z [m]	Displ z [mm]	acements		
Dist. [m] Vertical	c x [m] Offset 1	oordinates y [m]	z [m]	Displ z [mm]	acements		
Dist. [m] Vertical 0.0 0.79390	C x [m] Offset 1 526883.70000 526884.31667	cordinates y [m] 186054.45000 186053.95000	z [m] 0.00000 0.00000	Displ z [mm] 3.4751 3.4617	acements		
Dist. [m] Vertical 0.0 0.79390 1.5878 2.3817	C x [m] 0ffset 1 526883.70000 526884.31667 526884.93333 526885.55000	cordinates y [m] 186054.45000 186053.95000 186052.95000	z [m] 0.00000 0.00000 0.00000	Displ z [mm] 3.4751 3.4617 3.4457 3.4272	acements		
Dist. [m] Vertical 0.0 0.79390 1.5878 2.3817	c x [m] 0ffset 1 526883.70000 526884.31667 526884.93333 526885.55000	cordinates y [m] 186054.45000 186053.95000 186052.95000	z [m] 0.00000 0.00000 0.00000 0.00000	Disp] z [mm] 3.4751 3.4617 3.4457 3.4272	acements		
Dist. [m] Vertical 0.0 0.79390 1.5878 2.3817 Structur	C x [m] Offset 1 526883.70000 526884.31667 526884.9333 526885.55000 e: 2 E Heath	cordinates y [m] 186054.45000 186053.95000 186052.95000 Road Sub-s:	z [m] 0.00000 0.00000 0.00000 0.00000	Displ z [mm] 3.4751 3.4617 3.4457 3.4272 : Wall 3	acements		
Dist. [m] Vertical 0.0 0.79390 1.5878 2.3817 Structur Dist.	C x [m] Offset 1 526883.70000 526884.31667 526884.31667 526885.55000 e: 2 E Heath C	cordinates y [m] 186054.45000 186053.95000 186052.95000 Road Sub-s cordinates	z [m] 0.00000 0.00000 0.00000 0.00000 tructure:	Displ z [mm] 3.4751 3.4617 3.4457 3.4272 : Wall 3 Displ	Lacements		
Dist. [m] Vertical 0.0 0.79390 1.5878 2.3817 Structur Dist. [m]	C x [m] Offset 1 526884.31667 526884.93333 526885.55000 e: 2 E Heath C x [m]	xxxx y y [m] 186054.45000 186053.95000 186052.95000 Road Sub-s cordinates y [m]	z [m] 0.00000 0.00000 0.00000 0.00000 tructure: z [m]	Displ z [mm] 3.4751 3.44617 3.44617 3.4457 3.4457 3.4272 : Wall 3 Displ z [mm]	acements		
Dist. [m] Vertical 0.0 0.79390 1.5878 2.3817 Structur Dist. [m]	C x [m] Offset 1 526883.70000 526884.93333 526884.93333 526885.55000 e: 2 E Heath C x [m]	Note () Jub 3 oordinates y [m] 186054.45000 186053.45000 186052.95000 Road Sub-s oordinates y [m]	z [m] 0.00000 0.00000 0.00000 0.00000 tructure: z [m]	Displ z [mm] 3.4751 3.4617 3.4457 3.4457 3.4272 : Wall 3 Displ z [mm]	acements		
Dist. [m] Vertical 0.0 0.79390 1.5878 2.3817 Structur Dist. [m] Vertical	C x [m] Offset 1 52688.31667 526884.31667 526884.31667 526885.55000 e: 2 E Heath c m [m] Offset 1 526885.55000	Note () Sub S (m) 186054.55000 186053.45000 186052.95000 Road Sub-s cordinates y [m] 186052.95000	z [m] 0.00000 0.00000 0.00000 0.00000 tructure: z [m] 0.00000	Disp] z [mm] 3.4751 3.4617 3.4617 3.4457 3.4272 : Wall 3 Disp] z [mm] 3.4272	acements		
Dist. [m] Vertical 0.0 0.79390 1.5878 2.3817 Structur Dist. [m] Vertical 0.0 0.90785 1.8157	C x x x x x x x x x x x x x x x x x x x	Note + 540 s cordinates y [m] 186053,45000 186053,45000 186052,95000 Road Sub-s cordinates y [m] 186052,95000 186052,95000 186054,4500 186054,4500 186054,4500 186054,4500 186054,4500 186054,4500 186054,4500 186054,4500 186054,4500 186054,4500 186054,4500 186054,4500 186054,4500 186055,4500 186054,4500 186055,4500 186055,4500 186055,4500 186055,4500 186055,4500 186055,4500 186055,4500 186055,4500 186055,4500 186055,4500 186055,4500 186055,4500 186055,4500 186055,4500 186055,4500 186055,4500 186055,4500 186055,4500 186055,4500 186052,9500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 18605,4500 1	z [m] 0.00000 0.00000 0.00000 0.00000 tructure: z [m] 0.00000 0.00000	<pre>i wall 2</pre>	acements		
Dist. [m] Vertical 0.0 0.79390 1.5678 2.3817 Structur Dist. [m] Vertical 0.0 0.90785 1.9157 2.7236	C x C x C x C x C x C C x C C C C C C C	Nord 540 5 oordinates y [m] 186053.55000 186053.55000 Road 50b-s oordinates y [m] 186052.95000 186052.4000 186053.64000 186053.02000	z [m] 0.00000 0.00000 0.00000 0.00000 tructure: z [m] 0.00000 0.00000 0.00000 0.00000	. wall 2 Displ z [mm] 3.4751 3.4457 3.4457 3.44272 : Wall 3 Displ z [mm] 3.4272 3.4988 2.5889 3.5889	acements		
Dist. [m] Vertical 0.0 0.79390 1.5678 2.3817 Structur Dist. [m] Vertical 0.0 0.0 0.0 0.90785 1.6157 2.1236 3.6514 4.5333	C (m) Offset 1 526884.310000 526884.93333 526884.93333 526885.55000 e: 2 E Heath C (m) Offset 1 526885.55000 526886.73000 526887.91000 526887.91000 526887.91000	Notal Jub coordinates y [m] 186053.45000 186053.45000 186052.95000 Road Jub-s coordinates y [m] 186052.95000 186052.95000 186055.264000 186052.464000 186055.202000 186055.71000 186055.71000	z [m] 0.00000 0.00000 0.00000 0.00000 tructure: z [m] 0.00000 0.00000 0.00000 0.00000 0.00000	<pre>. wall 2 Displ z [mm] 3.4751 3.4617 3.4457 3.4272 wall 3 Displ z [mm] 3.4272 3.4988 3.3180 2.4958 3.3180 2.49589 2.4957 </pre>	acements		
Dist. [m] Vertical 0.0 0.79390 1.5878 2.3817 Structur Dist. [m] Vertical 0.0 0.90785 1.8157 2.7236 3.6314 4.5393	<pre>c 2 E Heath</pre>	Note + 540 5 coordinates y [m] 186053.45000 186053.45000 186053.45000 186052.95000 y [m] 186055.64000 186055.71000 186055.71000	z [m] 0.00000 0.00000 0.00000 tructure: z [m] 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000	<pre>. wall 2 Displ z [mm] 3.4457 3.4457 3.4457 3.44272 : Wall 3 Displ z [mm] 3.4272 3.4988 3.3180 2.9589 2.4857 1.9529</pre>	acements		
Dist. [m] Vertical 0.0 0.79390 1.5878 2.3817 Structur Dist. [m] Vertical 0.0 0.90785 1.8157 2.7236 3.6314 4.5393 Structur	<pre>c 2 E Heath</pre>	Notal + Sho S oordinates y [m] 186054.45000 186053.45000 186052.95000 Road Sub-s oordinates y [m] 186052.95000 186053.45000 186055.25000 186055.20000 186055.21000 186055.21000 186055.21000 186055.20000 Road Sub-s	z [m] 0.00000 0.00000 0.00000 0.00000 tructure: z [m] 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000	<pre>. wall 2 Displ z [mm] 3.4457 3.4457 3.4457 3.44272 : Wall 3 Displ z [mm] 3.4272</pre>	acements		
Strictur [m] Vertical 0.0 0.79390 1.5878 2.3817 Structur Dist. [m] Vertical 0.0 0.90785 1.8157 2.7236 3.6314 4.5393 Structur Dist.	<pre>C</pre>	Notal + 540 5 (m) 186054.55000 186053.55000 186052.95000 Road Sub-s cordinates y (m) 186052.95000 186054.502000 186055.250000 186055.202000 186055.202000 186055.202000 186055.202000 186055.202000 186055.202000 186055.202000 186055.202000 186055.202000 186055.202000 186055.20200 186055.20200 186055.20200 186055.20200 186055.20200 186055.20200 186055.20200 186055.20200 186055.20200 186055.20200 186055.20200 186055.20200 186055.20200 186055.20200 186055.20200 186055.20200 186055.20200 186055.20200 186055.20200 186055.20200 186055.20200 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.2050 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.20500 186055.	z [m] 0.00000 0.00000 0.00000 0.00000 tructure: z [m] 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 tructure:	Displ 	acements		
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[m] Structur Structur	<pre>c 2 E Heath</pre>	Nord Sub s coordinates y [m] 186054.45000 186053.45000 186052.95000 Road Sub-s coordinates y [m] 186052.95000 186055.02000 Road Sub-s coordinates y [m] 186055.43000 186055.02000 Road Sub-s coordinates y [m] 186055.85000 186055.85000 Road Sub-s coordinates y [m] 186055.85000 186055.85000 186055.85000 186055.85000 186055.85000 186055.85000 186055.85000 Road Sub-s coordinates y [m] 186055.85000 186059.25000 Road Sub-s cordinates y [m] 186059.25000 Road Sub-s coordinates (m) 186059.25000 Road Sub-s coordinates (m) (m) (m) (m) (m) (m) (m) (m)	z (m) 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 </td <td><pre>. wall 2 Displ rmm] 3.4751 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Oasys	125836		
Southside Lodge	Drg. Ref.		
Ground Movement Assessment	Made by	Date	Checked
	51	16-Apr-2018	
[m] [m] [m] [m]			
Vertical Offset 1 0.0526889.00001186061.800000.0.22714 0.89499 526888.430001186061.110000.0.000000.37830 1.7900526887.66001186606.42000.0.000000.595440 2.6850526887.290001186659.730000.0.0000001.22091 4.4749 526886.720001186058.350000.0.0000001.22091			
Structure: 2 E Heath Road Sub-structure: Wall 8			
x y z [m] [m] [m] [m] [m]			
Vertical Offset 1 0.0526886.15000 186058.35000 0.00000 1.7463 0.35532 526886.42500 186058.12500 0.00000 1.7689 0.71063 526886.70000 186057.90000 0.00000 1.7915			
Structure: 1 E Heath Road Sub-structure: Wall 9			
Dist. Coordinates Displacements x y z z [m] [m] [m] [m] [m]			
Vertical Offset 1 0.0 0.526908.3000 186048.55000 0.0000 0.0 0.9107 526908.3000 186048.25000 0.0000 0.0 1.921 526908.3000 186049.21667 0.00000 0.0 2.9732 526906.8333 186049.8333 0.00000 0.0 3.9643 526905.36667 186051.267 0.00000 0.051810 4.9554 526905.36667 186051.2670 0.00000 0.02799 5.9464 52693.39000 16652.55000 0.00000 0.02799 5.9464 52693.39000 186053.21667 0.00000 0.028200 6.9375 526902.43333 186053.833 0.00000 0.03391 8.9196 526901.70000 186054.55000 0.00000 0.031420			
Structure: 1 E Heath Road Sub-structure: Wall 10 Dist. Coordinates Displacements			
x y z z [m] [m] [m] [m]			
0.0 526901.70000 186054.55000 0.00000 0.031420 0.97930 526901.04167 186053.82500 0.00000 0.052788 1.9586 526910.8333 186053.10000 0.00000 0.094082 2.9379 526899.72500 186052.37500 0.00000 0.16470 3.9172 526899.06667 186051.65000 0.00000 0.26635 4.8965 526898.40833 186050.92500 0.000000 0.40307 5.8758 526898.40833 186050.92500 0.000000 0.59248			
Structure: 1 E Heath Road Sub-structure: Wall 11 Dist. Coordinates Displacements			
x y z z [m] [m] [m] [m]			
0.0 526897,75000 186050.20000 0.00000 0.59248 0.70799 526897.25200 186050.67500 0.000000 1.3956 1.4160 526896.70000 186051.15000 0.00000 1.3785			
Structure: 1 E Heath Road Sub-structure: Wall 12			
x y z [m] [m] [m] [m] [m]			
Vertical Offset 1 0.0526896.7000 186051.15000 0.00000 1.3785 0.95225 526896.05000 186050.45000 0.00000 1.9583 1.9105 526895.40000 186049.75000 0.000000 2.5208 2.8657 526894.75000 186049.05000 0.00000 3.0125 3.8210 526894.10000 186048.35000 0.00000 3.3675			
Structure: 1 E Heath Road Sub-structure: Wall 13 Dist. Coordinates Displacements			
x y z z [m] [m] [m] [mm]			
vertical Urfset 1 0.0526934.10000 186048.35000 0.00000 3.3675 0.79569 526894.67500 186047.80000 0.00000 3.3820 1.5914 526895.25000 186047.25000 0.00000 1.4187			
Structure: 1 E Heath Road Sub-structure: Wall 14			
Dist. Coordinates Displacements x y z z [m] [m] [m] [m]			
Vertical Offset 1 0.0526955.25000 186047.25000 0.00000 1.4187 0.92045 526894.6333 186046.56667 0.00000 1.4655 1.8409 526894.01667 186045.8333 0.00000 1.5027 2.7613 526893.40000 186045.20000 0.00000 1.3562			
Structure: 1 E Heath Road Sub-structure: Wall 15 Dist. Coordinates Displacements			
x y z z [m] [m] [m] [m] [m-1.12] [m]			
vertical vtfset 1 1.3562 0.0526893.40000 186045.20000 1.3562 0.97451 526894.15000 186044.57778 0.0000 1.6572 1.9490 526894.9000 186044.57778 0.0000 1.672 2.925 526894.9000 186043.33333 0.0000 1.672 3.8980 526894.9000 186043.33333 0.0000 1.6866 3.8980 526894.9000 186042.0889 0.00000 0.98639 5.8470 526897.9000 186042.0889 0.00000 0.95094 7.7960 526894.0000 186049.20000 0.92499 8.7705 52690.15000 186049.60000 0.59718			
Structure: 1 E Heath Road Sub-structure: Wall 16			
Dist. Coordinates Displacements x y z z [m] [m] [m] [m]			
Vertical Offset 1 0.0526900.15000 186039.60000 0.00000 0.59718 1.0887 525900.82917 186040.34583 0.00000 0.25734 2.0175 526901.50933 186041.09167 0.00000 0.1174 3.0262 526902.18750 186041.83705 0.00000			

	Job No.	Sheet No.	Rev.
Oasys	125836		
Southside Lodge	Drg. Ref.		4
Ground Movement Assessment	Made by D JT 1)ate Che 6-Apr-2018	cked
Dist. Coordinates Displacements [m] [m] [m] [m]		.	
4.0349 526902.86667 186042.58333 0.00000 0.10977 5.0436 526903.54583 186043.32917 0.00000 0.081331 6.0524 526904.90417 186044.07500 0.00000 0.054944 7.0611 526904.90417 186044.8030 0.00000 0.042083 8.0698 526905.26250 0.00000 0.022507 10.087 526906.26250 0.80000 0.00008758 11.096 526907.62083 86047.05833 0.00000 0.0 12.105 526905.30000 186044.35000 0.00000 0.0			
Specific Building Damage Results - All Segments			
Structure: 2 E Heath Road Sub-structure: Wall 1	the Min Demons		
from Line for Ratio Horizontal Tensile of of Vertica Vertical Strain Strain Horizontal Displacement Curve Calmalations Curve	n Ann Damage L Radius of Category at Curvature		
[m] [m] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] [%] <td>[m] -6 3312.8 1 (Very Slight)</td> <td></td> <td></td>	[m] -6 3312.8 1 (Very Slight)		
Tensile horizontal strains are +ve, compressive horizontal strains are -ve.	origin)		
Structure: 2 E Heath Road Sub-structure: Wall 2 Vertical Offset Segment Structure: Partice Nax Gradient Max	ent Min Damage Ll Radius of Category ent Curvature		
Calculations Curve [m] [m] [%] [%] 0.0 1 0.0 2.3800 sagging 105.51E-6 705.78E-6 831.16E-6 -7.1219E-6 23.295	[m] 2-6 246900. 0 (Negligible)		
Tensile horizontal strains are +ve, compressive horizontal strains are -ve.			
Structure: 2 E Heath Road Sub-structure: Wall 3 Vertical Offset Segment Structure: Displacement Ratio Movement Birlacement	nt Min Damage L Radius of Category Lt Curvature		
Calculations Curve [m] [m] [%] [%] 0.0 1 0.0 4.5380 Sagging 0.010554 0.057270 0.073246 -672.35E-6 586.63E	[m] -6 3047.0 1 (Very Slight)		
Tensile norizontal strains are +ve, compressive norizontal strains are -ve.			
Structure: 2 5 Heath Road Sub-structure: Wall 4 Vertical Offset Segment Start Length Curvature Deflection Average Max Max Gradient Max Grad from Line for Ratio Horizontal Tensile of of Verti Vertical Strain Strain Horizontal Displace Movement Displacement Curve Calculations	ent Min Damage cal Radius of Category ment Curvature		
(m) (m) <th(m)< th=""> <th(m)< th=""> <th(m)< th=""></th(m)<></th(m)<></th(m)<>	[m] DE-6 1.8679E+6 0 (Negligible)		
Tensile norizontal strains are +ve, compressive norizontal strains are -ve.			
Vertical Offset Segment Start Length Curvature Deflection Average Max Max Gradient Max Gradie from Line for Vertical Contract Curve Strain Strain Borizontal Displacement Curve	nt Min Damage L Radius of Category Lt Curvature		
Calculations Curve [m] [m] [%] [%] 0.0 1 0.0 4.5330 Hogging 0.0066043 0.036753 0.044361 -367.39E-6 602.04E Tensile horizontal strains are two compressive horizontal strains are t	[m] -6 7539.2 0 (Negligible)		
Structure: 2 E Heath Road Sub-structure: Wall 6			
Vertical Offset Segment Start Length Curvature Deflection Average Max Max Gradient Max Gradi from Line for Ratio Horizontal Tensile of of Vertic Vertical Strain Strain Horizontal Displacem	ent Min Damage al Radius of Category ent Curvature		
Movement Displacement Curve Calculations [m] [m] Curve Curve [m] [m] [%] [%] Curve [m] [m] [%] [%] Curve	[m] E-6 1.1066E+6 0		
Tensile horizontal strains are +ve, compressive horizontal strains are -ve.	(Negligible)		
Structure: 2 E Heath Road Sub-structure: Wall 7 Vertical Offset Segment Start Length Curvature Deflection Average Max Max Gradient Max Gradient Ratio Horizontal Tensile of Vertical Ratio Horizontal Tensile of of Vertical Wovement Strain Strain Displacement	nt Min Damage L Radius of Category Lt Curvature		
Calculations Curve [m] [m] [%] [%] 0.0 1 0.0 4.4730 Hogging 0.0059169 0.037055 0.043812 -370.42E-6 -599.95E	[m] -6 3380.2 0 (Negligible)		
Tensile horizontal strains are +ve, compressive horizontal strains are -ve.			
Vertical Offset Segment Start Length Curvature Deflection Average Max Max Gradient Max Grad from Line for of Verti Vertical Strain Strain Horizontal Displacement Curve Displacement Curve	eent Min Damage cal Radius of Category ment Curvature		
[m] [m] [%] [%] Curve 0.0 1 0.0 0.70900 Sagging 0.0 407.31E-6 -4.0721E-6 -63.56	[m] 2E-6 62.337E+6 0 (Negligible)		
Tensile horizontal strains are +ve, compressive horizontal strains are -ve.			
Structure: 1 E Heath Road Sub-structure: Wall 9 Vertical Offset Segment Start Length Curvature Deflection Average Max Max Gradient Max Gradient from Line for Ratio Horizontal Tensile of Vertic Vertical Strain Strain Horizontal Displacement Movement Displacement Curve	ent Min Damage 11 Radius of Category nnt Curvature		
[m] [m] [m] [%] [%] 0.0 All settlements are less than the Settlement Trough Limit Sensitivity. Tensile horizontal strains are +ve, compressive horizontal strains are -ve.	[m]		
Structure: 1 E Heath Road Sub-structure: Wall 10			
Vertical Offset Segment Start Length Curvature Deflection Average Max Max Gradient Max Gradi from Line for Ratio Horizontal Tensile of Of Vertico Vertical Strain Strain Horizontal Displacem Movement Displacement Curve Calculations Curve	ant Min Damage al Radius of Category ant Curvature		

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One	15			ŀ		Sneet No.	Rev.
Jus	yS				125836		
Southside Lodge Ground Moveme	e nt Assessment				Drg. Ref.		
					Made by JT	Date 16-Apr-2018	Checked
[m] 0.0	[m] [m] 1 2.9379 2.9361 Hogging	[%] [% 0.0015921 0.0] [%] 15669 0.015967 -157	.62E-6 -193.39E-6	[m] 15814. 0 (Negligible)		
Tensile horizontal strai	ins are +ve, compressive horizo	ontal strains are -	ve.				
Structure: 1 E Heath Roa Vertical Offset Segm from Line for	ad Sub-structure: Wall ll ment Start Length Curvature	e Deflection Avera Ratio Horizo	ge Max Max Grac ntal Tensile of	dient Max Gradient of Vertical	Min Damage Radius of Category		
Vertical Movement Calculations	[m] [m]	[%] [%]	in Strain Horizon Displace Curve	ntal Displacement ement Curve e	[m]		
0.0 Tensile horizontal strai	1 0.0 1.4140 Sagging ins are +ve, compressive horizo	0.028709 -0.005 ontal strains are -	0136 0.026759 100." ve.	74E-6 -0.0011344	610.24 0 (Negligible)		
Structure: 1 E Heath Roa	ad Sub-structure: Wall 12						
Vertical Offset Segm from Line for Vertical	ment Start Length Curvature	e Deflection Avera Ratio Horizo Stra	ge Max Max Grad ntal Tensile of in Strain Horizon	dient Max Gradient of Vertical ntal Displacement	Min Damage Radius of Category Curvature		
Movement Calculations [m] 0.0	[m] [m] 1 0.0 3.8190 Sagging	[%] [%] 0.0038634 0.04	Displace Curve [%] 9596 0.051440 -587.4	ement Curve e	[m] 5956.6 1 (Verv		
Tensile horizontal strai	ins are +ve, compressive horizo	ontal strains are -	ve.		Slight)		
Structure: 1 E Heath Roa	ad Sub-structure: Wall 13						
Vertical Offset Segm from Line for Vertical Movement	ment Start Length Curvature	e Deflection Avera Ratio Horizo Stra	ge Max Max Grac ntal Tensile of in Strain Horizon Displace	dient Max Gradient of Vertical ntal Displacement ement Curve	Min Damage Radius of Category Curvature		
Calculations [m] 0.0	[m] [m] 1 0.0 1.5900 Sagging	[%] [%] 0.061587 -0.01	[%] 2950 0.056622 262.3	e 10E-6 0.0024680	[m] 319.73 1 (Very		
Tensile horizontal strai	ins are +ve, compressive horizo	ontal strains are -	ve.		Siight)		
Structure: 1 E Heath Roa	ad Sub-structure: Wall 14	ture Deflection Av	erage Max Max (Gradient Max Gradie	nt Min Damage		
from Line for Vertical Movement		Ratio Hor S	izontal Tensile train Strain Hor: Disp	of of Vertica izontal Displaceme lacement Curve	l Radius of Category ent Curvature		
[m] 0.0	[m] [m] 1 0.0 0.36046 Hoggin	[%] ng 0.0 0	[%] [%] .026253 0.026252 -20	62.46E-6 -50.755E	[m] -6 24751. 0 (Negligible)		
Terreile benirentel etrei	2 0.36046 2.3995 Saggin	ng 0.0048046 -0	.051594 0.010682 0	.0017998 159.46E	-6 3717.2 0 (Negligible)		
		oncar ocraino are					
Structure: 1 E Heath Roa Vertical Offset Segn from Line for	ad Sub-structure: Wall 15 ment Start Length Curvat	ure Deflection Ave Ratio Hori	rage Max Max G zontal Tensile d	radient Max Gradien	t Min Damage . Radius of Category		
Vertical Movement Calculations		St	rain Strain Hori: Displa Cui	zontal Displacemen acement Curve rve	t Curvature		
[m] 0.0	[m] [m] 1 0.0 1.7513 Sagging	[%] [g 0.019304 -0.	%] [%] 013067 0.015512 364	4.60E-6 433.05E-	[m] 6 814.96 0 (Negligible)		
	2 1.7513 0.50368 Hoggin 3 2.2550 2.0755 Saggin	g 0.020635 0. g 0.016178 0.	015321 0.028717 -162 013841 0.023612 -14	2.61E-6 -434.44E- 7.11E-6 683.29E-	6 10355. 0 (Negligible) 6 4730.2 0		
	4 4.3305 1.1837 Hoggin	g 0.023649 0.	011536 0.029241 -129	9.86E-6 683.29E-	(Negligible) 6 4467.8 0 (Negligible)		
	5 5.5142 1.4547 Sagging	g 0.0097220 0.0	090708 0.014738 -103	3.09E-6 642.27E-	6 8553.0 0 (Negligible)		
Tencile benirentel etroi	6 6.9689 1.8001 Hoggin	g 0.022673 -146	.15E-6 0.022582 -87	.023E-6 642.27E-	6 774.61 0 (Negligible)		
Tenstie norizontal strai	ins are tve, compressive norizo	ontai Strains are -	ve.				
Vertical Offset Segn from Line for Vertical	ad Sub-structure: Wall 16 ment Start Length Curvature	e Deflection Avera Ratio Horizo Stra	ge Max Max Gra ntal Tensile of in Strain Horizo	adient Max Gradient f of Vertical	Min Damage Radius of Category		
Movement Calculations	[m] [m]	[%] [%]	Displac Cur [%]	cement Curve ve	[m]		
U.U Tensile horizontal strai	I 0.0 4.0349 Hogging ins are +ve, compressive horizo	ontal strains are -	///6 0.006/185 -250. ve.	.92E-6 336.82E-6	(Negligible)		
0	D	141 E 1 O					
Specific Building Damage I	Results - Critical Values for All Seg	ments within Each Su	b-Structure				
Structure: 2 E Heath Roa	ad Sub-structure: Wall 1	May May Gr	adient Max Gradient	Min Min	Damage Category		
Offset from Ratio Line for Vertical	Horizontal Settleme Strain	ent Tensile o Strain Horiz Displa	f of Vertical Ra ontal Displacement Cu cement Curve (1	adius of Radius of urvature Curvature Hogging) (Sagging)	Samage category		
Important Calculations [m] [%] 0.0 0.0094134	[%] [mm] 0.055295 -595.36E-6 3.4	[%] 751 0.069553 -654	.02E-6 -595.36E-6	[m] [m] - 3312.8	1 (Very Slight)		
Structure: 2 E Heath Roa	ad Sub-structure: Wall 2						
Vertical Deflection Offset from Ratio Line for	Average Max Slope Max Horizontal Settlemen Strain	Max Max Gr nt Tensile o Strain Horiz	adient Max Gradient f of Vertical Ra ontal Displacement Ca	Min Min adius of Radius of urvature Curvature	Damage Category		
Vertical Movement Calculations [m] [%]	[%] [mm]	Displa Cur	cement Curve (1 ve	[m] [m]			
0.0 105.51E-6	705.78E-6 23.295E-6 3.47	51 831.16E-6 -7.1	219E-6 23.295E-6	- 246900.	0 (Negligible)		
Vertical Deflection Offset from Ratio	Average Max Slope Max Horizontal Settlemen	Max Max Gra nt Tensile of	dient Max Gradient of Vertical Rad	Min Min dius of Radius of	Damage Category		
Line for Vertical Movement Calculations	Strain	Strain Horizo Displac Curv	ntal Displacement Cur ement Curve (Ho e	rvature Curvature ogging) (Sagging)			
[m] [%] 0.0 0.010554	[%] [mm] 0.057270 586.63E-6 3.49	[%] 70 0.073246 -672.	35E-6 586.63E-6	[m] [m] - 3047.0 1	(Very Slight)		
Structure: 2 E Heath Roa	ad Sub-structure: Wall 4						

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\bigcirc	Job No. Sheet No. Rev.
Oasys	125836
Southside Lodge	Drg. Ref.
Ground Movement Assessment	Made by Date Checked JT 16-Apr-2018
Vertical Deflection Average Max Slope Max Max Max Gradient Max Gradient Min Min Offset from Ratio Horizontal Settlement Tensile of of Vertical Radius of Radius of Line for Strain Strain Horizontal Displacement Curvature Vertical Displacement Curve (Hogging) (Sagging	Damage Category of re g)
Vertical Deflection Average Max Slope Max Max Gradient Max Gradient Min Min Offset from Ratio Horizontal Settlement Tensile of of Vertical Radius of Radius Line for Strain Strain Horizontal Displacement Curvature Curvat Vertical Displacement Curve (Hogging) (Saggi Movement Curve Rogging)	n Damage Category s of ture ing)
[m] [%] [mm] [%] [m] [m] <td>] 9E+6 0 (Negligible)</td>] 9E+6 0 (Negligible)
Structure: 2 E Heath Road Sub-structure: Wall 5 Vertical Deflection Average Max Slope Max Max Gradient Max Gradient Max Gradient Min Min Offset From Ratio Horizontal Settlement Tensile of of Vertical Radius of Radius of Line for Strain Strain Rorizontal Displacement Curvature Curvature Usertical Movement Curve (Hogging) (Sagging Calculations	Damage Category of re g)
[m] [%] [mm] [%] [m] [m] <td>- 0 (Negligible)</td>	- 0 (Negligible)
Structure: 2 E Heath Road Sub-structure: Wall 6 Vertical Deflection Average Max Slope Max Max Max Gradient Max Gradient Min Min Offset from Ratio Borizontal Strain Strain Line for Strain Strain Borizontal Displacement Curvature Curvature Curvature Curvature Curvature Curvature Curve (Hogging) (Saggin Curve Calculations (m) [%]	Damage Category of ure ng)
0.0 44.142E-6 427.90E-6 17.521E-6 0.29210 474.68E-6 -4.2790E-6 17.521E-6 1.1066E+6	- 0 (Negligible)
Vertical Deflection Average Max Slope Max Max Max Gradient Max Gradient Min Min Offset from Ratio Horizontal Settlement Tensile of of Vertical Radius of Radius Line for Strain Strain Horizontal Displacement Curvature Curvatur Vertical Displacement Curve (Hogging) (Saggin Courve Calculations	Damage Category of ure ng)
[m] [%] [mm] [%] [m] [m] <td>- 0 (Negligible)</td>	- 0 (Negligible)
Structure: 2 E Heath Road Sub-structure: Wall 8 Vertical Deflection Average Max Slope Max Max Max Gradient Max Gradient Min Min Offset from Ratio Horizontal Settlement Tensile of of Vertical Radius of Radiu Line for Strain Strain Borizontal Borizontal Displacement Curve Wovement Curve Curve Curve Curve	n Damage Category s of ture ing)
Calculations [%] [mm] [%] [m] [%] [mm] [m] [m] [m] 0.0 0.0 407.21E-6 -63.568E-6 1.7913 407.30E-6 -4.0721E-6 -63.568E-6 -62.337] 7E+6 0 (Negligible)
Structure: 1 E Heath Road Sub-structure: Wall 9	
Vertical Deflection Average Max Max Max Gradient Max Gradient Min Min I Offset from Ratio Horizontal Slope Settlement Tensile of of Vertical Radius of Radius of Line for Strain Strain Horizontal Displacement Curvature Curvature Vertical Displacement Curve (Hogging) (Sagging) Movement Calculations	Damage Category
[m] [%] [%] [mm] [%] [m] [m]	
Vertical Deflection Average Max Slope Max Max Max Gradient Max Gradient Min Min Offset from Ratio Horizontal Settlement Tensile of of Vertical Radius of Radius Line for Strain Strain Horizontal Displacement Curvature Curvatr Vertical Displacement Curve (Hogging) (Saggin Movement Curve (Hogging) (Saggin	Damage Category of ure ng)
[m] [%] [%] [m] [%] [m] [%] 0.0 0.0015921 0.015669 -193.39E-6 0.59214 0.015967 -157.62E-6 -193.39E-6 15814.	- 0 (Negligible)
Structure: 1 E Heath Road Sub-structure: Wall 11	
Vertical Deriection Average Max Slope Max Max Max Galent Max Galent Max Max Galent Max Galent Min Min Offset from Ratio Horizontal Settlement Tensile of of Vertical Radius of Radius Line for Strain Strain Horizontal Displacement Curvature Curvative Vertical Displacement Curve (Hogging) (Saggin Colselations	of of ure ng)
[m] [%] [mm] [%] [m] [m] <td>.24 0 (Negligible)</td>	.24 0 (Negligible)
Structure: 1 E Heath Road Sub-structure: Wall 12 Vertical Deflection Average Max Slope Max Max Gradient Max Gradient Max Gradient Min Min Offset from Ratio Horizontal Settlement Tensile of of Vertical Radius of Radius Line for Strain Strain Horizontal Displacement Curvature Cu	of of ure ng)
Calculations [%] [%] [mm] [%] [m] <	6.6 1 (Very Slight)
Structure: 1 E Heath Road Sub-structure: Wall 13 Vertical Deflection Average Max Slone Max Max Max Gradient May Gradient Min Min	Damage Category
Offset from Ratio Borizontal Settlement Tensile Description Radius of Radius of Radius of Line for Strain Vertical Strain Strain Strain Borizontal Displacement Curvature Curvature Vertical Vertical Offset from Curve Curve (Bogging) (Sagging Curve Calculations (b) (b) (c)	of Janaye Calegoly re g)
(m)	73 1 (Very Slight)
Structure: 1 E Heath Road Sub-structure: Wall 14 Vertical Deflection Average Max Slope Max Max Max Gradient Max Gradient Min Min Offset from Ratio Horizontal Settlement Tensile of of Vertical Radius of Line for Line for Strain Strain Horizontal Displacement Curvature Curvature Vertical Wovement Curve Curve	Damage Category re g)
Calculations [m] [%] [mm] [%] [m] <	.2 0 (Negligible)
Structure: 1 E Heath Road Sub-structure: Wall 15	Damage Category
Offset from Ratio Horizontal Settlement Tensile of of Vertical Radius of Radius (Radius of Line for Strain Strain Horizontal Displacement Curvature Curvatur Vertical Displacement Curve (Hogging) (Sagging	callegory of IP g)

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Ousys								125	836			
Southside Lodge								Drg. R	ef.			
	Diement As	Sessment						Made b JT	У	Date 16-Api	-2018	Checked
Movement				Curve								
[m] 0.0	[%] [%] 0.023649 0.015	321 683.29E-6	[mm] [%] 1.6983 0.029241	. 364.60E-6	683.29E-6	[m] [r 774.61 8	m] 14.96 0	(Negligibl	e)			
Structure: 1 E	Heath Road Sub	-structure: Wall	1 16									
Vertical D Offset from Line for Vertical Movement	eflection Averaç Ratio Horizon Strai	re Max Slope Ital Se in	Max Max ≥ttlement Tensile Strain	Max Gradient of Horizontal Displacement Curve	Max Gradient of Vertical Displacement Curve	Min I Radius of Rad: Curvature Cur (Hogging) (Sa	Min lius of vature lgging)	Damage Ca	tegory			
Calculations [m] 0.0	[%] 0.0053929 0.0027	1776 336.82E-6	[mm] [%] 0.59718 0.006718	15 -250.92E-6	336.82E-6	[m] 3348.9	[m] - (0 (Negligib	ole)			
Specific Building	g Damage Results -	Critical Segments	within Each Structu	ıre								
Structure Name	Parameter	Critical Sub-Structure	Critical Start Segment	End Curvatur	e Max Slope S	Max Ma Settlement Ten: St:	lax sile Ra rain Ci	Min adius of Ra urvature Cu Hogging) (S	Min dius of rvature agging)	Damage Category		
2 E Heath Road	Max Slope	Wall 5	[m] 1 0.0	[m] 4.5330 Hogging	602.04E-6	[mm] [' 2.0318 0.0	%])44361	[m] 7539.2	[m] - C) (Negligible)		
	Max Settlement Max Tensile	Wall 3 Wall 3	1 0.0 1 0.0	4.5380 Sagging 4.5380 Sagging	586.63E-6 586.63E-6	3.4970 0.0° 3.4970 0.0°	73246	-	3047.0 1 3047.0 1	(Very Slight) (Very Slight)		
	Strain Min Radius of	Wall 7	1 0.0	4.4730 Hogging	599.95E-6	1.7451 0.0	43812	3380.2	- C	(Negligible)		
	(Hogging) Min Radius of Curvature (Sagging)	Wall 3	1 0.0	4.5380 Sagging	586.63E-6	3.4970 0.0	73246	-	3047.0 1	(Very Slight)		
1 E Heath Road	Max Slope	Wall 13	1 0.0	1.5900 Sagging	0.0024680	3.3818 0.0	56622	-	319.73 1	(Very Slight)		
	Max Settlement Max Tensile	Wall 13 Wall 13	1 0.0	1.5900 Sagging 1.5900 Sagging	0.0024680	3.3818 0.03 3.3818 0.0	56622 56622	-	319.73 1 319.73 1	(Very Slight) (Very Slight)		
	Strain Min Radius of Curvature (Hogging)	Wall 15	6 6.9689	8.7690 Hogging	642.27E-6	0.85628 0.03	22582	774.61	- C) (Negligible)		
	Min Radius of Curvature (Sagging)	Wall 13	1 0.0	1.5900 Sagging	0.0024680	3.3818 0.0	56622	-	319.73 1	(Very Slight)		



Aberdeen Birmingham Bristol Dundee Edinburgh Elgin Glasgow Inverness Leeds London Manchester Newcastle upon Tyne Sheffield Sevenoaks Taunton Watford



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