

Highgate School Dyne House and Island Site

Basement Impact Assessment

EXP-REP-404-001

Rev 00

Issue	Date	Reason for Issue	Author	Checked	Approved
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1 Non-Technical Summary

- 1.1.1 The site location is Highgate School, Southwood Lane, Highgate, London, N6 5EE. The site is comprised of two plots: Dyne House and Island, located east and west of Southwood Lane, respectively.
- 1.1.2 The current development / properties on the Dyne House plot comprises the five-storey Dyne House school building with existing one-level basement and the two-storey Gym and Geography Building with no existing basement. Dyne House shares a Party Wall with a residential structure on 16 Southwood Lane.
- 1.1.3 The current development on the Island plot is comprised of a two-storey building with no existing basement. An underground tunnel can be found beneath Southwood Lane which connects the two-storey building to Dyne House. The building shares Party Walls to the west and south with the Central Hall and Big School buildings of Highgate School, respectively.
- 1.1.4 The proposed development works for the Dyne House plot comprises the redevelopment and expansion of Dyne House, the demolition of the existing Gym and Geography Building, excavation of a one- to three-level basement, and construction of a one- to two-storey teaching facility in its place. The Dyne House expansion will involve the excavation of a one-level basement adjacent to the existing basement.
- 1.1.5 The proposed development on the Island plot comprises the demolition of the existing structure, excavation of a one-level basement, and construction of a two-storey structure.
- 1.1.6 The proposed excavations will be supported by embedded retaining walls.
- 1.1.7 Temporary propping will be utilised, prior to proceeding with bulk excavation works. The propping will increase the stiffness of the retention systems during construction and reduce the risk of adversely affecting neighbouring structures and/or third-party assets, due to excessive ground movements.
- 1.1.8 The following assessments are presented in the current document:
- Screening.
 - Scoping.
 - Additional evidence/assessments (as required), including:
 - Slope stability assessment.
 - Hydrogeological assessment.
 - Ground movement assessment (GMA).
 - Construction methodology and management plan.
 - Architectural and structural drawings.
 - Basement Impact Assessment (BIA).
- 1.1.9 The site is generally sloping steeply downwards from west to east, with elevations ranging from approximately +126.0mOD to +111.0mOD.

- 1.1.10 The ground conditions beneath the site vary due to its sloping nature and generally comprise (based on a review of BGS data and site-specific ground investigations):
- Made Ground: to a depth of 1.0 to 1.5 metres below ground level (mBGL).
 - Bagshot Formation: to a maximum depth of 11.5mBGL. The thickness of this stratum reduces from west to east and is not observed under the eastern sections of the site.
 - Claygate Member: The thickness of the Claygate Member has not been proven by site-specific ground investigation works. Based on BGS boreholes in the vicinity of the site, the Claygate Member is expected to be at least 20m thick and is underlain by the London Clay Formation, which is present to depths of approximately 129mBGL.
- 1.1.11 The hydrogeological conditions at the site, relevant to the proposed development, are anticipated to comprise:
- Local bodies of water within the Made Ground and superficial deposits flowing from west to east.
 - A hydrostatic pore water pressure distribution within the London Clay Formation.
- 1.1.12 The BIA has assessed land stability, and the impacts of the proposed development on neighbouring structures will be limited to *Category 1 – Very Slight*, in accordance with the Burland Scale.
- 1.1.13 The BIA has identified that construction of the proposed rear basement is likely to result in a local increase in groundwater head of approximately 2m, with this maximum increase coincident with the upstream side of the retaining wall. In the areas surrounding the proposed basement, this effect is lesser. Considering the nature of the existing buildings, anticipated foundations, and depths to the groundwater table, the alterations to the local groundwater flow regime due to the proposed works are expected to have a limited effect on the neighbouring properties.

- Slope stability assessment.
 - Hydrogeological assessment.
 - Ground movement assessment (GMA).
 - Construction methodology and management plan.
 - Architectural and structural drawings.
- Basement Impact Assessment.

2.2 Credentials

- 2.2.1 The BIA has been reviewed by Alex Nikolic. Alex is a Chartered Member of the Institution of Civil Engineers (MICE) with 20 years of industry experience in geotechnical design and construction of ground engineering works. Alex has attained post-graduate qualifications, including a Master of Science in Soil Mechanics (MSc DIC) from the Imperial College London and a Master of Studies (MSt Cantab) in Sustainable Development from the University of Cambridge. Alex was formerly the Director of Ground Engineering at Buro Happold.
- 2.2.2 The BIA has been approved by Tony Suckling. Tony is a Chartered Fellow of the Institution of Civil Engineers (FICE) and a Fellow of the Geological Society (FGS). Tony has a Master of Science (MSc) in Geotechnical Engineering from City University. Tony is a Registered Ground Engineering Professional (RoGEP) with almost 30 years of industry experience in geotechnical design and construction of ground engineering works. Tony has previously held the position of Technical Director for Balfour Beatty Ground Engineering Ltd. Tony has been a past Chairman of the Federation of Piling Specialists Technical Committee and a Board Member of the Deep Foundation Institute Europe. Tony was part of the steering group for CIRIA C760 Guidance on Embedded Retaining Wall Design.

2.3 Sources of Information

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

- *Site Investigation Report* prepared by Geotechnical & Environmental Associates Ltd (GEA), dated September 2015.
- *Highgate School Dyne House Hydrogeological Desk Study Report* produced by A-squared, dated July 2015.
- *Highgate School Dyne House III RIBA Stage 2 Report* produced by Expedition, dated October 2018.
- *Dyne House 3 & Island Site Construction Methodology and Management Plan* prepared by Blue Sky Building (BSB), dated November 2019.
- *Drainage Strategy Report* produced by Expedition, dated January 2020.
- Architectural drawings produced by Hopkins Architects Ltd (Hopkins), dated March 2017.
- Public domain geological mapping from British Geological Society Geology of Britain Viewer and Borehole Viewer.

2.4 Existing Development

- 2.4.1 The development site is located along Southwood Lane, London, N6 5EE. The Dyne House plot has approximate dimensions of 170m-long by 30m-wide, while the Island plot has approximate dimensions of 25m-long by 15m-wide, covering areas of approximately 0.56ha and 0.02ha, respectively.

- 2.4.2 The Island plot is relatively flat, with existing ground surface elevations of approximately +126.0mOD. The existing ground level at the Dyne House plot varies from approximately +126.0mOD in the west to +111.0mOD in the east.
- 2.4.3 The site is within a wider setting and is founded on a slope, with decreasing ground level towards the east. The average slope angle of the Dyne House plot is approximately 8°, excluding the relatively flat Parade Grounds in the eastern section of the site.
- 2.4.4 The Dyne House plot is currently occupied by various structures of Highgate School. Dyne House, on the western end of the plot, is a five-storey reinforced concrete frame structure with a one-level basement. The Gym and Geography building, located at the centre of the plot, is a two-storey 'L'-shaped masonry structure with no basement. Both the Dyne House and the Gym and Geography Building are currently occupied. A 1m- to 2m-deep disused swimming pool is located directly south of the Gym and Geography Building. The eastern section of the plot is covered in asphalt and is currently used as a sports and recreation area.
- 2.4.5 The Island plot is comprised of a two-storey structure with no basement, directly adjacent to the Central Hall and Big School buildings of Highgate School. It is assumed to be currently occupied. An existing underground link tunnel to Dyne House can be accessed through the plot.

2.5 Neighbouring Properties and Infrastructure

- 2.5.1 The existing Dyne House structure shares a Party Wall along a portion of its northern boundary with the residential property at 16 Southwood Lane. The structure occupying the Island plot shares Party Walls on its western and southern boundaries with the Highgate School Central Hall and Big School buildings, respectively. The Gym and Geography Building shares no Party Walls with other structures and is detached on all sides.
- 2.5.2 The closest buildings to the Dyne House plot are 16 Southwood Lane, a three-storey residential building to the north, 12 Southwood Lane, a three-storey residential building to the south, and 23A & 23B Kingsley Place, a three-storey residential building to the north.
- 2.5.3 The closest buildings to the Island plot are the Highgate School Central Hall, Big School, and Science Buildings, three- to four-storey school buildings to the west, south, and north, respectively.
- 2.5.4 There are several listed buildings within the zone of influence of the proposed development, including the Highgate School Old School Building (Grade II Listed), Nos. 4 to 22 Southwood Lane (Grade II Listed), Highgate School Chapel (Grade II Listed), and the Highgate Tabernacle (Grade II Listed).
- 2.5.5 Southwood Lane separates the two plots, bounding the Dyne House plot to the east and the Island plot to the west.
- 2.5.6 An existing Thames Water sewer is present at the site and runs in a north-south direction between Dyne House and the Gym and Geography Building. At the time of writing, Thames Water has been engaged regarding this project in order to determine scheme proposals which effectively safeguard this asset.

2.5.7 Other asset owners with existing underground services that may be impacted by the proposed development include the following:

- London Borough of Haringey and the Greater London Authority.
- Thames Water Ltd – Clean water and wastewater
- BT (BT Group Plc) and Virgin Media Ltd – Telecoms.
- UK Power Networks Ltd – Electricity distribution.
- Cadent Gas Ltd and Southern Gas Networks Plc – Gas.

2.5.8 Asset protection teams for the assets listed in 2.5.7 will be engaged as the design of the proposed development continues. Where necessary, separate GMAs will be prepared to meet design assurance requirements.

2.6 Proposed Development

2.6.1 The proposed development sketches and drawings are included in Appendix B.

2.6.2 The developments are planned to be for private educational use.

2.6.3 The existing Dyne House structure will be redeveloped and extended towards Southwood Lane. This extension includes the excavation of a one-level basement connected to the existing basement and the construction of a five-storey reinforced concrete frame structure adjacent to the existing Dyne House. The average excavation depth to formation level is 4.0m (+121.0mOD). The existing Auditorium located in the eastern portion of Dyne House will not be modified.

2.6.4 The Gym and Geography Building will be demolished and a one- to two-level structure with one- to three-level basement, referred to as the 'Rear Block' will be constructed in its place. Excavation depths for the proposed basement range between 4.0mBGL and 11.0mBGL due to the sloping nature of the site (approximate basement formation level at +107.0mOD). This proposed structure will be connected to the redeveloped Dyne House via a proposed one-level bridge link structure.

2.6.5 The Island plot development involves the demolition of the existing structure on-site, excavation of a one-storey basement, and construction of a two-storey reinforced concrete structure. The average excavation depth to formation level at this plot is 4.5mBGL (+121.0mOD).

2.6.6 The proposed excavation perimeters will be retained by embedded retaining walls.

2.6.7 Outline structural arrangements and a Construction Methodology and Management Plan prepared by Expedition and Blue Sky Building respectively are presented in Appendix D.

2.6.8 Temporary props / shoring will be installed prior to proceeding with bulk excavation works. Such measures will increase the system stiffness of the retaining walls and reduce the risk of adversely affecting neighbouring structures and third-party assets, due to excessive ground movement.

2.6.9 The basements will be reduced to the formation level using standard means and methods of excavation.

3 Screening

3.1 Subterranean (Groundwater) Flow Screening Flowchart

Question		Response	Details
1a.	Is the site located directly above an aquifer?	Yes	Yes, the site is underlain by the Bagshot Formation and Claygate Member. Both strata are Secondary 'A' Aquifers.
1b.	Will the proposed basement extend beneath the water table surface?	Yes	Monitoring data from the GEA <i>Site Investigation Report</i> indicates that the proposed Rear Block basement in the east of the Dyne House site will extend beneath the water table surface. All other proposed basements will not extend beneath the water table surface.
2.	Is the site within 100m of a watercourse, well (used / disused) or potential spring line?	Yes	The boundary between the Bagshot Formation and Claygate Member is a potential spring line.
3.	Will the proposed basement development result in a change in the proportion of the hard surfaced / paved areas?	Yes	There will be an increase in the amount of hardstanding area present.
4.	As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and / or SUDS)?	No	The proposed development will maintain the existing surface water discharge conditions.

3.2 Stability Screening Flowchart

Question		Response	Details
1.	Does the existing site include slopes, natural or man-made, greater than 7 degrees (approximately 1 in 8)?	Yes	The Dyne House plot includes slopes of approximately 8 degrees. The Island plot is generally flat.
2.	Will the proposed re-profiling or landscaping at the site change slopes at the property boundary to more than 7 degrees (approximately 1 in 8)?	No	There are no re-profiling / landscaping works proposed that will increase the slopes existing on site to gradients greater than 7 degrees.
3.	Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately 1 in 8)?	Yes	Adjacent properties have a similar sloping topography to the site.
4.	Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately 1 in 8)?	Yes	The site is founded on a wider hillside setting, with the main Highgate School grounds immediately west of the site forming a localised plateau. Ground generally slopes away from the school grounds. There may be potential slopes with gradients greater than 7 degrees.
5.	Is the London Clay the shallowest strata at the site?	No	BGS information and previous site-specific ground investigation proved the presence of the Bagshot Formation and Claygate Member overlying the London Clay.
6.	Will any trees be felled as part of the development and/or are any works proposed within any tree protection zones where trees are to be retained?	Yes	Trees will be felled in order to enable the construction of the Dyne House front extension and to allow site access from Kingsley Place.
7.	Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?	Yes	The Claygate Member and London Clay strata can be classified as having a high volume change potential and hence can lead to seasonal shrink-swell subsidence where buildings are founded in desiccated soils. However, there is no specific evidence of subsidence having been experienced on site or in the immediate surrounding area.
8.	Is the site within 100m of a watercourse or a potential spring line?	Yes	The boundary between the Bagshot Formation and Claygate Member is a <i>potential</i> spring line.

9.	Is the site within an area of previously worked ground?	Yes	BGS 1:50,000 geological mapping does not show the site to be located in an area of previously worked ground. Historical maps show that the eastern section of the site has been subjected to filling and regrading. Borehole data found in the <i>GEA Site Investigation Report</i> also shows a significant thickness of made ground in the eastern sections of the site.
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	Yes, the site is underlain by the Bagshot Formation and Claygate Members, which are classified as Secondary 'A' Aquifers. Monitoring data from GEA indicates that the proposed basement will extend beneath the water table surface, particularly for the Rear Block eastern sections of the site. Dewatering is likely to be required during construction however this will be limited/mitigated by means of an embedded wall cut-off in the short-term condition.
11.	Is the site within 5m of a highway or pedestrian right of way?	Yes	Southwood Lane runs north to south through the site, between the Island and Dyne House plots. Kingsley Place also bounds the site in the north.
12.	Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes	The differential depth of the foundations of the existing development relative to neighbouring properties will increase, especially in the case of the Island plot.
13.	Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No	There are no tunnels passing through the site. It is noted that there is a Thames Water sewer onsite, running north-south immediately east of the existing Dyne House auditorium.

3.3 Surface Water and Flooding Screening Flowchart

Question		Response	Details
1.	As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No	The existing route is expected to be incorporated into the scheme.
2.	Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	Yes	There will be an increase in the amount of hardstanding area present.
3.	Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	No	The proposed basement is not anticipated to change the surface water discharged from the property. New surface water attenuation methods, such as attenuation tanks, landscaping, and green roofs, are proposed to manage the discharge, as detailed in the <i>Highgate School Dyne House III RIBA Stage 2 Report</i> .
4.	Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	No change in surface water quality is anticipated.
5.	Is the site in an area identified to have surface water flood risk according to either the Local Flood Risk Management Strategy or the Strategic Flood Risk Assessment or is it at risk from flooding, for example because the proposed basement is below the static water level of nearby surface water feature?	No	The Envirocheck Report found in the GEA <i>Site Investigation Report</i> indicates that the site has a very low flood risk. It is noted that there are areas of low to high flood risk surrounding the eastern section of the site. These are located downslope of the site and are not expected to affect the site's flood risk potential.

3.4 Non-Technical Summary of Screening Process

3.4.1 The screening process identifies the following issues to be carried forward to scoping for further assessment:

- The proposed Rear Block basement formation level will extend beneath the groundwater surface.
- Slopes greater than 7 degrees within and surrounding the site
- There may be a risk of shrink-swell subsidence in the Claygate Member and London Clay due to removal of trees and seasonal variations in groundwater table.

- The site is founded on some areas of previously worked ground related to the regrading of the eastern sections.
- Proposed excavations are adjacent to public highways and neighbouring structures.
- The proposed basement will increase the differential depth of foundations relative to neighbouring properties.
- A Thames Water sewer passes directly through the site.
- The impermeable site area will increase due to the proposed development

3.4.2 The other potential concerns considered within the screening process have been demonstrated to be not applicable or not significant when applied to the proposed development.

4 Scoping

4.1 Subterranean Flow: The proposed Rear Block basement formation level will extend beneath the groundwater surface.

Hazards

4.1.1 The groundwater regime at the site may be affected by the proposed basements.

Potential Impacts

4.1.2 Basement construction may result in damming of the aquifers and groundwater flow regime.

4.1.3 Changes in groundwater head resulting in stress changes or slope instability within the ground.

4.1.4 Ground movements associated with the stress changes in the ground may cause damage to existing properties.

Mitigating Factors

4.1.5 Based on data from site-specific groundwater monitoring conducted by GEA, the proposed basements of the Dyne House front extension and Island structure will not extend below the water table.

Assessments and Further Actions

4.1.6 A site-specific hydrogeological study, discussed in Section 6.1, was conducted in 2015 to assess the impact of proposed works on the groundwater regime. The assessment shows that construction of the proposed basement may cause an approximate rise in groundwater level of 2.0m immediately behind the proposed basement.

4.1.7 It is noted that this assessment did not consider the effects of the Dyne House front extension and Island basements on the groundwater regime. Site-specific groundwater monitoring data indicates that the water table at the site is located beneath these proposed basements, so they are not expected to significantly alter the results. The modelled groundwater table was also higher than observed during monitoring.

4.1.8 The results of this assessment can be considered as conservative and no further reanalysis of the hydrogeological site conditions is necessary at this stage.

4.2 Stability: Slopes greater than 7 degrees within and surrounding the site

Hazards

4.2.1 The site includes slopes greater than 7 degrees.

- 4.2.2 The site is founded on a greater hillside setting which may contain areas with slope gradients greater than 7 degrees.

Potential Impacts

- 4.2.3 Slope instability within the site and neighbouring sites.
- 4.2.4 Potential for larger slope failure systems, including re-activation of pre-existing slides as a result of the proposed works.

Mitigating Factors

- 4.2.5 No signs of instability or ground movements were observed during various site walkovers.
- 4.2.6 The proposed embedded retaining wall and associated temporary propping measures adopted for any basement extension works will be designed to provide adequate restraint to any potential slope instability surrounding the site.

Assessments and Further Actions

- 4.2.7 A slope stability assessment, discussed in Section 6.2, has been carried out based on indicative slope geometry provided by the project team. The assessment shows that adequate slope stability is maintained.

4.3 Stability: Risk of shrink-swell subsidence in the Claygate Member and London Clay due to removal of trees and seasonal variations in groundwater table.

Hazards

- 4.3.1 Seasonal shrinking and swelling (subsiding and heaving) of the Claygate Member and London Clay Formation underneath the site.
- 4.3.2 Swelling (heaving) of the Claygate Member and London Clay Formation due to removal of trees.

Potential Impacts

- 4.3.3 Damage to the proposed new foundation / retention systems and neighbouring properties.

Assessments and Further Actions

- 4.3.4 The western sections of the site have the Bagshot Formation overlying the Claygate Member and London Clay Formation. This stratum is not typically susceptible to seasonal shrink-swell.
- 4.3.5 Trees will mostly be removed in areas underlain by the Bagshot Formation and thus, this is not anticipated to cause ground swelling / heave.
- 4.3.6 Site-specific ground investigation data from GEA indicates the presence of near-surface desiccated clay layers in the eastern sections of the site. No construction is anticipated in these areas. Furthermore, the proposed basements and foundations will extend beneath these desiccated layers.

- 4.3.7 Where necessary, substructure elements requiring mitigation will be detailed accordingly with void formers or proprietary heave mitigation products.

4.4 Stability: The site is founded on some areas of previously worked ground related to the regrading of the eastern sections.

Hazards

- 4.4.1 Potential for Made Ground/reworking natural strata with more adverse geotechnical properties to be present beneath the site.

Potential Impacts

- 4.4.2 Exceedances of the ultimate limit states of the proposed new foundation / retention systems.
- 4.4.3 Exceedances of the serviceability thresholds of the proposed development due to unexpected settlements.

Mitigating Factors

- 4.4.4 The regrading works were focused on the eastern section of the site where no construction is anticipated.
- 4.4.5 Site-specific ground investigation indicates that the proposed basements will be founded in natural strata.

Assessments and Further Actions

- 4.4.6 The presence of previously worked ground will not have a significant impact on the proposed works.

4.5 Stability: Proposed excavations are adjacent to public highways and neighbouring structures.

Hazards

- 4.5.1 Deep excavations carried out adjacent to public highways and neighbouring structures.

Potential Impacts

- 4.5.2 Collapse of the excavation and associated impact on surrounding assets.
- 4.5.3 Damage to the road surface or buried services within the public highway due to excessive ground movements.
- 4.5.4 The proposed development will increase the differential foundation depths with neighbouring properties. Construction and excavation works will cause ground movements that may damage these properties.

Mitigating Factors

- 4.5.5 The proposed basements abutting neighbouring properties and adjacent to Southwood Lane are limited to a single storey basement. The risk profile for these basements are expected to be proportional to the excavation depth.
- 4.5.6 Basement excavation works are located more than 5m from Kingsley Place.
- 4.5.7 Numerous basements of similar depth and scale have been successfully constructed throughout London within similar geological conditions and urban settings.

Assessments and Further Actions

- 4.5.8 A ground movement assessment has been carried out to determine the impact of proposed excavation works on the neighbouring properties, discussed in Section 7.1.4. The assessment shows a maximum damage classification of *Category 1 – Very Slight* for the neighbouring properties, in accordance with the Burland Scale.
- 4.5.9 A ground movement assessment will be performed to determine the impact of the proposed excavation works on the buried utilities and other third-party assets surrounding the site. The proposed assessment will confirm anticipated damage categories in accordance with performance limits set by the relevant third-party asset protection teams.
- 4.5.10 Implement appropriate ground movement monitoring during construction to assess the performance of the earth retention system (baseline monitoring pre-commencement of the works should be carried out to determine any potential existing movement trends).
- 4.5.11 Design of the temporary propping shall be carried out by an appropriately experienced and qualified specialist / engineer in accordance with relevant Eurocodes/British Standards, Codes of Practice, and industry standards. The design should allow for appropriate surcharging behind the embedded retaining wall to reflect the type and intensity of traffic and building loads.

4.6 Stability: A Thames Water sewer passes directly through the site.

Hazards

- 4.6.1 A Thames Water sewer is present at a shallow depth passing immediately east of the existing Dyne House auditorium. The proposed Bridge Link is located above this sewer.

Potential Impacts

- 4.6.2 Damage to the sewer from the ground movements induced by the proposed works.

Assessments and Further Actions

- 4.6.3 A preliminary ground movement assessment has been performed to determine the potential impact of the proposed excavation works on the Thames Water sewer. The initial assessment indicates limited damage impact that is within the performance limits/thresholds set by Thames Water.

4.6.4 Thames Water has been engaged by the project team and is aware of the proposed development. Liaison with Thames Water will continue as the design of the basements progresses.

4.7 Surface Water and Flooding: The impermeable site area will increase due to the proposed development.

Hazards

4.7.1 The proposed development will increase impermeable site area.

Potential Impacts

4.7.2 Risk of flooding in the development.

Assessments and Further Actions

4.7.3 A SuDS strategy has been proposed for the site to manage the surface water discharge, as outlined in the *Drainage Strategy Report*.

4.7.4 This strategy currently involves mitigation measures to control the amount of surface water discharge, such as green roofs, drainage/attenuation and landscaping.

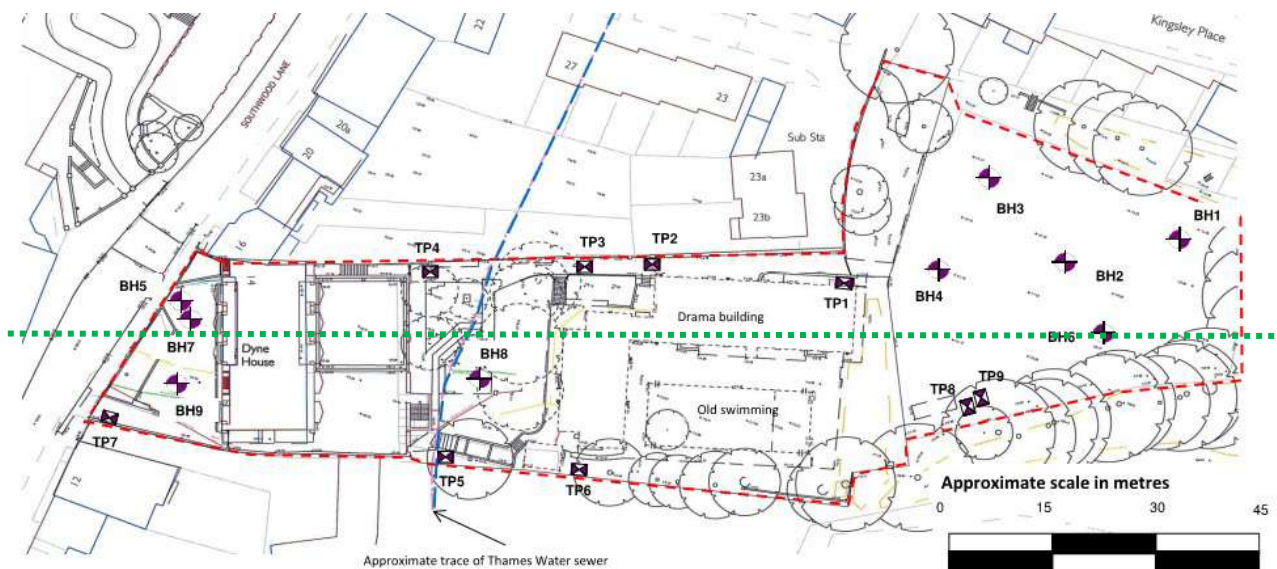
5 Site Investigation

5.1.1 A site-specific ground investigation was carried out in March to May 2015 by GEA.

5.1.2 The information from the investigation provided to the project team included the following:

- 5no. windowless sampler boreholes to a maximum depth of 6.0mBGL.
- 4no. cable percussive boreholes to a maximum depth of 24.0mBGL.
- 7no. hand excavated trial pit exposing the existing foundations and boundary walls.
- 2no. mechanically excavated trial pits for soakage tests.
- 3no. groundwater monitoring standpipes to 6.0mBGL, 8.0mBGL, and 13.0mBGL.
- 5no. vibrating wire piezometers depths of 16.0mBGL and 21.0mBGL in BH7 and 11.5mBGL to 23.5mBGL in BH8.
- Geotechnical in-situ and laboratory testing.
- Geo-environmental laboratory testing.
- Groundwater and gas monitoring.

5.1.3 The locations of the ground investigation positions are shown in Figure 5.1.



Section in Figure 5.2 marked by green dotted line.

Source: *Site Investigation Report* prepared by GEA, dated September 2015.

Figure 5.1: Exploratory hole locations of the site-specific ground investigation undertaken in 2015.

5.1.4 The site stratigraphy varies from west to east, as shown in Figure 5.2. There is a reduction in thickness of the Bagshot Formation from west to east, following the slope of the ground surface. In the eastern area of the site, the Bagshot Formation is no longer observed, and Made Ground is observed to directly overlie the Claygate Member.

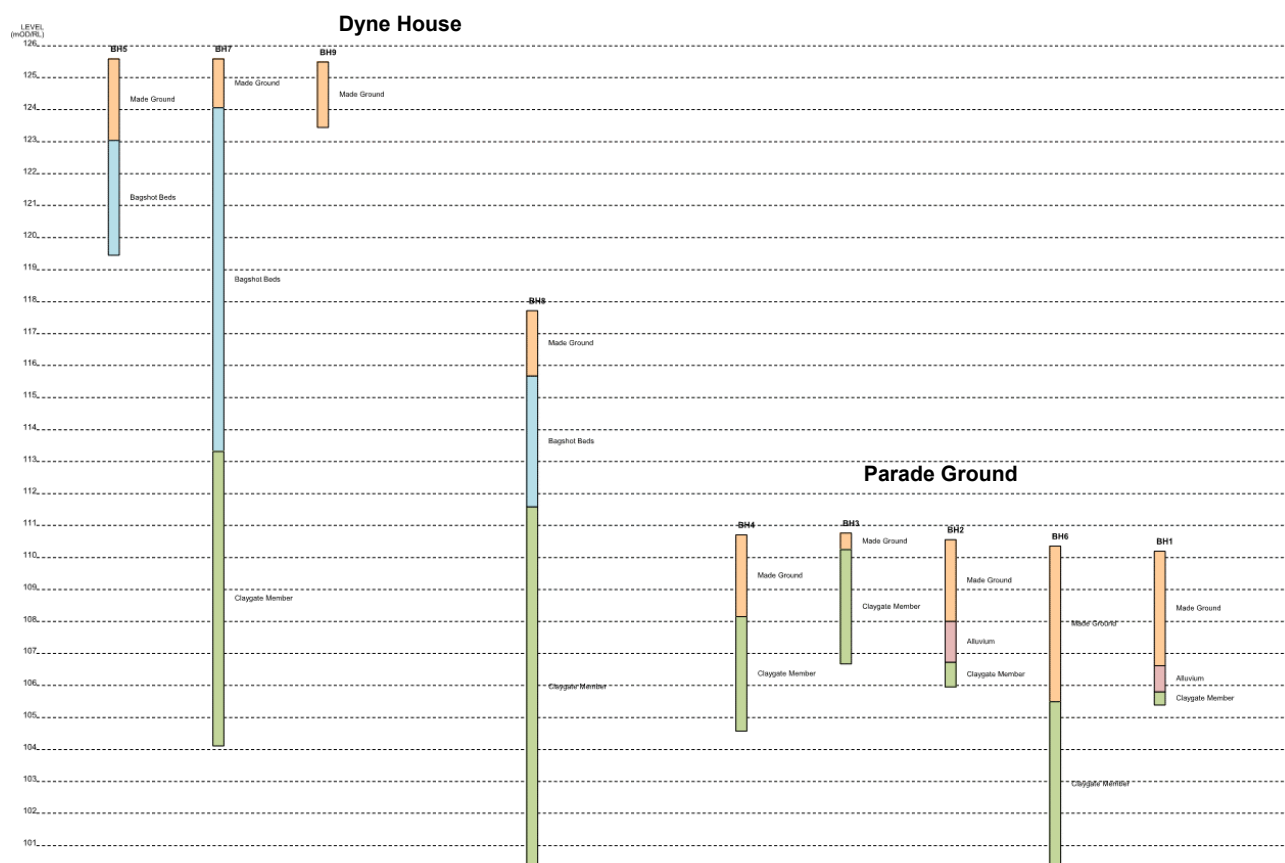


Figure 5.2: Indicative cross-section through site-specific boreholes (west to east)

5.1.5 The encountered ground conditions are summarised in Table 5.1.

Table 5.1: Encountered stratigraphic profile

Stratum	Depth Encountered (mBGL)	Thickness (m)	Description
Made Ground	0.0 ^[1]	1.0 to 1.5	Topsoil and anthropogenic deposits of undifferentiated clays, sands and gravels.
Bagshot Formation ^{[1][2]}	1.5 ^[3]	0 to 11.5	Firm light brown to brown silty sandy gravelly CLAY / SAND with sand partings.
Claygate Member ^[1]	1.0 to 13.0 ^[4]	Proven to depths of 15.0m	- Firm to stiff brown / orange slightly silty CLAY with occasional silt partings. - Stiff to very stiff fissured brown CLAY with occasional bands of silty sand.

- Ground surface elevation varies from approximately +126.0mOD in the west to +111.0mOD in the east.
- Depth and thickness of the Bagshot Formation and Claygate Member strata vary due to the sloping nature of the site.
- The Bagshot Formation stratum reduces in thickness from west to east and is not present over the eastern sections of the site.
- The Bagshot Formation is only encountered in the western sections of the site, from approximately 1.5mBGL (+124.5mOD).
- The Claygate Member is encountered at depths ranging from approximately 1.0mBGL (+110.0mOD) in the east to 13.0mBGL (+113.0mOD) in the west.

5.1.6 Standpipe monitoring encountered a perched water table in the Bagshot Formation and Claygate Member, as shown in Figure 5.3.

Table 1			
Date	Depth To Groundwater (mbgl) [Level (m OD)]		
	BH6	BH7	BH8
	Claygate Member	Bagshot Formation	Bagshot Formation
15/4/2015	5.65 [105.15]	7.75 [117.95]	n/a
27/5/2015	5.13 [104.87]	8.12 [117.58]	n/a
9/6/15	5.35 [105.45]	8.16 [117.54]	2.30 [115.70]

Source: *Site Investigation Report* prepared by GEA, dated September 2015.

Figure 5.3: Standpipe monitoring data

5.1.7 Vibrating wire piezometer monitoring also encountered a perched water table in the Bagshot Formation and Claygate Member, as shown in Figure 5.4.

Table 2					
VWP monitoring data (9/6/15)					
	BH7		BH8		
Depth of installations (level)	16.00 (109.70)	21.00 (104.70)	11.50 (106.5)	17.50 (100.5)	23.50 (94.50)
Geological formation	Claygate	Claygate	Claygate	Claygate	Claygate
Approximate pore water pressure (kPa)	65 to 71	65	45	104	155
Approximate depth to water (m) (Level m OD)	9.38 to 8.77 (116.32 to 116.93)	14.38 (111.32)	6.92 (111.08)	6.9 (111.10)	7.7 (110.3)

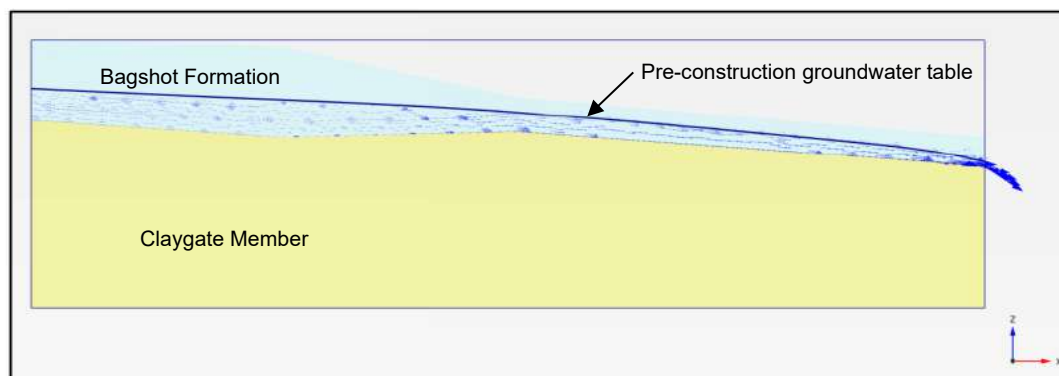
Source: *Site Investigation Report* prepared by GEA, dated September 2015.

Figure 5.4: Vibrating wire piezometer monitoring data

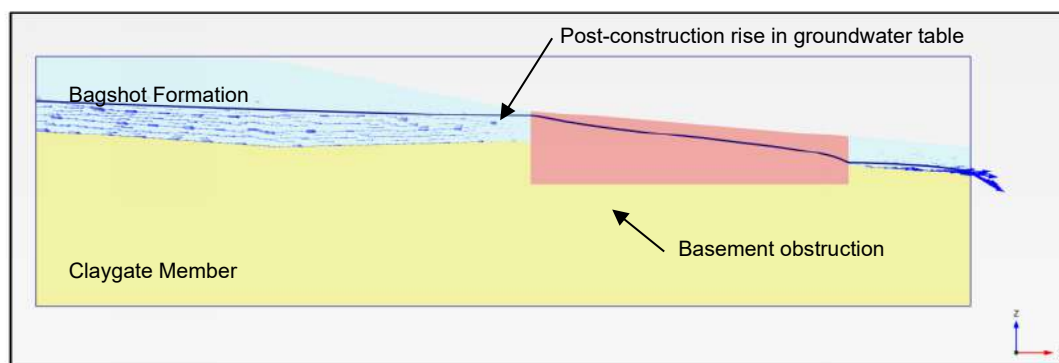
6 Additional Assessments

6.1 Hydrogeological Assessment

- 6.1.1 This assessment has been carried out by A-squared in 2015 to address Scoping Point 4.1.
- 6.1.2 The 3-dimensional flow of groundwater within the development site has been modelled using PLAXIS 3D to determine the effects of the proposed construction works on the hydrogeological regime.
- 6.1.3 The assessment has been performed adopting a moderately conservative ground model based on results of a desk-based review and bounding the groundwater table observed during subsequent site-specific ground investigation conducted by GEA.
- 6.1.4 The model geometry was based on previous indicative sections through the proposed substructure provided by the project team. It is noted that the model did not include the basements for the Island structure and Dyne House front extension (which are not considered to have a direct impact on the findings of the study in relation to current redevelopment proposals).
- 6.1.5 Figure 6.1 shows a sample output from the PLAXIS 3D showing the pre- and post-construction groundwater table elevation.



(a) Pre-construction groundwater table elevation



(b) Post-construction groundwater table elevation

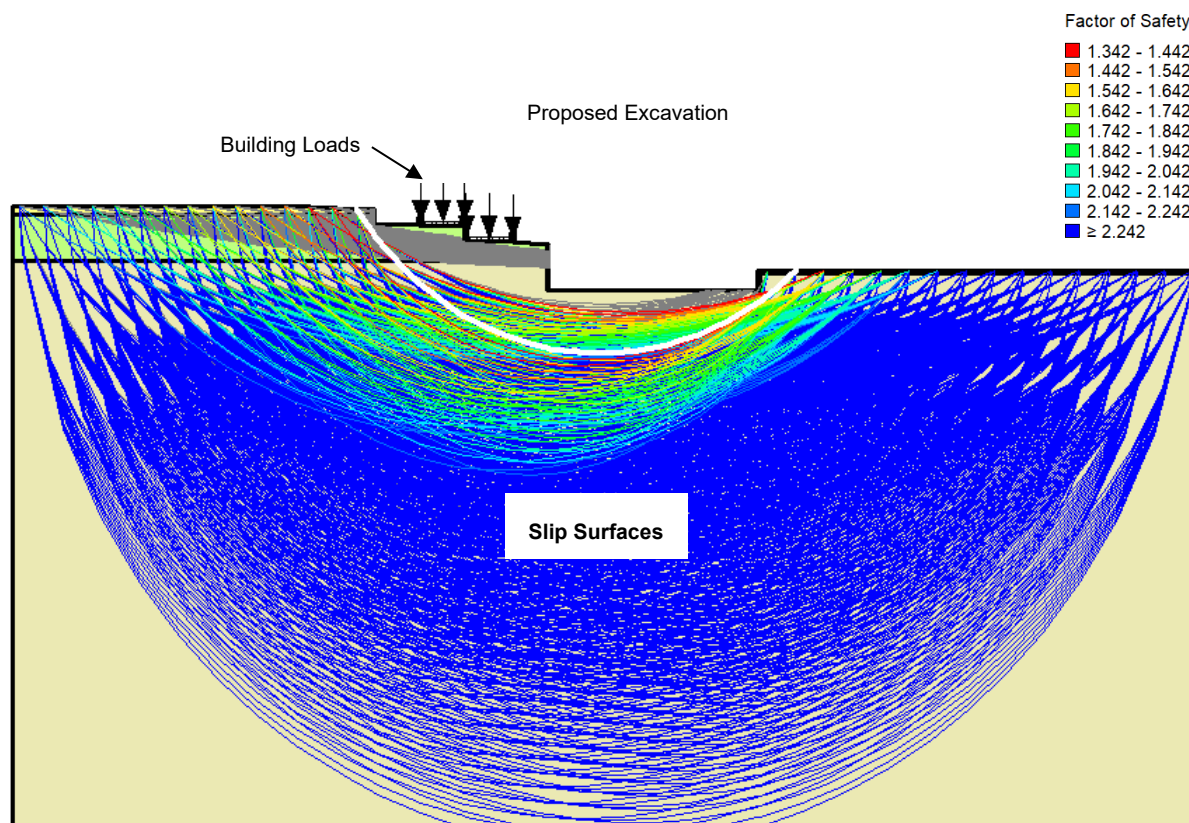
Source: *Highgate School Dyne House Hydrogeological Desk Study Report* prepared by A-squared, dated July 2015

Figure 6.1: Example cross-section of PLAXIS 3D output from hydrogeological assessment (west to east)

- 6.1.1 The assessments of the groundwater flow indicate that construction of the proposed basement may result in a rise in groundwater table surface of approximately 2.0m behind the proposed basement.
- 6.1.2 The proposed basement should be designed to mitigate the effects of any potential heave and uplift pressures from the low permeability Claygate Member.
- 6.1.3 The maximum head increase of approximately 2.0m is observed to be coincident with the flow obstruction (i.e. the upstream basement wall). In the areas surrounding the proposed basement, the extent of the groundwater head rise is lesser. As flow is permitted around the basement, this effect reduces with lateral offset from the basement perimeter.
- 6.1.4 Indicatively, the range of increase in groundwater head in the vicinity of the neighbouring properties is between 0.5m and 0.9m. Considering the nature of the existing buildings, anticipated foundations, and depths to the groundwater table, the change to the local groundwater regime is expected to have a limited effect on the neighbouring properties.
- 6.1.5 The results of this assessment can be considered as conservative due to the modelling assumptions and boundary conditions adopted in the analytical simulation. No further reanalysis is considered to be required at this stage.
- 6.1.6 Further assessment is proposed to determine the effect of a rise in groundwater level on any nearby below-ground structures and utilities, should they be present.

6.2 Slope Stability Assessment

- 6.2.1 This assessment has been carried out to address Scoping Point 4.2.
- 6.2.2 The profile of the sloping ground surface of the Dyne House plot has been modelled using the GeoStudio SLOPE software package to determine its stability condition following construction of the proposed development.
- 6.2.3 The assessment considers both local and larger slip mechanisms that may impact the site and surrounding areas.
- 6.2.4 Soil parameters have been selected based on results from the site-specific ground investigation conducted by GEA.
- 6.2.5 Eurocode 7 Design Approach 1 Combination 2 (EC7 DA1-C2) partial safety factors have been applied to all modelled soils.
- 6.2.6 The model geometry is based on architectural plans provided by the project team.
- 6.2.7 The building loads from the existing Dyne House building have been modelled.
- 6.2.8 The assessments of the profile indicate the slope is stable following the proposed works, with Eurocode 7 Factor of Safety (FoS) values greater than 1, which corresponds to an additional stability over and above the soil strength and loading partial factors applied in the EC7 DA1-C2 analysis. An indicative image showing the slip surfaces assessed is presented in Figure 6.2.



All slip surfaces satisfy Eurocode 7 ultimate limit state criteria.

Figure 6.2: Indicative plot of the slip surfaces assessed in GeoStudio SLOPE for the slope following the proposed works on the Dyne House plot

6.2.9 The analysis of the slope has not highlighted any hazards or instability issues and no further assessment is required.

6.3 Thames Water Ground Movement Assessment

6.3.1 A preliminary ground movement assessment has been conducted to address Scoping Point 4.6.

6.3.2 The impact of the proposed works on the Thames Water sewer running through the site has been assessed using the Oasys Pdisp and Xdisp software packages, in general accordance with typical thresholds for the type of structure concerned (which will be confirmed through engagement with the asset protection teams).

6.3.3 The GMA has been carried out in accordance with CIRIA C760 and takes into account the construction methodology and site-specific ground and groundwater conditions.

6.3.4 The sewer deformations induced by ground movements have been assessed in the long-term condition, accounting for time-dependent heave and load redistribution.

6.3.5 Soil parameters have been selected based on results from the site-specific ground investigation conducted by GEA.

- 6.3.6 The location of the Thames Water sewer is assumed based on the *Highgate School Dyne House III RIBA Stage 2 Report*. The sewer is modelled as a 450mm diameter vitrified clay pipe at ground level.
- 6.3.7 It is noted that the *Highgate School Dyne House III RIBA Stage 2 Report* specifies that selected sections of the existing sewer will be realigned and replaced with a 450mm cast iron pipe.
- 6.3.8 The preliminary assessment indicates that the induced strains, joint rotation and joint pull-out are within Thames Water criteria.
- 6.3.9 This assessment will be refined as the substructure design progresses and will take cognisance of both temporary and permanent works proposals.

7 Construction Methodology / Engineer Statements

7.1 Outline Temporary and Permanent Works Proposals

- 7.1.1 The outline basement construction proposal is to construct the basement using a *bottom-up* methodology.
- 7.1.2 Standard means and methods of excavation are expected to be suitable to excavate the basement, based upon the ground conditions proven through previous ground investigation works. This will be confirmed by the upcoming site-specific ground investigation.
- 7.1.3 The basement excavation will be restrained by embedded retaining walls.
- 7.1.4 Design of the retaining walls and temporary propping shall be carried out in accordance with the relevant Eurocodes, non-conflicting codes of practice, and associated design best practice.

7.2 Ground Movement and Damage Impact Assessment

- 7.2.1 A GMA has been carried out in accordance with CIRIA C760 and takes into account the construction methodology and site-specific ground and groundwater conditions.
- 7.2.2 All structures / properties within the zone of influence of the proposed development have been assessed.
- 7.2.3 The following assumptions have been made within the GMA:
- The buildings included in the GMA are assumed to be founded on ground surface.
 - The walls of the above-mentioned buildings are assumed to behave as equivalent beams.
- 7.2.4 The ground movements resulting from the works comprise deformations arising from the following mechanisms:
- Installation of the embedded retaining walls.
 - Bulk excavation works.
- 7.2.5 The following structures were assessed, having been identified as falling within the zone of influence of the proposed development:
- Highgate School – Big School Building
 - Highgate School – Science Building
 - Highgate School – Link Building
 - Highgate School – Central Hall
 - 10 Southwood Lane
 - 12 Southwood Lane
 - 14 Southwood Lane
 - 16 Southwood Lane

- 18 Southwood Lane
- 20 Southwood Lane
- 22 Southwood Lane
- Highgate Tabernacle
- 23-27 Kingsley Place
- 23A & 23B Kingsley Place
- 28 Kingsley Place

7.2.6 In accordance with the Burland Scale, the potential damage impacts are assessed not to be greater than *Category 1 – Very Slight*.

7.2.7 The expected ground movements resulting from the proposed works are proposed to be limited by means of temporary propping, which is planned to be installed during the basement excavation phase.

7.2.8 The following mitigation measures are proposed to reduce ground movements and damage:

- Design of the embedded retaining wall and temporary propping measures shall be carried out in accordance with the relevant Eurocodes, non-conflicting codes of practice, and associated design best practice.
- Retaining wall construction to be performed by an experienced ground engineering contractor.
- Frequent monitoring of neighbouring properties to be carried out during excavation, to validate ground movement predictions against reality.
- Development of a monitoring-trigger-action plan that identifies trigger levels, responsible personnel and actions to be followed in the event of a trigger level exceedance.
- Incorporating stiff, high level props into the temporary works design of the basement excavation, so as to provide a high stiffness wall. Design details regarding minimum wall flexural stiffness, prop stiffness and arrangement, shall be defined as part of detailed design development.
- Designated areas for stacking and storing materials behind the embedded retaining wall should be identified. These should be located away from sensitive structures. The design of the retaining wall should incorporate an appropriate surcharge load to the rear of the wall, to capture effects of stacking and storing materials, vehicle traffic, etc.
- The GMA did not consider the impact of the proposed development on existing buried utilities surrounding the site. It is expected that these assets will be assessed (if applicable to the proposed works) following engagement of the asset owner and direction from the asset protection team, with regards to establishing limiting performance criteria. In the instance of Thames Water, a preliminary assessment has been performed for the existing sewer passing through the site, as discussed in Section 6.3.

7.3 Control of Construction Works

7.3.1 A preliminary Construction Management Plan (*Construction Methodology and Management Plan*) for the site has been developed by BSB which covers the items in this section in detail.

- 7.3.2 Work method statements and logistics strategies developed for main stages of the construction works, outlining the means and methods of safely carrying out the works. Key risks and associated mitigation measures are also detailed.
- 7.3.3 Details of temporary propping and temporary works, required to ensure structural stability is maintained throughout demolition and excavation.
- 7.3.4 Construction traffic management plans.
- 7.3.5 Environmental considerations, including site waste management and noise / vibration / dust mitigation.

8 Basement Impact Assessment

8.1 General

8.1.1 The Conceptual Site Model (CSM) is described below:

- The ground conditions of the site generally comprise Made Ground overlying the Bagshot Formation and Claygate Member. The Bagshot Formation thins from west to east and is not observed in the eastern sections of the site.
- Groundwater monitoring indicates finite bodies of local perched groundwater were observed to be present within the Bagshot Formation and Claygate Beds.
- The site is within a wider hillside setting and is founded on a slope, with increasing ground level towards the west.
- The current development on the Dyne House plot comprises the five-storey Dyne House building with one-level basement and the two-storey Gym and Geography Building with no underground space. Dyne House shares a Party Wall with 16 Southwood Lane in the north. The Gym and Geography Building is detached on all sides.
- The current development on the Island plot comprises a two-storey structure with no below ground space / basements. The structure shares Party Walls with the Highgate School Central Hall and Big School buildings to the west and south, respectively.
- The proposed development works on the Dyne House plot comprise the redevelopment of Dyne House and expansion towards Southwood Lane through the construction of a five-storey extension with one-level basement. The Gym and Geography Building will be demolished and a one- to two-level structure with one- to three-level basement will be constructed in its place. A one-level bridge structure linking this new development with the existing Dyne House will also be constructed.
- The Island plot proposed development works involve the demolition of the existing structure and construction of a two-storey structure with one-level basement.
- Neighbouring buildings are assumed to be founded near surface.
- The distance from the proposed basement excavation works to the nearest highway/footpath is approximately 3m.
- The proposed development may result in limited impact/cosmetic damage to the neighbouring buildings. Any potential damage will be mitigated by appropriate construction means and methods (such as temporary propping/shoring and controlled excavation operations).

8.2 Land Stability / Slope Stability

8.2.1 There is a risk of movement and damage to the development due to volumetric changes of the Claygate Member and London Clay Formation. Evidence of seasonal shrink-swell has been observed during site-specific ground investigations. The scheme design development will consider heave mitigation measures (if appropriate) and the relevant soil structure interaction mechanisms.

8.2.2 A GMA has concluded that ground movements caused by excavation and construction of the proposed development will be limited. The upper bound damage category for surrounding structures within the zone of influence of the proposed development has been assessed as *Category 1 – Very Slight*, in accordance with the Burland Scale.

- 8.2.3 Assessments of the stability of the adjacent slope and hillside have concluded that no instability is induced by the development.
- 8.2.4 Preliminary assessments of the impact of the proposed works on the Thames Water sewer running through the site indicate that induced movements do not exceed Thames Water criteria.
- 8.2.5 The BIA has concluded that the risks to the adjacent properties, slopes and infrastructure (including ultimate and serviceability limit state considerations) is limited and will be mitigated in a reasonable fashion as part of design development.

8.3 Hydrology and Groundwater Flooding

- 8.3.1 The BIA has concluded that there is a low risk of groundwater flooding.
- 8.3.2 The BIA has identified that construction of the proposed rear basement is likely to result in a local increase in groundwater head of approximately 2m, with this maximum increase coincident with the upstream side of the retaining wall. In the areas surrounding the proposed basement, this effect is lesser. Considering the nature of the existing buildings, anticipated foundations, and depths to the groundwater table, the alterations to the local groundwater flow regime due to the proposed works are expected to have a limited effect on the neighbouring properties.

8.4 Hydrology, Surface Water Flooding and Sewer Flooding

- 8.4.1 The BIA has concluded that there is a very low to low risk of surface water flooding.
- 8.4.2 The BIA has concluded that there are no significant impacts to the wider hydrological environment.

Appendix A. Site investigation report

SITE INVESTIGATION & BASEMENT IMPACT ASSESSMENT REPORT

Dyne House
Highgate School
London N6

Client: Highgate School

Engineer: A-squared Studio

J15093

September 2015



Document Control

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EXECUTIVE SUMMARY

This executive summary contains an overview of the key findings and conclusions. No reliance should be placed on any part of the executive summary until the whole of the report has been read. Other sections of the report may contain information that puts into context the findings that are summarised in the executive summary.

BRIEF

This report describes the findings of a site investigation carried out by Geotechnical and Environmental Associates Limited (GEA) on the instructions of A-squared Studio, on behalf of Highgate School, with respect to the refurbishment and extension of the existing Dyne House structure. Additional accommodation and teaching space will be provided by a new extension to the front of Dyne House including a 4 m deep basement and construction of buildings at the rear of the Dyne House including another basement which will be approximately 13.5 m deep. The purpose of the investigation has been to determine the ground conditions, to provide information for the design of new foundations and retaining walls, to assess the impact that the basement will have on the hydrogeology of the surrounding area, and to provide a preliminary assessment of the presence of contamination. The report also includes a Basement Impact Assessment (BIA) to assist with the planning application; the site is located within the London Borough of Haringey but for the purpose of the BIA the approach followed by the London Borough of Camden has been adopted.

SITE HISTORY

The historical maps indicate the site to have been occupied by a school for its entire development history. The existing layout of the school is shown to have been constructed between maps dated 1935 and 1952 and the existing Dyne House structure was built in the 1960s. The historical maps indicate that the playing field in the east had been subject to re-levelling by the placement of fill between 1935 and 1952. Several pond features were identified within 120 m of the site on the historical maps. A tank was formerly located at the front of Dyne House and was removed in the last 10 to 15 years.

GROUND CONDITIONS

The investigation has generally confirmed the expected ground conditions in that, below a typically moderate, but locally significant thickness of made ground, the Bagshot Formation was found to be underlain by the Claygate Member, which extended to the maximum depth of the investigation, of 24.00 m (94.00 m OD). An increased thickness of made ground was recorded in the east of the site, varying from 0.50 m (110.70 m OD) to 4.0 m (106.80 m OD), reflecting levelling of this area in the 1950s. Elsewhere the made ground extended to depths of 2.3 m (123.40 m OD) and 2.0 m (116.00 m OD) and comprised grey and brown sandy gravelly clay with occasional cobbles of concrete, tile, coal, ash, clinker, metal, slate and redundant pipes. Alluvium was encountered in some boreholes drilled in the east of the site and extended to depths of between 3.75 m (107.25 m OD) and 4.75 m (106.05 m OD). The Bagshot Formation typically comprised firm brown silty sandy gravelly clay with partings of coarse sand to buff silty sand and extended to depths of 6.0 m (112 m OD) and 15.0 m (110.70 m OD). The Claygate Member comprised firm becoming stiff orange-brown or brown and grey silty sandy clay with partings of clayey sand and extended to the maximum depth of the investigation, of 24.00 m (94.00 m OD). Water strikes and groundwater monitoring information generally indicate groundwater to be at a level of about 116 m OD in the west of the site, lowering to around 105 m OD in the east. Contamination testing has indicated elevated concentrations of arsenic, lead and polycyclic aromatic hydrocarbons in samples of made ground tested.

RECOMMENDATIONS

Given the depth of the proposed basements, a bored pile retaining wall is likely to be the most appropriate means of supporting the excavation and some form of groundwater control will be required as water has been measured within the proposed depth of the basement excavations. The redevelopment will not introduce any pathways to the measured contamination, however localised remediation will be required in any new soft landscaping areas. It would be prudent to conduct further investigation around the former tank or carry out a watching brief during construction.

BASEMENT IMPACT ASSESSMENT

It has been concluded that the impacts identified can be mitigated by appropriate design and standard construction practice. Groundwater is expected to be present within the deeper basement excavation and a ground movement assessment and slope stability analysis will allow the design to account for any potential issues.

Part 1: INVESTIGATION REPORT

This section of the report details the objectives of the investigation, the work that has been carried out to meet these objectives and the results of the investigation. Interpretation of the findings is presented in Part 2.

1.0 INTRODUCTION

Geotechnical and Environmental Associates Limited (GEA) has been commissioned by A-squared Studio, on behalf of Highgate School, to carry out a desk study and ground investigation at Dyne House, Southwood Lane, London, N6 5EE. The report also includes a Basement Impact Assessment (BIA) to assist with the planning application; the site is located within the London Borough of Haringey but for the purpose of the BIA the approach followed by the London Borough of Camden has been adopted as it is now widely known and is considered to provide a robust approach to the issues of potential concern.

GEA has previously worked at the site in 2008 and information from the previous investigation (report ref J08021 dated 4 April 2008) is included where necessary.

1.1 Proposed Development

It is understood that consideration is being given to the redevelopment and extension of Dyne House. Construction of additional accommodation and teaching space will include an extension at the front of Dyne House and a 4 m deep basement plus the construction of buildings to the rear of Dyne House which will include a 13.5 m deep basement extending to a level of 103.66 m OD.

This report is specific to the proposed development and the advice herein should be reviewed once the development proposals have been finalised.

1.2 Purpose of Work

The principal technical objectives of the work carried out were as follows:

- ❑ to check the history of the site with respect to previous contaminative uses;
- ❑ to determine the ground conditions and their engineering properties;
- ❑ to provide advice and information with respect to the design of suitable foundations and retaining walls;
- ❑ to assess the impact of the proposed basement on the local hydrogeology;
- ❑ to determine the feasibility of shallow soakaways;
- ❑ to determine the foundation details of shallow foundations;
- ❑ to provide an indication of the degree of soil contamination present; and
- ❑ to assess the risk that any such contamination may pose to the proposed development, its users or the wider environment.

1.3 Scope of Work

In order to meet the above objectives, a desk study was carried out followed by a ground investigation. The desk study comprised:

- a review of available historical Ordnance Survey (OS) maps;
- a review of readily available geology maps and hydrogeology maps; and
- a walkover survey of the site carried out in conjunction with the fieldwork.

In the light of this desk study an intrusive ground investigation was carried out which comprised, in summary, the following activities:

- three boreholes advanced by cable percussive methods to a maximum depth of 24.00 m;
- a series of boreholes advanced to a maximum depth of 6.00 m by window sampling methods;
- installation of three groundwater monitoring standpipes within the boreholes, to depths of between 6.00 m and 13.00 m;
- installation of five vibrating wire piezometers to depths of between 11.50 m and 23.50 m;
- a series of hand excavated trial pits to investigate the existing foundations;
- a mechanically excavated trial pit to allow a soakage test to be carried out;
- standard penetration tests (SPTs), carried out at regular intervals in the cable percussion borehole, to provide additional quantitative data on the strength of the soils;
- testing of selected soil samples for contamination and geotechnical purposes; and
- provision of a report presenting and interpreting the above data, together with our advice and recommendations with respect to the proposed development.

The report includes a contaminated land assessment which has been undertaken in accordance with the methodology presented in Contaminated Land Report (CLR) 11¹ and involves identifying, making decisions on, and taking appropriate action to deal with, land contamination in a way that is consistent with government policies and legislation within the United Kingdom. The risk assessment is thus divided into three stages comprising Preliminary Risk Assessment, Generic Quantitative Risk Assessment, and Site-Specific Risk Assessment.

1.3.1 Basement Impact Assessment

The work carried out also includes a Hydrological and Hydrogeological Assessment and Land Stability Assessment (also referred to as Slope Stability Assessment), all of which form part of the BIA procedure specified in the London Borough of Camden (LBC) Planning Guidance

1 *Model Procedures for the Management of Land Contamination* issued jointly by the Environment Agency and the Department for Environment, Food and Rural Affairs (DEFRA) Sept 2004

CPG4² and their Guidance for Subterranean Development³ prepared by Arup (“the Arup report”). The aim of the work is to provide information on surface water, land stability and groundwater and in particular to assess whether the development will affect neighbouring properties or groundwater movements and whether any identified impacts can be appropriately mitigated by the design of the development.

1.3.2 Qualifications

The land stability element of the Basement Impact Assessment (BIA) has been carried out by Martin Cooper, a BEng in Civil Engineering, a chartered engineer (CEng), member of the Institution of Civil Engineers (MICE), and Fellow of the Geological Society (FGS) who has over 20 years’ specialist experience in ground engineering. The subterranean (groundwater) flow assessment has been carried out by John Evans, MSc in Hydrogeology, Chartered Geologist (CGeol) and Fellow of the Geological Society of London (FGS). The surface water and flooding assessment has been carried out by Rupert Evans, a hydrologist with more than ten years consultancy experience in flood risk assessment, surface water drainage schemes and hydrology / hydraulic modelling. Rupert Evans is a Chartered Environmentalist, Chartered Water and Environmental Manager and a Member of CIWEM.

The assessments have been made in conjunction with Steve Branch, a BSc in Engineering Geology and Geotechnics, MSc in Geotechnical Engineering, a chartered geologist (CGeol) and Fellow of the Geological Society (FGS) with 25 years’ experience in geotechnical engineering and engineering geology.

All assessors meet the qualification requirements of the Council guidance.

1.4 Limitations

The conclusions and recommendations made in this report are limited to those that can be made on the basis of the investigation. The results of the work should be viewed in the context of the range of data sources consulted and the number of locations where the ground was sampled. No liability can be accepted for information in other data sources or conditions not revealed by the sampling or testing. Any comments made on the basis of information obtained from the client or other third parties are given in good faith on the assumption that the information is accurate; no independent validation of such information has been made by GEA.

2.0 THE SITE

2.1 Site Description

The site is located approximately 0.75 km southwest of Highgate London Underground Station, and fronts onto Southwood Lane to the west. It is bounded to the north, east and along part of the southern boundary by houses with associated garden areas, whilst what appears to be a storage yard borders the site to the southeast. The site may be additionally located by National Grid Reference 528432, 187532 and is shown on the map extract overleaf.

A walkover of the site was carried out by a geotechnical engineer from GEA at the time of the fieldwork. The site covers an irregular area measuring approximately 170 m west-east by

2 London Borough of Camden Planning Guidance CPG4 *Basements and lightwells*

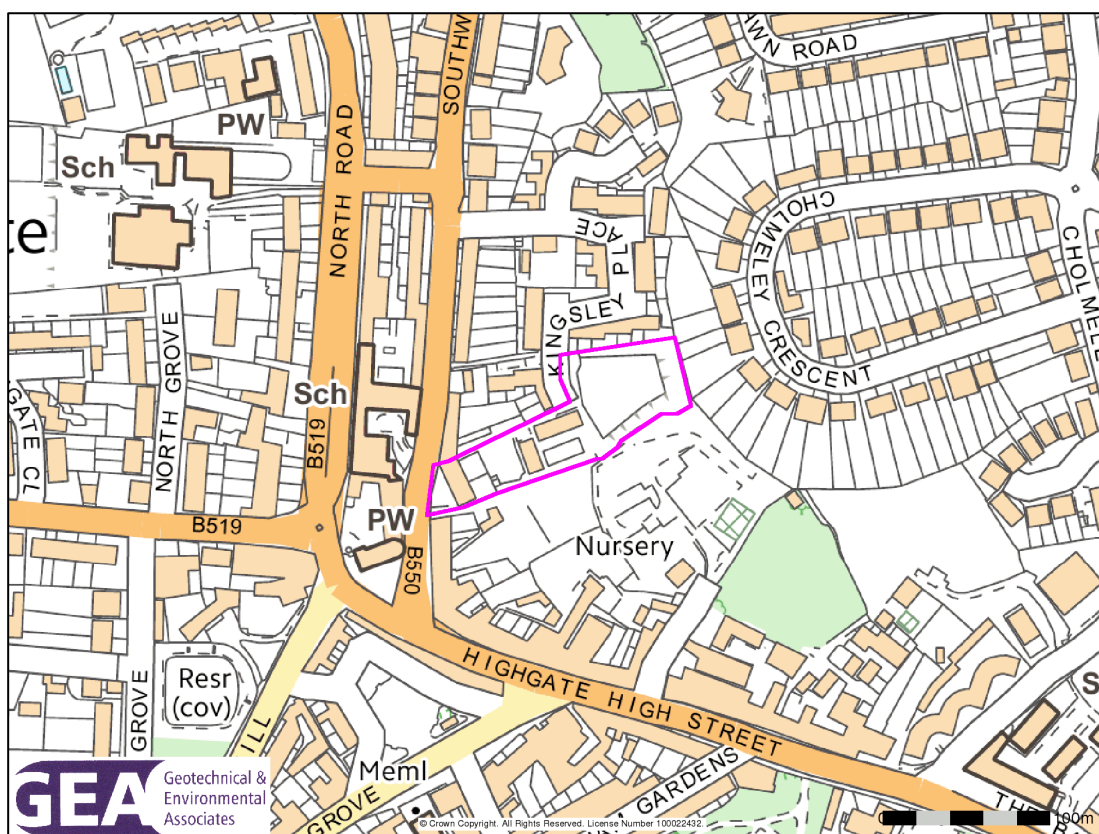
3 Ove Arup & Partners (2010) *Camden geological, hydrogeological and hydrological study. Guidance for Subterranean Development*. For London Borough of Camden November 2010

70 m north-south at its maximum extents and is currently occupied by several school buildings and a playground located in the east. The site slopes relatively steeply down towards the east and south, with the highest point at the western boundary with Southwood Lane, at a level of about 125.80 m OD, reducing to a level of about 111.20 m OD at the playground.

Dyne House is a five-storey block of classrooms with a single level basement and fronts onto Southwood Lane to the west with a small parking area directly in front of the building. A driveway off Southwood Lane leads to an area of parking along the southern boundary of the site.

The two-storey Drama Department building is located in the centre of the site and forms an approximately 'L' shaped building. A disused, 1 m to 2 m deep, outdoor swimming pool is located to the south of this building and was partially filled with vegetation, discarded wood and fencing.

Between Dyne House and the Drama Department building is an area of hardstanding and a steeply sloping bank and retaining wall. The area between Dyne House and the Drama Department building is at a level of about 117.70 m OD. The playground in the east is tarmac covered and a gate provides vehicular access to the playground from Kingsley Place to the north.



Due to the sloping nature of the site there are numerous retaining walls within the site and along the boundary. The northern boundary wall, to the west of Kingsley Place, is a retaining wall varying from 1 m to 3 m high, with the ground to the north at a higher elevation.

A small area of soft landscaping is present at the front of Dyne House and with the exception of vegetated banks along the boundaries the site is essentially all hard covered.

There is a series of semi-mature deciduous trees in the centre of the site which are about 15 m to 18 m high. Parts of the southern boundary are almost entirely covered with semi-mature deciduous trees ranging from about 5 m to 15 m in height and several other trees are located around the playground in the east of the site. A Tree Survey Report has been produced for the site by Arbtech and detailed information is contained within their report dated 10 April 2015.

Anecdotal information from the school suggests that there was formerly an underground heating oil tank located at the front of Dyne House which has recently been removed. Some parts of the pipework are still present within the basement at the front of Dyne House, but the buried pipes that connected to the tank are understood to have been removed at the same time as the tank.

Dyne House forms part of a larger area occupied by Highgate School and buildings on the western side of Southwood Lane are also occupied by the school. The two sites are connected by an underpass which enters the Dyne House basement in the northwestern corner of the site.

2.2 Site History

The site history has been researched by reference to internet sources and historical Ordnance Survey (OS) maps obtained from the Envirocheck database.

The earliest map studied, dated 1864, shows a building on the westernmost part of the site which appears to be labelled as Cholmeley School, a small outbuilding and deciduous trees or possibly an orchard are shown in the centre of the site whilst the eastern part is shown as open land with trees. Houses fronting onto Southwood Lane are shown to the north and south of the site whilst other surrounding land is typically shown as fields. A chapel is shown about 40 m west of the site and a clay pit is shown about 200 m northeast of the site. Four circular features or possible ponds are shown within 20 m to 120 m of the site, towards the north, east, southeast and south of the site.

Cholmeley School was re-labelled as Cholmeley House between 1870 and 1896, and between 1896 and 1915 two buildings were constructed in the centre of the site, along with an outbuilding in the north. The existing housing to the east was constructed between 1915 and 1935. During the same period, Southwood Lodge was constructed to the north and the land immediately adjacent to the north of the site had been subject to levelling and the nearby ponds had also been infilled during this time.

Between 1935 and 1952 the buildings in the centre of the site had been redeveloped with what appears to be the existing building, including the swimming pool adjacent to the southern boundary and the playing field in the east had reportedly been levelled by the placement of fill. Cholmeley House was renamed Dyne House by 1952 and between 1962 and 1968 the original house was redeveloped with the existing building and the entire site is shown in the current layout on the 1968 map.

Southwood Lodge was demolished and redeveloped with the existing housing at some time between 1962 and 1968, whilst the adjacent land to the south continued to be labelled as a nursery.

A Thames Water sewer crosses the site at an assumed depth of approximately 2 m, to the east of Dyne House and the approximate surface trace is shown on the site plan in the appendix.

2.3 Other Information

A search of public registers and databases has been made via the Envirocheck database and relevant extracts from the search are appended. Full results of the search can be provided if required.

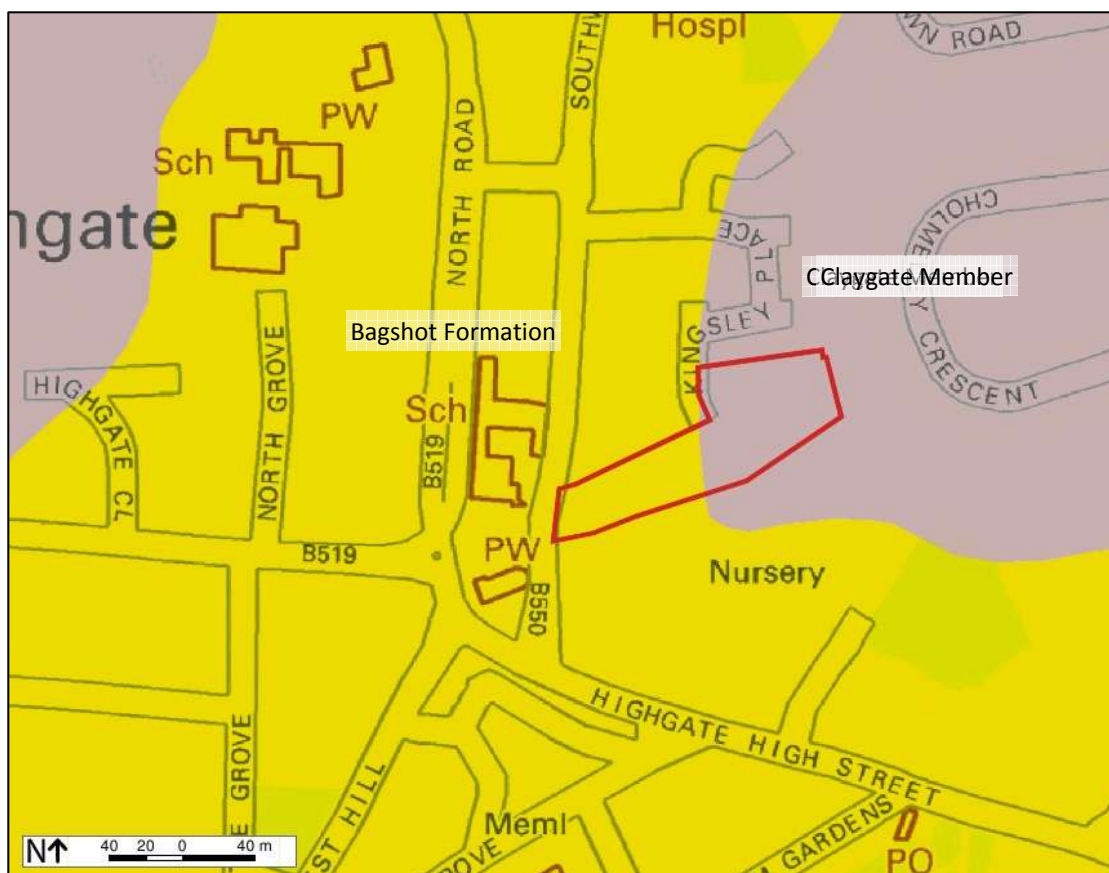
The Envirocheck report has indicated no landfill sites, waste management or waste transfer sites located within 1 km of the site.

Additionally, there have been no pollution incidents to controlled waters within 500 m of the site.

The site is not within an area shown by the Environment Agency to be at risk from flooding from rivers or the sea and does not lie within any known areas of sensitive land use.

Reference to records compiled by the Health Protection Agency (formerly the National Radiological Protection Board) indicates that the site falls within an area where less than 1% of homes are affected by radon emissions and therefore radon protective measures will not be necessary.

2.4 Geology



The extract above of the British Geological Survey map of the area (sheet 256) indicates that the western part of the site is underlain by the Bagshot Formation, overlying the Claygate

Member, whilst the Claygate Member outcrops at the surface in the eastern part of the site, and is in turn underlain by the London Clay Formation. The geology in this area is generally approximately horizontally bedded such that the boundary between the geological formations roughly follows the ground surface contour lines. The boundary of the Bagshot Formation and Claygate Member shown on the map above is at a level of between about 113.50 m OD and 111.00 m OD and the Claygate Member extends to a level of between 95 m OD and 90 m OD.

A borehole drilled by the BGS on Hampstead Lane, generally referred to as the Hampstead Heath borehole, to a depth of 66.74 m (61.97 m OD), about 2.3 km southwest of the site at National Grid Reference 526455, 186890, found the Bagshot Formation to extend to a level of 109.71 m OD and penetrated the full thickness of the Claygate Member. This borehole found the Claygate Member to extend to a level of 93.71 m OD and in the lower 5 m to 10 m of the Claygate Member, it encountered yellowish brown silt interbedded with occasional sand and clay with varying quantities of silt, sand and clay. A band of limestone was encountered between 97.06 m OD and 96.76 m OD. The London Clay was encountered at a level of 93.71 m OD and comprised an initial layer of clayey slightly sandy silt with occasional layers of silty clay extending to a depth of 42.92 m (85.82 m OD) which was underlain by layers of fissured grey clay, silty clay and clayey silt and extended to a depth of 66.74 m (61.97 m OD).

The British Geological Society Lexicon describes the Bagshot Formation as pale yellow-brown to pale grey or white, locally orange or crimson, fine to coarse grained sand that is frequently micaceous and locally clayey, with sparse glauconite and sparse seams of gravel. The sands are commonly cross-bedded but some are laminated. Thin beds and lenses of laminated pale grey to white sandy or silty clay or clay ('pipe-clay') occur sporadically, becoming thicker towards the top of the formation. According to the British Geological Society memoir, the Claygate Member comprises alternating beds of clayey silt, very silty clay, sandy silt and glauconitic silty fine sand. The lower part of the Claygate Member is generally more bioturbated. A bed of calcareous concretions is present near the base in many places.

The London Clay Formation is homogenous, slightly calcareous silty clay to very silty clay, with some beds of clayey silt grading to silty fine grained sand.

The 2008 GEA borehole was drilled from a level of about 118.00 m OD in the centre of the site and encountered the expected ground conditions, in that below a moderate thickness of made ground, the Bagshot Formation was underlain by the Claygate Member which extended to the full depth of the borehole. The made ground comprised brown silty slightly sandy clay with brick fragments and gravel and extended to a depth of 1.0 m. The Bagshot Formation initially comprised loose pale brown very clayey silty medium to coarse sand with occasional fine to medium gravel and layers of orange-brown silty very sandy clay to a depth of 4.0 m, which was underlain by firm orange-brown silty very sandy clay with fine to coarse angular to rounded gravel, partings of grey silt and layers of very clayey silty sand to a depth of 6.0 m (112 m OD). The Claygate Member initially comprised firm becoming stiff dark grey silty slightly sandy clay with partings of orange-brown silty sand to a depth of 8.0 m, which was in turn underlain by stiff becoming very stiff dark grey silty fissured clay to a depth of 11.0 m. Below 11.0 m, very stiff dark grey silty slightly sandy fissured clay was encountered to a depth of 11.5 m and underlain by medium dense dark greenish grey very clayey silty sand to a depth of 12.5 m. Beneath the sand horizon, the Claygate Member comprised very stiff silty very sandy clay and very clayey sand, to the maximum depth investigated of 15.5 m. A claystone was encountered at a depth of 12.5 m within this horizon.

An inflow of groundwater was encountered at a depth of 4.2 m and subsequently rose to a depth of 3.8 m.

2.5 Hydrology and Hydrogeology

The Bagshot Formation and Claygate Member are classified as Secondary 'A' Aquifers, meaning they have 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 as defined by the Environment Agency (EA). The London Clay Formation is classified as Unproductive Strata with soils that have a low permeability and negligible significance to local water supply, as defined by the EA.

Spring lines can be present at the interface of the Bagshot Formation and the Claygate Member, and to a much lesser extent at a lower level at the boundary between the Claygate Member and the underlying, essentially impermeable London Clay. These springs have been the source of a number of London's "lost" rivers, notably the Fleet, Westbourne and Tyburn, which all rose on Hampstead Heath.

The nearest surface water feature to the site is located 339 m to the south of the site which is a pond in Waterlow Park. The site is not within an area at risk from flooding as defined by the EA.

The historical maps indicate several ponds within the vicinity of the site and the boundary between the Bagshot Formation and Claygate Member is located on the site which can be a source of springs. It is likely that any springs in the vicinity of the site would have drained towards the southeast, east or northeast, based on the local topography. Reference to Appendix 4, Map 3.1 in the Haringey Draft Basement Policy⁴ indicates that a number of tributaries of Cholmeley Brook originated on or close to the eastern part of the site and flowed eastwards. Historically⁵, an eastern tributary of the Fleet originated near Kenwood House, Highgate, which drained into man made ponds before crossing what is now Highgate West Hill toward Swain's Lane, which is southwest of the site, adjacent to Waterlow Park. The Fleet flowed in a southerly direction where it ultimately joined the River Thames near Blackfriars Bridge.

Groundwater is likely to be present within the Bagshot Formation sand and is likely to flow in a generally easterly direction, following topographic contours. Groundwater within the Claygate will also flow toward the east, however at a significantly lower rate than in the Bagshot Formation. Any groundwater flow within the London Clay will be at a very slow rate, due to its negligible permeability. The permeability will be predominantly secondary, through fissures in the clay. Published data indicates the horizontal permeability of the London Clay to generally range between 1×10^{-11} m/s and 1×10^{-9} m/s. Vertical permeability within the Claygate is also likely to be slow in view of the presence of layers of clay, but horizontal permeability is likely to be one or two orders of magnitude higher.

The site is predominantly covered in hardstanding, such that infiltration of rain water into the ground beneath the site is limited to isolated areas of soft landscaping in the west of the site, the centre of the site and the ramp down to the playground. The majority of surface runoff is likely to drain into sewers.

4 Haringey Council Planning Regeneration & Economy, *Draft Basement Development Guidance Note*, June 2012

5 Nicholas Barton (2000) *London's Lost Rivers*. Historical Publications Ltd

2.6 Preliminary Risk Assessment

Part IIA of the Environmental Protection Act 1990, which was inserted into that Act by Section 57 of the Environment Act 1995, provides the main regulatory regime for the identification and remediation of contaminated land. The determination of contaminated sites is based on a “suitable for use” approach which involves managing the risks posed by contaminated land by making risk-based decisions. This risk assessment is carried out on the basis of a source-pathway-receptor approach.

2.6.1 Source

The historical usage of the site that has been established by the desk study and the site walkover indicates that the site has a small potential for contamination in association with the orchard, however the use of the site as a school does not provide obvious sources of contamination at the site, nor are there any nearby in the immediate vicinity. This is with the exception of the possibility of the oil tank at the front of Dyne House, which is a potential source of contamination.

No sources of landfill gas have been identified within 1 km of the site. Several ponds are located within the proximity of the site, but the maps generally indicate these to have been infilled prior to 1935 and it is therefore considered that any generation of gas is now complete. However, traces of hydrocarbons may be present in the soil to the west of Dyne House, associated with the former underground tank, which would be a potential source of soil vapours.

2.6.2 Receptor

The continued use of the site as a school will not result in extensive exposure to the soil and thus represents a moderate to low sensitivity end-use. Being underlain by a Secondary ‘A’ Aquifer, groundwater is likely to represent a relatively sensitive receptor. Adjacent sites are a potential receptor for contamination migrating off the site.

2.6.3 Pathway

The redevelopment will not create any new exposure pathways for end users. The presence of the building and the hardstanding will effectively form a barrier between any contaminants within the near-surface soils and end users or infiltration of surface water. Only in soft landscaped areas could there be a potential for contaminant exposure pathways, although such pathways are already in existence. Surface water run-off will create a pathway for contamination to reach groundwater and adjacent sites, although this pathway is already in existence.

Buried services will be exposed to any contaminants within the soil through direct contact and site workers will come into contact with the soils during demolition and construction works.

2.6.4 Preliminary Risk Appraisal

On the basis of the above it is considered that there is a low to moderate risk of there being a significant contaminant linkage at this site which would result in a requirement for major remediation work. The moderate assessment is primarily being driven by the presence of the former heating oil tank.

3.0 SCREENING

The London Borough of Camden guidance suggests that any development proposal that includes a subterranean basement should be screened to determine whether or not a full Basement Impact Assessment (BIA) is required.

3.1 Screening Assessment

A number of screening tools are included in the Arup report and for the purposes of this report reference has been made to Appendix E which includes a series of questions within a screening flowchart for three categories; groundwater flow; land stability; and surface water flow. Responses to the questions are tabulated on the following page.

3.1.1 Subterranean (groundwater) Screening Assessment

Question	Response for Dyne House
1a. Is the site located directly above an aquifer?	Yes, the western part of the site is located above the Bagshot Formation and the eastern part is above the Claygate Member, both are Secondary 'A' Aquifers.
1b. Will the proposed basement extend beneath the water table surface?	Likely; the deepest part of the basement will be at a level of about 103.66 m OD, within the Claygate Member and groundwater is likely to be present in the overlying Bagshot Formation.
2. Is the site within 100 m of a watercourse, well (used/disused) or potential spring line?	Yes, the boundary between the Bagshot Formation and Claygate Member is a potential spring line.
3. Is the site within the catchment of the pond chains on Hampstead Heath?	No. These are located about 600 m southwest of the site and groundwater flowing from the site is likely to flow toward the east.
4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	Yes, there will be a very small increase in hard surfacing as two small planting beds will be removed.
5. As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?	Yes, shallow soakaways are being considered however it is likely that the majority of drainage will be discharged as present, to sewers.
6. Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to or lower than, the mean water level in any local pond or spring line?	Yes, the basement will extend to a depth of about 103.66 m OD and the potential spring line between the Bagshot Formation and Claygate Member is at a level of about 111.00 m OD.

The above assessment has identified the following potential issues that need to be assessed:

- Q1a. The site is located above a Secondary 'A' Aquifer.
- Q1b. The proposed basement may extend beneath the water table surface.
- Q2. The boundary between the Bagshot Formation and Claygate Member is a spring line.
- Q4. The area of hardstanding will increase.
- Q5. Shallow soakaways are being considered.
- Q6. The basement will extend below a spring line.

The potential issues that need to be assessed, along with the possible effects of the basement construction on the local hydrology and hydrogeology and are discussed further in Part 2 of this report.

3.1.2 Stability Screening Assessment

Question	Response for Dyne House
1. Does the existing site include slopes, natural or manmade, greater than 7°?	Yes, reference to the ARUP Slope Angle Map indicates that the site has slope angles from less than 7° to greater than 10°. Based on site survey information, the angle of the slope at the site is approximately 10°.
2. Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7°?	Yes, steps will be introduced to connect different levels which will probably have angles greater than 7°.
3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°?	Yes, the ARUP map indicates the surrounding landscape to also have slopes greater than 7°.
4. Is the site within a wider hillside setting in which the general slope is greater than 7°?	Yes, as above, the ARUP map indicates the surrounding landscape to also have slopes greater than 7°.
5. Is the London Clay the shallowest strata at the site?	No, as shown on the geology map
6. Will any trees be felled as part of the proposed development and / or are any works proposed within any tree protection zones where trees are to be retained?	Yes, several trees will be felled.
7. Is there a history of seasonal shrink-swell subsidence in the local area and / or evidence of such effects at the site?	Yes, the area is prone to these effects as a result of the presence of shrinkable Claygate Member and abundant mature trees.
8. Is the site within 100 m of a watercourse or potential spring line?	Yes, the potential spring line between the Bagshot Formation and Claygate Member crosses the site.
9. Is the site within an area of previously worked ground?	No.
10a. Is the site within an aquifer?	Yes, both the Bagshot Formation and Claygate Member are classified as Secondary 'A' Aquifers.
10b. Will the proposed basement extend beneath the water table such that dewatering may be required during construction?	Yes, the previous investigation indicated that groundwater is present at a level of 114.00 m OD and the deepest part of the basement will be at a level of about 103.66 m OD.
11. Is the site within 50 m of Hampstead Heath ponds?	No, the Hampstead Ponds are located over 500 m to southwest of the site.
12. Is the site within 5 m of a highway or pedestrian right of way?	Yes, the site fronts onto a public road to the west and another to the north of the site.
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes, the development will increase the foundation depths relative to the neighbouring properties to a relatively significant extent.
14. Is the site over (or within the exclusion zone of) any tunnels, eg railway lines?	No, online mapping indicates no nearby tunnels or railway lines.

The above assessment has identified the following potential issues that need to be assessed:

- Q1. There are slopes on the site greater than 7°
- Q2. Some reprofiling at the site will lead to future slopes greater than 7°
- Q3. Neighbouring land is greater than 7°
- Q4. Site is within a wider hillside setting where the slopes are generally greater than 7°
- Q6. Trees will be removed
- Q7. There is a history of seasonal shrink-swell in the Claygate Member
- Q8. The site is within 100 of a spring line and watercourse
- Q9. The site has an area of worked ground
- Q10a. The site is above a Secondary 'A' Aquifer
- Q10b. The proposed basement may extend beneath the water table
- Q12. The site is within 5 m of a public highway

Q13. The development will increase the foundation depths relative to the neighbouring properties to a relatively significant extent.

The potential issues that need to be assessed, along with the possible effects of the basement construction on the local hydrology and hydrogeology and are discussed further in Part 2 of this report.

3.1.3 Surface Flow and Flooding Screening Assessment

Question	Response for Dyne House
1. Is the site within the catchment of the pond chains on Hampstead Heath?	No. Figure 14 of the Arup report confirms that the site is not located within this catchment area.
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 – any additional surface water gained from an increased hardstanding area will be attenuated to ensure they are not increased or altered.
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	Yes – two small areas of planting will be removed resulting in a slight increase in the percentage of hardstanding of about 3%.
4. Will the proposed basement development 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 – it is proposed to allow for new attenuation to control how water is stored from additional hardstanding areas. The attenuation size will be based upon peak surface water flows and discharge rates into existing sewers will be agreed with Thames Water
5. Will the proposed basement result in changes to the quantity of surface water being received by adjacent properties or downstream watercourses?	No - the proposed basement is very unlikely to result in any changes to the quality of surface water being received by adjacent properties or downstream watercourses. It is proposed to allow for new attenuation to control how water is stored from additional hardstanding areas.
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 Kings Cross, or is it at risk of flooding because the proposed basement is below the static water level of a nearby surface water feature?	Yes. The Haringey SFRA indicates a low risk from rivers and reservoirs. However, the Environment Agency online flood map shows that the part of the site intended for the basement and above ground works has a very low to low flooding risk from surface water. The area of hardstanding across the north east part of the site has a low and medium surface water flooding risk. The basement is likely to be constructed within perched water tables, however, the mitigation measures outlined in this BIA such as tanking the basement will reduce the risk to acceptable levels. The site is located within the Haringey Drainage Area number HDA-01 as identified in the Haringey SFRA. Therefore, a flood risk assessment may be required.

The above assessment has identified the following potential issues that need to be assessed further.

Q3 The area of hardstanding will increase by about 3%.

Q6 The site is in an area of low risk of flooding.

The basement will largely be beneath the footprint of the buildings and existing hardstanding area, such that 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. However, as the basement and development will also extend into parts of the site that are currently permeable, these parts will have a distance between the roof of the basement and ground surface of less than 1 m. It is considered that the use of SUDS attenuation will mitigate any impact by not meeting the 1 m requirement.

4.0 SCOPING AND SITE INVESTIGATION

The purpose of scoping is to assess in more detail the factors to be investigated in the impact assessment. Potential impacts are assessed for each of the identified potential impact factors.

The potential impacts of the proposed development on surface flow and flooding and subterranean flow will need to be dealt with in separate assessments, such that the following section focuses on the potential impacts that may have an impact on slope stability.

4.1 Potential Impacts

The following potential impacts have been identified.

Potential Impact	Consequence
The site is located above a Secondary 'A' Aquifer and the basement may be below the groundwater table.	The basement may alter the groundwater regime and result in a upstream damming effect or divert the groundwater flow to cause flooding. Dewatering can cause settlement issues.
The site is on a potential spring line and the basement may impact on the groundwater regime. Additionally, groundwater may flow into the basement excavation and if infiltration is reduced this may decrease stability.	The basement may alter the existing groundwater regime, either by increasing or decreasing the flow or it may reactivate old springs in the vicinity. It may also impact groundwater quality downstream. Water flowing into the excavation would decrease stability of the excavation. Seasonal spring lines can also affect slope stability.
An increase in hardstanding will decrease the recharge to the underlying aquifer.	Groundwater flow levels may decrease and the groundwater regime may be altered leading to potential instability, and reduction in groundwater quality.
The usage of shallow soakaways may increase groundwater flow in some areas.	An increase in flow will change the groundwater regime and may activate old springs, change water quality and potentially cause instability.
Slopes greater than 7° on and surrounding the site may be unstable	Changes to slopes with an angle greater than 7° may induce ground instability on the site and surrounding area.
Trees being removed and seasonal shrink-swell can result in foundation movements.	If a new basement is not dug to below the depth likely to be affected by tree roots this could lead to damaging differential movement between the subject site and adjoining properties. Removing trees can result in heave in desiccated soil. However at this site the trees will be removed in areas underlain by the Bagshot Formation, and seasonal shrink swell is not considered to be an issue in this predominantly sandy soil.
Worked ground comprises unpredictable material	The made ground could be loose or comprise soft or hard material or layers which could lead to instability in excavations and groundwater flow may be difficult to determine.
Site within 5 m of a highway or pedestrian right of way.	Excavation of a basement may result in structural damage to the road or footway.
Founding depths relative to neighbours.	If not designed and constructed appropriately, the excavation of a basement may result in structural damage to neighbouring buildings and structures.
There may be a risk of flooding	The proposed basement may flood

These potential impacts have been investigated through the site investigation, as detailed in Section 9.0.

4.2 Exploratory Work

In view of the limited access and in order to meet the objectives described in Section 1.2 as far as possible within these access constraints, three boreholes were advanced to depths of 15.00 m, 21.00 m and 24.00 m by means of cable percussion techniques; two of the boreholes were drilled using a dismantlable rig whilst the third was drilled using a standard rig. In addition, five window sampler boreholes were drilled across the site to a maximum depth of 6.00 m. Seven trial pits were hand excavated to expose the existing foundations of buildings on site and boundary walls and two trial pits were mechanically excavated to enable a soakage test to be carried out.

During boring, disturbed and undisturbed samples were obtained from the boreholes for subsequent laboratory examination and testing. Standard Penetration Tests (SPTs) were carried out at regular intervals to provide additional quantitative data on the strength of soils encountered.

Three groundwater monitoring standpipes were installed, within Borehole Nos 6, 7 and 8 to depths of 8 m, 13 m and 6 m respectively. Vibrating Wire Piezometers (VWPs) were installed in Borehole Nos 7 and 8. The VWP tips were placed at depths of 16 m and 21 m in Borehole No 7 and 11.5 m, 17.5 m and 23.5 m in Borehole No 8. The standpipes in Borehole Nos 6 and 7 have been monitored on three occasions; the standpipe in Borehole No 8 and the VWPs have been monitored on a single occasion.

A selection of the samples recovered from the boreholes was submitted to a soil mechanics laboratory for a programme of geotechnical testing and an analytical laboratory for a programme of contamination testing.

All of the above work was carried out under the supervision of a geotechnical engineer from GEA.

The borehole records and results of the contamination laboratory testing are appended, together with a site plan indicating the exploratory positions. The Ordnance Datum (OD) levels indicated on the borehole and trial pit records and quoted within the report have been interpreted from spot heights shown on a topographical survey drawing provided by A-squared Studio (ref 1040/GA/002, dated April 2014).

4.3 Sampling Strategy

The borehole and trial pit locations were generally specified by A-squared Studio and agreed on site with GEA, in accessible areas whilst avoiding areas of buried services.

It was originally proposed to drill a series of boreholes in proximity of the former tank but access restrictions and the presence of buried obstructions and services prevented these from being carried out. A cable percussion borehole, Borehole No 9 was commenced in close proximity to the former location of the tank, but was abandoned at a depth of 2.0 m due to a significant thickness of concrete. It was originally proposed to drill Borehole No 8 to a depth of 25 m, but the presence of a claystone and associated water strike at 23.0 m prevented the borehole achieving the proposed depth.

Seven samples of made ground were subjected to analysis for a range of common industrial contaminants and contamination indicative parameters. For this investigation the analytical suite for the soil included a range of metals, speciation of total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAH), total cyanide and monohydric phenols. The

soil samples were selected to provide a general view of the chemical conditions of the soils that are likely to be involved in a human exposure or groundwater pathway and to provide advice in respect of re-use or for waste disposal classification. In addition, a single sample was also scheduled for Waste Acceptance Criteria testing.

The contamination analyses were carried out at a MCERTs accredited laboratory with the majority of the testing suite accredited to MCERTS standards. Details of the MCERTs accreditation and test methods are included in the Appendix together with the analytical results.

5.0 GROUND CONDITIONS

The investigation has generally confirmed the expected ground conditions in that, below a typically moderate, but locally significant thickness of made ground, the Bagshot Formation was found to be underlain by the Claygate Member, which extended to the maximum depth of the investigation, of 24.00 m (94.00 m OD).

5.1 Made Ground

The made ground encountered in the playground extended to depths of between 0.50 m (110.70 m OD) and 4.0 m (106.80 m OD) and was found to be shallower in the northwestern corner and deeper toward the south and east of the playground, where more filling is likely to have occurred. The made ground comprised various layers including dark brown and grey clayey occasionally gravelly sand with coal, charcoal and brick fragments, grey and brown sandy gravel, with whole bricks, occasional fragments and sections of concrete up to about 400 mm in diameter, tile, coal, ash, clinker, metal, slate and redundant pipes.

The made ground elsewhere on site typically comprised brown and grey clayey gravelly sand with pockets of clay and fragments of brick or brown sandy gravelly clay with pockets of cobbles of brick which extended to depths of between 1.2 m (124.50 m OD) and 2.0 m (116.00 m OD).

A significant thickness of concrete and compacted brick was encountered in Borehole No 9, the base of which was not proved but extended beyond 2.0 m and is likely to be associated with the infilling of the former tank excavation.

Apart from the presence of fragments of extraneous material noted above, no visual or olfactory evidence of contamination was observed during the fieldwork. Seven samples of the made ground have been sent for contamination testing and the results are presented in Section 5.6.

No obvious olfactory signs of contamination were noted in boreholes drilled near the former tank to the front of Dyne House.

5.2 Alluvium

Alluvium was encountered in Borehole Nos 1, 2 and 6 which were drilled in the east of the playground area. It comprised either firm grey mottled brown and slightly organic silty sandy clay or grey and black slightly organic sand with occasional gravel, grading into a sandy gravelly clay which extended to depths of between 3.75 m (107.25 m OD) and 4.75 m (106.05 m OD). These boreholes were drilled in the east of the site and the Alluvium may be associated with the former tributaries of Cholmeley Brook in this area.

The results of laboratory testing indicate organic contents of 2.1 % and 2.6 % in this soil.

No evidence of contamination was noted in these soils.

5.3 Bagshot Formation

The Bagshot Formation was encountered in Borehole Nos 5, 7 and 8 and typically comprised firm, low strength brown silty occasionally very sandy gravelly clay with partings of coarse sand, orange-brown very clayey fine to coarse sand with occasional fine gravel and light brown to buff slightly silty fine sand and extended to depths of 6.0 m (112 m OD) and 12.0 m (113.70 m OD).

5.4 Claygate Member

The Claygate Member comprised firm becoming stiff, high to very high strength orange-brown or brown and grey silty occasionally sandy clay with indistinct partings of clayey sand or silt and extended to the maximum depth of the investigation, of 24.00 m (94.00 m OD).

The clay was visually assessed to be partially desiccated in Borehole No 3 to a depth of 1.0 m.

Claystones were encountered in Borehole No 7 at a depth of 20.70 m (105.00 m OD) and Borehole No 8 at a depth of 23.0 m (95.00 m OD).

The results of laboratory plasticity index tests indicate that the clay is of medium to high volume change potential.

No evidence of contamination was noted in these soils.

5.5 Groundwater

Seepages of groundwater were encountered in the Bagshot Formation at depths of 4.0 m (121.70 m OD) and 6.0 m (119.70 m OD) in Borehole No 5. Borehole No 7 encountered a groundwater strike at 9.0 m (116.70 m OD) which rose to 8.0 m after a rest period of 20 minutes and seepages were also encountered in Borehole No 8 at depths of 4.30 m (113.70 m OD) and 6.27 m (111.73 m OD), the latter of which rose to a depth of 5.70 m after a rest period of 20 minutes.

Groundwater inflows were also encountered within the Claygate Member; Borehole No 4 encountered a seepage at a depth of 4.0 m (107.15 m OD) and Borehole No 6 encountered a seepage at 6.0 m (104.80 m OD). Borehole Nos 7 and 8 encountered slow inflows at depths of 21.00 m (104.70 m OD) and 14.70 m (103.30 m OD) respectively which both rose after a rest period of 20 minutes by 3 m and 2.4 m respectively. Numerous seepages of groundwater were encountered below about 15 m in Borehole No 8.

The results of the monitoring of the three standpipes and three VWP's are shown in the table below.

Table 1			
Date	Depth To Groundwater (mbgl) [Level (m OD)]		
	BH6	BH7	BH8
	Claygate Member	Bagshot Formation	Bagshot Formation
15/4/2015	5.65 [105.15]	7.75 [117.95]	n/a
27/5/2015	5.13 [104.87]	8.12 [117.58]	n/a
9/6/15	5.35 [105.45]	8.16 [117.54]	2.30 [115.70]

Table 2					
VWP monitoring data (9/6/15)					
	BH7		BH8		
Depth of installations (level)	16.00 (109.70)	21.00 (104.70)	11.50 (106.5)	17.50 (100.5)	23.50 (94.50)
Geological formation	Claygate	Claygate	Claygate	Claygate	Claygate
Approximate pore water pressure (kPa)	65 to 71	65	45	104	155
Approximate depth to water (m) (Level m OD)	9.38 to 8.77 (116.32 to 116.93)	14.38 (111.32)	6.92 (111.08)	6.9 (111.10)	7.7 (110.3)

The monitoring indicates a groundwater level at around 117.95m OD to 115.70m OD in the west of the site. The water level across the site generally mirrors the topography with a water level measured at around 111.1 m OD in the centre of the site and at 105.00 m OD in the east.

The groundwater levels indicate a hydraulic gradient down towards the east, generally following the topography.

The piezometers indicate pore water pressures in the Claygate Member in the region of 45 kPa to 70 kPa. Higher pore water pressures have been measured in piezometers below the measured water table in the Claygate Member.

The raw data from the vibrating wire piezometer monitoring is included in the appendix.

5.6 Soil Contamination

The table below sets out the range of values measured within seven samples analysed; all concentrations are in mg/kg unless otherwise stated.

Determinant	Maximum Concentration	Minimum Concentration	Number of samples below detection limit
Arsenic	150	19	none
Cadmium	26	0.1	none
Chromium	83	32	none
Copper	700	37	none
Mercury	1.4	0.49	none
Nickel	110	16	None
Lead	5900	230	none
Selenium	0.31	<0.2	four
Zinc	2000	120	none
Total Cyanide	<0.5	<0.5	seven
Total Phenols	<0.3	<0.3	seven
Sulphide	30	1.6	none
Total PAH	250	17	none
Benzo(a)pyrene	24	1.3	none
Naphthalene	1.8	<0.1	two
TPH	420	20	none
Total Organic Carbon %	13	1.1	none
Figure in bold indicates concentration in excess of risk-based soil guideline values, as discussed in Part 2 of this report			

5.6.1 Generic Quantitative Risk Assessment

The use of a risk-based approach has been adopted to provide an initial screening of the test results to assess the need for subsequent site-specific risk assessments. To this end the table below indicates those contaminants of concern that have values in excess of a generic human health risk based guideline values which are either that of the CLEA⁶ Soil Guideline Value where available, or is a Generic Screening Value calculated using the CLEA UK Version 1.06⁷ software assuming a residential end use with plant uptake, or is based on the DEFRA Category 4 Screening values⁸. The key generic assumptions for this end use are as follows:

- ❑ that groundwater will not be a critical risk receptor;
- ❑ that the critical receptor for human health will be young female children aged zero to six years old;
- ❑ that the exposure duration will be six years;

6 Updated Technical Background to the CLEA Model (Science Report SC050021/SR3) Jan 2009 and Soil Guideline Value reports for specific contaminants; all DEFRA and Environment Agency.

7 Contaminated Land Exposure Assessment (CLIEA) Software Version 1.06 Environment Agency 2009

8 CL:AIRE (2013) *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination* Final Project Report SP1010 and DEFRA (2014) *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination* Policy Companion Document SP1010

- ❑ that the critical exposure pathways will be direct soil and indoor dust ingestion, skin contact with soils and indoor dust, and inhalation of indoor and outdoor dust and vapours; and
- ❑ that the building type equates to a two-storey small terraced house.

It is considered that these assumptions are acceptable for this generic assessment of this site, although conservation as the site is a school and exposure pathways will be significantly less. The tables of generic screening values derived by GEA and an explanation of how each value has been derived are included in the Appendix.

Where contaminant concentrations are measured at concentrations below the generic screening value it is considered that they pose an acceptable level of risk and thus further consideration of these contaminant concentrations is not required. However, where concentrations are measured in excess of these generic screening values there is considered to be a potential that they could pose an unacceptable risk and thus further action will be required which could include;

- ❑ additional testing to zone the extent of the contaminated material and thus reduce the uncertainty with regard to its potential risk;
- ❑ site specific risk assessment to refine the assessment criteria and allow an assessment to be made as to whether the concentration present would pose an unacceptable risk at this site; or
- ❑ soil remediation or risk management to mitigate the risk posed by the contaminant to a degree that it poses an acceptable risk.

The concentrations of the contaminants of concern highlighted by a comparison of the measured concentrations against the generic screening values are arsenic, lead and several components of polycyclic aromatic hydrocarbons (PAH) and total PAH.

Contaminant of Concern	Maximum concentration recorded (mg/kg)	Location(s) of elevated concentration(s)	Generic Risk-Based Screening Value
Arsenic	150	BH2 0.5 m BH4 0.80 m	40
Lead	5900	BH1 0.5 m BH2 0.5 m BH3 0.3 m BH4 0.8 m BH5 0.8 m TP7 0.2 m	310
Total Organic Carbon	13	BH2 0.5 m BH3 0.3 m BH4 0.8 m	6
Benzo(a)anthracene	21	BH1 0.5 m BH2 0.5 m	9.4
chrysene	24	BH1 0.5 m BH2 0.5 m	15
Benzo(b)fluoranthene	29	BH1 0.5 m BH2 0.5 m	11.2

Contaminant of Concern	Maximum concentration recorded (mg/kg)	Location(s) of elevated concentration(s)	Generic Risk-Based Screening Value
Benzo(a)pyrene	24	BH1 0.5 m BH2 0.5 m	5.3
Indeno(1,2,3-c,d)pyrene	16	BH1 0.5 m BH2 0.5 m	6.7
Dibenzo(a,h)anthracene	4.6	BH1 0.5 m BH2 0.5 m	1.41
Total PAH	250	BH1 0.5 m BH2 0.5 m	75.7

The significance of these results is considered further in Part 2 of the report.

5.7 Existing Foundations

The findings of the trial pits are summarised in the table below. Sketches and photographs of each pit are included in the Appendix.

Trial Pit No	Structure	Foundation detail	Bearing Stratum
1	Drama building	Corbels and concrete strip Top 70 mm Base 690 mm Lateral projection 450 mm	Firm brown mottled orange-brown and grey sandy gravelly clay
2	Retaining wall along northern boundary	Variable, concrete strip and brick Top zero to 40 mm Base 400 mm to 700 mm Lateral projection zero to 1050 mm	Made ground and firm brown silty sandy clay
3	Retaining wall along northern boundary	Variable, brick corbel and concrete Top 60 mm to 200 mm Base 50 mm to 800 mm Lateral projection 90 mm to 1000 mm	Dark orange-brown clayey sand
4	Retaining wall along northern boundary	Concrete Top 70 mm Base 190 mm to 210 mm Lateral projection zero to 1000 mm	Firm brown silty slightly sandy clay
5	Southern boundary fence	Concrete beam Top n/a Base 100 mm Lateral projection zero	Made ground
6	Southern boundary fence	Cobbles Top 210 mm Base 390 mm Lateral 60 mm	Brown clayey silty sand
7	Retaining wall along southern boundary	Concrete strip Top 100 mm Base 520 mm Lateral 600 mm	Made ground

Part 2: DESIGN BASIS REPORT

This section of the report provides an interpretation of the findings detailed in Part 1, in the form of a ground model, and then provides advice and recommendations with respect to the basement excavation and the potential impact on the hydrogeology.

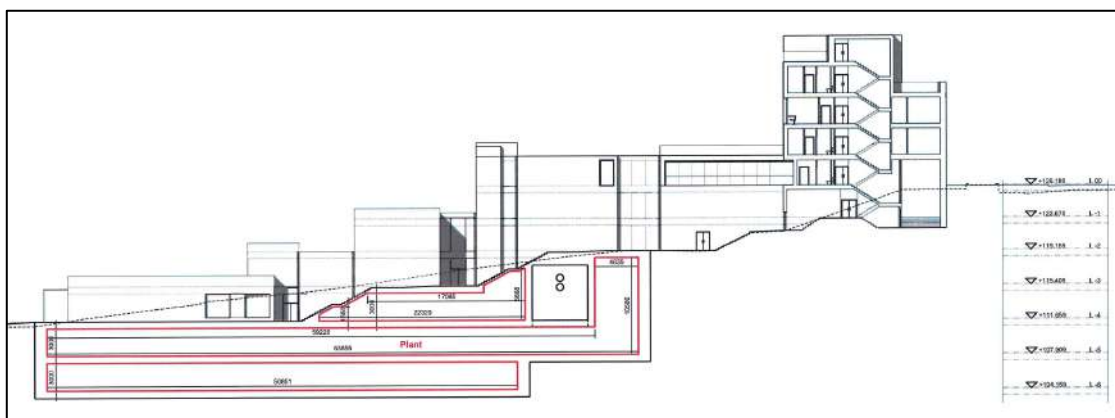
6.0 INTRODUCTION

It is understood that consideration is being given to the redevelopment and extension of the existing Dyne House structure and construction of additional accommodation and teaching space. The development will include the extension of Dyne House towards the front and rear, each with a separate basement structure. The extension at the front of the Dyne House will comprise a single level basement over three-storeys, the basement is assumed to be about 4 m deep extending to a level of about 121.00 m OD.

The extension at the rear will be more extensive, replacing the existing Drama Department building, and will comprise single storey to three-storey buildings over a double and triple level basement. The maximum depth of the basement excavation will be about 13.50 m, extending to levels of about 106.66 m OD and 103.66 m OD.

Loads are anticipated to be moderate to high.

The section below provides an indication of the extent of the proposed basement.



7.0 GROUND MODEL

The desk study indicated that the site has been used as part of a school for its entire development history, although the maps indicate several buildings to have occupied the site, and on the basis of the fieldwork, the ground conditions at this site can be characterised as follows:

- The site is underlain by a moderate to significant thickness of made ground overlying the Bagshot Formation which is underlain by the Claygate Member;
- a Thames Water sewer crosses the site;
- the made ground generally extends to depths of between about 1.0 m and 2.0 m across

the site, with an increase in thickness in the east of the site of up to 4.0 m where historical regrading has occurred;

- ❑ made ground generally comprises grey and brown sandy gravelly cobble with occasional boulders and fragments of concrete and tile, coal, ash, clinker, metal, slate and redundant pipes to brown silty clay;
- ❑ Alluvium comprising organic clay or organic clayey gravelly sand and extends to depths of between 3.75 m (107.25 m OD) and 4.75 m (106.05 m OD) in the east of the site;
- ❑ the Bagshot Formation was encountered on the higher ground in the west of the site and comprises either firm brown silty very sandy gravelly clay or light brown to buff silty fine sand and extends to depths of between 6.0 m (112.00 m OD) and 12.0 m (113.70 m OD);
- ❑ the Claygate Member comprises firm becoming stiff and very stiff orange-brown or brown and grey silty occasionally sandy clay with indistinct partings of clayey sand or silt and extends to the maximum depth investigated, of 24.00 m (94.00 m OD);
- ❑ the clay was visually assessed to be partially desiccated in Borehole No 3 to a depth of 1.0 m;
- ❑ groundwater has been measured at a level of approximately 116 m OD in the west of the site, lowering to around 105 m OD in the east;
- ❑ groundwater flow is likely to be toward the east; and
- ❑ contamination testing has indicated elevated concentrations lead, arsenic, several constituent PAH's and total PAH in the made ground.

8.0 ADVICE AND RECOMMENDATIONS

Given the depth of the proposed basements, it would be practical to consider using a bored piled retaining wall to support the excavation and some form of groundwater control will be required in the deep basement excavation as groundwater inflows will be encountered.

The redevelopment will not introduce any pathways from measured contamination, but localised remediation will be required in soft landscaping areas. It would be prudent to maintain a watching brief during construction.

8.1 Basement Construction

8.1.1 Basement Excavations

It is understood that the the basement excavations will have three levels; the basement to the front of Dyne House will be about 4 m deep, to a level of about 121.00 m OD and the basement to the rear of Dyne House will extend to depths of about 10.50 m (106.66 m OD) and 13.50 m (103.66 m OD). Formation level for the shallowest basement will be within the Bagshot Formation and for the deeper sections will be in the Claygate Member.

Groundwater seepage was noted at depths of 4.0 m (121.70 m OD), 6.0 m (119.7 m OD) and

9.0 m (116.7 m OD) in the location of the shallowest basement at the front of Dyne House. On this basis water may be present near the base of the excavation, although monitoring has indicated groundwater to be present at a depth of about 8.0 m (117 m OD) in the west of the site, which is below the assumed basement depth in this area. Monitoring of the standpipes should be continued to provide an understanding of water levels across the site and whether the groundwater in the Claygate and Bagshot Formations are connected hydraulically.

The deeper basement in the central and eastern part of the site which will extend to a level of about 103.66 m OD is likely to encounter groundwater. Initial inflows can be expected from within the Bagshot Formation at around 115 m OD in the western part of the excavation, lowering to 105 m OD in the east. As noted above, monitoring of the standpipes should however be continued to establish equilibrium levels and determine the extent of any seasonal fluctuations.

It would therefore be prudent, once access is available, to carry out a number of trial excavations, to depths as close to the full basement depth as possible, to provide an indication of the likely groundwater conditions. It is likely that the rate of groundwater inflow may be significant near the base of the Bagshot Formation and relatively slow within the clayey Claygate Member but it is recommended that the selected contractor has a contingency plan in place to deal with more significant or prolonged inflows as a precautionary measure if a watertight temporary retention scheme is not adopted.

The design of basement support in the temporary and permanent conditions needs to take account of the need to maintain the stability of the excavation, slopes and surrounding structures, namely the neighbouring houses to both the north and south, and to protect against groundwater inflows. The depth of the foundations of the nearby buildings is unknown.

The most appropriate form of supporting the basement excavations may be by some form of bored pile wall, which would have the advantage of being incorporated into the permanent works and will be able to provide support for structural loads. The monitoring carried out to date indicates that groundwater will be encountered within the excavation; it is therefore recommended that a secant wall should be adopted, particularly in the central part of the site.

The ground movements associated with the basement excavation will depend on the method of excavation and support and the overall stiffness of the basement structure in the temporary condition. Thus, a suitable amount of propping will be required to provide the necessary rigidity. In this respect the timing of the provision of support to the wall will have an important effect on movements.

An assessment of the ground movements associated with the basement excavation may be required as part of the planning process or could be completed as design progresses.

8.1.2 Retaining Walls

The following parameters are suggested for the design of the permanent basement retaining walls.

Stratum	Bulk Density (kg/m ³)	Effective Cohesion (c' – kN/m ²)	Effective Friction Angle (Φ' – degrees)
Made ground	1700	Zero	27
Bagshot Formation (clay)	1850	Zero	24
Bagshot Formation (sand)	1850	Zero	33
Claygate Formation	1950	Zero	25

Monitoring has indicated that groundwater will not be encountered in the shallow basement to the front of Dyne House, monitoring should be continued to confirm the design water level in this area. Groundwater will be encountered in the deeper basement excavation at the rear of Dyne House and further monitoring should be done to confirm the design water level, however this is likely to be at a level of about 115 m OD. Reference should be made to BS8102:2009⁹ with regard to requirements for waterproofing and design with respect to groundwater pressures.

8.1.3 Basement Heave

It is unlikely that any significant heave will be realised at the base of the 4 m deep basement upon the assumption that about 11 m of sand will remain above the Claygate Member, however it may be prudent to check this once loads are known.

The proposed construction of the deep basement will result in an unloading of the Claygate Member at formation level. The excavations will result in an approximate unloading of around 270 kN/m² which will result in an elastic heave and long term swelling of Claygate Member and underlying London Clay.

The effects of these movements will need to be considered in more detail once the basement design has been finalised and a Ground Movement Analysis (GMA) is proposed to be carried out.

8.2 Spread Foundations

The excavation of the shallow basement will result in a formation level within the Bagshot Formation and it should be possible to adopt moderate width pad or strip foundations in the dense sand, designed to apply a net allowable bearing pressure of 120 kN/m² below the level of the proposed basement floor. It is unlikely that it will be possible to attain the required depths without encountering groundwater inflows, and if inflows are such that spread foundations cannot be utilised, then recourse should be made to the use of a piled foundation solution.

8.3 Piled Foundations

For the ground conditions at this site, driven or bored piles could be adopted. Driven piles would have the advantage of minimising the spoil that is generated, but consideration would need to be given to the effects of noise and vibrations on neighbouring sites. Some form of bored pile may therefore be more appropriate. A conventional rotary augered pile could be

⁹ BS8102 (2009) *Code of practice for protection of below ground structures against water from the ground*

considered, but temporary casing would be needed to protect against groundwater inflows and instability from within the made ground, Bagshot Formation and Claygate Member. Therefore, to avoid the requirement for casing, bored piles installed using continuous flight auger (cfa) techniques may be more appropriate.

The following tables of ultimate coefficients may be used for the preliminary design of bored piles, for retaining walls and for any structural loads, based on the measured SPT & cohesion / level graph in the appendix. For the purposes of preliminary design, the boundary between the Bagshot Formation and Claygate Member has been assumed to be at 113.00 m OD. Groundwater has been assumed to be at a level of 116 m OD.

Stratum	Level m OD	kN / m ²
Ultimate Skin Friction		
Made Ground, Bagshot Formation, Claygate Member	GL to 4.00 (126.00 m OD to 122.00 m OD) and GL to 13.5 m (118 m OD to 104 m OD)	Ignore (Basement excavations)
Bagshot Formation ($\phi=36$)	122.00 m OD to 113.00 m OD	65
Claygate Member (BH8) ($\alpha=0.5$)	113.00 m OD to 106.00 m OD	Increasing linearly 50 to 90
Claygate Member (BH6) ($\alpha=0.5$)	106.00 m OD to 94.00 m OD	Increasing linearly 35 to 70
Ultimate End Bearing		
Bagshot Formation	118 m OD to 116 m OD	Increasing linearly 9,300 to 11,700
Claygate Member (BH8) ($\alpha=0.5$)	113.00 m OD to 106.00 m OD	Increasing linearly 945 to 1665
Claygate Member (BH6) ($\alpha=0.5$)	106.00 m OD to 94.00 m OD	Increasing linearly 630 to 1350

On the basis of the above coefficients and using factor of safety of 3.0 it has been estimated that a 450 mm diameter pile extending 10 m below ground level or 6.0 m below the shallow basement level of about 124 m OD to 114 m OD, should provide a safe working load of about 800 kN.

Using the lower cohesion values for the Claygate Member encountered in Borehole No 6, 450 mm diameter piles extending to a level of about 94 m OD, or about 10 m below the deepest part of the deeper basement should provide a safe working load of about 340 kN.

The above examples are not intended to constitute any form of recommendation with regard to pile size or type, but merely serve to illustrate the use of the above coefficients. Specialist piling contractors should be consulted with regard to the design of an appropriate piling scheme, and

their attention should be drawn to the presence of groundwater within the Bagshot Formation, Claygate Member, claystones and sloping nature of the site and apparent variability in strength of the Bagshot Formation and Claygate Member horizontally.

8.4 Shallow Excavations

On the basis of the trial pit findings it is considered likely that it will not be feasible to form relatively shallow excavations terminating within the made without the requirement for lateral support.

Where personnel are required to enter excavations, a risk assessment should be carried out and temporary lateral support or battering of the excavation sides considered in order to comply with normal safety requirements.

Inflows of groundwater are likely to be encountered in shallow excavations from perched water tables within the made ground, such inflows should be suitably controlled by sump pumping.

8.5 Basement Floor Slab

Following the excavation of the deeper basement, it is possible that the floor slab for the proposed basement will need to be suspended over a void or layer of compressible material to accommodate the anticipated heave and any potential uplift forces from groundwater pressures unless the slab can be suitably reinforced to cope with these movements. This should be reviewed once the levels and loads are known. Consideration may need to be given to the requirement for tension piles.

It should be possible to adopt a ground bearing floor slab for the shallow basement floor slab, assuming soft spots are identified and remove and replaced with suitable fill.

8.6 Effect of Sulphates

Chemical analyses has revealed relatively low concentrations of soluble sulphate and near-neutral pH in accordance with Class DS-1 conditions of Table C2 of BRE Special Digest 1:SD Third Edition (2005). The measured pH values of the samples show that an ACES class of AC-1 would be appropriate for the site. This assumes a mobile water condition at the site. The guidelines contained in the above digest should be followed in the design of foundation concrete.

8.7 Surface Water Drainage

A single soakage test was carried out in Trial Pit No 9 which extended to a depth of 2.6 m. A total of 1000 litres of water was quickly transferred into the trial pit to create a head of water to allow a soakage test to be conducted, however the rate of soakage was equal or better than the rate at which it was pumped into the trial pit.

On this basis shallow soakaways within the made ground would be feasible at the site, however consideration would need to be given to the migration of contamination and the method will need to be agreed by the local authority.

8.8 Site Specific Risk Assessment

The desk study research has indicated that the site has not generally had a contaminative history,

having been occupied by school buildings throughout its developed history. A tank was formerly located at the front of Dyne House which was removed in the last ten years. Boreholes drilled in proximity to this area did not indicate any olfactory signs of contamination. In addition, the eastern part of the site has been subject to the placement of fill.

Contamination testing has measured elevated concentrations of arsenic, lead, several constituents of PAH and total PAH in some of the samples of made ground tested. These concentrations could pose a potentially unacceptable risk to human health through direct contact, accidental ingestion or inhalation of soil or soil derived dust. Most of the samples tested were derived from the filled area in the east of the site, with a single sample tested from the car park in the west.

The source of the lead and PAH contamination is not known but is most likely as a result of fragments of extraneous material such as coal, charcoal and ash within the made ground. Further assessment of the PAH concentrations indicate that the PAH is probably of a petrogenic origin, and is typical of made ground containing coal.

The arsenic, lead and PAH contamination, including benzo(a)pyrene, is considered unlikely to be in a soluble form, such that a risk to groundwater or adjacent sites is not envisaged. The underlying London Clay is classed as Unproductive Strata and therefore contamination to the chalk aquifer at depth is not anticipated. The basement excavation will remove much of the made ground and the hardstanding will provide a barrier between the contaminated soil and end users.

Although no visual or olfactory evidence of contamination was identified in the boreholes in close proximity to the tank, there is a possibility that residual contamination remains in this area. However, the proposed excavation to the front of Dyne House would be expected to remove any potentially contaminated soil and prevent a risk to end users. It is also recommended that a watching brief is maintained during groundwork in the area of the former tank. If contamination is encountered further investigation will be required and the risk assessment should be reviewed.

8.8.1 End Users

End users will be effectively isolated from direct contact with the identified contaminants by the extent of buildings and areas of external hardstanding. All of the samples tested as part of the investigation are currently in areas covered by hardstanding. If the proposals are amended to incorporate new soft landscaping in the eastern playground then imported soil will be required to prevent a risk to site users. Similarly, if new landscaping is proposed towards the centre of the site additional testing is recommended in this area, or imported soil will need to be provided.

8.8.2 Site Workers

Site workers should be made aware of the contamination and a programme of working should be identified to protect workers handling any soil. The method of site working should be in accordance with guidelines set out by HSE and CIRIA¹⁰ and the requirements of the Local Authority Environmental Health Officer.

¹⁰ CIRIA (1996) *A guide for safe working on contaminated sites* - Report 132, Construction Industry Research and Information Association

8.8.3 Buried Services

Consideration may need to be given to the protection of buried plastic services if they are to be laid within the made ground which is rich in ash. Details of the proposed protection measures for buried plastic services will in any case need to be approved by the EHO and the relevant service authority prior to the adoption of any scheme.

8.9 Waste Disposal

Any spoil arising from excavations or landscaping works, which is not to be re-used in accordance with the CL:AIRE guidance¹¹, will need to be disposed of to a licensed tip. Under the European Waste Directive, waste is classified as being either Hazardous or Non-Hazardous and landfills receiving waste are classified as accepting hazardous or non-hazardous wastes or the non-hazardous sub-category of inert waste in accordance with the Waste Directive. Waste going to landfill is subject to landfill tax at either the standard rate of £82.60 per tonne (about £150 per m³) or at the lower rate of £2.60 per tonne (roughly £5 per m³). However, the classification for tax purposes is not the same as that for disposal purposes. Currently all made ground and topsoil is taxable at the 'standard' rate and only naturally occurring rocks and soils which are accurately described as such in terms of the 2011 Order¹² would qualify for the 'lower rate' of landfill tax.

Based upon on the technical guidance provided by the Environment Agency¹³ it is considered likely that the made ground from this site, as represented by the seven chemical analyses carried out, would be classified as a hazardous waste under the waste code 17 05 03 (soils and stones containing dangerous substances) and would be taxable at the higher rate. This is due to the 5900 mg/kg concentration of lead encountered in one sample from Borehole No 2 and it may be that further testing or zoning could reduce the amount of hazardous material removed from site. It is likely that the natural soils, if separated out, could be classified as an inert waste also under the waste code 17 05 04. This material would be taxable at the lower rate, if accurately described as naturally occurring sand and gravel in terms of the 2011 Order on the waste transfer note. As this site has not had a contaminative history there should be no requirement for WAC leaching analyses to confirm that this material is suitable for landfilling, although this would require confirmation from the receiving site.

Under the requirements of the European Waste Directive all waste needs to be pre-treated prior to disposal. The pre-treatment process must be physical, thermal, chemical or biological, including sorting. It must change the characteristics of the waste in order to reduce its volume, hazardous nature, facilitate handling or enhance recovery. The waste producer can carry out the treatment but they will need to provide documentation to prove that this has been carried out. Alternatively, the treatment can be carried out by an approved contractor. The Environment Agency has issued a position paper¹⁴ which states that in certain circumstances, segregation at source may be considered as pre-treatment and thus excavated material may not have to be treated prior to landfilling if the soils can be segregated onsite prior to excavation by sufficiently characterising the soils insitu prior to excavation.

The above opinion with regard to the classification of the excavated soils and its likely landfill taxable rate is provided for guidance only and should be confirmed by the receiving landfill once the soils to be discarded have been identified.

11 CL:AIRE (2011) *The Definition of Waste: Development Industry Code of Practice* Version 2, March 2011

12 *Landfill Tax (Qualifying Material) Order 2011*

13 Environment Agency (2013) *Hazardous Waste: Interpretation of the definition and classification of hazardous waste. Technical Guidance WM2* Third Edition, August 2013

14 Regulatory Position Statement (2007) *Treating non-hazardous waste for landfill - Enforcing the new requirement* Environment Agency 23 Oct 2007

The local waste regulation department of the Environment Agency should be contacted to obtain details of tips that are licensed to accept the soil represented by the test results. The tips will be able to provide costs for disposing of this material but may require further testing.

9.0 BASEMENT IMPACT ASSESSMENT

Superseded - refer to Basement Impact Assessment 2019

Superseded - refer to Basement Impact Assessment 2019

Superseded - refer to Basement Impact Assessment 2019

10.0 OUTSTANDING RISKS AND ISSUES

This section of the report aims to highlight areas where further work is required as a result of limitations on the scope of this investigation, or where issues have been identified by this investigation that warrant further consideration. The scope of risks and issues discussed in this section is by no means exhaustive, but covers the main areas where additional work is considered to be required.

The ground is a heterogeneous natural material and variations will inevitably arise between the locations at which it is investigated. This report provides an assessment of the ground conditions based on the discrete points at which the ground was sampled, but the ground conditions should be subject to review as the work proceeds to ensure that any variations from the Ground Model are properly assessed by a suitably qualified person.

As discussed throughout the report, groundwater is likely to be encountered during the basement excavations although groundwater monitoring should be continued to confirm equilibrium levels and trial excavations should be considered to assess the extent of inflows to be expected.

Samples of soil tested indicated elevated concentrations of contaminants and some form of remediation will be required if new areas of soft landscaping are proposed. It would be prudent to review the risk assessment once the construction methodology has been agreed.

Further investigation or a watching brief should be maintained in the area of the former tank at the front of Dyne House.

A ground movement assessment will be completed in conjunction with this report and the design of the basement will need to consider the slope stability of the site, which should be assessed separately.

APPENDIX

Borehole Records

Trial Pit Records

Geotechnical Test Results

Chemical Test Results

Generic Risk-Based Soil Screening Values

SPT & Cohesion Level Graph

Envirocheck Information

Historical Maps

Site Plan

				Widbury Barn Widbury Hill Ware, Herts SG12 7QE		Site Dyne House, Highgate School, London, N6 5EE		Number BH1	
Excavation Method Drive-in Window Sampler		Dimensions		Ground Level (mOD) 110.65		Client Highgate School		Job Number J15093	
		Location		Dates 30/03/2015		Engineer A-squared Studio		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.50	D			110.55	(0.10)	Tarmac			
					0.10	MADE GROUND (dark brown and grey clayey occasional gravelly sand with coal, charcoal and brick fragments)			
					(0.90)				
				109.65	1.00	MADE GROUND (brown silty clay)			
4.00	D				(0.60)				
				109.05	1.60	MADE GROUND (bricks)			
					(0.40)				
				108.65	2.00	MADE GROUND (blackish grey clayey sand and gravel with brick fragments)			
4.50	D				(1.50)				
				107.15	3.50	Firm grey mottled brown and slightly organic silty sandy CLAY			
					(0.80)				
				106.35	4.30	Firm brown mottled grey silty CLAY			
					(0.40)				
				105.95	4.70	Complete at 4.70m			
Remarks								Scale (approx)	
								1:50	
								Logged By ME	
								Figure No. J15093.BH1	

GEA Geotechnical & Environmental Associates				Widbury Barn Widbury Hill Ware, Herts SG12 7QE		Site Dyne House, Highgate School, London, N6 5EE		Number BH2	
Excavation Method Drive-in Window Sampler		Dimensions		Ground Level (mOD) 111.00		Client Highgate School		Job Number J15093	
		Location		Dates 30/03/2015		Engineer A-squared Studio		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.50	D			110.90	(0.10) 0.10	Tarmac			
					(0.90)	MADE GROUND (dark grey gravelly sand with occasional coal and clinker with concrete and sandstone fragments)			
				110.00	1.00 (0.20)	MADE GROUND (brown mottled grey silty clay)			
				109.80	1.20	MADE GROUND (brown and black clayey gravelly sand with coal and clinker fragments)			
3.00	D				(1.10)				
				108.70	2.30 (0.20)	MADE GROUND (bricks)			
				108.50	2.50	Grey and black slightly organic SAND with occasional gravel grading into sandy gravell clay at the base			
					(1.25)				
4.00	D			107.25	3.75	Firm orange-brown mottled grey silty sandy CLAY with partings of firm to medium sand			
					(0.75)				
				106.50	4.50	Complete at 4.50m			
Remarks								Scale (approx) 1:50	Logged By ME
								Figure No. J15093.BH2	

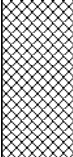
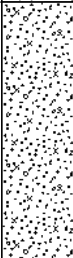
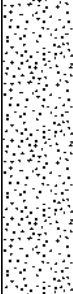
				Widbury Barn Widbury Hill Ware, Herts SG12 7QE		Site Dyne House, Highgate School, London, N6 5EE		Number BH3	
Excavation Method Drive-in Window Sampler		Dimensions		Ground Level (mOD) 111.20		Client Highgate School		Job Number J15093	
		Location		Dates 30/03/2015		Engineer A-squared Studio		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.30	D			111.14	(0.06)	Tarmac			
0.60	D			110.70	0.06 (0.44)	MADE GROUND (dark grey sandy gravelly clay with fragments of clinker, ash, coal, tarmac and bricks)			
0.80	D			110.50	0.50 (0.20)	'Firm to stiff' orange-brown sandy gravelly CLAY. Gravel is fine to coarse and rounded, desiccated soil.			
				110.20	0.70 (0.30)	'Stiff' orange brown mottled grey sandy CLAY			
					1.00	Soft becoming firm sandy CLAY			
1.80	D				(2.70)				
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
Remarks								Scale (approx) 1:50	Logged By ME
								Figure No. J15093.BH3	

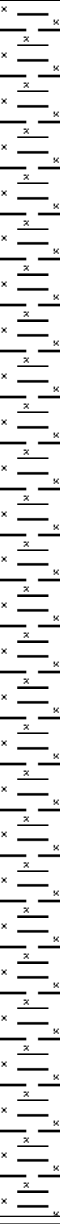
GEA Geotechnical & Environmental Associates				Widbury Barn Widbury Hill Ware, Herts SG12 7QE		Site Dyne House, Highgate School, London, N6 5EE		Number BH4			
Excavation Method Drive-in Window Sampler		Dimensions		Ground Level (mOD) 111.15		Client Highgate School		Job Number J15093			
		Location		Dates 30/03/2015		Engineer A-squared Studio		Sheet 1/1			
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water			
0.80	D		pp = 4.5 pp = 4.5	111.10	(0.05) 0.05	Tarmac					
			pp = 4.5 pp = 4.5		(1.45)	MADE GROUND (Black and grey cobbly gravelly sand with pockets of clay and fragments of ash, clinker, brick and concete)					
			pp = 4.5 pp = 1		109.65	1.50			MADE GROUND (Grey silty very sandy slightly organic clay with rare brick fragments)		
			pp = 1.25 pp = 1.5			(1.00)					
3.00	D		pp = 2	108.65	2.50	Firm becoming stiff orange-brown mottled grey silty sandy CLAY with partings of fine to medium sand		▽1			
			pp = 2.75 pp = 1.5								
			pp = 2 pp = 2.25								
			pp = 3								
4.00	D		pp = 2.5 pp = 3		(2.90)						
			pp = 3 pp = 2								
			seepage(1) at 4.00m. pp = 2 pp = 2.5 pp = 2.25								
			pp = 2.5 pp = 2.75								
5.50	D		pp = 3.5	105.75	5.40	Stiff grey silty CLAY with occasional light grey partings of fine sand					
			pp = 3 pp = 3.25								
			pp = 4 pp = 3.25							(0.60)	
			pp = 3.5						105.15	6.00	Complete at 6.00m
Remarks pp denotes pocket penetrometer reading								Scale (approx) 1:50	Logged By ME		
								Figure No. J15093.BH4			

GEA Geotechnical & Environmental Associates				Widbury Barn Widbury Hill Ware, Herts SG12 7QE		Site Dyne House, Highgate School, London, N6 5EE		Number BH5	
Excavation Method Drive-in Window Sampler		Dimensions		Ground Level (mOD) 125.70		Client Highgate School		Job Number J15093	
		Location		Dates 30/03/2015		Engineer A-squared Studio		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.80	D			125.63	(0.07) 0.07	Tarmac			
					(1.13)	MADE GROUND (brown clayey gravelly sand with pocklets of clay and brick fragments)			
1.50	D		pp = pp = 1.25	124.50	1.20	Firm brown silty occasionally very sandy gravelly CLAY with partings of coarse sand. Gravel is fine to coarse and rounded			
					(0.80)				
2.30	D		pp = 1.5 pp = 2	123.70	2.00	Orange-brown very clayey fine to coarse SAND with occasional fine flint gravel. Gravel is rounded and fine			
					(0.50)				
3.00	D		pp = 2	123.20	2.50	Firm becoming stiff orange-brown silty very sandy CLAY with partings of fine sand			
					(1.50)				
5.00	D		pp = 2.25 pp = 1.25 pp = 1.5 pp = 1.5 pp = 1.75 seepage(1) at 4.00m. pp = 3	121.70	4.00	Light brown to buff slightly silty fine SAND			▽1
					(2.00)				
			seepage(2) at 6.00m.	119.70	6.00	Complete at 6.00m			▽2
Remarks pp denotes pocket penetrometer reading								Scale (approx) 1:50	Logged By ME
								Figure No. J15093.BH5	

					Widbury Barn Widbury Hill Ware, Herts SG12 7QE		Site Dyne House, Highgate School, London, N6 5EE		Borehole Number BH6
Boring Method Cable Percussion		Casing Diameter		Ground Level (mOD) 110.80		Client Highgate School		Job Number J15093	
		Location		Dates 30/03/2015		Engineer A-squared Studio		Sheet 1/2	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30	D				110.74	(0.06) 0.06	Tarmac		
0.50	B						MADE GROUND (grey and brown sandy gravel with pockets of clay and fragments of coal, brick and concrete)		
1.20-1.65 1.20	CPT N=27 B		DRY	5,8/4,4,11,8					
1.75	D					(3.69)			
2.00-2.45 2.00	CPT N=19 B	2.00	DRY	5,8/4,4,3,8					
2.75	D								
3.00-3.45 3.00	CPT N=10 B	3.00	DRY	8,2/2,2,4,2					
3.75	D				107.05	3.75	MADE GROUND (grey silty slightly organic clay with sand and rare brick fragments)		
4.00-4.45 4.00	CPT N=11 B	4.00	DRY	1,1/2,3,3,3	106.80	(0.25) 4.00	Soft pale grey clayey silty SAND (possible made ground)		
4.75	D				106.05	4.75	Soft becoming firm orange-brown mottled grey silty sandy CLAY with partings of clayey sand		
5.00-5.45 5.00	CPT N=10 B	5.00	DRY	1,1/2,2,3,3					▽1
6.00	D			Seepage(1) at 6.00m.		(2.25)			
6.50-6.95	U	6.00	6.00	24 blows					
7.50	D				103.80	7.00	Stiff high strength grey silty slight sandy CLAY with partings of fine grey sand, clayey sand and rare shell fragments and pyrite nodules		
8.00-8.45 8.00	SPT N=17 D	7.00	7.00	2,3/3,4,5,5					
9.00	D								
9.50-9.95	U	7.00	7.00	26 blows					
Remarks Setup rig over position, 1 hr Standpipe installed to a depth of 8.0 m Demobilise rig, bag spoil and clean down position, 1 hr								Scale (approx) 1:50	Logged By ME
								Figure No. J15093.BH6	

 Geotechnical & Environmental Associates					Widbury Barn Widbury Hill Ware, Herts SG12 7QE		Site Dyne House, Highgate School, London, N6 5EE		Borehole Number BH6
Boring Method Cable Percussion		Casing Diameter			Ground Level (mOD) 110.80		Client Highgate School		Job Number J15093
		Location			Dates 30/03/2015		Engineer A-squared Studio		Sheet 2/2
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.50	D								
11.00-11.45 11.00	SPT N=19 D	7.00	8.00	2,4/4,5,5,5					
12.00	D								
12.50-12.95	U	7.00	9.00	27 blows		(8.00)			
13.50	D								
14.55-15.00 14.55	SPT N=23 D	7.00	10.00	2,3/5,5,6,7					
					95.80	15.00			
							Complete at 15.00m		
Remarks								Scale (approx) 1:50	Logged By ME
								Figure No. J15093.BH6	

 Geotechnical & Environmental Associates					Widbury Barn Widbury Hill Ware, Herts SG12 7QE		Site Dyne House, Highgate School, London, N6 5EE		Borehole Number BH7
Boring Method Cable Percussion		Casing Diameter 120 mm to 10.00m 100mm to 20.00m		Ground Level (mOD) 125.70		Client Highgate School		Job Number J15093	
		Location		Dates 08/04/2015- 09/04/2015		Engineer A-squared Studio		Sheet 1/3	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B				125.64	(0.06)	Tarmac		
					125.40	0.06 (0.24)	Concrete		
1.00	D					0.30	MADE GROUND (brown and grey clayey gravelly sand with pockets of clay and fragments of brick)		
1.20-1.65	CPT N=6			1,1/2,1,1,2		(1.20)			
1.20	B				124.20	1.50			
1.75	D					(0.80)	Soft orange-brown silty sandy gravelly CLAY. Gravel is fine to coarse, rounded to subround		
2.00-2.45	CPT N=14			2,2/3,3,3,5		2.30			
2.00	B				123.40		Medium dense dark orange-brown silty fine SAND with occasional fine rounded gravel with partings of pale orange-brown clay		
2.75	D					(1.70)			
3.00-3.45	U FAIL								
3.45	D						Medium dense brown slightly silty fine SAND		
3.50-3.95	CPT N=17			2,2/3,4,4,6		4.00			
3.50	B				121.70				
4.00-4.45	SPT N=22			2,4/5,5,6,6		(2.00)	Medium dense brown silty fine SAND with partings of sot orange-brown mottled grey clay		
4.00	D								
4.75	D								
5.00-5.45	SPT N=26			3,5/6,6,7,7					
5.00	D								
6.00	D				119.70	6.00			
6.50-6.95	SPT N=21			5,4/5,5,6,5					
6.50	B								
7.50	D								
8.00-8.45	CPT N=23			3,5/6,5,6,6					
8.00	B								
9.00	D			Water strike(1) at 9.00m, rose to 8.00m in 20 mins.		(6.00)			
9.50-9.95	SPT N=26			3,5/5,7,7,7					
9.50	B								
Remarks								Scale (approx) 1:50	Logged By ME
								Figure No. J15093.BH7	

GEA Geotechnical & Environmental Associates					Widbury Barn Widbury Hill Ware, Herts SG12 7QE		Site Dyne House, Highgate School, London, N6 5EE		Borehole Number BH7	
Boring Method Cable Percussion		Casing Diameter 120 mm to 10.00m 100mm to 20.00m			Ground Level (mOD) 125.70		Client Highgate School		Job Number J15093	
		Location			Dates 08/04/2015- 09/04/2015		Engineer A-squared Studio		Sheet 2/3	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
10.50	D									
11.00-11.45 11.00	SPT N=21 D			3,4/4,5,5,7		(6.00)				
12.00	D				113.70	12.00	Firm becoming stiff and very high strength dark brownish grey silty sandy CLAY with partings of grey silty sand and silt. Claystone encountered at 20.70 m			
12.50-12.95 12.50	SPT N=22 D			3,4/5,6,5,6						
13.50	D									
14.00-14.45 14.00	CPT N=25 B			3,5/5,6,6,8						
15.00	D									
15.50-15.95	U			35 blows						
16.50	D					(9.00)				
17.00-17.45 17.00	SPT N=29 D			3,5/6,7,8,8						
18.00	D									
18.50-18.95	U			45 blows						
19.50	D									
20.00-20.45	SPT N=32			4,5/7,7,8,10						
Remarks								Scale (approx)	Logged By	
								1:50	ME	
								Figure No. J15093.BH7		



Geotechnical &
Environmental
Associates

Widbury Barn
Widbury Hill
Ware, Herts
SG12 7QE

Site

Dyne House, Highgate School, London, N6 5EE

Borehole
Number
BH8

Boring Method Cable Percussion	Casing Diameter 150mm to 15.00m	Ground Level (mOD) 118.00	Client Highgate School	Job Number J15093
	Location	Dates 22/05/2015- 28/05/2015	Engineer A-squared Studio	Sheet 1/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40	D1				117.90	(0.10) 0.10	Concrete		
0.90	D2					(1.70)	MADE GROUND (brown sandy gravelly clay with cobbles and pockets of gravelly cobbles of brick)		
1.20-1.65 1.20	CPT N=2 B1	1.20	DRY	1,0/0,1,0,1					
1.80	D3				116.20	1.80 (0.20)	MADE GROUND (brown sandy clay)		
2.00-2.45 2.00	SPT N=5 S1	1.50	DRY	1,0/1,2,1,1	116.00	2.00	Soft becoming firm brown mottled grey silty very sandy CLAY with occasional gravel		
2.70	D4								
3.00-3.45 3.00	SPT N=7 S2	1.50	DRY	1,0/2,1,2,2		(2.30)			
3.70	D5								
4.00-4.45	U1								
4.50	D6			seepage(1) at 4.30m, no rise after 20 mins, sealed at 7.50m.	113.70	4.30	Medium dense orange-brown very clayey fine SAND with partings of firm sandy CLAY		▼1
4.80	D7								
5.00-5.45 5.00	SPT N=10 S3	1.50	DRY	2,2/1,3,3,3		(1.70)			▼2
6.00-6.45	U2				112.00	6.00	Firm becoming stiff high strength grey mottled dark brown silty sandy CLAY with silt horizons		▼2
6.50	D8			seepage(2) at 6.27m, rose to 5.70m in 20 mins, sealed at 7.50m. 27/05/2015: DRY					
7.50-7.95 7.50	SPT N=11 S4	7.50	DRY	2,3/2,3,2,4					
9.00	U3								
9.50	D9								

Remarks Manhandle rig and ancillary equipment to position with four man crew and mini digger, 8 hrs Excavating service pit to 1.2 m, 1 hr 15 mins Chiselling from 23.0 m to 23.4 m, 30 mins Groundwater seepages from 15.0 m downward constant Vibrating wire piezometers installed at 23.5 m, 17.5 m and 11.5 m Groundwater monitoring standpipe installed to a depth of 6.0 m, response zone between 4 m and 6 m Tidy drilling position and demobilise rig with four man crew and mini digger, 8 hrs	Scale (approx)	Logged By
	1:50	ME
	Figure No. J15093.BH8	



Geotechnical &
Environmental
Associates

Widbury Barn
Widbury Hill
Ware, Herts
SG12 7QE

Site

Dyne House, Highgate School, London, N6 5EE

Borehole
Number
BH8

Boring Method
Cable Percussion

Casing Diameter
150mm to 15.00m

Ground Level (mOD)
118.00

Client
Highgate School

Job
Number
J15093

Location

Dates
22/05/2015-
28/05/2015

Engineer
A-squared Studio

Sheet
2/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.50-10.95 10.50	SPT N=18 S5	7.50	DRY	3,3/4,4,5,5					
12.00-12.45	U4								
12.50	D10								
13.50-13.95 13.50	SPT N=23 S6	7.50	13.10	3,4/5,5,6,7					
15.00-15.45	U5			slow/medium(3) at 14.70m, rose to 12.30m in 20 mins, sealed at 15.00m.					
15.50	D11								
16.50-16.95	U6								
17.00	D12					(18.00)			
18.00-18.45	U7								
18.50	D13								
19.50-19.95	U8								

Remarks

Scale
(approx)

1:50

Logged
By

ME

Figure No.
J15093.BH8

 Geotechnical & Environmental Associates		Widbury Barn Widbury Hill Ware, Herts SG12 7QE		Site Dyne House, Highgate School, London, N6 5EE		Borehole Number BH8			
Boring Method Cable Percussion		Casing Diameter 150mm to 15.00m		Ground Level (mOD) 118.00		Client Highgate School		Job Number J15093	
		Location		Dates 22/05/2015-28/05/2015		Engineer A-squared Studio		Sheet 3/3	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
20.00	D14								
21.00-21.45	U9								
21.50	D15					(18.00)			
22.50-22.95	U10								
23.00	D16								
23.50-23.95 23.50	SPT N=32 S7	15.00	18.20	6,6/7,8,8,9	94.00	24.00			
							Complete at 24.00m		
Remarks									
								Scale (approx) 1:50	Logged By ME
								Figure No. J15093.BH8	



Widbury Barn
Widbury Hill
Ware, Herts
SG12 7QE

Dyne House, Highgate School, London, N6 5EE

**Borehole
Number**
BH9

Casing Diameter
100mm to 1.00m

Ground Level (mOD)	125.60
--------------------	--------

Client
Highgate School

**Job
Number**
J15093

Location

Dates 07/04/2015

Engineer
A-squared Studio

Sheet
1/1

[illegible]

Remarks
Chiselling from ground level to 2.0 m, 2 hrs
Unable to instal casing vertically, spent 1 hr 30 mins breaking side of borehole, no progress so abandoned borehole
Groundwater not encountered

Scale (approx)	Logged By
1:50	ME

Figure No.
J15093.BH9

				Widbury Barn Widbury Hill Ware, Herts SG12 7QE		Standard Penetration Test Results						
Site : Dyne House, Highgate School, London, N6 5EE												Job Number J15093
Client : Highgate School												Sheet
Engineer : A-squared Studio												1 / 1
Borehole Number	Base of Borehole (m)	End of Seating Drive (m)	End of Test Drive (m)	Test Type	Seating Blows per 75mm		Blows for each 75mm penetration				Result	Comments
					1	2	1	2	3	4		
BH6	1.20	1.35	1.65	CPT	5	8	4	4	11	8	N=27	
BH6	2.00	2.15	2.45	CPT	5	8	4	4	3	8	N=19	
BH6	3.00	3.15	3.45	CPT	8	2	2	2	4	2	N=10	
BH6	4.00	4.15	4.45	CPT	1	1	2	3	3	3	N=11	
BH6	5.00	5.15	5.45	CPT	1	1	2	2	3	3	N=10	
BH6	8.00	8.15	8.45	SPT	2	3	3	4	5	5	N=17	
BH6	11.00	11.15	11.45	SPT	2	4	4	5	5	5	N=19	
BH6	14.55	14.70	15.00	SPT	2	3	5	5	6	7	N=23	
BH7	1.20	1.35	1.65	CPT	1	1	2	1	1	2	N=6	
BH7	2.00	2.15	2.45	CPT	2	2	3	3	3	5	N=14	
BH7	3.50	3.65	3.95	CPT	2	2	3	4	4	6	N=17	
BH7	4.00	4.15	4.45	SPT	2	4	5	5	6	6	N=22	
BH7	5.00	5.15	5.45	SPT	3	5	6	6	7	7	N=26	
BH7	6.50	6.65	6.95	SPT	5	4	5	5	6	5	N=21	
BH7	8.00	8.15	8.45	CPT	3	5	6	5	6	6	N=23	
BH7	9.50	9.65	9.95	SPT	3	5	5	7	7	7	N=26	
BH7	11.00	11.15	11.45	SPT	3	4	4	5	5	7	N=21	
BH7	12.50	12.65	12.95	SPT	3	4	5	6	5	6	N=22	
BH7	14.00	14.15	14.45	CPT	3	5	5	6	6	8	N=25	
BH7	17.00	17.15	17.45	SPT	3	5	6	7	8	8	N=29	
BH7	20.00	20.15	20.45	SPT	4	5	7	7	8	10	N=32	
BH7	21.00	21.01		CPT	25						25*/10mm	
BH8	1.20	1.35	1.65	CPT	1	0	0	1	0	1	N=2	
BH8	2.00	2.15	2.45	SPT	1	0	1	2	1	1	N=5	
BH8	3.00	3.15	3.45	SPT	1	0	2	1	2	2	N=7	
BH8	5.00	5.15	5.45	SPT	2	2	1	3	3	3	N=10	
BH8	7.50	7.65	7.95	SPT	2	3	2	3	2	4	N=11	
BH8	10.50	10.65	10.95	SPT	3	3	4	4	5	5	N=18	
BH8	13.50	13.65	13.95	SPT	3	4	5	5	6	7	N=23	
BH8	23.50	23.65	23.95	SPT	6	6	7	8	8	9	N=32	



Geotechnical &
Environmental
Associates

Widbury Barn
Widbury Hill
Ware
Herts SG12 7QE

Site

Dyne House, Highgate School, London, N6
5EE

Trial Pit
Number

1

Excavation Method

Manual

Dimensions

Ground Level (mOD)

Client

Highgate School

Job

Number

J15093

Location

Dates

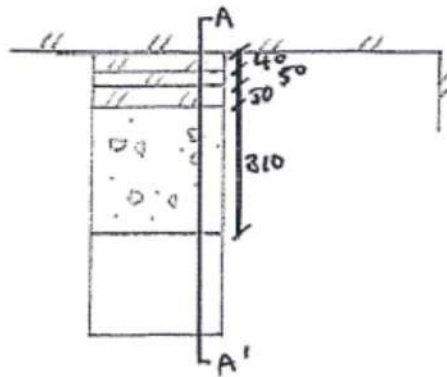
Engineer

A-squared Studio

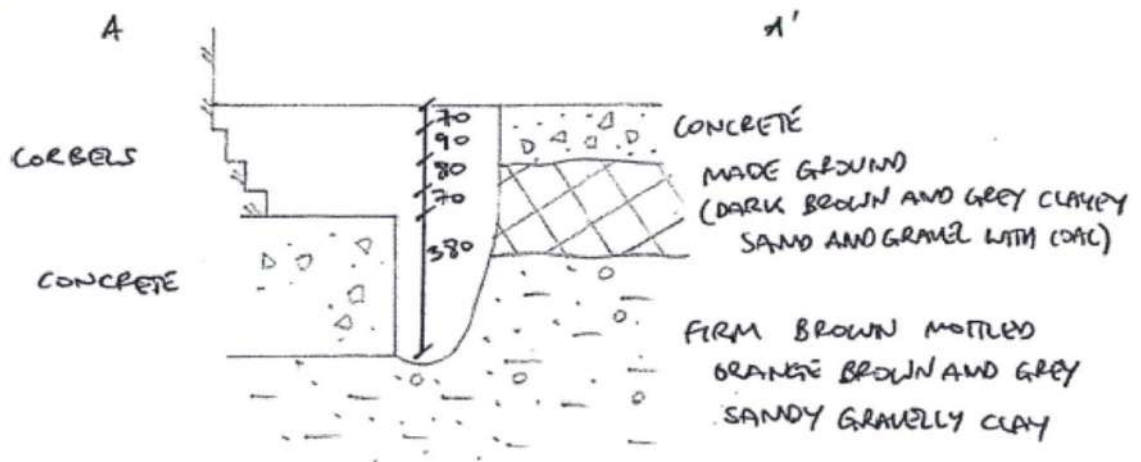
Sheet

1 / 1

PLAN



SECTION



Remarks:

All dimensions in millimetres

Sides of trial pit remained stable during excavation

Groundwater: Not encountered

Scale:

1:20

Logged by:

ME



Geotechnical &
Environmental
Associates

Widbury Barn
Widbury Hill
Ware
Herts SG12 7QE

Site
Dyne House, Highgate School, London, N6
5EE

Trial Pit
Number
2

Excavation Method
Manual

Dimensions (mm)

Ground Level (mOD)

Client

Highgate School

Job
Number
J15093

Location

Dates

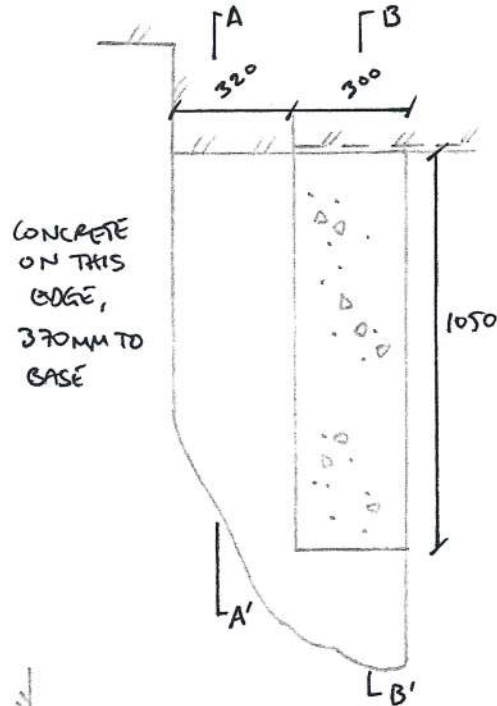
31/3/15

Engineer

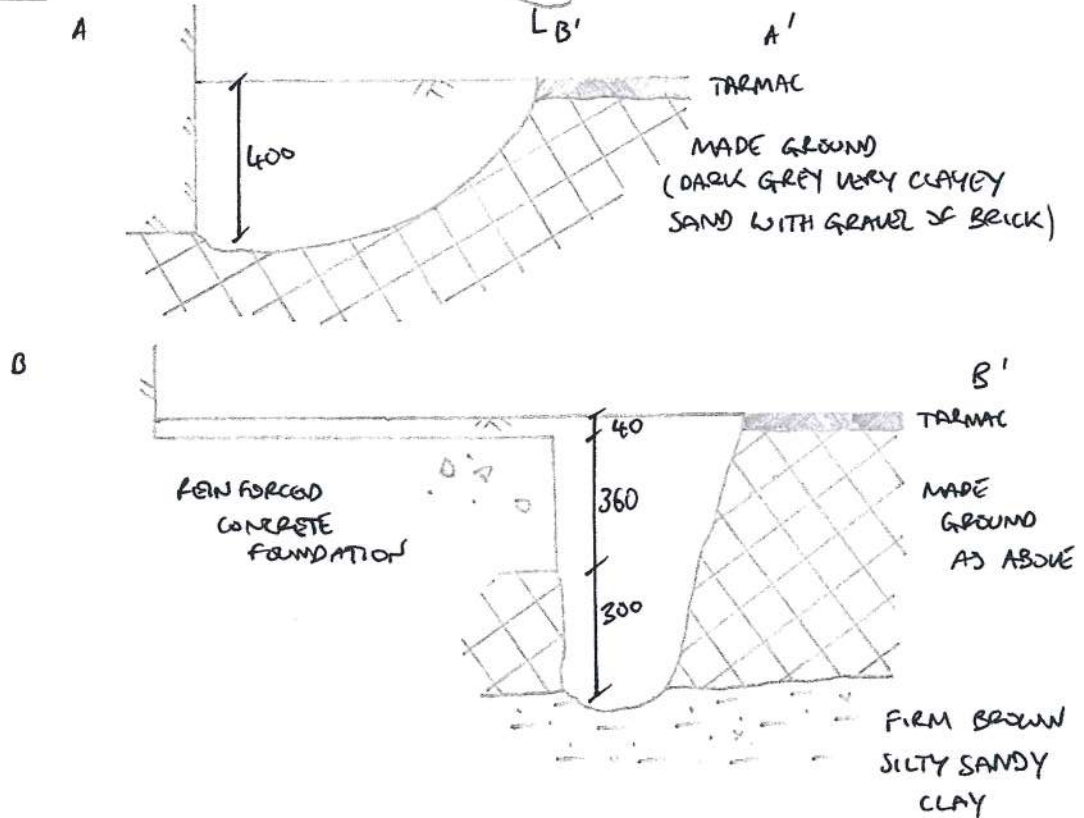
A-squared Studio

Sheet
1 / 1

PLAN



SECTIONS



Remarks:

All dimensions in millimetres

Sides of trial pit remained stable during excavation

Groundwater not encountered

Scale:

1:20

Logged by:

ME



Geotechnical &
Environmental
Associates

Widbury Barn
Widbury Hill
Ware
Herts SG12 7QE

Site
Dyne House, Highgate School, London, N6
5EE

Trial Pit
Number
3

Excavation Method
Manual

Dimensions (mm)

Ground Level (mOD)

Client

Highgate School

Job
Number
J15093

Location

Dates

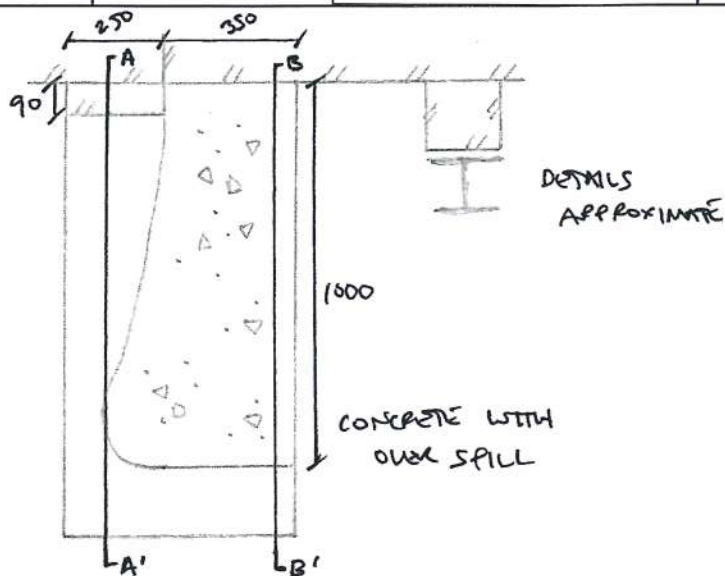
30/3/15

Engineer

A-squared Studio

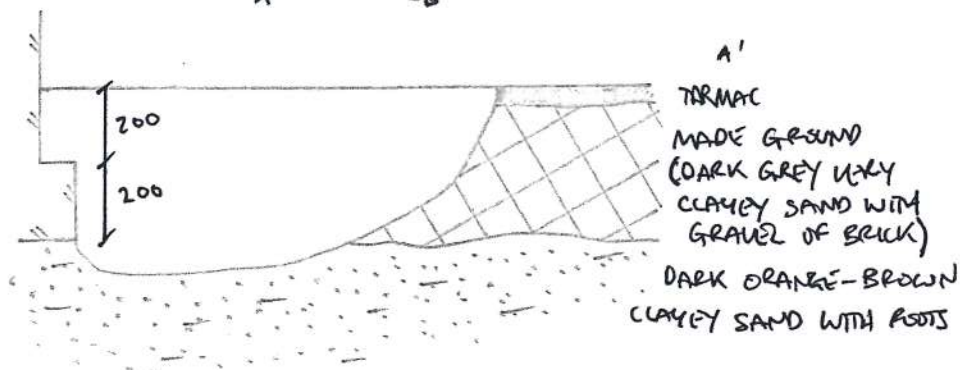
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1 / 1

PLAN

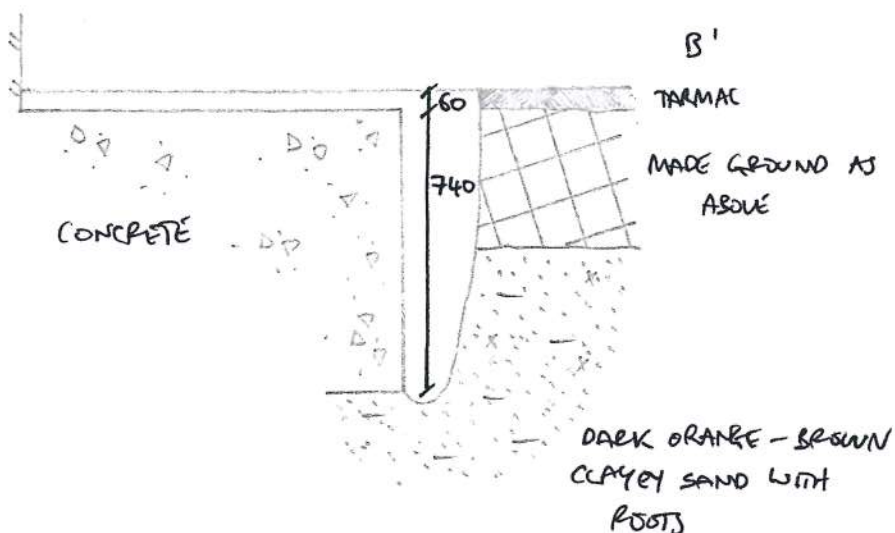


SECTION

A



B



Remarks:

All dimensions in millimetres

Sides of trial pit remained stable during excavation

Groundwater not encountered

Scale:

1:20

Logged by:

ME



Geotechnical &
Environmental
Associates

Widbury Barn
Widbury Hill
Ware
Herts SG12 7QE

Site
Dyne House, Highgate School, London, N6
5EE

Trial Pit
Number
4

Excavation Method
Manual

Dimensions (mm)

Ground Level (mOD)

Client

Highgate School

Job
Number
J15093

Location

Dates

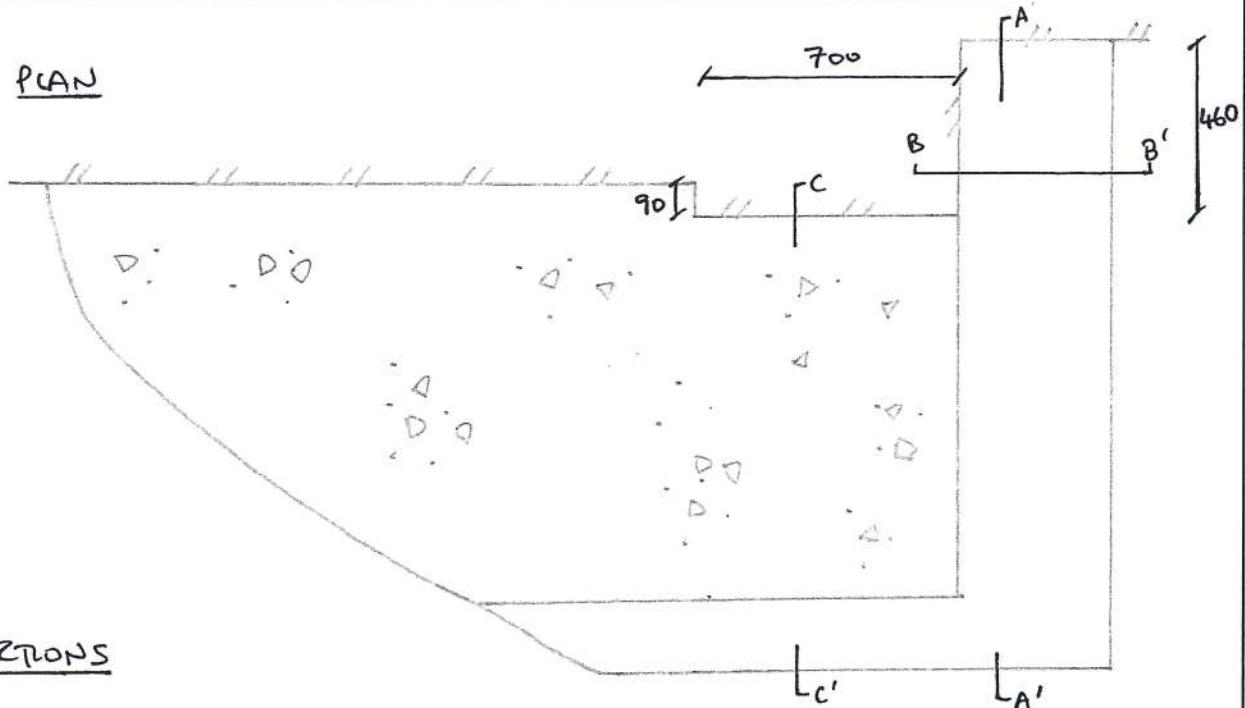
31/3/15

Engineer

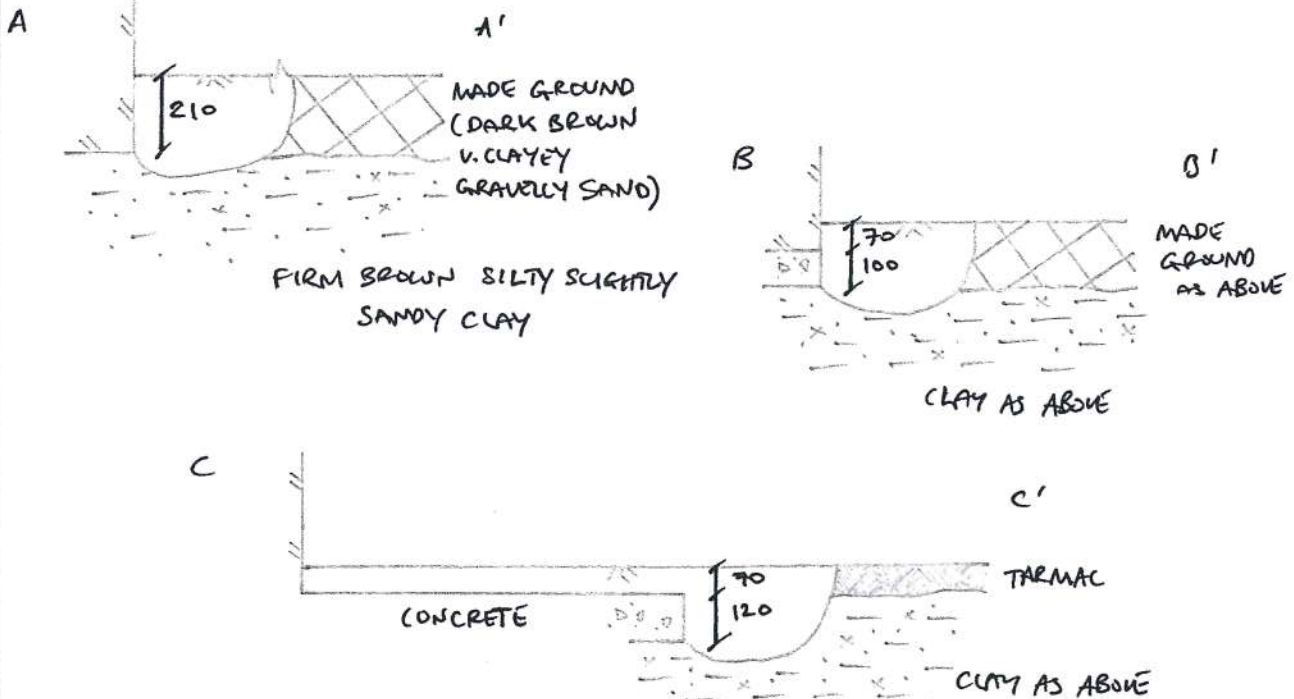
A-squared Studio

Sheet
1 / 1

PLAN



SECTIONS



Remarks:

All dimensions in millimetres

Sides of trial pit remained stable during excavation

Groundwater not encountered

Scale:

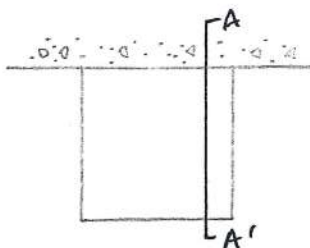
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Logged by:

ME

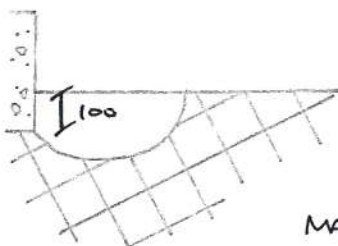
GEA Geotechnical & Environmental Associates		Widbury Barn Widbury Hill Ware Herts SG12 7QE		Site Dyne House, Highgate School, London, N6 5EE	Trial Pit Number 5
Excavation Method Manual	Dimensions (mm)	Ground Level (mOD)	Client Highgate School	Job Number J15093	
	Location	Dates 30/3/15	Engineer A-squared Studio	Sheet 1 / 1	

PLAN



SECTION

A
 CONCRETE
 BASE
 TO
 WOODEN
 FENCE
 DEPTH TO
 BASE
 VARIES



A'
 MADE GROUND
 (BROWN CLAYEY GRAVELLY
 SAND WITH BRICKS AND
 ROOTS)

Remarks:
 All dimensions in millimetres
 Sides of trial pit unstable during excavation

Scale:
 1:20

Logged by:
 ME



Geotechnical &
Environmental
Associates

Widbury Barn
Widbury Hill
Ware
Herts SG12 7QE

Site

Dyne House, Highgate School, London, N6
5EE

Trial Pit
Number

6

Excavation Method

Manual

Dimensions (mm)

Ground Level (mOD)

Client

Highgate School

Job
Number

J15093

Location

Dates

30/3/15

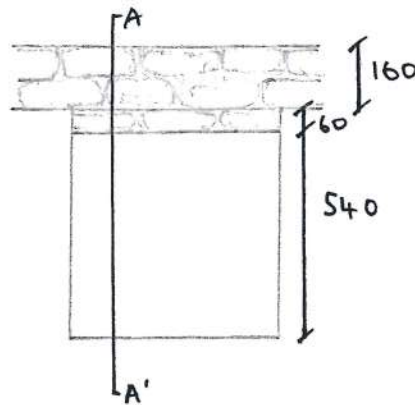
Engineer

A-squared Studio

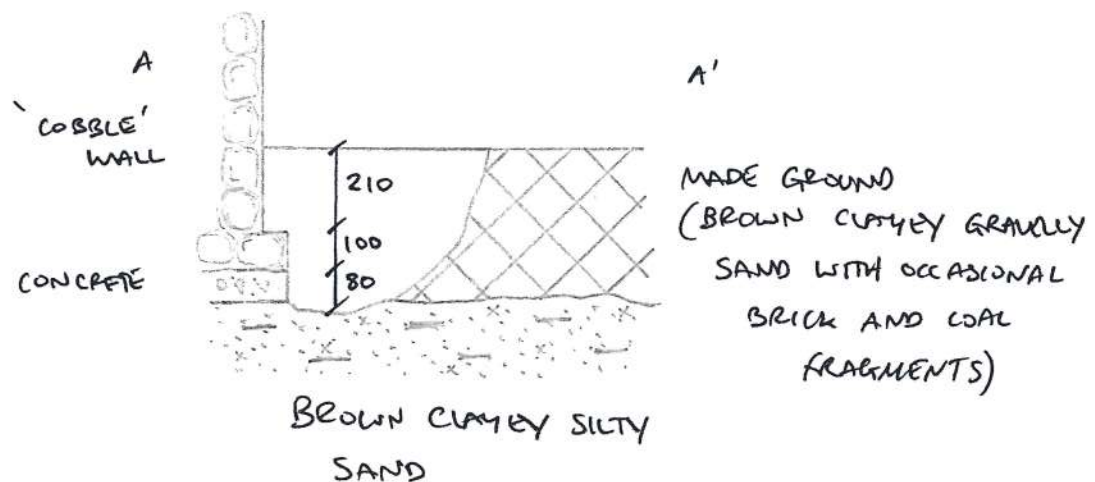
Sheet

1 / 1

PLAN



SECTION



Remarks:

All dimensions in millimetres

Sides of trial pit remained stable during excavation

Groundwater not encountered

Scale:

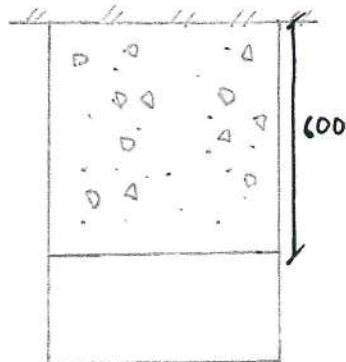
1:20

Logged by:

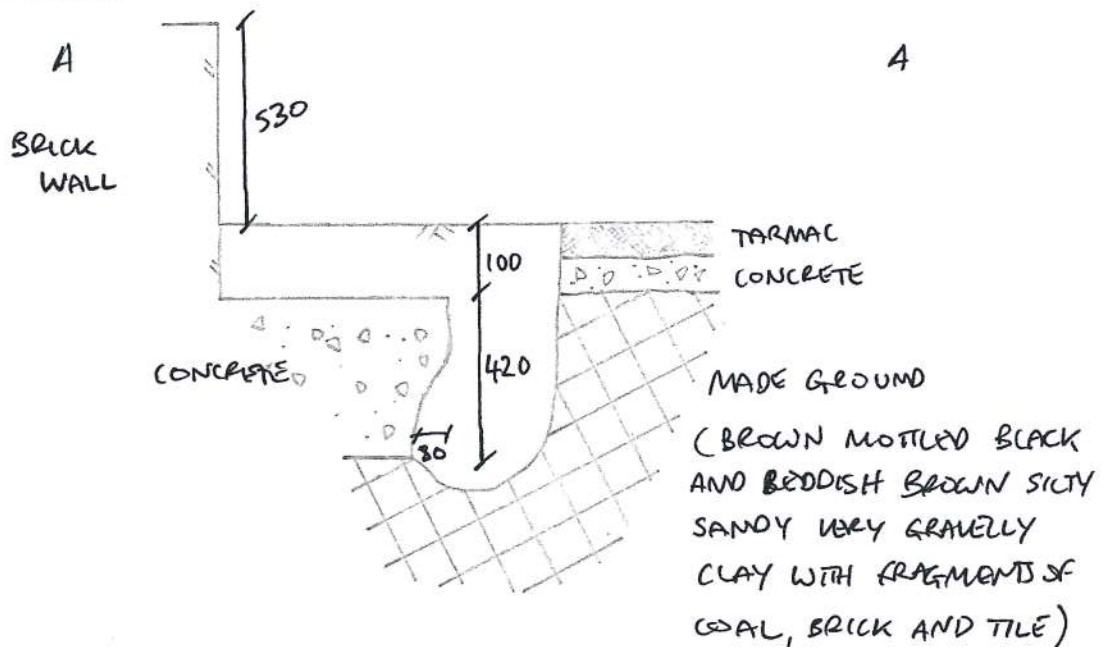
ME

GEA Geotechnical & Environmental Associates		Widbury Barn Widbury Hill vvaire Herts SG12 7QE	Site Dyne House, Highgate School, London, N6 5EE	Trial Pit Number 7
Excavation Method Manual	Dimensions (mm)	Ground Level (mOD)	Client Highgate School	Job Number J15093
	Location	Dates 31/3/15	Engineer A-squared Studio	Sheet 1 / 1

PLAN



SECTION



Remarks:

All dimensions in millimetres

Sides of trial pit remained stable during excavation

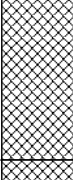
Groundwater not encountered

Scale:

1:20

Logged by:

ME

				Widbury Barn Widbury Hill Ware, Herts SG12 7QE		Site Dyne House, Highgate School, London, N6 5EE		Trial Pit Number TP8							
Excavation Method Back hoe excavator (JCB 3CX)		Dimensions		Ground Level (mOD)		Client Highgate School		Job Number J15093							
		Location		Dates 30/03/2015		Engineer A-squared Studio		Sheet 1/1							
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water						
					(0.10) 0.10 (1.10) 1.20 (0.20) 1.40	Tarmac MADE GROUND (brown and grey silty clay with gravel and fragments of brick, ash, concrete and roots. Ash rich layer between 0.80 m and 0.85 m) MADE GROUND (brown clay with cobbles of brick, tarmac, concrete ad redundant pipes) Abandoned at 1.40m		  							
Plan .						Remarks Groundwater not encountered Trial pit terminated at 1.4 m due to stability, side unstable durig excavation									
										Scale (approx)		Logged By		Figure No.	
										1:50		ME		J15093.TP8	

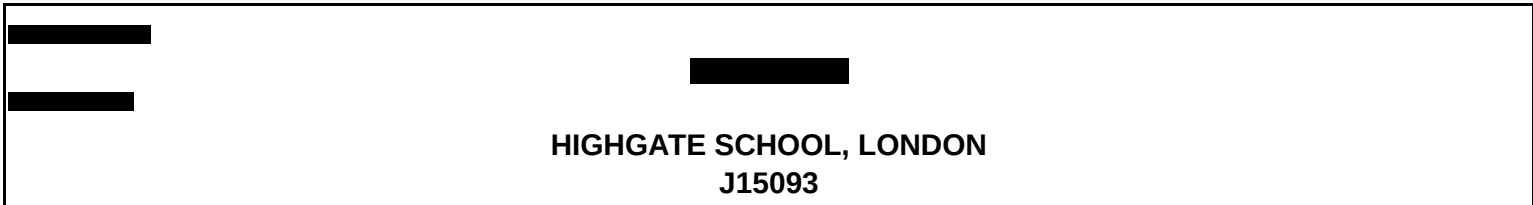
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.06) 0.06	Tarmac		
					(0.54) 0.60	MADE GROUND (blackish grey sandy gravelly cobbly clay with bricks, roots, tarmac, coal and ash fragments)		
					(0.30) 0.90	MADE GROUND (brown mottled grey clay silty sandy clay with fragmnets of brick and occasional coal)		
					(1.70) 2.60	MADE GROUND (grey and brown sandy gravelly cobble with occasional boulders of concete, tile, coal, ash, clinker, metal and slate)		
						Abandoned at 2.60m		

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SUMMARY OF GEOTECHNICAL TESTING	
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Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression			Chemical Tests			Other tests and comments
Borehole / Trial Pit	Sample Ref	Depth (m)	Type	Description	MC (%)	LL (%)	PL (%)	PI (%)	<425 μm (%)	Bulk Mg/m³	Dry Mg/m³	Cell Pressure kPa	Deviator Stress kPa	Shear Stress kPa	pH	2:1 W/S SO4 (g/L)	W/S Mg (mg/L)	
BH1		4.00	D	Mottled orange-brown grey and black silty CLAY.	31	62	22	40	100						7.3	0.36		
BH2		4.00	D	Orange-brown with grey mottling silty CLAY.	29	66	22	44	100									
BH3		0.80	D	Orange with grey mottling silty CLAY.	21	48	21	27	100									
BH3		1.80	D	Orange with grey mottling silty CLAY.	27	52	21	31	100									
BH4		3.00	D	Mottled orange-brown and grey silty CLAY.	34	68	21	47	100						7.6	0.07		
BH5		1.50	D	Mottled brown and dark orange slightly sandy, gravelly silty CLAY. Gravel is fine to medium flint.	16	38	18	20	67						7.2	0.32		
BH5		5.00	D	Yellow-brown silty fine SAND.														Particle Size Distribution
BH6		2.00-2.45	B	Dark grey clayey sandy GRAVEL. Gravel includes concrete, brick and flint.														Particle Size Distribution
BH6		4.75	D	Mottled brown, orange and grey slightly fine sandy silty CLAY with rare rootlets.	27	48	17	31	100									
BH6		6.50-6.95	U	Firm brown and blue grey mottled silty fine sandy CLAY	14	47	18	29	100									Effective Stress, Oedometer Consolidation
BH6		9.50-9.95	U	Stiff dark grey silty CLAY with rare medium pyrite nodules.	25	45	15	30	100	2.01	1.61	190	163	81				Oedometer Swelling
BH6		12.50-12.95	U	Firm dark grey-brown clayey SILT with rare fine sand.	26					1.99	1.58	250	225	113				

NP=Non Plastic



SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression			Chemical Tests			Other tests and comments
Borehole / Trial Pit	Sample Ref	Depth (m)	Type	Description	MC	LL	PL	PI	<425 μm	Bulk	Dry	Cell Pressure	Deviator Stress	Shear Stress	pH	2:1 W/S SO4	W/S Mg	
					(%)	(%)	(%)	(%)	(%)	Mg/m³	Mg/m³							
BH7		2.75	D	Yellow-brown with rare light grey mottling silty clayey fine SAND.														Particle Size Distribution
BH7		3.50-3.95	B	Yellow-brown clayey silty fine SAND.														Particle Size Distribution
BH7		4.75	D	Yellow-brown slightly gravelly clayey silty SAND. Gravel is fine to medium.														Particle Size Distribution
BH7		6.50-6.95	B	Yellow-brown clayey silty fine SAND.														Particle Size Distribution
BH7		8.00-8.45	B	Yellow-brown silty clayey fine SAND.														Particle Size Distribution
BH7		9.50-9.95	B	Yellow-brown very sandy silty CLAY. Sand is fine.														Particle Size Distribution
BH7		11.00-11.45	D	Yellow-brown very sandy CLAY. Sand is fine.														Particle Size Distribution
BH7		15.00	D	Brown and dark grey silty CLAY.	28	51	22	29	100									
BH7		15.50	U	Very stiff fissured dark brown / grey silty CLAY with vertical fissures lined with orange silty fine sand.	25	51	20	31	100									Effective Stress, Oedometer Consolidation
BH7		18.50-18.95	U	Very stiff dark grey-brown silty CLAY with rare black staining.	26	72	25	47	100	1.98	1.57	370	302	151				Oedometer Swelling
BH8		2.00	D	Yellow-brown with light brown mottling slightly fine sandy gravelly silty CLAY.	19	25	16	9.0	74						7.9	0.05		
BH8		4.00	U	Soft to firm orange brown mottled grey gravelly sandy CLAY	25					2.07	1.66	80	69	35				

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

NP=Non Plastic

Project Number:

GEO / 22564

Project Name:

HIGHGATE SCHOOL, LONDON
J15093



SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression			Chemical Tests			Other tests and comments
Borehole / Trial Pit	Sample Ref	Depth (m)	Type	Description	MC (%)	LL (%)	PL (%)	PI (%)	<425 µm (%)	Bulk Mg/m³	Dry Mg/m³	Cell Pressure kPa	Deviator Stress kPa	Shear Stress kPa	pH	2:1 W/S SO4 (g/L)	W/S Mg (mg/L)	
BH8		4.50	D	Yellow-brown slightly clayey fine SAND.	27		NP		26									
BH8		5.00	D	Yellow-brown slightly fine sandy CLAY with rare pockets of orange fine sand.	33	40	23	17	100									
BH8		6.00	U	Firm fine sandy silty CLAY	22	44	24	20	100	1.87	1.53	120	168	84				
BH8		9.00	U	Firm to stiff fissured dark brown grey CLAY	28					1.99	1.55	180	254	127				Oedometer Swelling
BH8		10.50	D	Dark grey with a dark brown crust micaceous silty CLAY.	23	57	21	36	100						7.4	1.50		
BH8		12.00	U	Dark brown mottled dark grey and black fine sandy CLAY.	23	41	24	17	100									Effective Stress, Oedometer Consolidation
BH8		15.00	U	Firm dark grey silty CLAY.	22	46	19	27	100									Oedometer Consolidation
BH8		16.50	U	Firm to stiff dark grey fine sandy silty CLAY.	25					2.04	1.63	330	244	122				
BH8		18.00	U	Stiff brown-grey slightly fine sandy CLAY.	22	49	21	28	99	1.99	1.63	360	317	158				
			U	Stiff dark grey fine sandy silty CLAY.	22					2.04	1.67	390	493	246				
			U	Stiff brown-grey slightly fine sandy CLAY.	23	52	19	33	99	2.01	1.63	420	498	249	8.3	1.10		
			U	Firm to stiff dark grey fine sandy silty CLAY.	25					1.90	1.52	450	142	71				

D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

NP=Non Plastic

Project Number:

GEO / 22564

Project Name:

HIGHGATE SCHOOL, LONDON
J15093



ane, Garston, Watford, Hertfordshire, WD25 9XX

Client : Geotechnical & Environmental Associates Limited, Widbury Barn, Widbury Hill, Ware, Hertfordshire

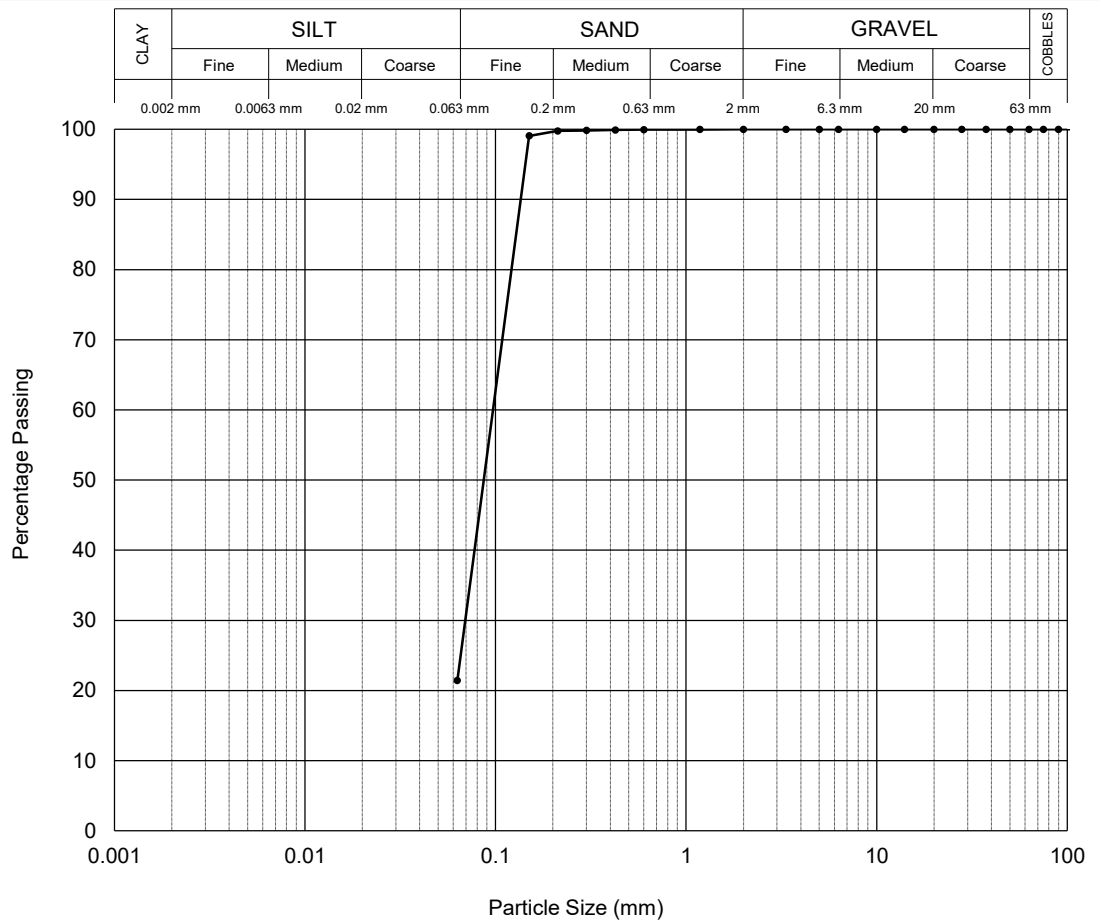
PARTICLE SIZE DISTRIBUTION

BH/TP No: BH5
Depth (m): 5.00
Sample Type D

Description:
Yellow-brown silty fine SAND.

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	100
0.212	100
0.15	99
0.063	21



Particle Proportions	
Cobbles	0.0 %
Gravel	0.0 %
Sand	78.6 %
Silt & Clay	21.4 %

Project Number:

GEO / 22564

Project Name:

**HIGHGATE SCHOOL, LONDON
J15093**

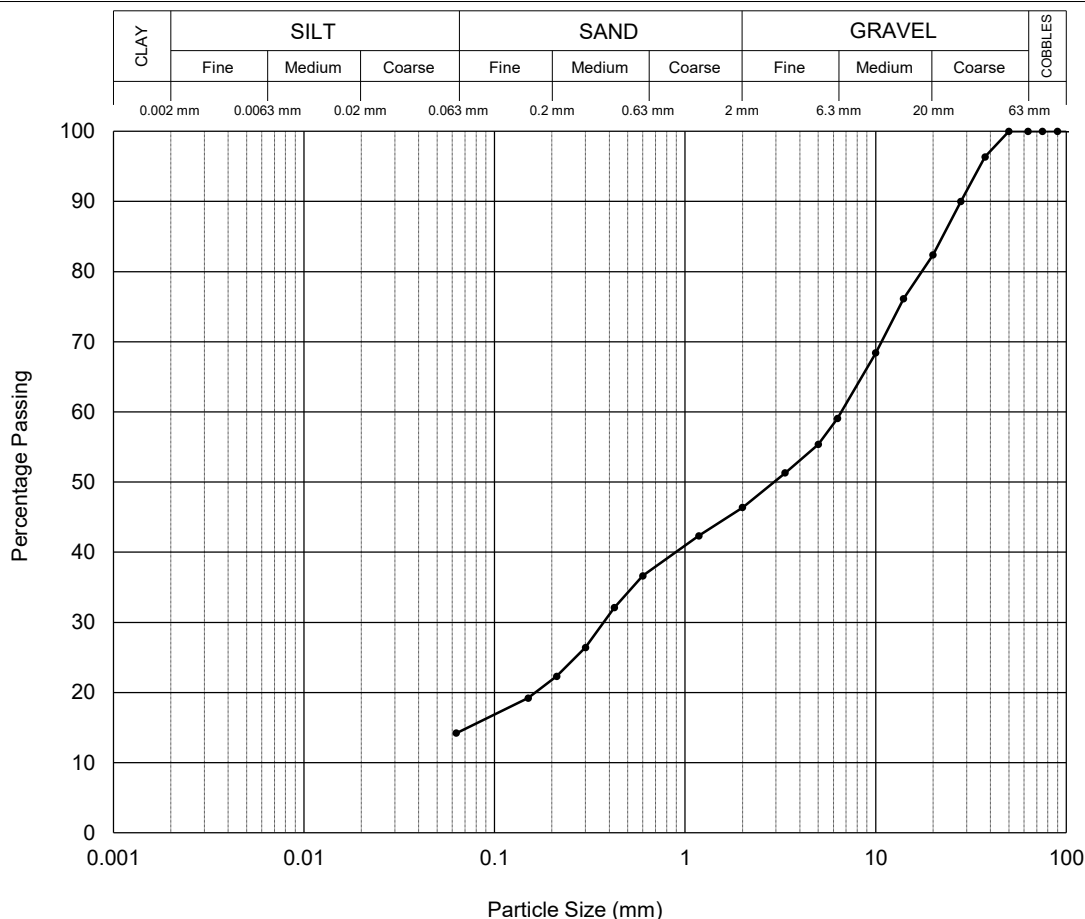
PARTICLE SIZE DISTRIBUTION

BH/TP No: BH6
 Depth (m): 2.00-2.45
 Sample Type: B

Description:
 Dark grey clayey sandy GRAVEL. Gravel includes concrete, brick and flint.

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	100
37.5	96
28	90
20	82
14	76
10	68
6.3	59
5	55
3.35	51
2	46
1.18	42
0.6	37
0.425	32
0.3	26
0.212	22
0.15	19
0.063	14



Particle Proportions	
Cobbles	0.0 %
Gravel	53.6 %
Sand	32.2 %
Silt & Clay	14.2 %

Project Number:

GEO / 22564

Project Name:

HIGHGATE SCHOOL, LONDON
J15093



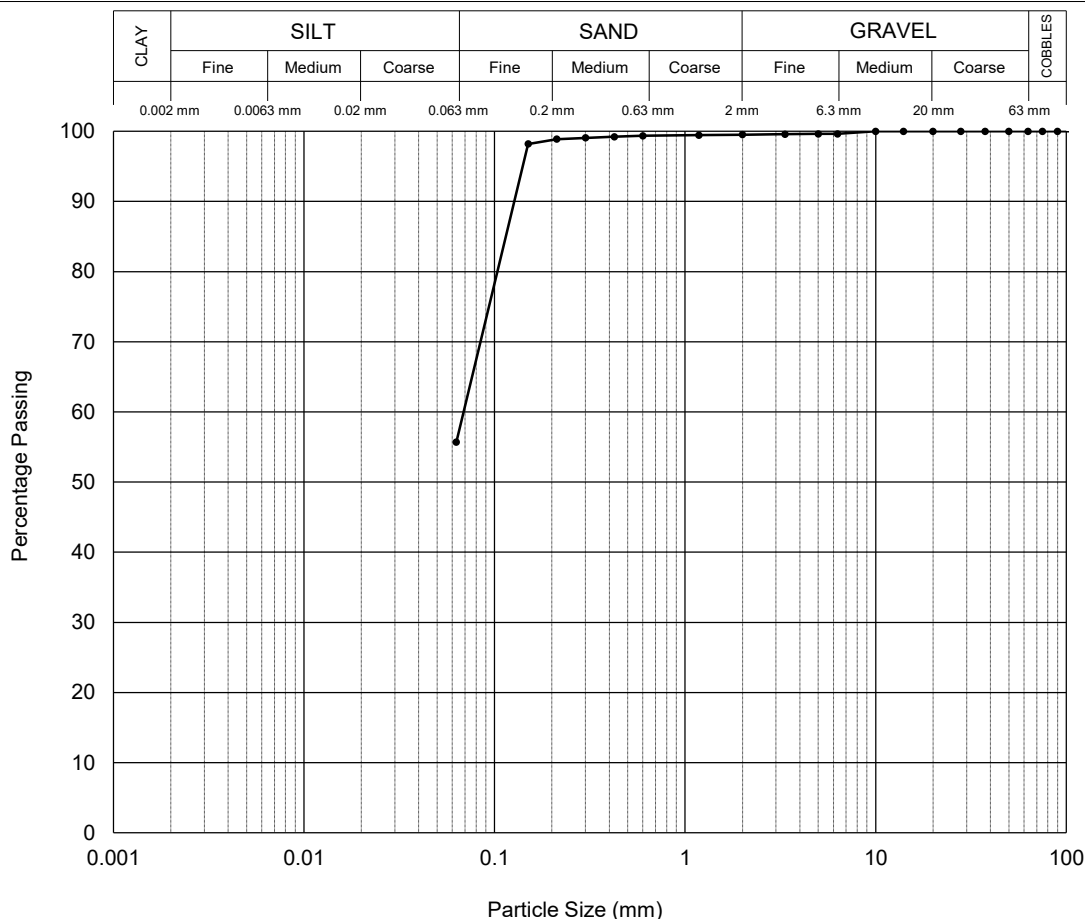
PARTICLE SIZE DISTRIBUTION

BH/TP No: BH7
 Depth (m): 2.75
 Sample Type: D

Description:
 Yellow-brown with rare light grey mottling silty clayey fine SAND.

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	99
0.6	99
0.425	99
0.3	99
0.212	99
0.15	98
0.063	56



Particle Proportions	
Cobbles	0.0 %
Gravel	0.5 %
Sand	43.8 %
Silt & Clay	55.7 %

Project Number:

GEO / 22564

Project Name:

HIGHGATE SCHOOL, LONDON
J15093



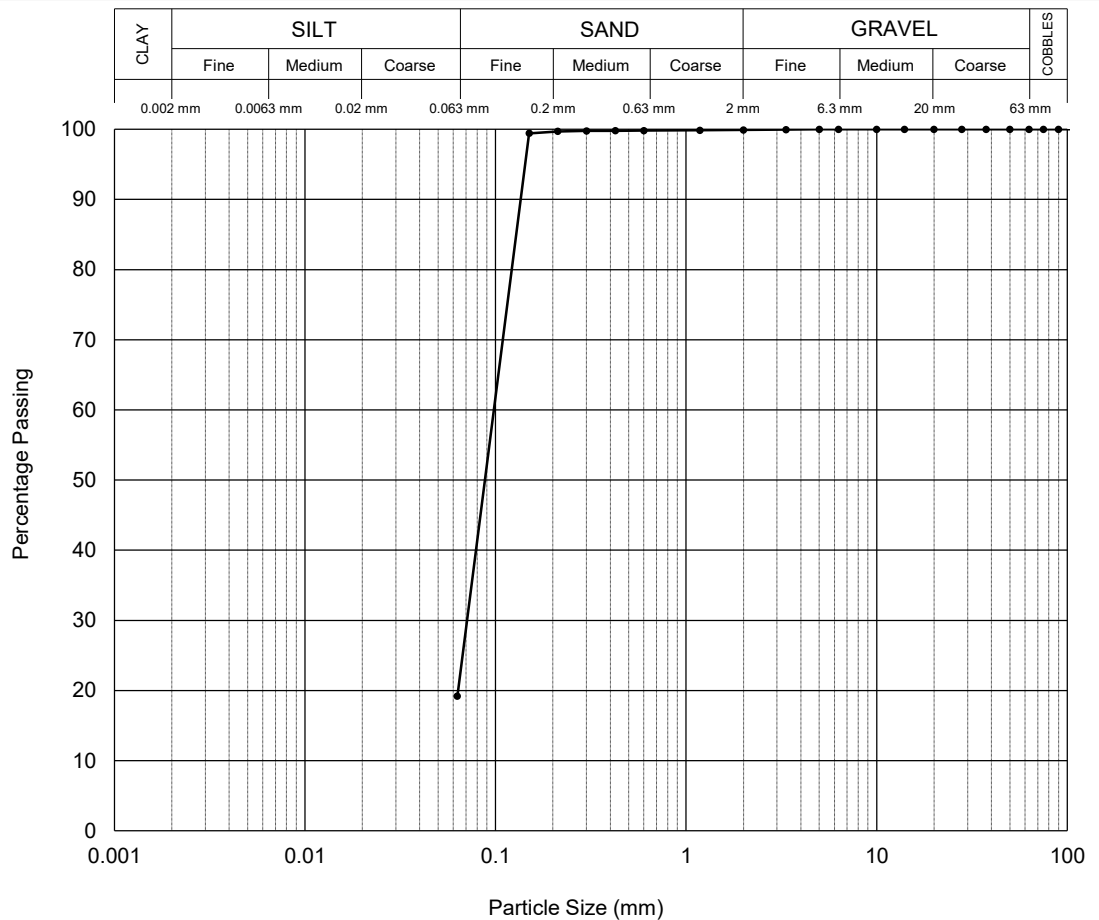
PARTICLE SIZE DISTRIBUTION

BH/TP No: BH7
 Depth (m): 3.50-3.95
 Sample Type: B

Description:
 Yellow-brown clayey silty fine SAND.

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	100
0.212	100
0.15	99
0.063	19



Particle Proportions	
Cobbles	0.0 %
Gravel	0.1 %
Sand	80.7 %
Silt & Clay	19.2 %

Project Number:

GEO / 22564

Project Name:

HIGHGATE SCHOOL, LONDON
J15093



PARTICLE SIZE DISTRIBUTION

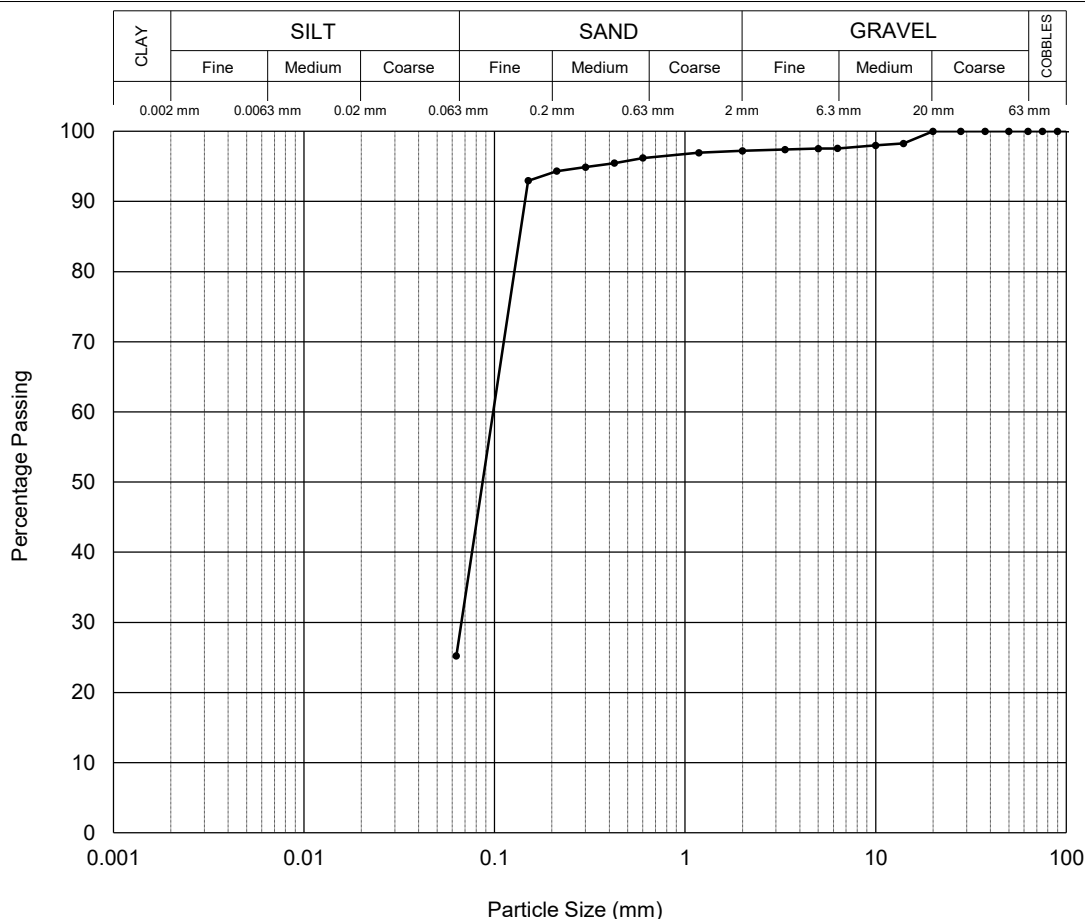
BH/TP No: BH7
 Depth (m): 4.75
 Sample Type: D

Description:

Yellow-brown slightly gravelly clayey silty SAND. Gravel is fine to medium.

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	98
10	98
6.3	98
5	98
3.35	97
2	97
1.18	97
0.6	96
0.425	95
0.3	95
0.212	94
0.15	93
0.063	25



Particle Proportions	
Cobbles	0.0 %
Gravel	2.8 %
Sand	72.0 %
Silt & Clay	25.2 %

Project Number:

GEO / 22564

Project Name:

HIGHGATE SCHOOL, LONDON
J15093

GEOLABS

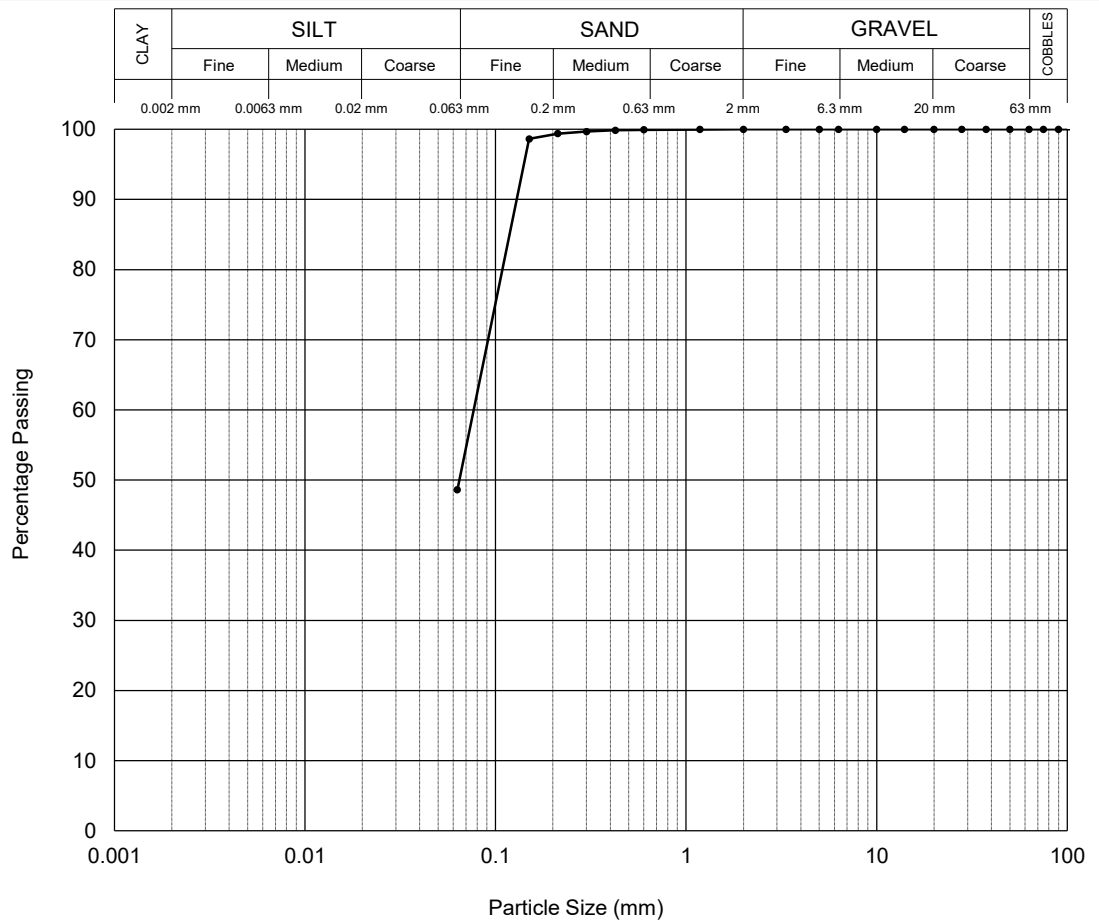
PARTICLE SIZE DISTRIBUTION

BH/TP No: BH7
 Depth (m): 6.50-6.95
 Sample Type: B

Description:
 Yellow-brown clayey silty fine SAND.

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	100
0.212	99
0.15	99
0.063	49



Particle Proportions	
Cobbles	0.0 %
Gravel	0.0 %
Sand	51.4 %
Silt & Clay	48.6 %

Project Number:

GEO / 22564

Project Name:

HIGHGATE SCHOOL, LONDON
J15093



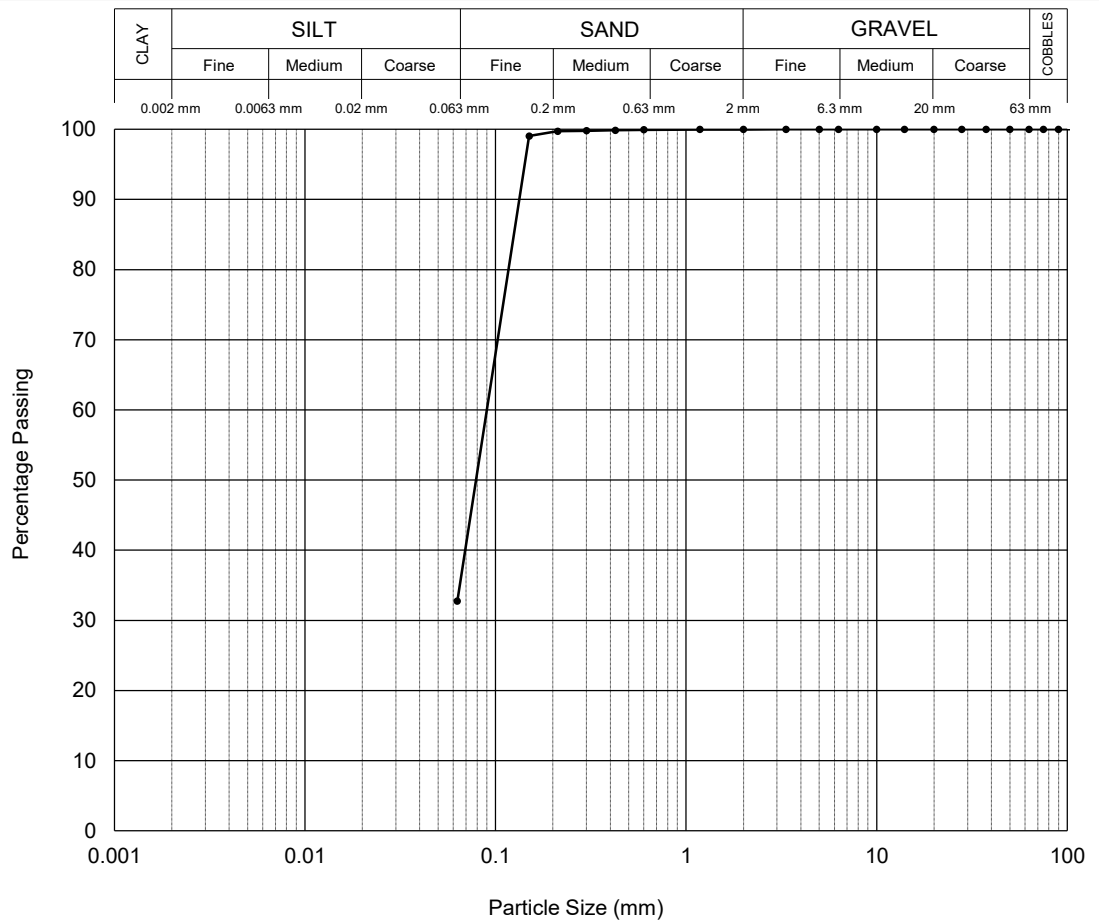
PARTICLE SIZE DISTRIBUTION

BH/TP No: BH7
 Depth (m): 8.00-8.45
 Sample Type: B

Description:
 Yellow-brown silty clayey fine SAND.

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	100
0.212	100
0.15	99
0.063	33



Particle Proportions	
Cobbles	0.0 %
Gravel	0.0 %
Sand	67.2 %
Silt & Clay	32.7 %

Project Number:

GEO / 22564

Project Name:

HIGHGATE SCHOOL, LONDON
J15093



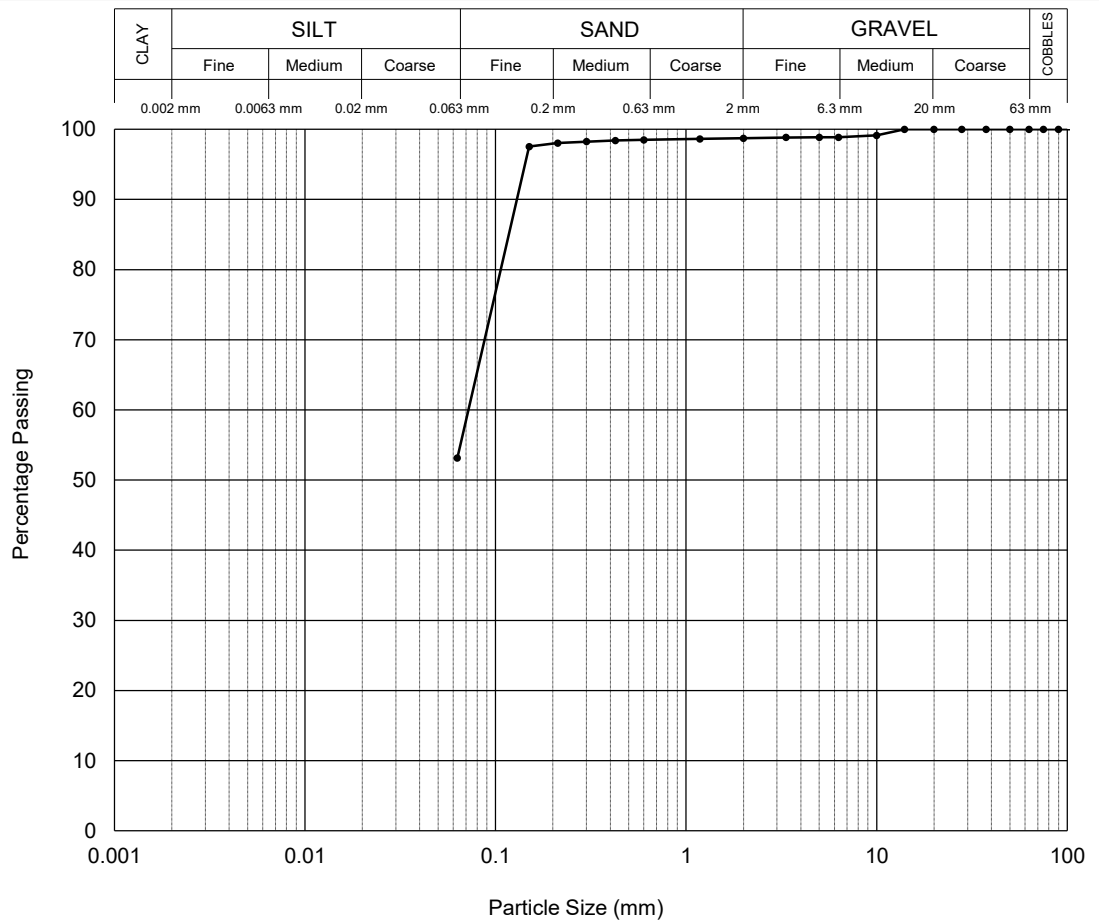
PARTICLE SIZE DISTRIBUTION

BH/TP No: BH7
 Depth (m): 9.50-9.95
 Sample Type: B

Description:
 Yellow-brown very sandy silty CLAY. Sand is fine.

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	99
6.3	99
5	99
3.35	99
2	99
1.18	99
0.6	98
0.425	98
0.3	98
0.212	98
0.15	98
0.063	53



Particle Proportions	
Cobbles	0.0 %
Gravel	1.3 %
Sand	45.6 %
Silt & Clay	53.2 %

Project Number:

GEO / 22564

Project Name:

HIGHGATE SCHOOL, LONDON
J15093



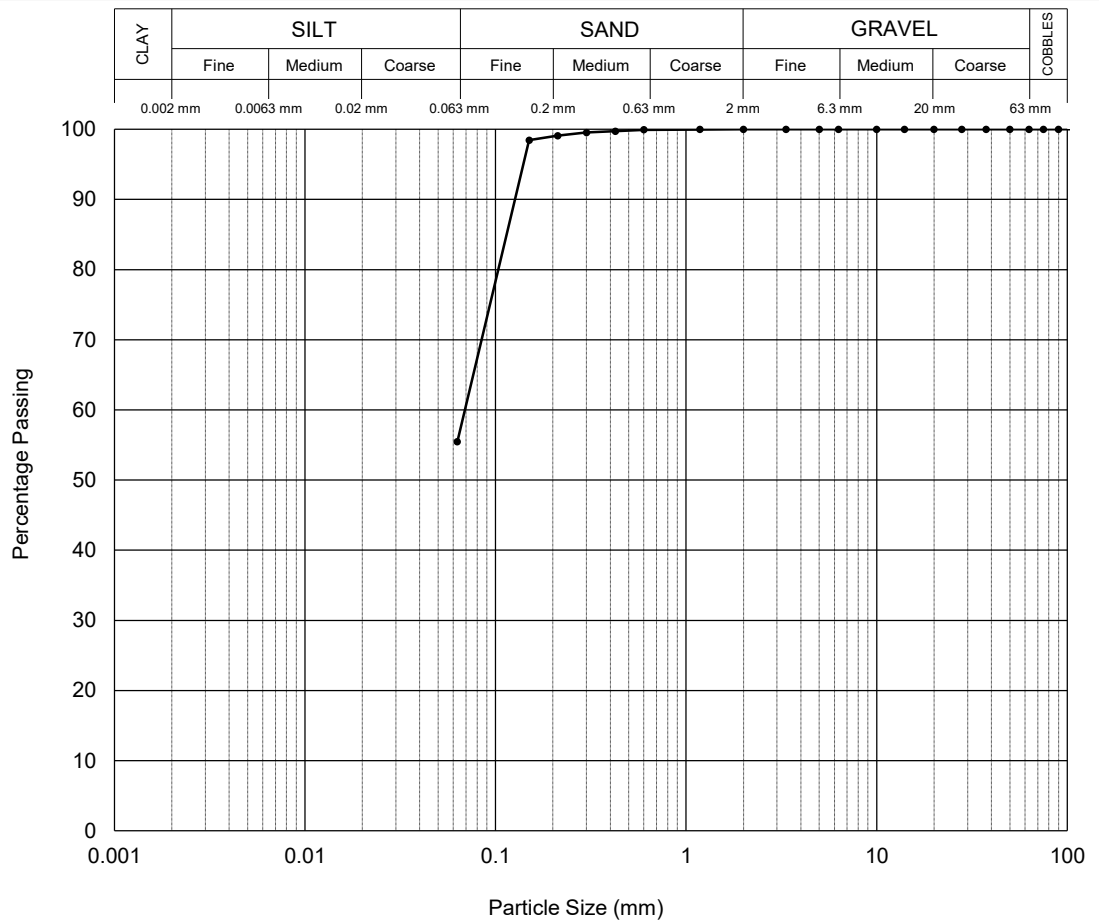
PARTICLE SIZE DISTRIBUTION

BH/TP No: BH7
 Depth (m): 11.00-11.45
 Sample Type: D

Description:
 Yellow-brown very sandy CLAY. Sand is fine.

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	100
0.212	99
0.15	98
0.063	55



Particle Proportions	
Cobbles	0.0 %
Gravel	0.0 %
Sand	44.5 %
Silt & Clay	55.5 %

Project Number:

GEO / 22564

Project Name:

HIGHGATE SCHOOL, LONDON
J15093



Quick Undrained Triaxial Compression Test

BH/TP No BH6
Depth (m) 9.50-9.95
Sample Type U

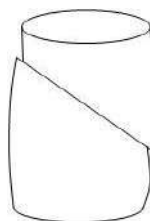
Description:

Stiff dark grey silty CLAY with rare medium pyrite nodules.

Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	200.9
Diameter	(mm)	103.3
Moisture Content	(%)	25
Bulk Density	(Mg/m ³)	2.01
Dry Density	(Mg/m ³)	1.60
Test Details		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	1.0
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	190
Strain at failure	(%)	16.4
Maximum Deviator Stress	(kPa)	163
Shear Stress Cu	(kPa)	81

Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	40

Project Number:

GEO / 22564

Project Name:

**HIGHGATE SCHOOL, LONDON
J15093**



Quick Undrained Triaxial Compression Test

BH/TP No BH6
 Depth (m) 12.50-12.95
 Sample Type U

Description:

Firm dark grey-brown clayey SILT with rare fine sand.

Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	200.7
Diameter	(mm)	102.1
Moisture Content	(%)	26
Bulk Density	(Mg/m ³)	1.99
Dry Density	(Mg/m ³)	1.58
Test Details		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	1.1
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	250
Strain at failure	(%)	19.9
Maximum Deviator Stress	(kPa)	225
Shear Stress Cu	(kPa)	113

Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	10

Project Number:

GEO / 22564

Project Name:

**HIGHGATE SCHOOL, LONDON
J15093**



Quick Undrained Triaxial Compression Test

BH/TP No BH7
 Depth (m) 18.50-18.95
 Sample Type U

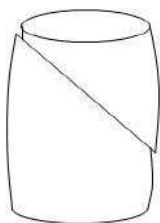
Description:

Very stiff dark grey-brown silty CLAY with rare black staining.

Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	201.1
Diameter	(mm)	103.3
Moisture Content	(%)	26
Bulk Density	(Mg/m ³)	1.98
Dry Density	(Mg/m ³)	1.58
Test Details		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.5
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	370
Strain at failure	(%)	7.0
Maximum Deviator Stress	(kPa)	302
Shear Stress Cu	(kPa)	151

Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	20

Project Number:

GEO / 22564

Project Name:

**HIGHGATE SCHOOL, LONDON
J15093**



Quick Undrained Triaxial Compression Test

BH/TP No BH8
Depth (m) 4.00
Sample Type U

Description:

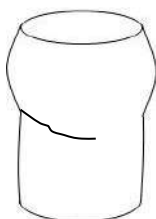
Soft to firm orange brown mottled grey gravelly sandy CLAY

Remarks : Some patching required

Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	200.4
Diameter	(mm)	104.2
Moisture Content	(%)	25
Bulk Density	(Mg/m ³)	2.07
Dry Density	(Mg/m ³)	1.65
Test Details		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.7
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	80
Strain at failure	(%)	10.5
Maximum Deviator Stress	(kPa)	69
Shear Stress Cu	(kPa)	35

Mode of failure



Orientation of the sample

Vertical

Distance from top of tube mm

40

Project Number:

GEO / 22564

Project Name:

**HIGHGATE SCHOOL, LONDON
J15093**



Quick Undrained Triaxial Compression Test

BH/TP No BH8
 Depth (m) 6.00
 Sample Type U

Description:

Firm fine sandy silty CLAY

Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	201.1
Diameter	(mm)	104.2
Moisture Content	(%)	22
Bulk Density	(Mg/m ³)	1.87
Dry Density	(Mg/m ³)	1.53
Test Details		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.4
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	120
Strain at failure	(%)	5.5
Maximum Deviator Stress	(kPa)	168
Shear Stress Cu	(kPa)	84

Mode of failure



Orientation of the sample

Vertical

Distance from top of tube mm

30

Project Number:

GEO / 22564

Project Name:

**HIGHGATE SCHOOL, LONDON
J15093**

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Quick Undrained Triaxial Compression Test

BH/TP No BH8
Depth (m) 9.00
Sample Type U

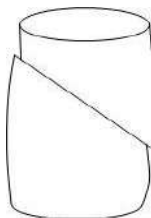
Description:

Firm to stiff fissured dark brown grey CLAY

Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	201.2
Diameter	(mm)	103.5
Moisture Content	(%)	28
Bulk Density	(Mg/m ³)	1.99
Dry Density	(Mg/m ³)	1.55
Test Details		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.5
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	180
Strain at failure	(%)	7.0
Maximum Deviator Stress	(kPa)	254
Shear Stress Cu	(kPa)	127

Mode of failure



Orientation of the sample

Vertical

Distance from top of tube mm

40

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Project Number:

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Project Name:

**HIGHGATE SCHOOL, LONDON
J15093**

GEOLABS



Quick Undrained Triaxial Compression Test

BH/TP No BH8
Depth (m) 16.50
Sample Type U

Description:

Firm to stiff dark grey fine sandy silty CLAY.

Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	202.5
Diameter	(mm)	103.1
Moisture Content	(%)	25
Bulk Density	(Mg/m ³)	2.04
Dry Density	(Mg/m ³)	1.63
Test Details		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	1.1
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	330
Strain at failure	(%)	19.8
Maximum Deviator Stress	(kPa)	244
Shear Stress Cu	(kPa)	122

Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	20

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Project Name:

**HIGHGATE SCHOOL, LONDON
J15093**



Quick Undrained Triaxial Compression Test

BH/TP No BH8
 Depth (m) 18.00
 Sample Type U

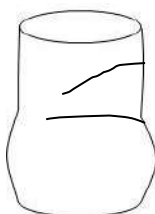
Description:

Stiff brown-grey slightly fine sandy CLAY.

Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	203.0
Diameter	(mm)	102.8
Moisture Content	(%)	22
Bulk Density	(Mg/m ³)	1.99
Dry Density	(Mg/m ³)	1.63
Test Details		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	1.1
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	360
Strain at failure	(%)	18.7
Maximum Deviator Stress	(kPa)	317
Shear Stress Cu	(kPa)	158

Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	50

Project Number:

GEO / 22564

Project Name:

**HIGHGATE SCHOOL, LONDON
J15093**



Quick Undrained Triaxial Compression Test

BH/TP No BH8
Depth (m) 19.50
Sample Type U

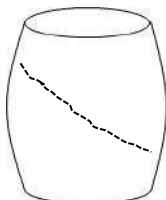
Description:

Stiff dark grey fine sandy silty CLAY.

Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	202.6
Diameter	(mm)	103.2
Moisture Content	(%)	22
Bulk Density	(Mg/m ³)	2.04
Dry Density	(Mg/m ³)	1.67
Test Details		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.6
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	390
Strain at failure	(%)	8.4
Maximum Deviator Stress	(kPa)	493
Shear Stress Cu	(kPa)	246

Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	30

Subject Number:

GEO / 22564

Subject Name:

**HIGHGATE SCHOOL, LONDON
J15093**

Bucknalls Lane, Garston, Watford, Hertfordshire, WD25 9XX
Associates Limited, Widbury Barn, Widbury Hill, Ware, Hertfordshire



Quick Undrained Triaxial Compression Test

BH/TP No BH8
Depth (m) 21.00
Sample Type U

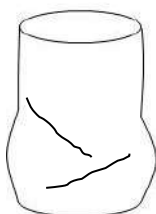
Description:

Stiff brown-grey slightly fine sandy CLAY.

Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	202.4
Diameter	(mm)	103.8
Moisture Content	(%)	23
Bulk Density	(Mg/m ³)	2.01
Dry Density	(Mg/m ³)	1.63
Test Details		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.9
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	420
Strain at failure	(%)	14.8
Maximum Deviator Stress	(kPa)	498
Shear Stress Cu	(kPa)	249

Mode of failure



Orientation of the sample

Vertical

Distance from top of tube mm

20

Project Number:

GEO / 22564

Project Name:

**HIGHGATE SCHOOL, LONDON
J15093**

Bucknalls Lane, Garston, Watford, Hertfordshire, WD25 9XX
Associates Limited, Widbury Barn, Widbury Hill, Ware, Hertfordshire



Quick Undrained Triaxial Compression Test

BH/TP No BH8
Depth (m) 22.50
Sample Type U

Description:

Firm to stiff dark grey fine sandy silty CLAY.

Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	202.5
Diameter	(mm)	103.5
Moisture Content	(%)	25
Bulk Density	(Mg/m ³)	1.90
Dry Density	(Mg/m ³)	1.52
Test Details		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	1.1
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	450
Strain at failure	(%)	18.8
Maximum Deviator Stress	(kPa)	142
Shear Stress Cu	(kPa)	71

Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	20

Project Number:

GEO / 22564

Project Name:

**HIGHGATE SCHOOL, LONDON
J15093**

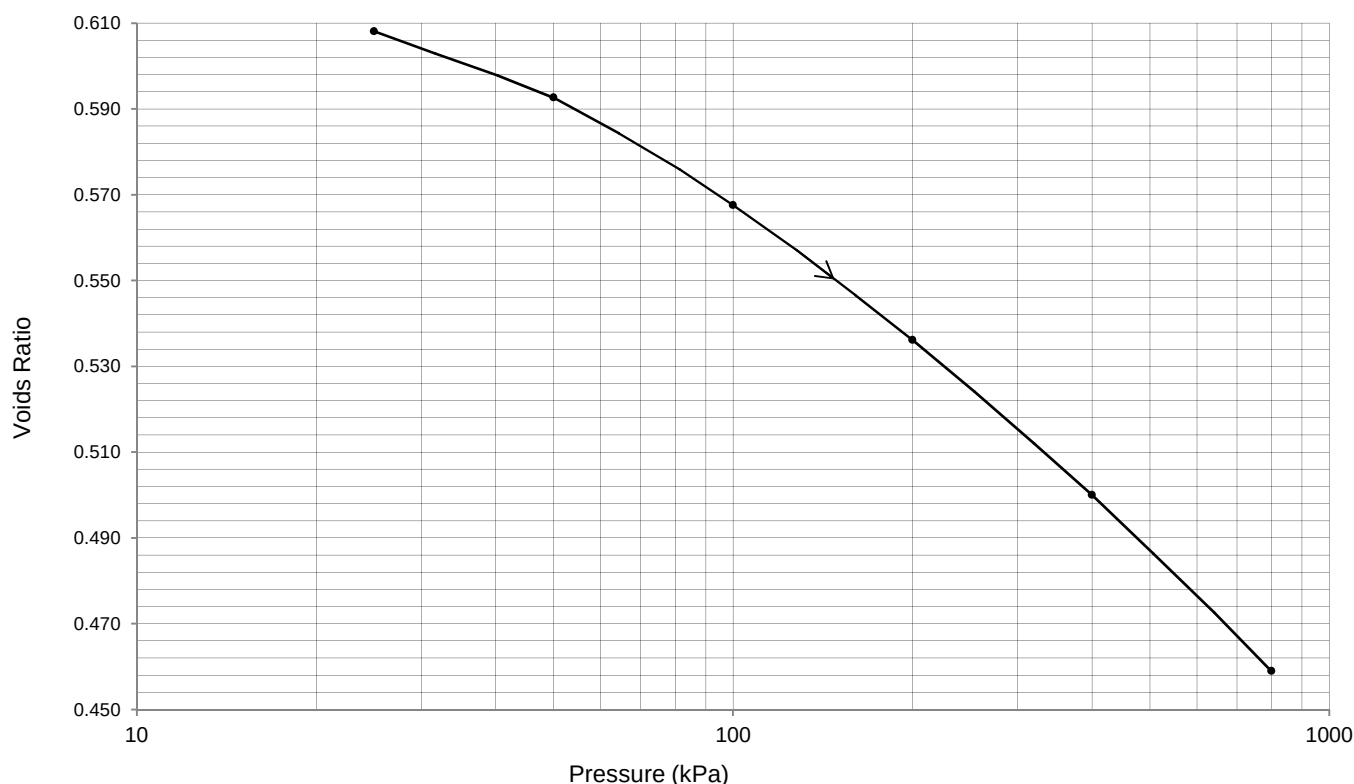


Determination of One Dimensional Consolidation Properties of Soil

Borehole No.: BH6
 Sample Ref.: -
 Depth (m): 6.50
 Depth within original: 6.57
 Orientation within original: Vertical
 Specimen preparation: Undisturbed

Description:

Firm brown and blue grey mottled silty fine sandy CLAY



Initial Conditions:

Height	(mm)	19.0	Moisture Content	(%)	14
Diameter	(mm)	75.0	Voids Ratio		0.614
Area	(mm ²)	4413.2	Bulk Density	(Mg/m ³)	1.90
Volume	(cm ³)	83.6	Dry Density	(Mg/m ³)	1.67
Laboratory Temperature	(°C)	20	Particle density	(Mg/m ³)	2.7 (Assumed)

Pressure Range (kPa)	m_v (m ² /MN)	c_v (m ² /year)	Time Fitting Method	Void Ratio
0 - 25	0.15	6.4	t90	0.608
25 - 50	0.38	8.7	t90	0.593
50 - 100	0.31	6.6	t90	0.568
100 - 200	0.20	7.7	t90	0.536
200 - 400	0.12	7.0	t90	0.500
400 - 800	0.068	5.6	t90	0.459

Checked and Approved by

J Sturges (Ops Mgr)

Date: 19/05/2015

Project Number:

GEO / 22564

Project Name:

Highgate School, London

Project Ref.: J15093

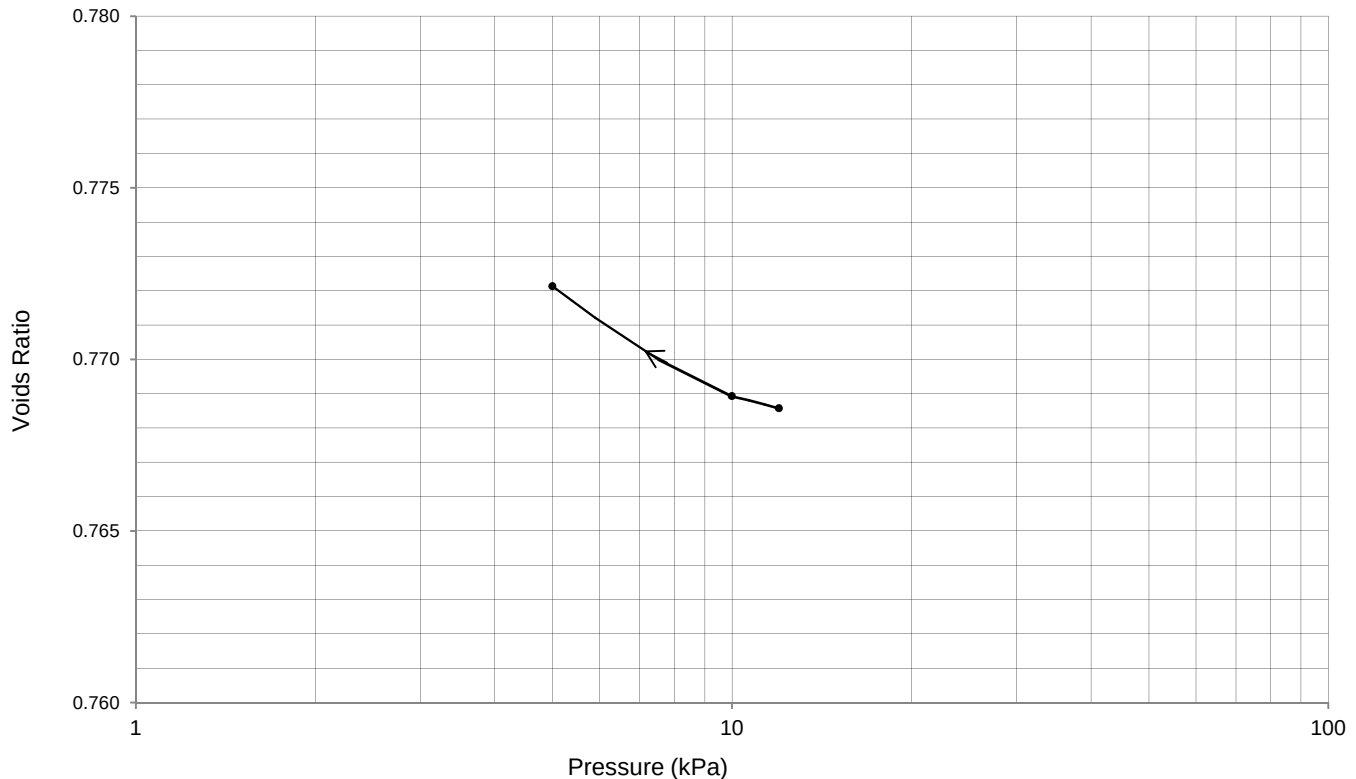


Determination of Swelling Properties of Soil

Borehole No.: BH6
 Sample Ref.: -
 Depth (m): 9.50
 Depth within original: 9.60
 Orientation within original: Vertical
 Specimen preparation: Undisturbed

Description:

 Soft dark grey silty CLAY



Initial Conditions:

				Initial
Height	(mm)	19.0	Moisture Content	(%) 27
Diameter	(mm)	75.0	Voids Ratio	0.767
Area	(mm ²)	4412.0	Bulk Density	(Mg/m ³) 1.93
Volume	(cm ³)	83.9	Dry Density	(Mg/m ³) 1.53
Laboratory Temperature	(°C)	20	Particle density	(Mg/m ³) 2.7 (Assumed)

Pressure Range (kPa)	m_v (m ² /MN)	c_v (m ² /year)	Time Fitting Method	Void Ratio
0 - 12	-	Swelling Pressure	-	0.769
12 - 10	0.099	Unable to assess (Sv)	-	0.769
10 - 5	0.36	7.4 (Sv)	t90	0.772

Checked and Approved by

J Sturges (Ops Mgr)

Date: 19/05/2015

Project Number:

GEO / 22564

Project Name:

Highgate School, London
Project Ref.: J15093

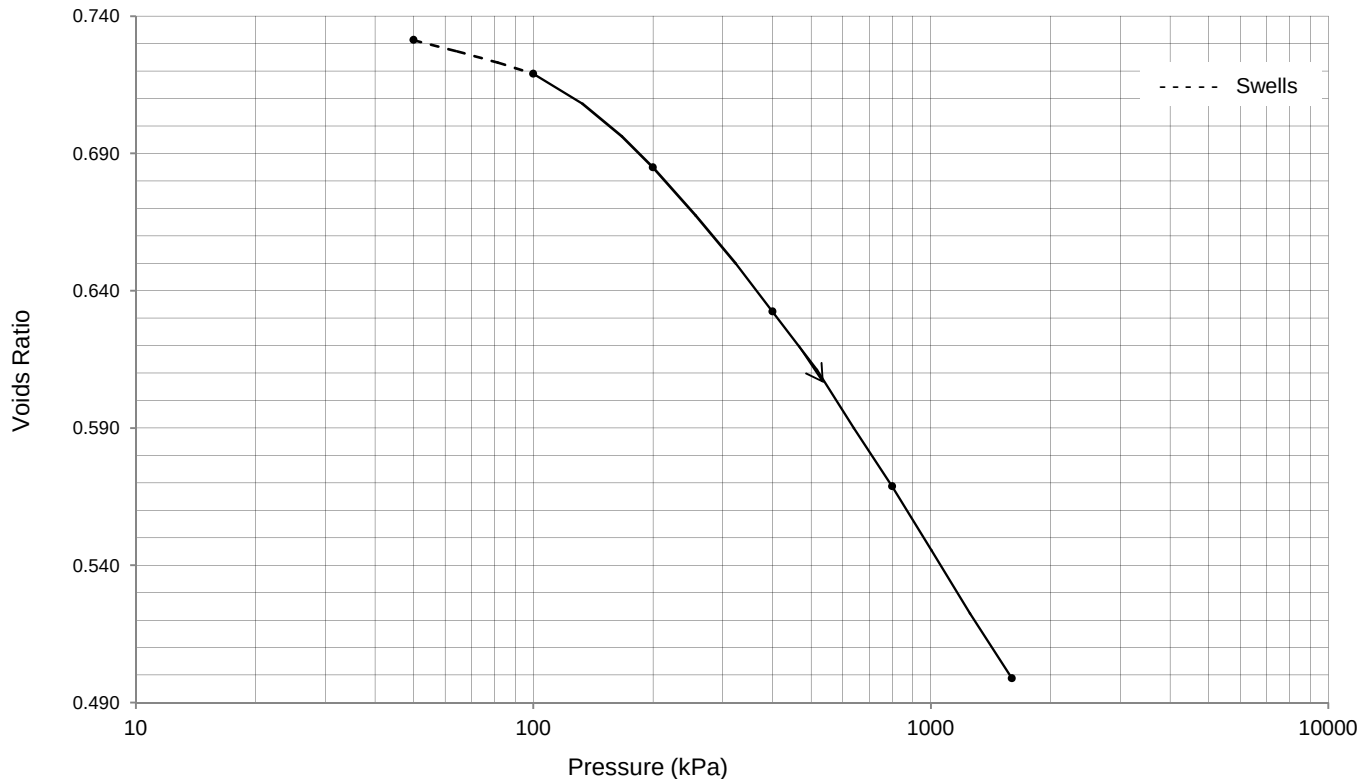


Determination of One Dimensional Consolidation Properties of Soil

Borehole No.: BH7
 Sample Ref.: -
 Depth (m): 15.50
 Depth within original: 15.55
 Orientation within original: Vertical
 Specimen preparation: Undisturbed

Description:

Firm dark grey and orange brown mottled silty CLAY



Initial Conditions:

Height	(mm)	18.4	Moisture Content	(%)	25
Diameter	(mm)	76.2	Voids Ratio		0.735
Area	(mm ²)	4555.6	Bulk Density	(Mg/m ³)	1.95
Volume	(cm ³)	84.0	Dry Density	(Mg/m ³)	1.56
Laboratory Temperature	(°C)	20	Particle density	(Mg/m ³)	2.7 (Assumed)

Pressure Range (kPa)	m_v (m ² /MN)	c_v (m ² /year)	Time Fitting Method	Void Ratio
0 - 50	-	Specimen swelled	-	0.731
50 - 100	0.14	5.4	t50	0.719
100 - 200	0.20	5.6	t50	0.685
200 - 400	0.16	4.1	t50	0.632
400 - 800	0.097	3.4	t50	0.569
800 - 1600	0.056	2.5	t50	0.499

Checked and Approved by

JS

J Sturges (Ops Mgr)

Date: 19/05/2015

Project Number:

GEO / 22564

Project Name:

Highgate School, London

Project Ref.: J15093

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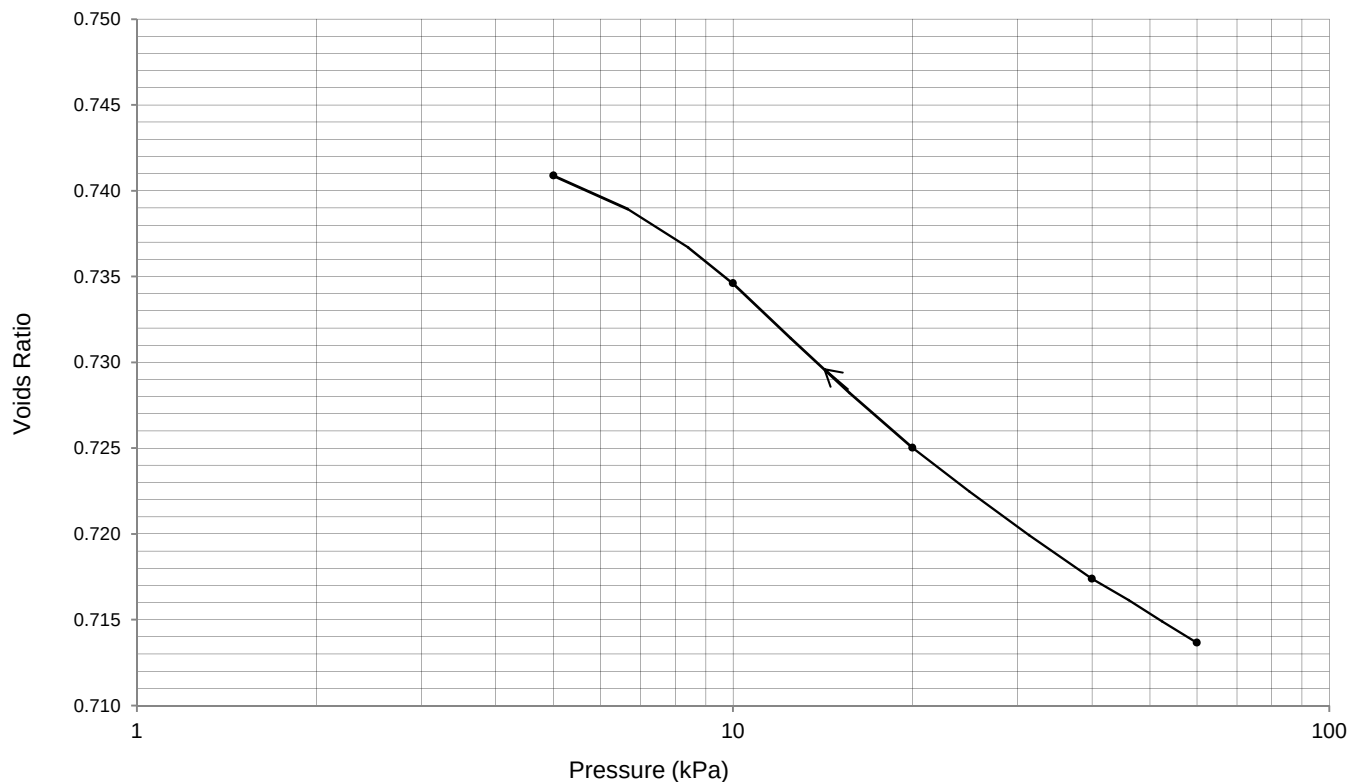


Determination of Swelling Properties of Soil

Borehole No.: BH7
 Sample Ref.: -
 Depth (m): 18.50
 Depth within original: 18.55
 Orientation within original: Vertical
 Specimen preparation: Undisturbed

Description:

 Firm grey silty CLAY



Initial Conditions:

Height	(mm)	16.4	Moisture Content	(%)	Initial
Diameter	(mm)	76.2	Voids Ratio		0.716
Area	(mm ²)	4555.6	Bulk Density	(Mg/m ³)	1.99
Volume	(cm ³)	74.7	Dry Density	(Mg/m ³)	1.57
Laboratory Temperature	(°C)	20	Particle density	(Mg/m ³)	2.7 (Assumed)

Pressure Range (kPa)	m_v (m ² /MN)	c_v (m ² /year)	Time Fitting Method	Void Ratio
0 - 60	-	Swelling Pressure	-	0.714
60 - 40	0.11	0.87 (Sv)	t50	0.717
40 - 20	0.22	0.57 (Sv)	t50	0.725
20 - 10	0.56	0.22 (Sv)	t50	0.735
10 - 5	0.72	0.12 (Sv)	t50	0.741

Checked and Approved by

J Sturges (Ops Mgr)

Date: 19/05/2015

Project Number:

GEO / 22564

Project Name:

Highgate School, London

Project Ref.: J15093

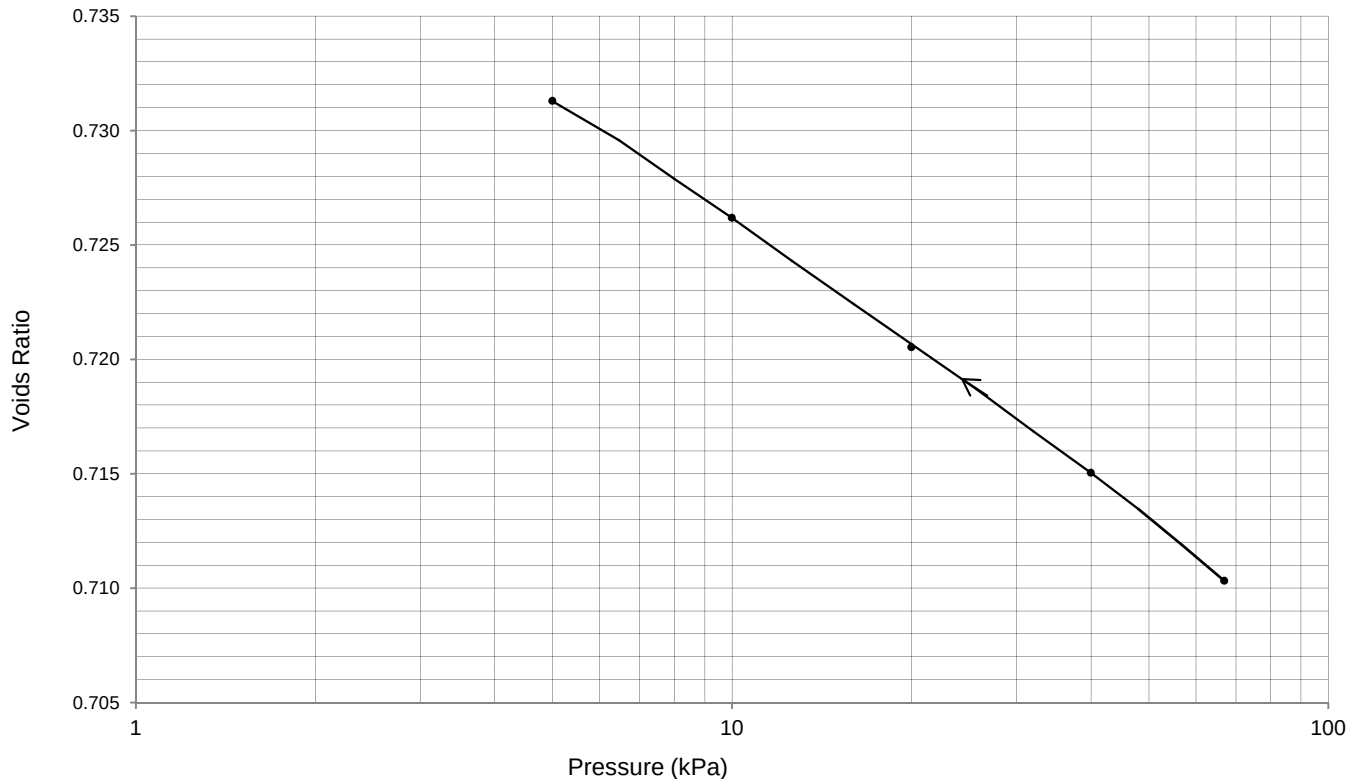


Determination of Swelling Properties of Soil

Borehole No.: BH8
 Sample Ref.: 3
 Depth (m): 9.00
 Depth within original: 9.06
 Orientation within original: Vertical
 Specimen preparation: Undisturbed

Description:

 Stiff fissured grey silty CLAY



Initial Conditions:

Height	(mm)	17.0	Moisture Content	(%)	27
Diameter	(mm)	75.0	Voids Ratio		0.716
Area	(mm ²)	4417.9	Bulk Density	(Mg/m ³)	1.99
Volume	(cm ³)	75.1	Dry Density	(Mg/m ³)	1.57
Laboratory Temperature	(°C)	20	Particle density	(Mg/m ³)	2.7 (Assumed)

Pressure Range (kPa)	m _v (m ² /MN)	c _v (m ² /year)	Time Fitting Method	Void Ratio
0 - 67	-	Swelling Pressure	-	0.710
67 - 40	0.10	0.95 (Sv)	t50	0.715
40 - 20	0.16	0.87 (Sv)	t50	0.721
20 - 10	0.33	0.51 (Sv)	t50	0.726
10 - 5	0.59	0.18 (Sv)	t50	0.731

Checked and Approved by

J Sturges (Ops Mgr)

Date: 16/06/2015

Project Number:

GEO / 22717

Project Name:

Highgate School, London
Project Ref.: J15093

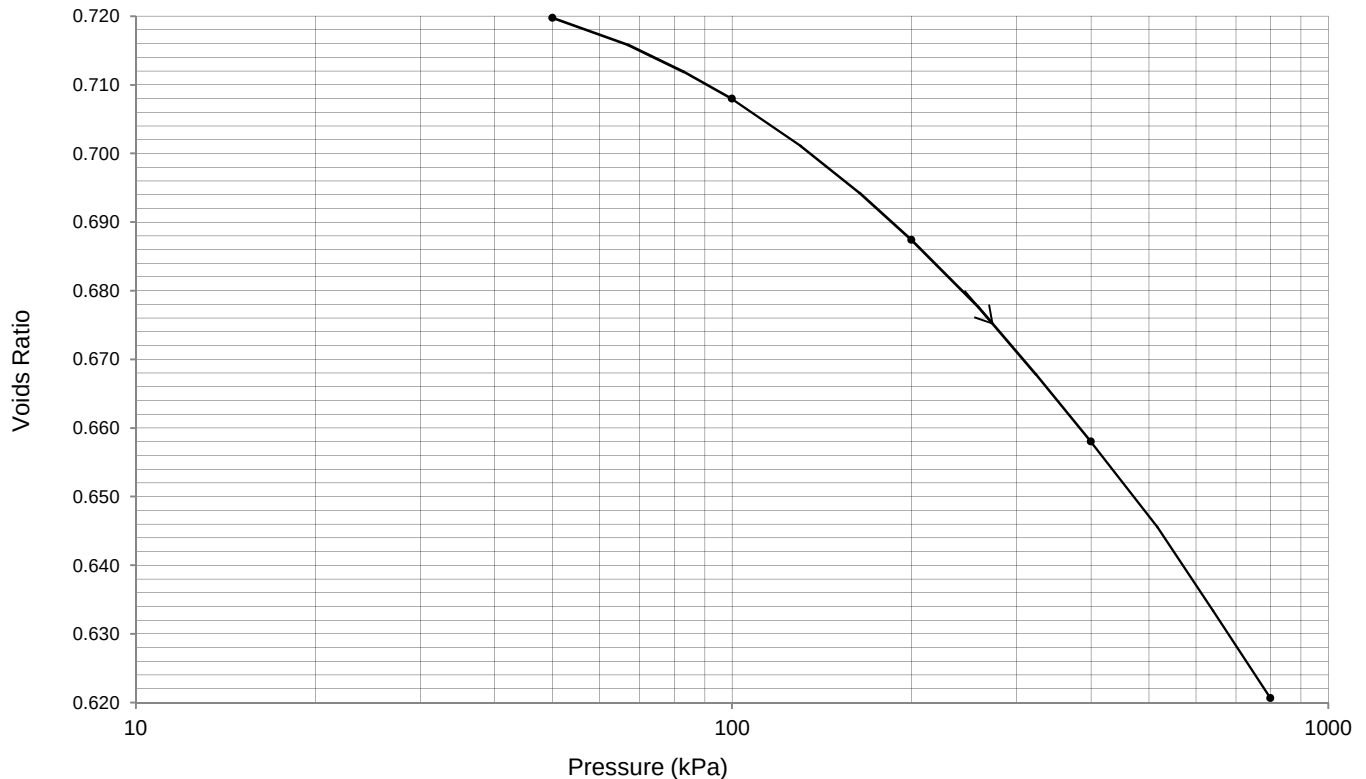


Determination of One Dimensional Consolidation Properties of Soil

Borehole No.: BH8
 Sample Ref.: 4
 Depth (m): 12.00
 Depth within original: 12.13
 Orientation within original: Vertical
 Specimen preparation: Undisturbed

Description:

Firm friable grey fine sandy silty CLAY



Initial Conditions:

Height	(mm)	18.5	Moisture Content	(%)	24
Diameter	(mm)	76.2	Voids Ratio		0.726
Area	(mm ²)	4560.4	Bulk Density	(Mg/m ³)	1.94
Volume	(cm ³)	84.1	Dry Density	(Mg/m ³)	1.56
Laboratory Temperature	(°C)	20	Particle density	(Mg/m ³)	2.7 (Assumed)

Pressure Range (kPa)	m_v (m ² /MN)	c_v (m ² /year)	Time Fitting Method	Void Ratio
0 - 50	0.074	3.9	t90	0.720
50 - 100	0.14	8.8	t90	0.708
100 - 200	0.12	5.8	t90	0.687
200 - 400	0.087	5.9	t90	0.658
400 - 800	0.056	5.0	t90	0.621

Checked and Approved by

JS

J Sturges (Ops Mgr)

Date: 16/06/2015

Project Number:

GEO / 22717

Project Name:

Highgate School, London
 Project Ref.: J15093

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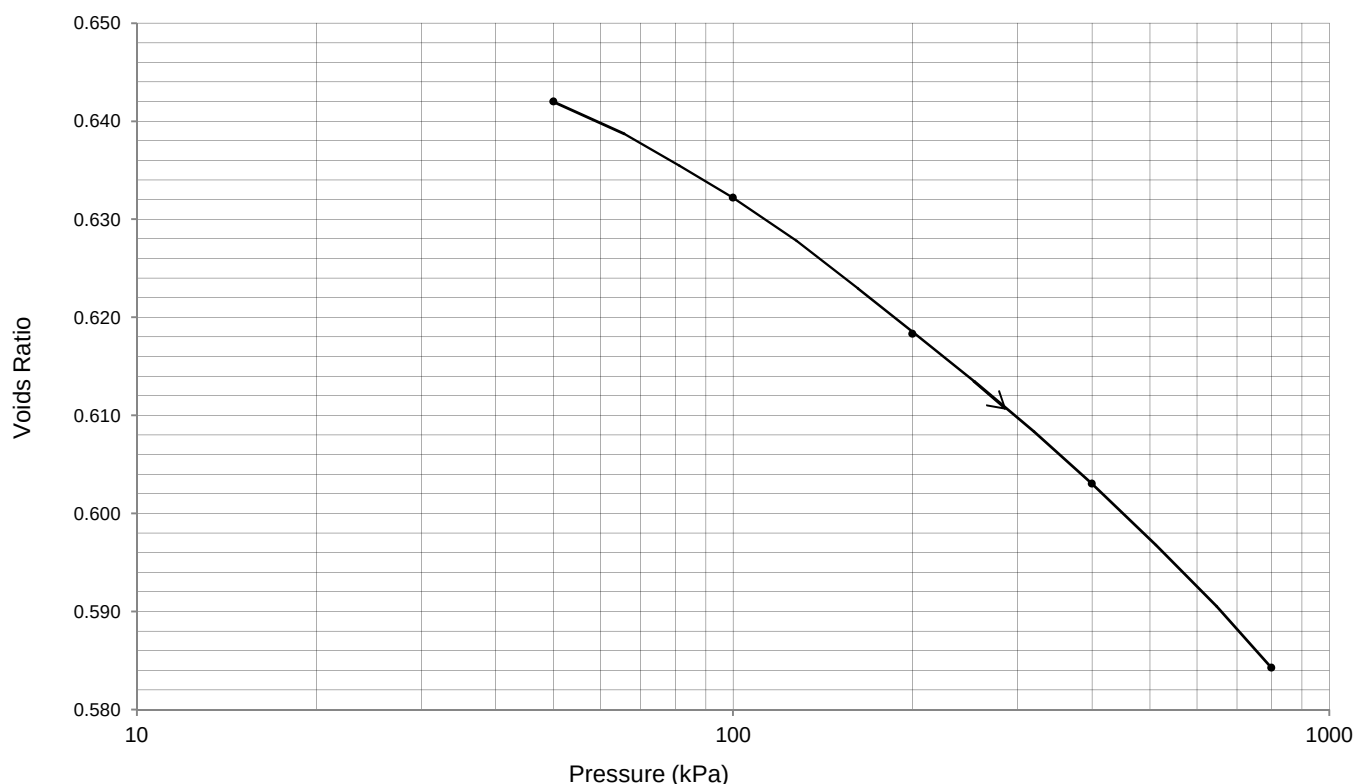


Determination of One Dimensional Consolidation Properties of Soil

Borehole No.: BH8
 Sample Ref.: 5
 Depth (m): 15.00
 Depth within original: 15.10
 Orientation within original: Vertical
 Specimen preparation: Undisturbed

Description:

Firm friable grey silty CLAY



Initial Conditions:

Height	(mm)	18.0	Moisture Content	(%)	22
Diameter	(mm)	76.2	Voids Ratio		0.643
Area	(mm ²)	4554.4	Bulk Density	(Mg/m ³)	2.01
Volume	(cm ³)	82.1	Dry Density	(Mg/m ³)	1.64
Laboratory Temperature	(°C)	20	Particle density	(Mg/m ³)	2.7 (Assumed)

Pressure Range (kPa)	m_v (m ² /MN)	c_v (m ² /year)	Time Fitting Method	Void Ratio
0 - 50	0.018	5.7	t90	0.642
50 - 100	0.12	7.2	t90	0.632
100 - 200	0.085	7.9	t90	0.618
200 - 400	0.047	7.4	t90	0.603
400 - 800	0.029	6.6	t90	0.584

Checked and Approved by

JS

J Sturges (Ops Mgr)

Date: 16/06/2015

Project Number:

GEO / 22717

Project Name:

Highgate School, London
 Project Ref.: J15093

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BS1377 : Part 8 : Clause 7 Consolidated Undrained Triaxial Compression Test with Measurement of Pore Pressure																															
Borehole Number: BH6 Sample Number: Depth (m): 6.50		Description: Soft to firm brownish grey silty CLAY with fine sand.																													
SPECIMEN DETAILS Depth within original sample Orientation within original sample		10mm from top Vertical																													
TEST DETAILS Specimen Preparation Cell Preparation Specimen Number Initial Diameter mm Initial Length mm Initial Moisture Content % Initial Wet Density Mg/m ³ Drainage Conditions		Undisturbed Checks performed in accordance with Clause 3.5 <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <thead> <tr> <th style="width: 25%;">Specimen No 1</th> <th style="width: 25%;">Specimen No 2</th> <th style="width: 25%;">Specimen No 3</th> </tr> </thead> <tbody> <tr> <td>38.0</td> <td>38.0</td> <td>38.0</td> </tr> <tr> <td>76.4</td> <td>76.3</td> <td>76.6</td> </tr> <tr> <td>25</td> <td>25</td> <td>25</td> </tr> <tr> <td>1.98</td> <td>2.01</td> <td>1.99</td> </tr> </tbody> </table> One end and radial boundary			Specimen No 1	Specimen No 2	Specimen No 3	38.0	38.0	38.0	76.4	76.3	76.6	25	25	25	1.98	2.01	1.99												
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76.4	76.3	76.6																													
25	25	25																													
1.98	2.01	1.99																													
SATURATION STAGE Final Cell Pressure kPa Final Pore Pressure kPa Final Pore Pressure Parameter B Duration day(s)		<table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td>360</td> <td>420</td> <td>480</td> </tr> <tr> <td>340</td> <td>402</td> <td>465</td> </tr> <tr> <td>0.96</td> <td>1.00</td> <td>0.99</td> </tr> <tr> <td>3</td> <td>3</td> <td>3</td> </tr> </tbody> </table>			360	420	480	340	402	465	0.96	1.00	0.99	3	3	3															
360	420	480																													
340	402	465																													
0.96	1.00	0.99																													
3	3	3																													
CONSOLIDATION STAGE Cell Pressure kPa Back Pressure kPa Effective Pressure kPa Final Pore Pressure kPa Final Pore Pressure Dissipation % Duration day(s)		<table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td>360</td> <td>420</td> <td>480</td> </tr> <tr> <td>300</td> <td>300</td> <td>300</td> </tr> <tr> <td>60</td> <td>120</td> <td>180</td> </tr> <tr> <td>300</td> <td>300</td> <td>300</td> </tr> <tr> <td>99</td> <td>100</td> <td>100</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table>			360	420	480	300	300	300	60	120	180	300	300	300	99	100	100	1	1	1									
360	420	480																													
300	300	300																													
60	120	180																													
300	300	300																													
99	100	100																													
1	1	1																													
SHEARING STAGE Cell Pressure kPa Rate of Axial Displacement mm/min Initial Pore Pressure kPa Initial Effective Stress kPa		<table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td>360</td> <td>420</td> <td>480</td> </tr> <tr> <td>0.0060</td> <td>0.0060</td> <td>0.0060</td> </tr> <tr> <td>300</td> <td>300</td> <td>300</td> </tr> <tr> <td>60</td> <td>120</td> <td>180</td> </tr> </tbody> </table>			360	420	480	0.0060	0.0060	0.0060	300	300	300	60	120	180															
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CONDITIONS AT FAILURE criteria		Maximum Principal Stress Ratio <table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td>320</td> <td>320</td> <td>365</td> </tr> <tr> <td>40</td> <td>100</td> <td>115</td> </tr> <tr> <td>131</td> <td>309</td> <td>334</td> </tr> <tr> <td>171</td> <td>409</td> <td>449</td> </tr> <tr> <td>4.29</td> <td>4.09</td> <td>3.89</td> </tr> <tr> <td>0.15</td> <td>0.06</td> <td>0.19</td> </tr> <tr> <td>2.9</td> <td>3.2</td> <td>3.0</td> </tr> <tr> <td>11</td> <td>11</td> <td>11</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table>			320	320	365	40	100	115	131	309	334	171	409	449	4.29	4.09	3.89	0.15	0.06	0.19	2.9	3.2	3.0	11	11	11	1	1	1
320	320	365																													
40	100	115																													
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11	11	11																													
1	1	1																													
Final Moisture Content % Final Wet Density Mg/m ³		<table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td>26</td> <td>25</td> <td>24</td> </tr> <tr> <td>2.01</td> <td>2.05</td> <td>2.05</td> </tr> </tbody> </table>			26	25	24	2.01	2.05	2.05																					
26	25	24																													
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EFFECTIVE STRESS PARAMETERS Cohesion kPa Angle of Shear Resistance degrees		<table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td>5</td> <td></td> <td></td> </tr> <tr> <td>35.5</td> <td></td> <td></td> </tr> </tbody> </table>			5			35.5																							
5																															
35.5																															
FAILURE SKETCHES																															

Checked and Approved

Initials:

Date: 24/06/15

Project Number:

GEO / 22677

Project Name:

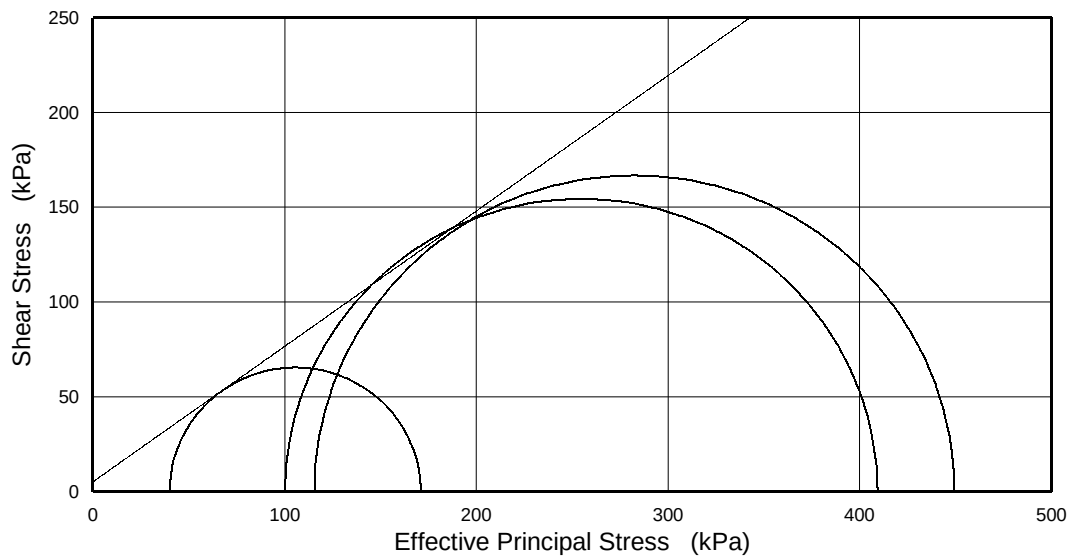
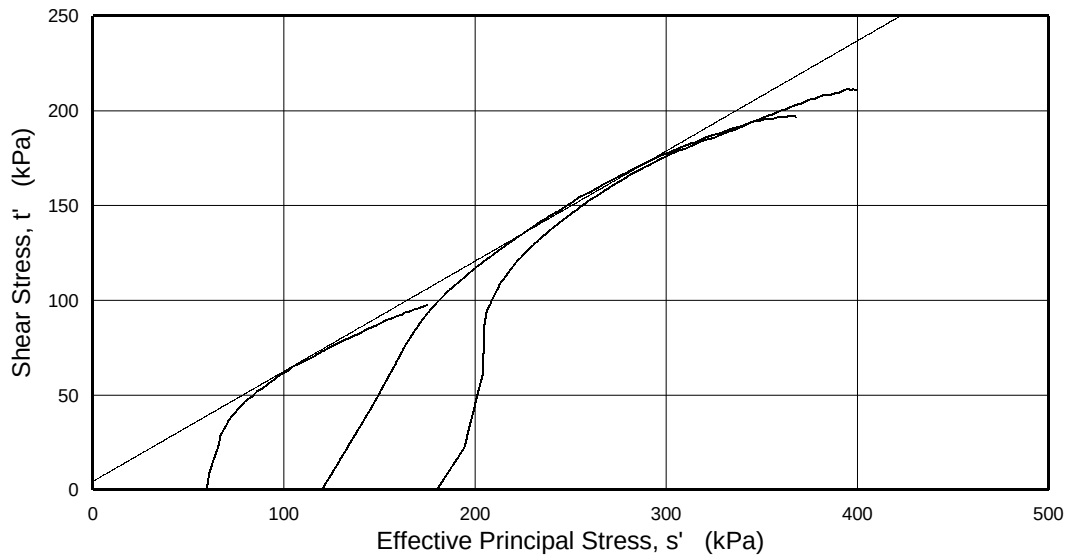
HIGHGATE SCHOOL, LONDON

Project reference J15093

BS1377 : Part 8 : Clause 7
Consolidated Undrained Triaxial Compression Test
 with Measurement of Pore Pressure

Borehole Number: BH6
 Sample Number:
 Depth (m): 6.50

Description:
 Soft to firm brownish grey silty CLAY with fine sand.



Checked and
 Approved

Initials:

24/06/15

Date: 24/06/15

Project Number:

GEO / 22677

Project Name:

HIGHGATE SCHOOL, LONDON
Project reference J15093

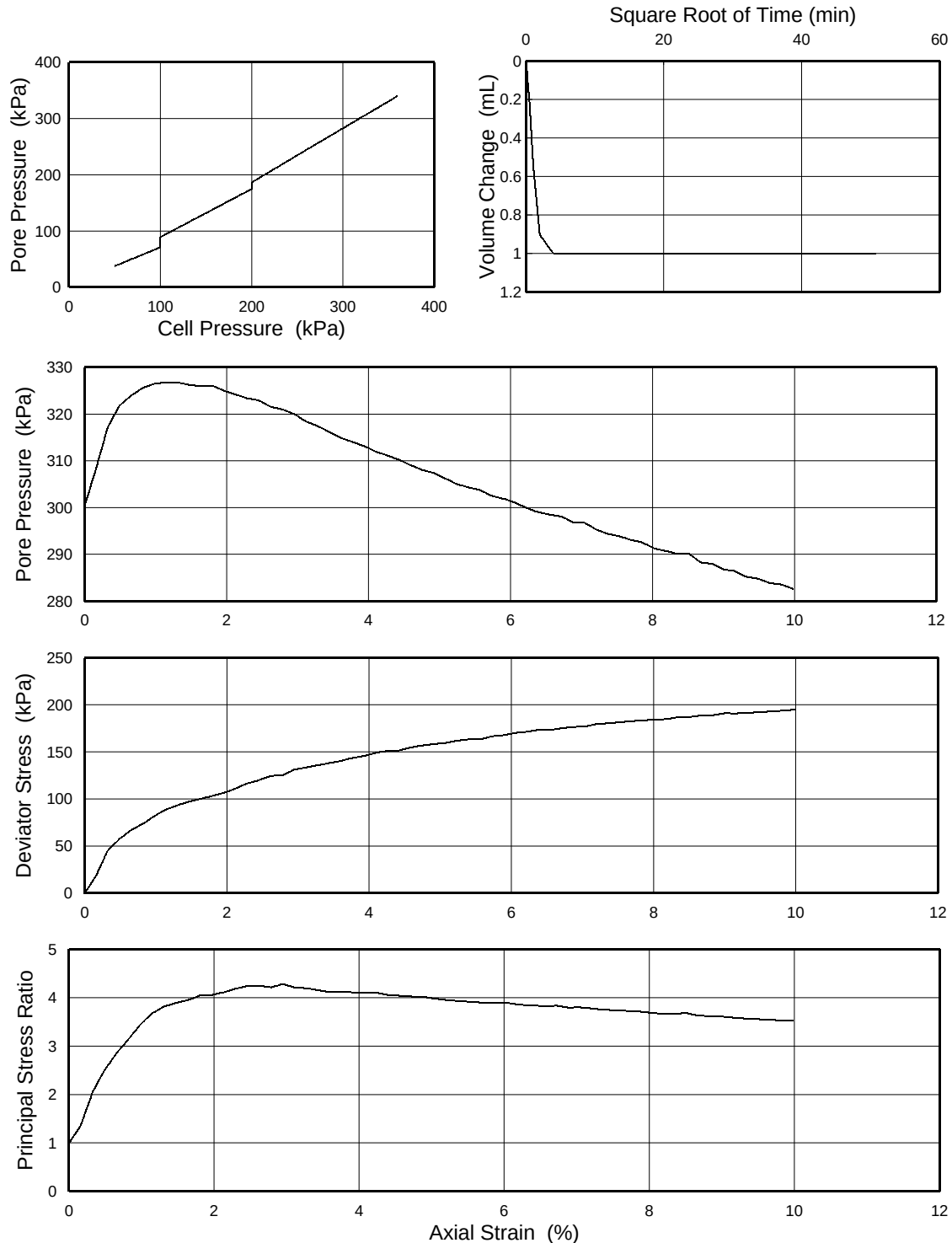


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BS1377 : Part 8 : Clause 7
Consolidated Undrained Triaxial Compression Test
with Measurement of Pore Pressure

Borehole Number: BH6
Sample Number:
Depth (m): 6.50

Specimen No 1



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Approved

Initials:

24/06/15

Date: 24/06/15

Project Number:

GEO / 22677

Project Name:

HIGHGATE SCHOOL, LONDON
Project reference J15093

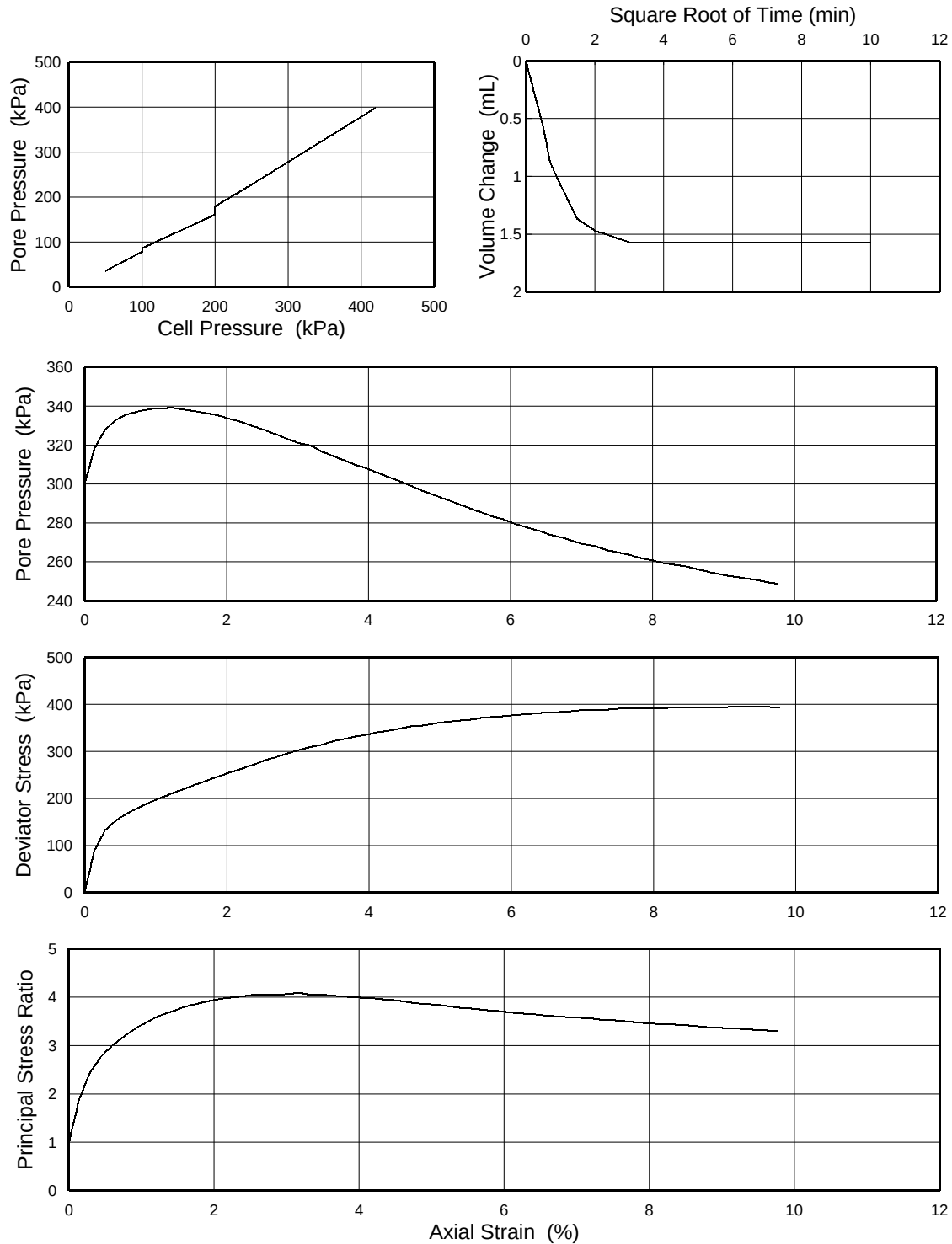


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BS1377 : Part 8 : Clause 7
Consolidated Undrained Triaxial Compression Test
 with Measurement of Pore Pressure

Borehole Number: BH6
 Sample Number:
 Depth (m): 6.50

Specimen No 2



Checked and Approved

Initials:

24/06/15

Date:

24/06/15

Project Number:

GEO / 22677

Project Name:

HIGHGATE SCHOOL, LONDON
Project reference J15093

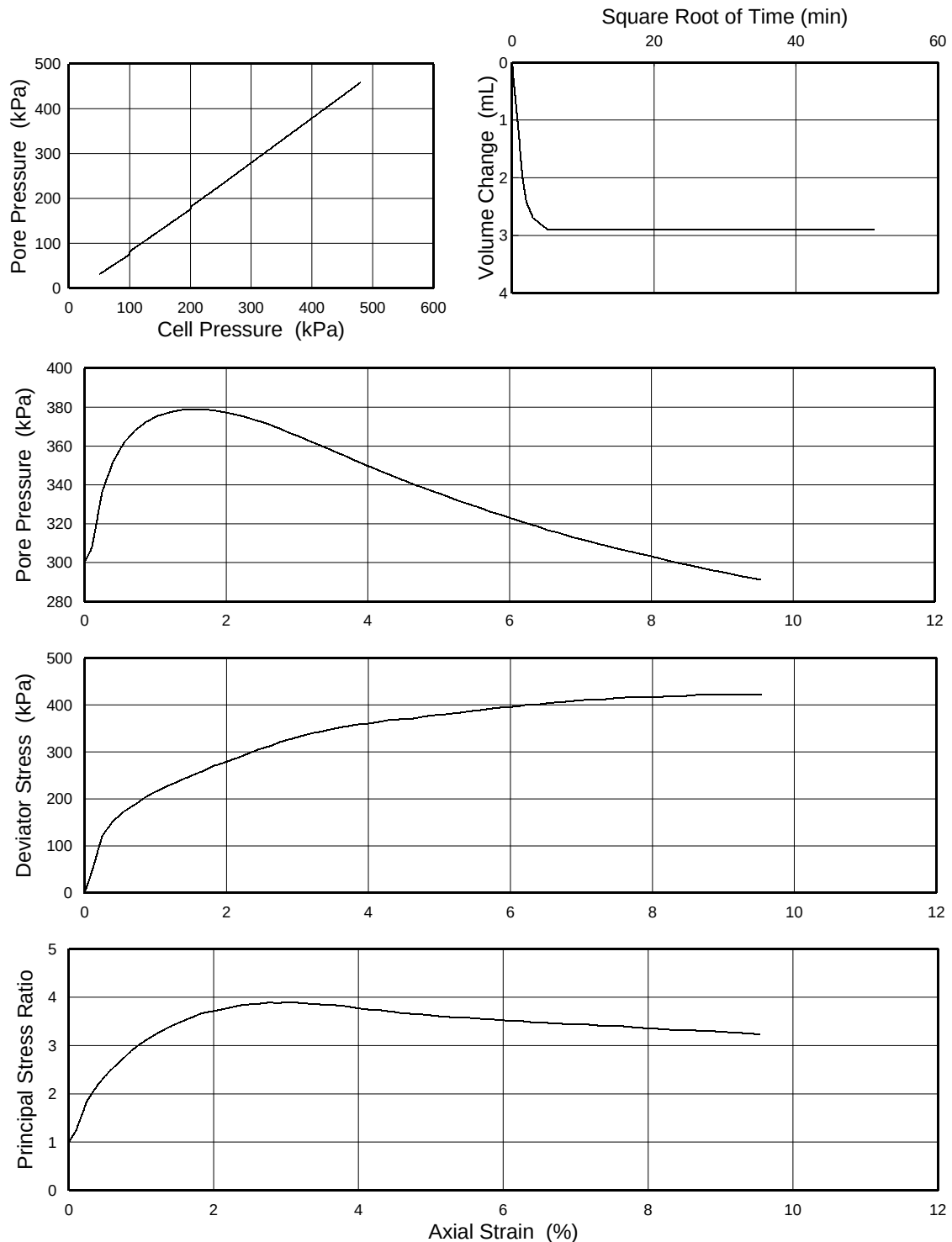


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BS1377 : Part 8 : Clause 7
Consolidated Undrained Triaxial Compression Test
with Measurement of Pore Pressure

Borehole Number: BH6
Sample Number:
Depth (m): 6.50

Specimen No 3



Checked and
Approved

Initials:

24/06/15

Date: 24/06/15

Project Number:

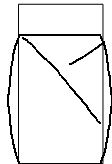
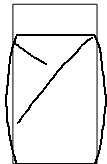
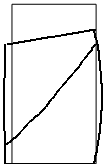
GEO / 22677

Project Name:

HIGHGATE SCHOOL, LONDON
Project reference J15093



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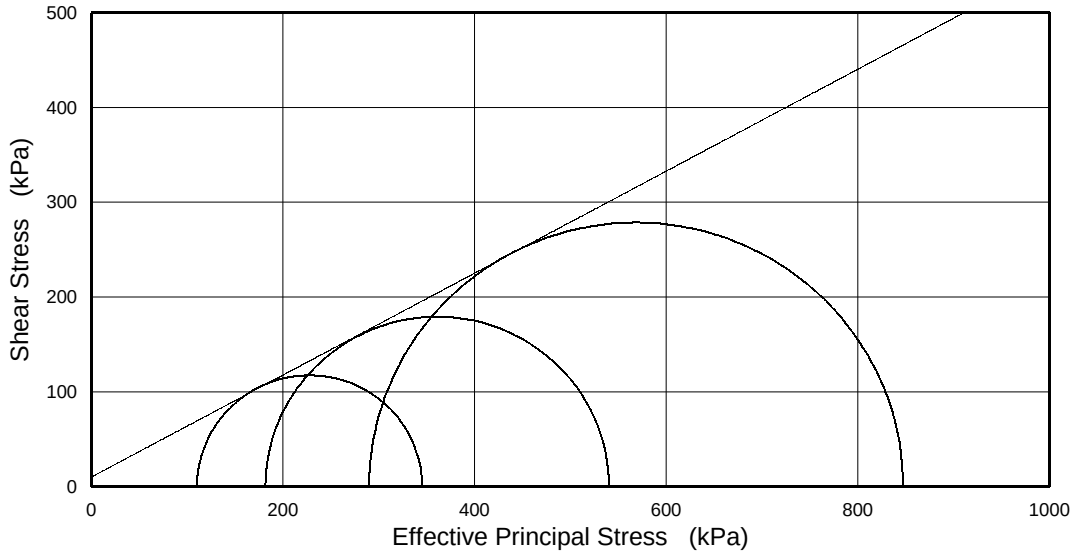
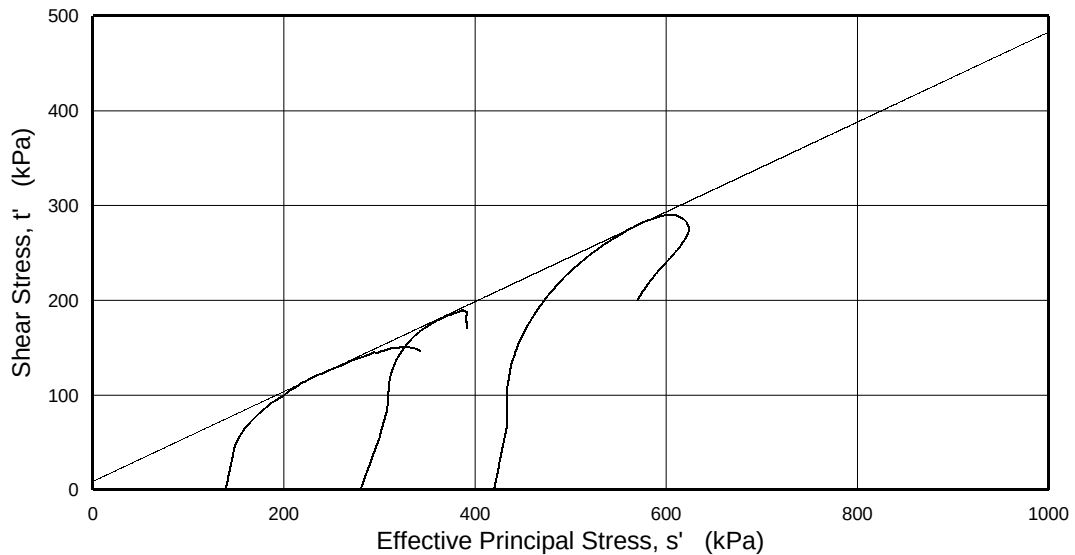
BS1377 : Part 8 : Clause 7 Consolidated Undrained Triaxial Compression Test with Measurement of Pore Pressure																			
Borehole Number: BH7 Sample Number: Depth (m): 15.50		Description: Very stiff fissured dark brownish grey CLAY with some fissures lined with orange silty fine sand																	
SPECIMEN DETAILS Depth within original sample Orientation within original sample		70mm from top Vertical																	
TEST DETAILS Specimen Preparation Cell Preparation Specimen Number Initial Diameter mm Initial Length mm Initial Moisture Content % Initial Wet Density Mg/m ³ Drainage Conditions		Undisturbed Checks performed in accordance with Clause 3.5 <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%; text-align: center;">Specimen No 1</th> <th style="width: 25%; text-align: center;">Specimen No 2</th> <th style="width: 25%; text-align: center;">Specimen No 3</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">37.9</td> <td style="text-align: center;">37.9</td> <td style="text-align: center;">37.9</td> </tr> <tr> <td style="text-align: center;">75.3</td> <td style="text-align: center;">75.4</td> <td style="text-align: center;">75.3</td> </tr> <tr> <td style="text-align: center;">24</td> <td style="text-align: center;">25</td> <td style="text-align: center;">24</td> </tr> <tr> <td style="text-align: center;">2.03</td> <td style="text-align: center;">2.01</td> <td style="text-align: center;">2.04</td> </tr> </tbody> </table> One end and radial boundary			Specimen No 1	Specimen No 2	Specimen No 3	37.9	37.9	37.9	75.3	75.4	75.3	24	25	24	2.03	2.01	2.04
Specimen No 1	Specimen No 2	Specimen No 3																	
37.9	37.9	37.9																	
75.3	75.4	75.3																	
24	25	24																	
2.03	2.01	2.04																	
SATURATION STAGE Final Cell Pressure kPa Final Pore Pressure kPa Final Pore Pressure Parameter B Duration day(s)		540 524 0.98 5	680 664 1.00 5	820 811 1.00 5															
CONSOLIDATION STAGE Cell Pressure kPa Back Pressure kPa Effective Pressure kPa Final Pore Pressure kPa Final Pore Pressure Dissipation % Duration day(s)		540 400 140 401 99 1	680 400 280 400 100 1	820 400 420 400 100 1															
SHEARING STAGE Cell Pressure kPa Rate of Axial Displacement mm/min Initial Pore Pressure kPa Initial Effective Stress kPa		540 0.0060 401 139	680 0.0060 400 280	820 0.0060 400 420															
CONDITIONS AT FAILURE criteria		Maximum Principal Stress Ratio																	
Pore Pressure kPa Minor Effective Principal Stress kPa Deviator Stress kPa Major Effective Principal Stress kPa Effective Principal Stress Ratio Pore Pressure Parameter A Axial Strain % Correction applied to Deviator Stress kPa Duration day(s)		430 110 235 345 3.13 0.12 3.9 12 1	498 182 359 541 2.97 0.27 6.2 13 1	530 290 558 848 2.93 0.23 3.7 12 1															
Final Moisture Content % Final Wet Density Mg/m ³		27 2.15	26 2.13	26 2.21															
EFFECTIVE STRESS PARAMETERS Cohesion kPa Angle of Shear Resistance degrees		10 28.5																	
FAILURE SKETCHES																			

Checked and Approved Initials: RJP Date: 25/06/15	Project Number: GEO / 22677 Project Name: HIGHGATE SCHOOL, LONDON Project reference J15093 
---	---

BS1377 : Part 8 : Clause 7
Consolidated Undrained Triaxial Compression Test
with Measurement of Pore Pressure

Borehole Number: BH7
 Sample Number:
 Depth (m): 15.50

Description:
 Very stiff fissured dark brownish grey CLAY with some
 fissures lined with orange silty fine sand



Checked and
Approved

Initials:

RJP

Date: 25/06/15

Project Number:

GEO / 22677

Project Name:

HIGHGATE SCHOOL, LONDON
 Project reference J15093

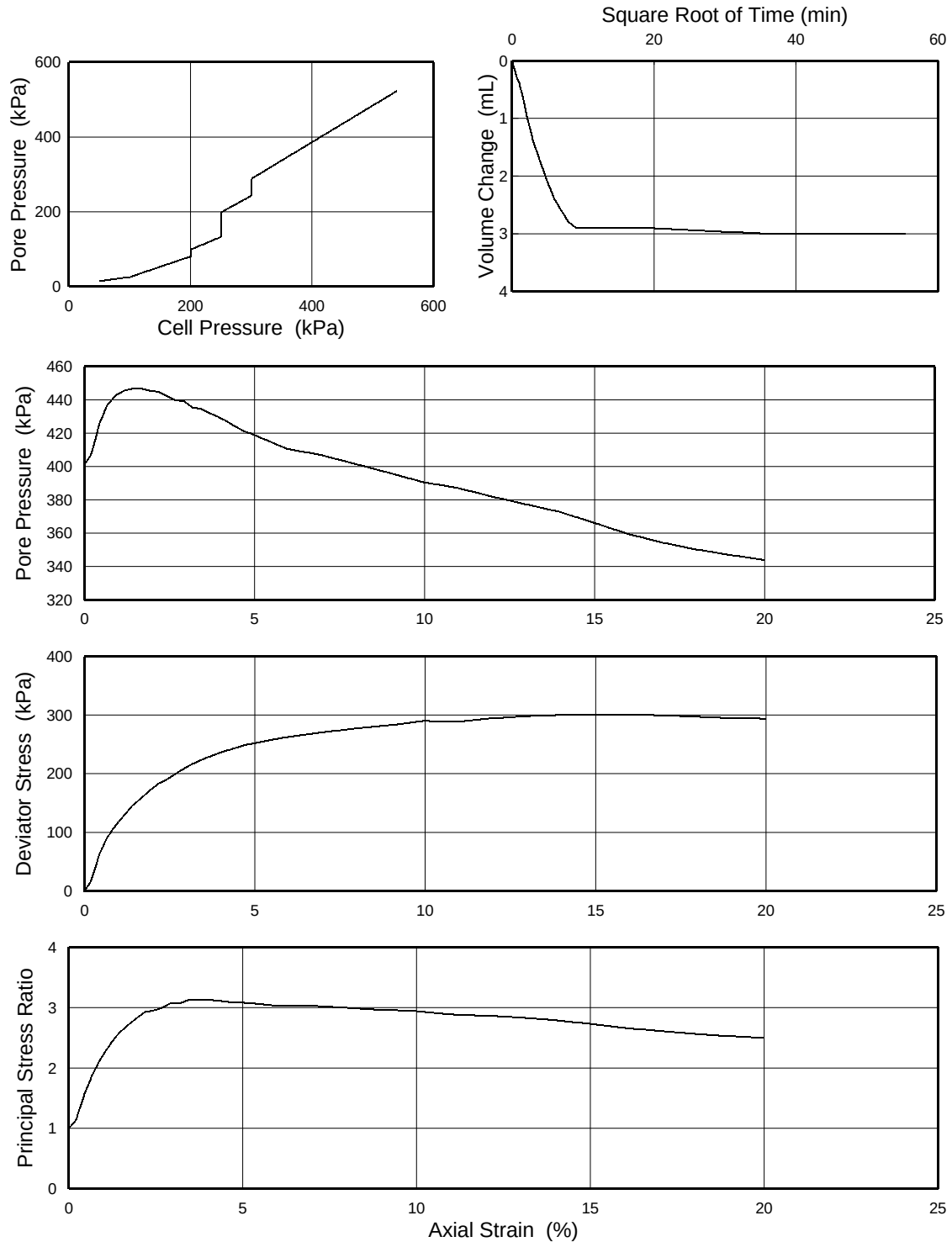


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BS1377 : Part 8 : Clause 7
Consolidated Undrained Triaxial Compression Test
with Measurement of Pore Pressure

Borehole Number: BH7
Sample Number:
Depth (m): 15.50

Specimen No 1



Checked and
Approved

Initials:

RJP

Date: 25/06/15

Project Number:

GEO / 22677

Project Name:

HIGHGATE SCHOOL, LONDON
Project reference J15093

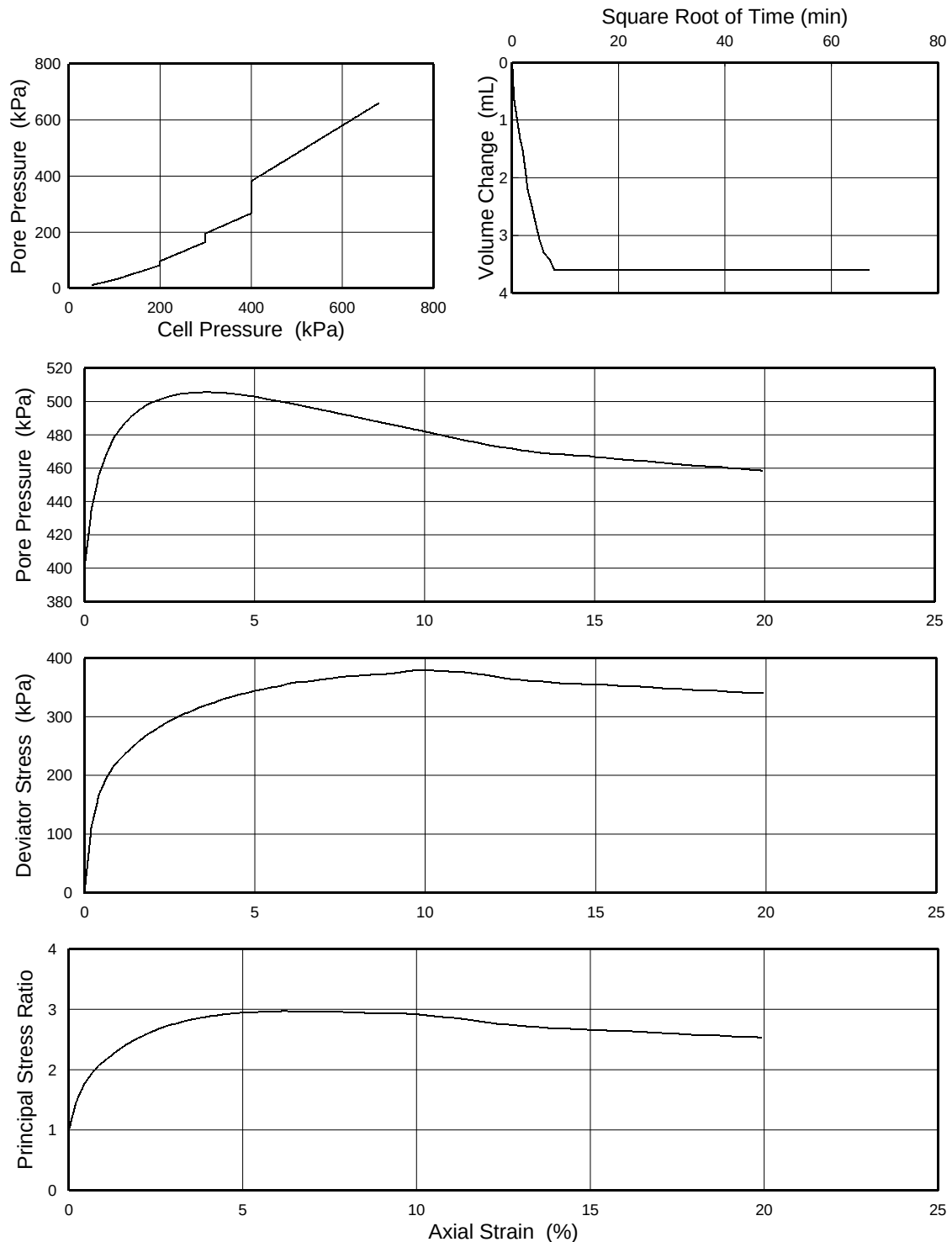


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BS1377 : Part 8 : Clause 7
Consolidated Undrained Triaxial Compression Test
with Measurement of Pore Pressure

Borehole Number: BH7
Sample Number:
Depth (m): 15.50

Specimen No 2



Checked and
Approved

Initials:

RJP

Date: 25/06/15

Project Number:

GEO / 22677

Project Name:

HIGHGATE SCHOOL, LONDON

Project reference J15093

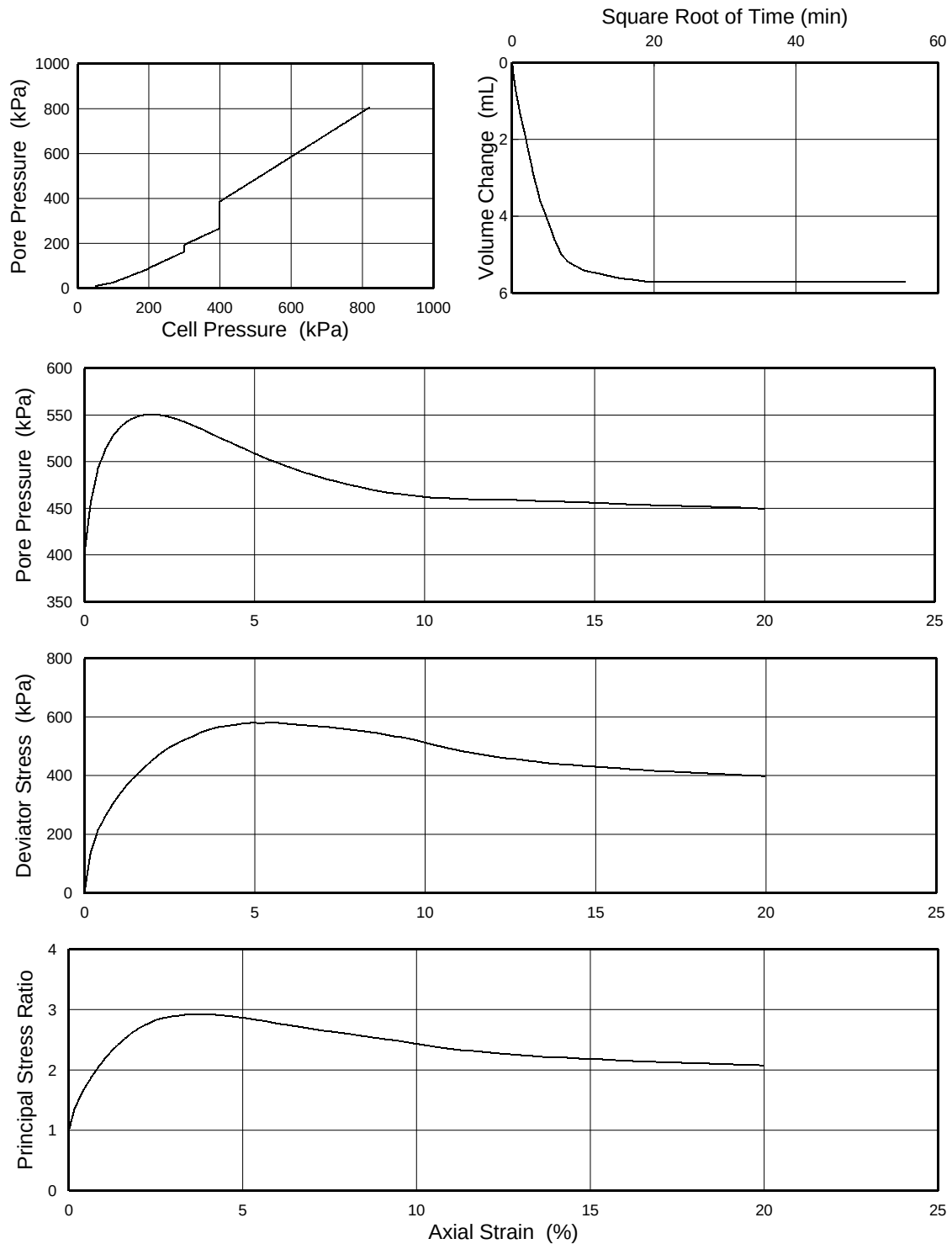


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BS1377 : Part 8 : Clause 7
Consolidated Undrained Triaxial Compression Test
with Measurement of Pore Pressure

Borehole Number: BH7
Sample Number:
Depth (m): 15.50

Specimen No 3



Checked and
Approved

Initials:

RJP

Date: 25/06/15

Project Number:

GEO / 22677

Project Name:

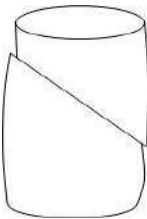
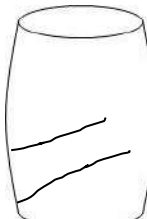
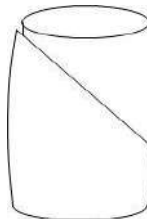
HIGHGATE SCHOOL, LONDON
Project reference J15093



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Consolidated Undrained Triaxial Compression Test with Measurement of Pore Pressure

Borehole No.:	BH8	Description: Dark brown mottled dark grey and black fine sandy CLAY.
Depth (m):	12.00	

SPECIMEN DETAILS Depth within original sample Orientation within original sample		20 mm from top Vertical		
TEST DETAILS Specimen Type and Preparation Cell Preparation Specimen Number Initial Diameter Initial Length Initial Moisture Content Initial Wet Density Drainage Conditions		U (Undisturbed) Checks performed in accordance with Clause 3.5		
		Specimen No. 1	Specimen No. 2	Specimen No. 3
	mm	38.19	38.21	38.23
	mm	75.08	75.07	75.13
	%	23	24	21
	Mg/m ³	2.01	2.01	2.01
		One end and radial boundary		
SATURATION STAGE		Method: Clause 5.2 & 5.3	Method: Clause 5.2 & 5.3	Method: Clause 5.2 & 5.3
Final Cell Pressure	kPa	520	640	760
Final Pore Pressure	kPa	503	611	746
Final Pore Pressure Parameter B		0.99	1.00	1.00
Duration	day(s)	3	3	3
CONSOLIDATION STAGE				
Cell Pressure	kPa	520	640	760
Back Pressure	kPa	400	400	400
Effective Pressure	kPa	120	240	360
Final Pore Pressure	kPa	400	401	401
Final Pore Pressure Dissipation	%	100	99	100
Duration	day(s)	1	1	1
SHEARING STAGE				
Cell Pressure	kPa	520	640	760
Rate of Axial Displacement	mm/min	0.0060	0.0060	0.0060
Initial Pore Pressure	kPa	400	401	401
Initial Effective Stress	kPa	120	239	359
CONDITIONS AT FAILURE		Maximum effective principal stress ratio		
Pore Pressure	kPa	432	472	521
Minor Effective Principal Stress	kPa	88	168	239
Deviator Stress	kPa	255	410	575
Major Effective Principal Stress	kPa	343	578	814
Effective Principal Stress Ratio		3.90	3.43	3.40
Pore Pressure Parameter A		0.13	0.17	0.21
Axial Strain	%	2.6	4.0	2.6
Correction applied to Deviator Stress	kPa	11	12	11
Duration	day(s)	1	1	1
Final Moisture Content	%	24	24	22
Final Wet Density	Mg/m ³	2.08	2.05	2.14
EFFECTIVE STRESS PARAMETERS				
Cohesion	kPa	18		
Angle of Shear Resistance	degrees	31		
FAILURE SKETCH				

Project Number:

GEO / 22770

Project Name:

HIGHGATE SCHOOL, LONDON J15093



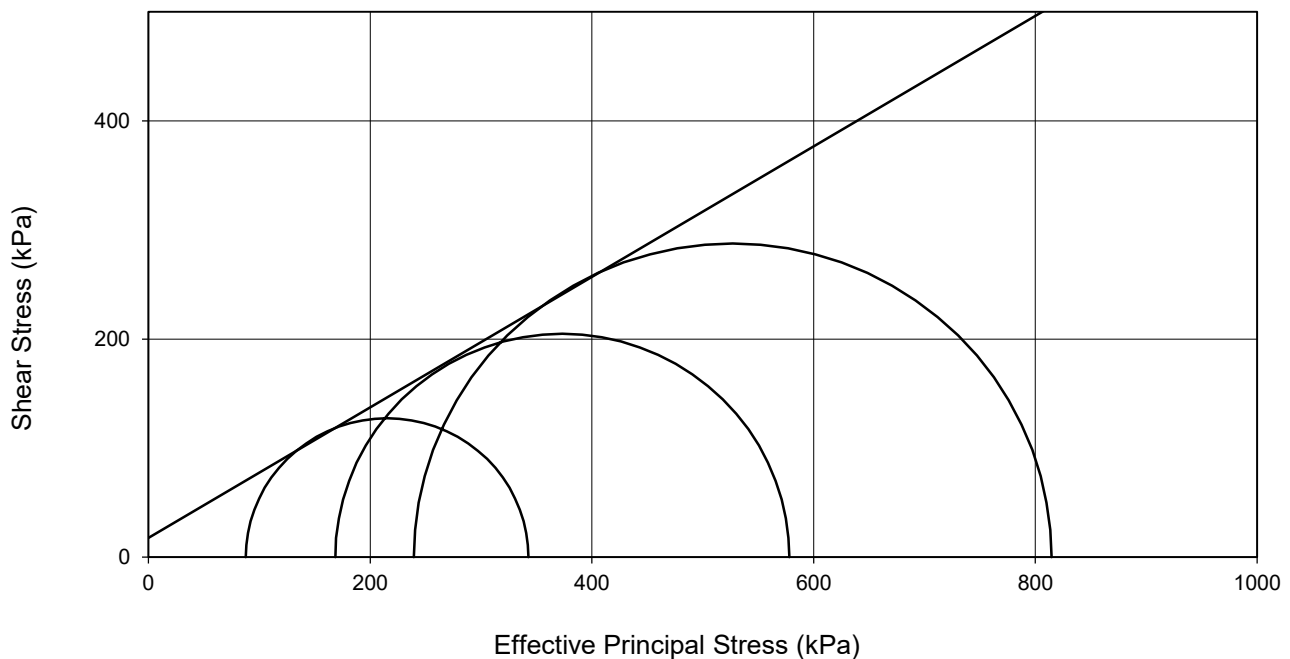
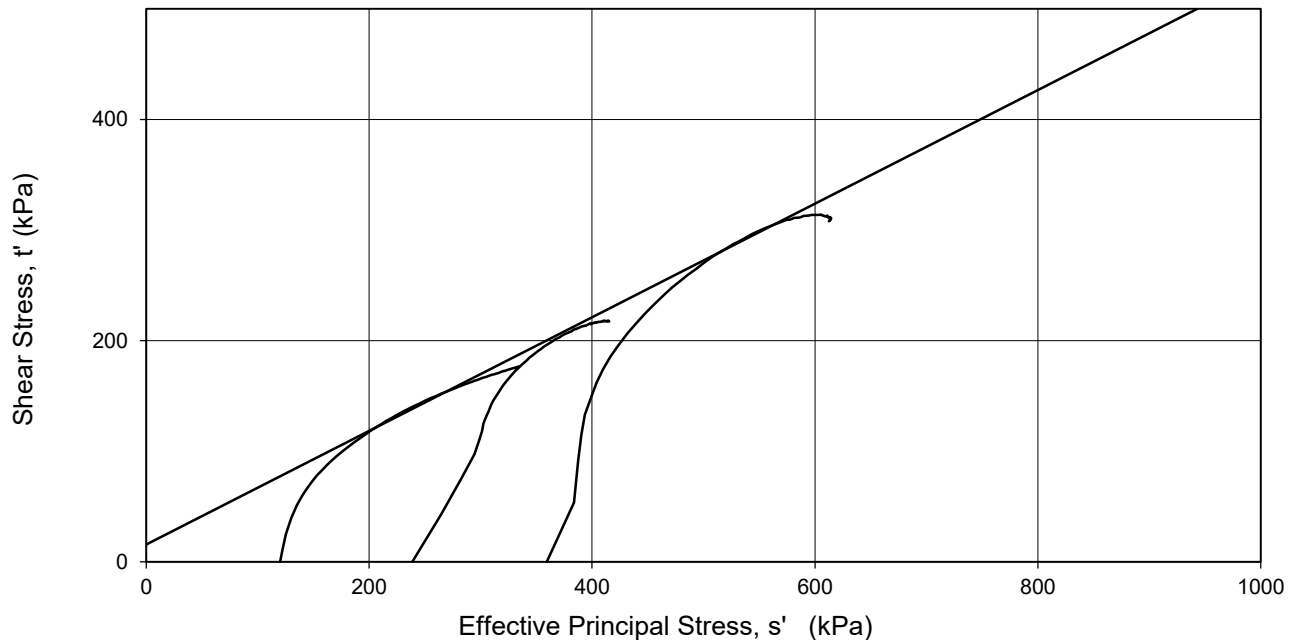

Lucknalls Lane, Garston, Watford, Hertfordshire, WD25 9XX

Client : Geotechnical & Environmental Associates Limited, Widbury Barn, Widbury Hill, Ware, Hertfordshire

Consolidated Undrained Triaxial Compression Test with Measurement of Pore Pressure

Borehole No.: BH8
Depth (m): 12.00

Description:
Dark brown mottled dark grey and black fine sandy CLAY.



Project Number:

GEO / 22770

Project Name:

**HIGHGATE SCHOOL, LONDON
J15093**

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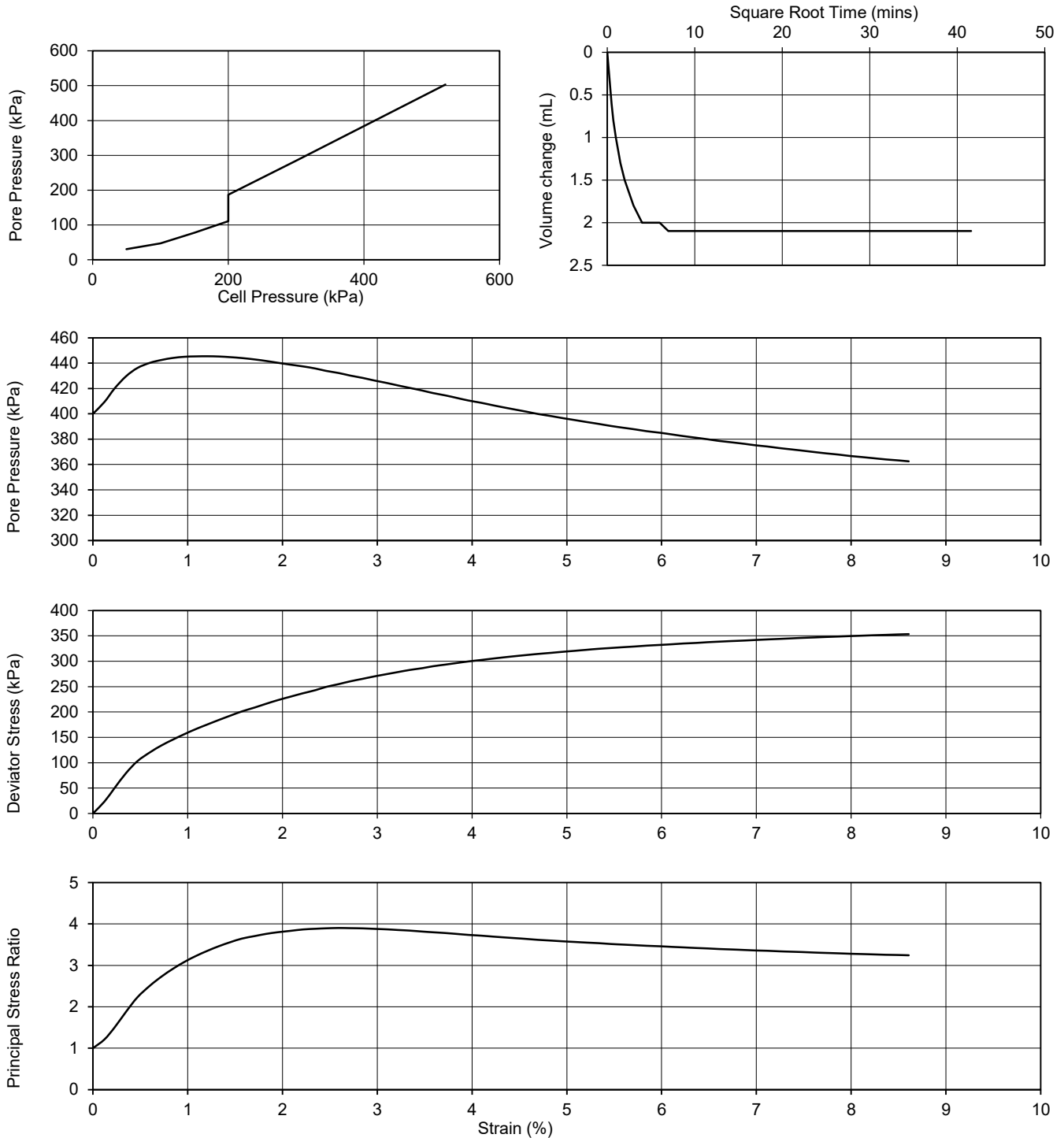
ucknalls Lane, Garston, Watford, Hertfordshire, WD25 9XX

Client : Geotechnical & Environmental Associates Limited, Widbury Barn, Widbury Hill, Ware, Hertfordshire

Consolidated Undrained Triaxial Compression Test with Measurement of Pore Pressure

Borehole No.: BH8
Depth (m): 12.00

Specimen 1



Object Number:

GEO / 22770

Object Name:

**HIGHGATE SCHOOL, LONDON
J15093**

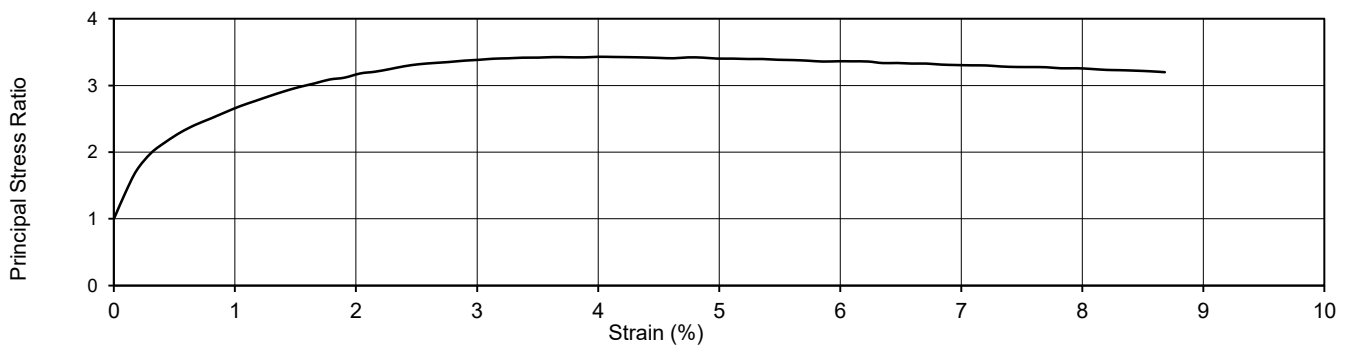
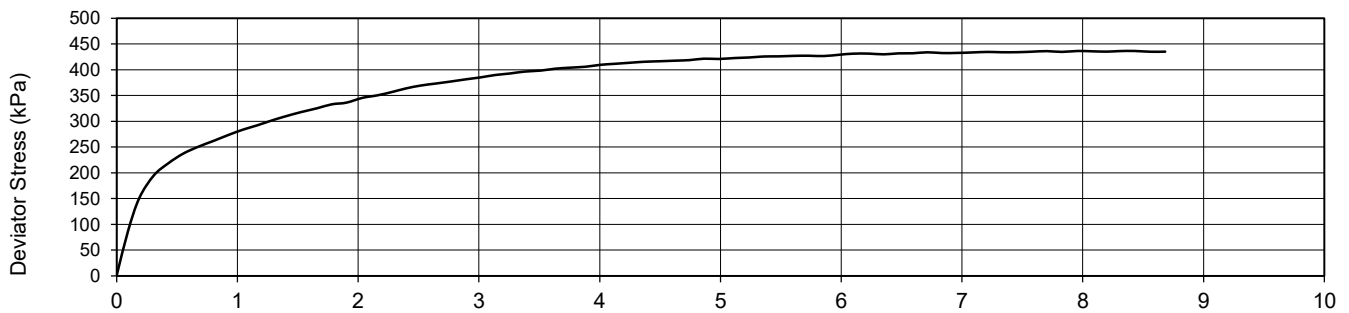
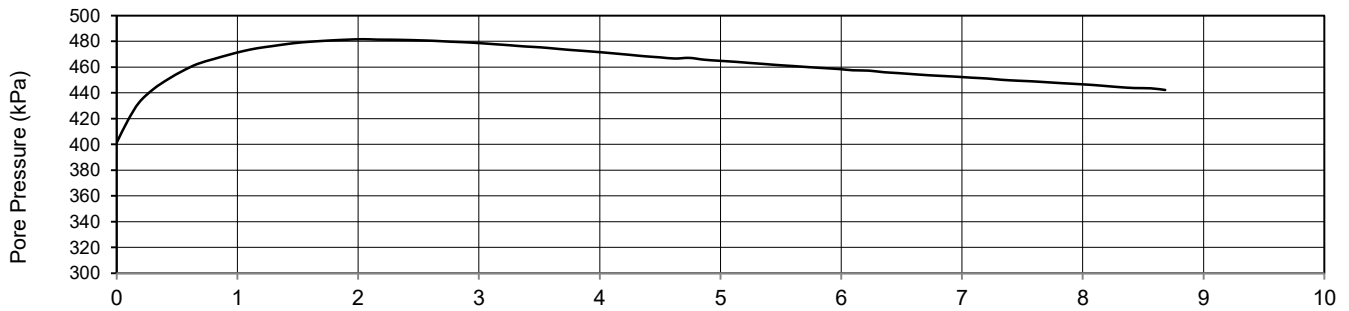
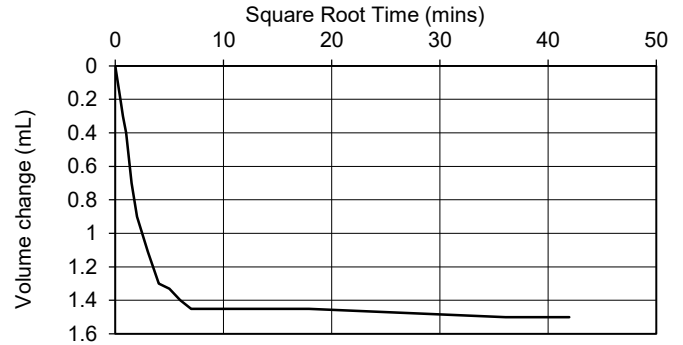
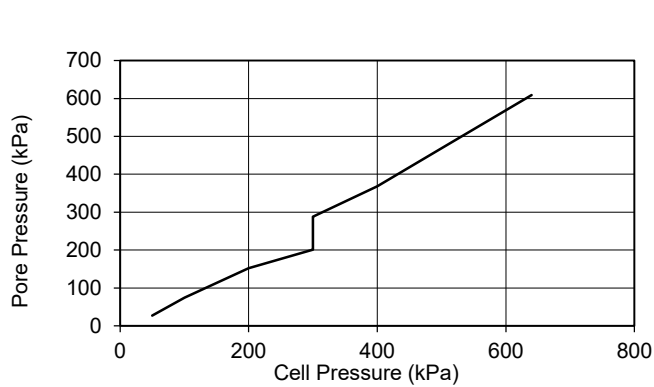
GEOLABS



Consolidated Undrained Triaxial Compression Test with Measurement of Pore Pressure

Borehole No.: BH8
Depth (m): 12.00

Specimen 2



Project Number:

GEO / 22770

Project Name:

**HIGHGATE SCHOOL, LONDON
J15093**

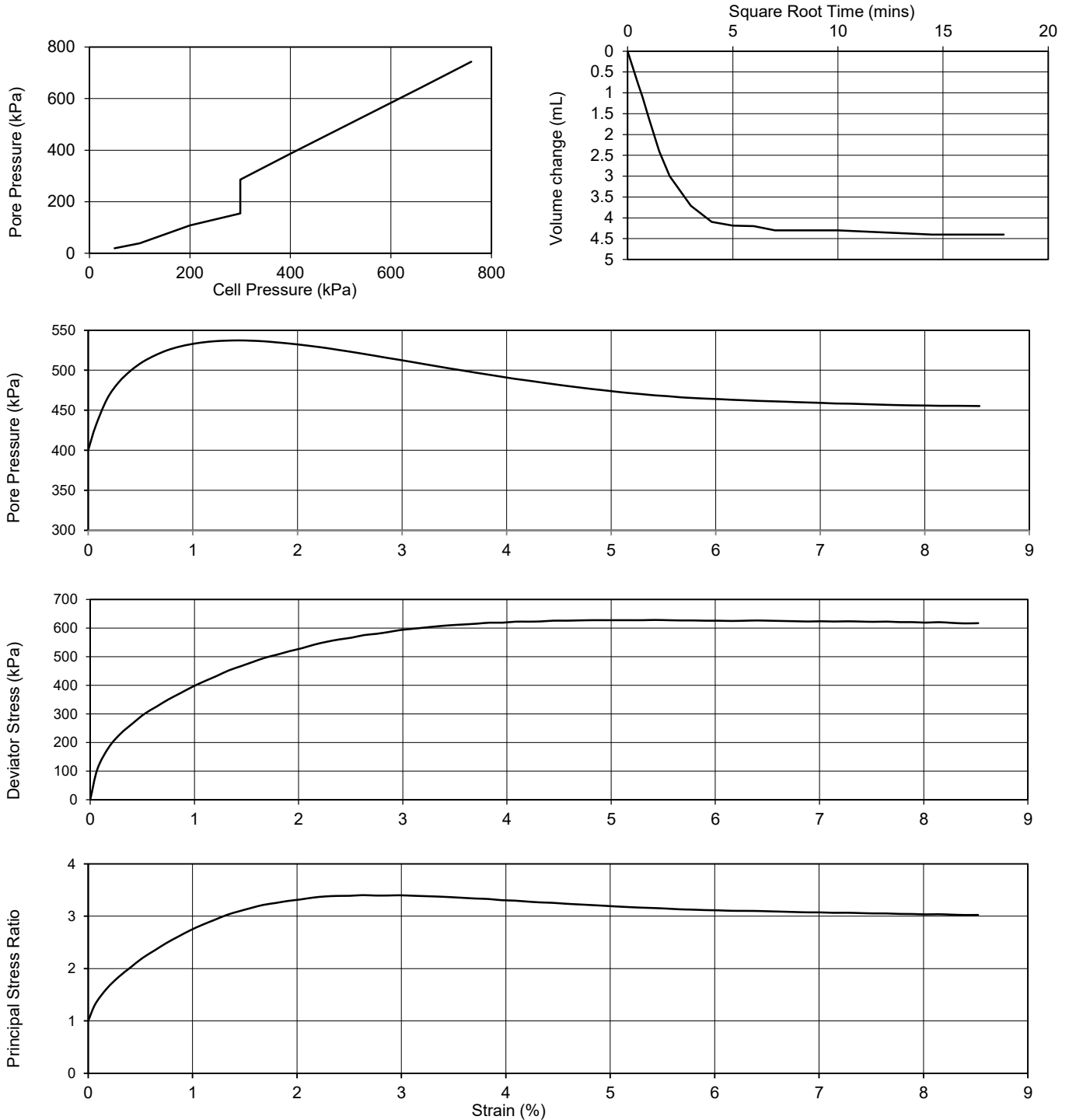
GEOLABS®



Consolidated Undrained Triaxial Compression Test with Measurement of Pore Pressure

Borehole No.: BH8
Depth (m): 12.00

Specimen 3



ject Number:

GEO / 22770

ject Name:

**HIGHGATE SCHOOL, LONDON
J15093**





Final Report

Report Number: 15-08489 Issue-1

Initial Date of Issue: 27-Apr-2015

Client: GEA

Client Address: Widbury Barn
Widbury Hill
Ware
Hertfordshire
SG12 7QE

Contact(s): Bryan O'Gorman
Matthew Elcock

Project: J15093- Highgate School

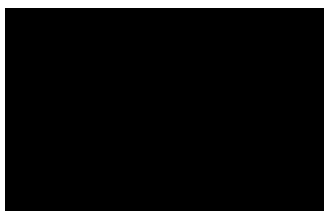
Quotation No.: **Date Received:** 15-Apr-2015

Order No.: **Date Instructed:** 22-Apr-2015

No. of Samples: 11 **Target Due Date:** 24-Apr-2015

Turnaround: (Wkdays) 4 **Results Due Date:** 27-Apr-2015

Date Approved: 27-Apr-2015



Darrell Hall, Laboratory Director

Results Summary - Soil

Project: J15093- Highgate School

Client: GEA	Chemtest Job No.:				15-08489	15-08489	15-08489	15-08489	15-08489	15-08489	15-08489
Quotation No.:	Chemtest Sample ID.:				127711	127712	127714	127715	127716	127720	127721
Order No.:	Client Sample Ref.:										
	Client Sample ID.:				BH1	BH2	BH3	BH4	BH5	TP7	TP9
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.5	0.5	0.3	0.8	0.8	0.2	0.4
	Bottom Depth(m):										
	Date Sampled:				31-Mar-15	31-Mar-15	31-Mar-15	31-Mar-15	31-Mar-15	31-Mar-15	31-Mar-15
Determinand	Accred.	SOP	Units	LOD							
Moisture	N	2030	%	0.02	10	21	17	17	13	13	18
Stones	N	2030	%	0.02	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
Soil Colour	N				brown	brown	brown	brown	brown	brown	brown
Other Material	N				stones	stones	stones	stones	stones	stones	stones
Soil Texture	N				clay	sand	clay	sand	sand	clay	clay
pH	M	2010			9.9	8.4	7.4	9.8	8.7	8.1	7.6
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.01	0.27	0.11	0.21	0.24	0.19	0.11	0.012
Chloride (Extractable)	M	2220	g/l	0.01	0.039	< 0.010	< 0.010	0.016	< 0.010	0.012	< 0.010
Cyanide (Total)	M	2300	mg/kg	0.5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Sulphide (Easily Liberatable)	M	2325	mg/kg	0.5	30	5.1	3.9	2.9	3.2	3.0	1.6
Sulphate (Total)	M	2430	mg/kg	100	3600	6400	1300	3500	1500	770	680
Arsenic	M	2450	mg/kg	1	21	150	19	63	19	22	19
Cadmium	M	2450	mg/kg	0.1	1.2	26	0.44	0.73	0.10	2.2	0.13
Chromium	M	2450	mg/kg	1	47	83	41	47	32	41	49
Copper	M	2450	mg/kg	0.5	73	700	52	120	37	38	38
Mercury	M	2450	mg/kg	0.1	1.4	1.1	1.4	0.49	0.58	1.4	1.1
Nickel	M	2450	mg/kg	0.5	30	110	16	52	17	17	22
Lead	M	2450	mg/kg	0.5	720	5900	360	760	340	760	230
Selenium	M	2450	mg/kg	0.2	< 0.20	0.50	0.31	< 0.20	< 0.20	0.35	< 0.20
Zinc	M	2450	mg/kg	0.5	160	2000	160	420	130	120	280
Total Organic Carbon	M	2625	%	0.2	3.0	10	13	7.4	1.1	2.9	1.5
TPH >C5-C6	N	2670	mg/kg	1	B < 1.0	B < 1.0	B < 1.0	B < 1.0	B < 1.0	B < 1.0	B < 1.0
TPH >C6-C7	N	2670	mg/kg	1	B < 1.0	B < 1.0	B < 1.0	B < 1.0	B < 1.0	B < 1.0	B < 1.0
TPH >C7-C8	N	2670	mg/kg	1	B < 1.0	B < 1.0	B < 1.0	B < 1.0	B < 1.0	B < 1.0	B < 1.0
TPH >C8-C10	N	2670	mg/kg	1	B < 1.0	B < 1.0	B < 1.0	B < 1.0	B < 1.0	B < 1.0	B < 1.0
TPH >C10-C12	N	2670	mg/kg	1	B < 1.0	B 3.8	B < 1.0	B 2.4	B 1.9	B < 1.0	B 2.8
TPH >C12-C16	N	2670	mg/kg	1	B < 1.0	B 18	B < 1.0	B 8.5	B 8.6	B 7.5	B 20
TPH >C16-C21	N	2670	mg/kg	1	B 7.0	B 63	B 7.6	B 18	B 18	B 12	B 140
TPH >C21-C35	N	2670	mg/kg	1	B 12	B 300	B 16	B 35	B 28	B 21	B 260
Total TPH >C5-C35	N	2670	mg/kg	10	B 20	B 380	B 23	B 64	B 56	B 42	B 420
Naphthalene	M	2700	mg/kg	0.1	0.77	1.8	0.54	0.54	< 0.10	< 0.10	0.32
Acenaphthylene	M	2700	mg/kg	0.1	2.0	1.6	0.22	0.25	< 0.10	< 0.10	0.31
Acenaphthene	M	2700	mg/kg	0.1	1.2	1.8	0.31	0.23	< 0.10	< 0.10	0.15

Results Summary - Soil

Project: J15093- Highgate School

Client: GEA	Chemtest Job No.:					15-08489	15-08489	15-08489	15-08489	15-08489	15-08489	15-08489
Quotation No.:	Chemtest Sample ID.:					127711	127712	127714	127715	127716	127720	127721
Order No.:	Client Sample Ref.:											
	Client Sample ID.:					BH1	BH2	BH3	BH4	BH5	TP7	TP9
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.5	0.5	0.3	0.8	0.8	0.2	0.4
	Bottom Depth(m):											
	Date Sampled:					31-Mar-15	31-Mar-15	31-Mar-15	31-Mar-15	31-Mar-15	31-Mar-15	31-Mar-15
Determinand	Accred.	SOP	Units	LOD								
Fluorene	M	2700	mg/kg	0.1	1.6	1.8	0.25	0.32	< 0.10	< 0.10	0.37	
Phenanthrene	M	2700	mg/kg	0.1	17	20	1.5	2.7	3.4	1.9	6.5	
Anthracene	M	2700	mg/kg	0.1	5.9	5.4	0.39	0.54	0.20	0.16	0.81	
Fluoranthene	M	2700	mg/kg	0.1	38	29	3.1	4.5	6.0	3.2	6.9	
Pyrene	M	2700	mg/kg	0.1	40	27	3.2	4.5	3.3	2.4	5.5	
Benzo[a]anthracene	M	2700	mg/kg	0.1	21	16	2.4	2.1	2.2	1.5	2.7	
Chrysene	M	2700	mg/kg	0.1	24	17	2.0	2.5	3.0	1.8	3.1	
Benzo[b]fluoranthene	M	2700	mg/kg	0.1	29	18	2.1	2.6	3.7	2.0	3.3	
Benzo[k]fluoranthene	M	2700	mg/kg	0.1	11	7.2	0.99	1.2	1.3	0.80	1.3	
Benzo[a]pyrene	M	2700	mg/kg	0.1	24	15	2.1	1.9	1.9	1.3	2.0	
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.1	16	9.7	1.6	1.7	1.9	1.1	1.8	
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.1	4.6	2.9	0.63	0.62	0.46	0.19	0.40	
Benzo[g,h,i]perylene	M	2700	mg/kg	0.1	17	9.9	1.5	1.7	1.9	0.95	1.6	
Total Of 16 PAH's	M	2700	mg/kg	2	250	180	23	28	29	17	37	
Total Phenols	M	2920	mg/kg	0.3	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request. The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Chemtest Sample ID:	Sample Ref:	Sample ID:	Sampled Date:	Containers Received:	Deviation Code(s):
127711		BH1	31-Mar-2015	Amber Glass 250ml	B
127711		BH1	31-Mar-2015	Plastic Tub 500g	B
127712		BH2	31-Mar-2015	Amber Glass 250ml	B
127712		BH2	31-Mar-2015	Plastic Tub 500g	B
127714		BH3	31-Mar-2015	Amber Glass 250ml	B
127714		BH3	31-Mar-2015	Plastic Bag	B
127715		BH4	31-Mar-2015	Amber Glass 250ml	B
127715		BH4	31-Mar-2015	Plastic Bag	B
127716		BH5	31-Mar-2015	Amber Glass 250ml	B
127716		BH5	31-Mar-2015	Plastic Bag	B
127720		TP7	31-Mar-2015	Amber Glass 250ml	B
127720		TP7	31-Mar-2015	Plastic Bag	B
127721		TP9	31-Mar-2015	Amber Glass 250ml	B
127721		TP9	31-Mar-2015	Plastic Tub 500g	B

Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVCOs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at our Coventry laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container

Sample Retention and Disposal

All soil samples will be retained for a period of 60 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.co.uk



Final Report

Report Number: 15-12555 Issue-1

Initial Date of Issue: 10-Jun-2015

Client: GEA

Client Address: Widbury Barn
Widbury Hill
Ware
Hertfordshire
SG12 7QE

Contact(s): Matthew Elcock

Project: WAC Analysis

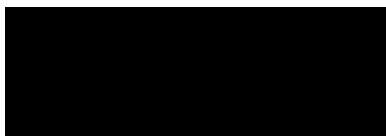
Quotation No.: **Date Received:** 02-Jun-2015

Order No.: J15093 **Date Instructed:** 02-Jun-2015

No. of Samples: 1

Turnaround: (Wkdays) 7 **Results Due Date:** 10-Jun-2015

Date Approved: 10-Jun-2015



Details: Keith Jones, Technical Manager

Results Summary - 2 Stage WAC

Project: WAC Analysis

Chemtest Job No: 15-12555 Chemtest Sample ID: 147685 Sample Ref: Sample ID: BH8 Top Depth(m): 1.20 Bottom Depth(m): Sampling Date:							Landfill Waste Acceptance Criteria Limits		
							Inert Waste Landfill	Stable Non-reactive Hazardous waste in non-hazardous	Hazardous Waste Landfill
Determinand	SOP	Accred.	Units						
Total Organic Carbon	2625	U	%				2.3	3	5
Loss on Ignition	2610	U	%				3.2	--	10
Total BTEX	2760	U	mg/kg				< 0.01	6	--
Total PCBs (7 congeners)	2815	U	mg/kg				< 0.10	1	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg				< 10	500	--
Total (of 17) PAHs	2700	N	mg/kg				< 2.0	100	--
pH	2010	U					7.7	--	>6
Acid Neutralisation Capacity	2015	N	mol/kg				0.012	--	To evaluate
Eluate Analysis			2:1 mg/l	8:1 mg/l	2:1 mg/kg	Cumulative 10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
Arsenic	1450	U	0.004	0.002	< 0.050	< 0.050	0.5	2	25
Barium	1450	U	0.008	0.005	< 0.50	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.001	< 0.001	< 0.050	< 0.050	0.5	10	70
Copper	1450	U	< 0.001	< 0.001	< 0.050	< 0.050	2	50	100
Mercury	1450	U	< 0.0005	< 0.0005	< 0.001	< 0.005	0.01	0.2	2
Molybdenum	1450	U	0.005	0.002	< 0.050	< 0.050	0.5	10	30
Nickel	1450	U	< 0.001	< 0.001	< 0.050	< 0.050	0.4	10	40
Lead	1450	U	< 0.001	0.001	< 0.010	0.012	0.5	10	50
Antimony	1450	U	0.002	< 0.001	< 0.010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.001	< 0.001	< 0.010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.001	0.002	< 0.50	< 0.50	4	50	200
Chloride	1220	U	3	2.8	< 10	28	800	15000	25000
Fluoride	1220	U	0.37	0.14	< 1.0	1.7	10	150	500
Sulphate	1220	U	13	3.1	26	44	1000	20000	50000
Total Dissolved Solids	1020	N	62	27	120	310	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	5.5	< 2.5	< 50	< 50	500	800	1000

Soild Information	
Dry mass of test portion/kg	0.175
Moisture (%)	15

Leachate Test Information	
Leachant volume 1st extract/l	0.318
Leachant volume 2nd extract/l	1.4
Eluant recovered from 1st extract/l	0.224

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Chemtest Sample ID:	Sample Ref:	Sample ID:	Sampled Date:	Deviation Code(s):	Containers Received:
147685		BH8	None Supplied	A	Plastic Bag

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customerservices@chemtest.co.uk

		Widbury Barn Widbury Hill Ware Herts SG12 7QE		Generic Risk-Based Soil Screening Values																			
Site Dyne House, Highgate School, London, N6 5EE				Job Number J15093																			
Client Highgate School				Sheet 1 / 1																			
Agent A- squared studio																							
Proposed End Use Residential without plant uptake																							
Soil pH 8																							
Soil Organic Matter content % 6.0																							
Contaminant			Screening Value mg/kg			Data Source																	
Metals						Anions																	
Arsenic			40			C4SL			Soluble Sulphate			0.5 g/l			Structures								
Cadmium			149			C4SL			Sulphide			50			Structures								
Chromium (III)			3000			LQM/CIEH			Chloride			400			Structures								
Chromium (VI)			21			C4SL			Others														
Copper			2,330			LQM/CIEH			Organic Carbon (%)			6			Methanogenic potential								
Lead			310			C4SL			Total Cyanide			140			WRAS								
Elemental Mercury			1.02			SGV			Total Mono Phenols			520			SGV								
Inorganic Mercury			235			SGV			PAH														
Nickel			130			LQM/CIEH			Naphthalene			13.10			Rev. LQM/CIEH								
Selenium			595			SGV			Acenaphthylene			3,870			LQM/CIEH								
Zinc			3,750			LQM/CIEH			Acenaphthene			3,910			LQM/CIEH								
Hydrocarbons						Fluorene						2,870						LQM/CIEH					
Benzene			3.3			C4SL			Phenanthrene			970			LQM/CIEH								
Toluene			610			SGV			Anthracene			23,300			LQM/CIEH								
Ethyl Benzene			350			SGV			Fluoranthene			1,000			LQM/CIEH								
Xylene			230			SGV			Pyrene			2,400			LQM/CIEH								
Aliphatic C5-C6			110			LQM/CIEH			Benzo(a) Anthracene			9.4			Rev. LQM/CIEH								
Aliphatic C6-C8			370			LQM/CIEH			Chrysene			15			Rev. LQM/CIEH								
Aliphatic C8-C10			110			LQM/CIEH			Benzo(b) Fluoranthene			11.2			Rev. LQM/CIEH								
Aliphatic C10-C12			540			LQM/CIEH			Benzo(k) Fluoranthene			15.8			Rev. LQM/CIEH								
Aliphatic C12-C16			3000			LQM/CIEH			Benzo(a) pyrene			5.30			C4SL								
Aliphatic C16-C35			76,000			LQM/CIEH			Indeno(1 2 3 cd) Pyrene			6.7			Rev. LQM/CIEH								
Aromatic C6-C7			See Benzene			LQM/CIEH			Dibenzo(a h) Anthracene			1.41			Rev. LQM/CIEH								
Aromatic C7-C8			See Toluene			LQM/CIEH			Benzo (g h i) Perylene			72			Rev. LQM/CIEH								
Aromatic C8-C10			151			LQM/CIEH			Screening value for PAH			75.7			B(a)P / 0.15								
Aromatic C10-C12			346			LQM/CIEH			Chlorinated Solvents														
Aromatic C12-C16			593			LQM/CIEH			1,1,1 trichloroethane (TCA)			28.4			LQM/CIEH								
Aromatic C16-C21			770			LQM/CIEH			tetrachloroethane (PCA)			5.76			LQM/CIEH								
Aromatic C21-C35			1230			LQM/CIEH			tetrachloroethene (PCE)			5.26			LQM/CIEH								
PRO (C5 –C10)			1354			Calc			trichloroethene (TCE)			0.511			LQM/CIEH								
DRO (C12 –C28)			80,363			Calc			1,2-dichloroethane (DCA)			0.016			LQM/CIEH								
Lube Oil (C28 –C44)			77,230			Calc			vinyl chloride (Chloroethene)			0.00107			LQM/CIEH								
TPH			1000			Trigger for speciated testing			tetrachloromethane (Carbon tetra			0.18			LQM/CIEH								
									trichloromethane (Chloroform)			3.22			LQM/CIEH								
Notes																							
Concentrations measured below the above values may be considered to represent 'uncontaminated conditions' which pose 'LOW' risk to human health. Concentrations measured in excess of these values indicate a potential risk which require further, site specific risk assessment.																							
SGV - Soil Guideline Value, derived from the CLEA model and published by Environment Agency 2009																							
LQM/CIEH - Generic Assessment Criteria for Human Health Risk Assessment 2nd edition (2009)derived using CLEA 1.04 model 2009																							
C4SL - Defra Category 4 Screening value based on Low Level of Toxicological Risk																							
Rev LQM/CIEH calculated using C4SL revisions to exposure assessment but LQM/CIEH health criteria values																							
Calc - sum of nearest available carbon range specified including BTEX for PRO fraction																							
B(a)P / 0.15 - GEA experience indicates that Benzo(a) pyrene (one of the most common and most carcinogenic of the PAHs) rarely exceeds 15% of the total PAH concentration, hence this Total PAH threshold is regarded as being conservative																							

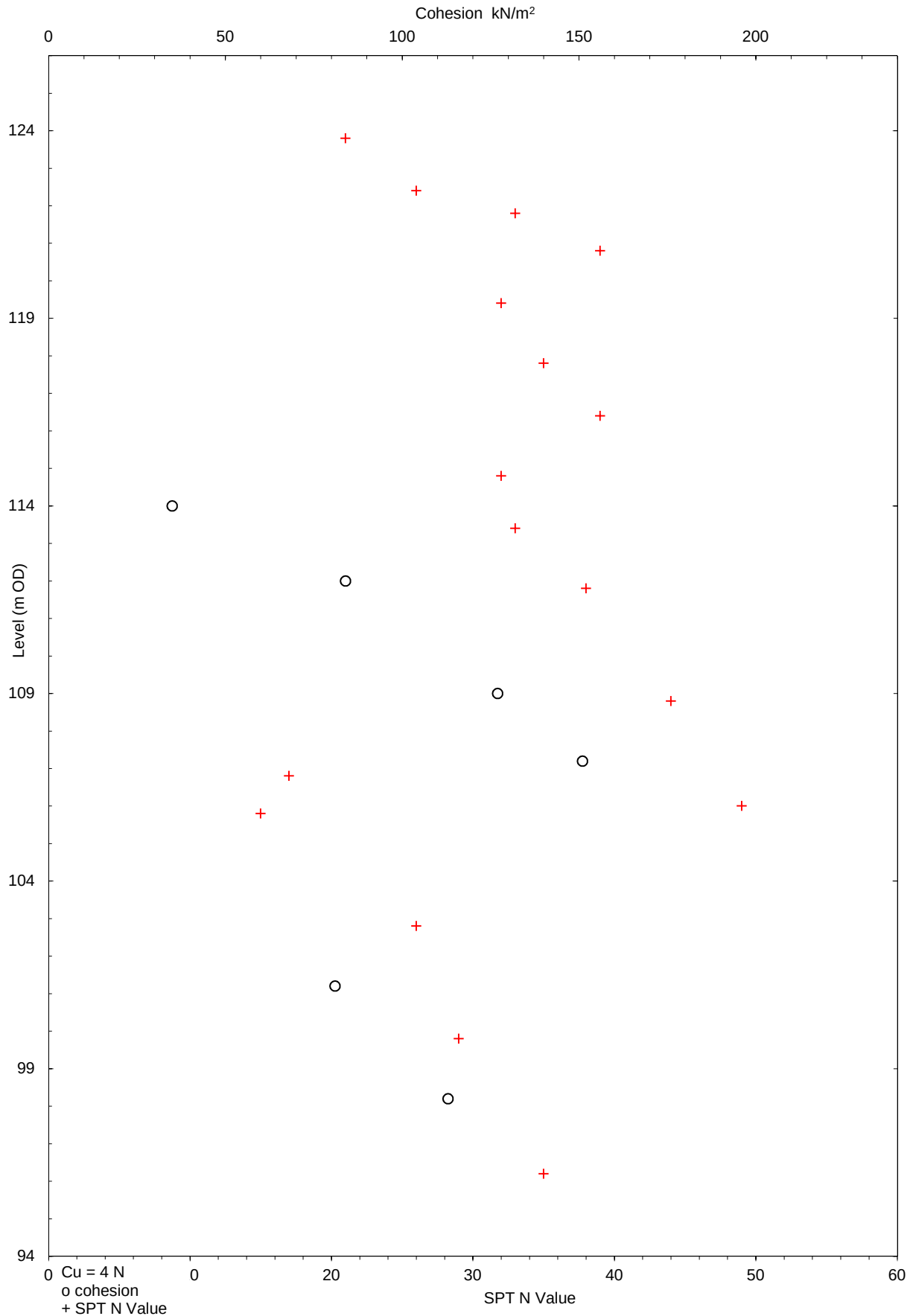
Site Dyne House, Highgate School, London, N6 5EE

Client Highgate School

Engineer A-squared Studio

Job Number
J15093

Sheet
1 / 1



Envirocheck[®] Report:

Datasheet

Order Details:

Order Number:

66091368_1_1

Customer Reference:

J15093

National Grid Reference:

528450, 187540

Slice:

A

Site Area (Ha):

0.68

Search Buffer (m):

1000

Site Details:

Highgate School

Highgate

LONDON

N6 5EE

Client Details:

Mr S Branch

GEA Ltd

Widbury Barn

Widbury Hill

Ware

Herts

SG12 7QE

Report Section	Page Number
Summary	-
Agency & Hydrological	1
Waste	6
Hazardous Substances	-
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Data Currency	21
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Introduction

The Environment Act 1995 has made site sensitivity a key issue, as the legislation pays as much attention to the pathways by which contamination could spread, and to the vulnerable targets of contamination, as it does the potential sources of contamination. For this reason, Landmark's Site Sensitivity maps and Datasheet(s) place great emphasis on statutory data provided by the Environment Agency/Natural Resources Wales and the Scottish Environment Protection Agency; it also incorporates data from Natural England (and the Scottish and Welsh equivalents) and Local Authorities; and highlights hydrogeological features required by environmental and geotechnical consultants. It does not include any information concerning past uses of land. The datasheet is produced by querying the Landmark database to a distance defined by the client from a site boundary provided by the client.

In the attached datasheet the National Grid References (NGRs) are rounded to the nearest 10m in accordance with Landmark's agreements with a number of Data Suppliers.

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Report Version v49.0

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Agency & Hydrological					
Contaminated Land Register Entries and Notices					
Discharge Consents	pg 1		1		
Enforcement and Prohibition Notices					
Integrated Pollution Controls					
Integrated Pollution Prevention And Control					
Local Authority Integrated Pollution Prevention And Control					
Local Authority Pollution Prevention and Controls	pg 1		2	3	
Local Authority Pollution Prevention and Control Enforcements					
Nearest Surface Water Feature	pg 1			Yes	
Pollution Incidents to Controlled Waters	pg 2				3
Prosecutions Relating to Authorised Processes					
Prosecutions Relating to Controlled Waters					
Registered Radioactive Substances	pg 2				15
River Quality					
River Quality Biology Sampling Points					
River Quality Chemistry Sampling Points					
Substantiated Pollution Incident Register					
Water Abstractions					
Water Industry Act Referrals	pg 5			1	
Groundwater Vulnerability	pg 5	Yes	n/a	n/a	n/a
Bedrock Aquifer Designations	pg 5	Yes	n/a	n/a	n/a
Superficial Aquifer Designations			n/a	n/a	n/a
Source Protection Zones					
Extreme Flooding from Rivers or Sea without Defences				n/a	n/a
Flooding from Rivers or Sea without Defences				n/a	n/a
Areas Benefiting from Flood Defences				n/a	n/a
Flood Water Storage Areas				n/a	n/a
Flood Defences				n/a	n/a
Detailed River Network Lines					n/a
Detailed River Network Offline Drainage					n/a

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Waste					
BGS Recorded Landfill Sites					
Historical Landfill Sites					
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)					
Licensed Waste Management Facilities (Locations)					
Local Authority Recorded Landfill Sites					
Registered Landfill Sites					
Registered Waste Transfer Sites					
Registered Waste Treatment or Disposal Sites					
Hazardous Substances					
Control of Major Accident Hazards Sites (COMAH)					
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)					
Planning Hazardous Substance Consents					
Planning Hazardous Substance Enforcements					
Geological					
BGS 1:625,000 Solid Geology	pg 7	Yes	n/a	n/a	n/a
BGS Estimated Soil Chemistry	pg 7	Yes	Yes	Yes	Yes
BGS Recorded Mineral Sites					
BGS Urban Soil Chemistry	pg 10		Yes	Yes	Yes
BGS Urban Soil Chemistry Averages	pg 13	Yes			
Brine Compensation Area			n/a	n/a	n/a
Coal Mining Affected Areas			n/a	n/a	n/a
Mining Instability			n/a	n/a	n/a
Man-Made Mining Cavities					
Natural Cavities					
Non Coal Mining Areas of Great Britain				n/a	n/a
Potential for Collapsible Ground Stability Hazards	pg 13	Yes		n/a	n/a
Potential for Compressible Ground Stability Hazards				n/a	n/a
Potential for Ground Dissolution Stability Hazards				n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 14	Yes		n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 14	Yes		n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 14	Yes		n/a	n/a
Radon Potential - Radon Affected Areas			n/a	n/a	n/a
Radon Potential - Radon Protection Measures			n/a	n/a	n/a

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Industrial Land Use					
Contemporary Trade Directory Entries	pg 15		17	40	n/a
Fuel Station Entries	pg 19		1		
Sensitive Land Use					
Areas of Adopted Green Belt					
Areas of Unadopted Green Belt					
Areas of Outstanding Natural Beauty					
Environmentally Sensitive Areas					
Forest Parks					
Local Nature Reserves	pg 20			1	1
Marine Nature Reserves					
National Nature Reserves					
National Parks					
Nitrate Sensitive Areas					
Nitrate Vulnerable Zones					
Ramsar Sites					
Sites of Special Scientific Interest					
Special Areas of Conservation					
Special Protection Areas					

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
1	Discharge Consents Operator: Thames Water Utilities Ltd Property Type: Reservoir/Borehole Site Location: Highgate Authority: Environment Agency, Thames Region Catchment Area: Not Supplied Reference: Temp.0148 Permit Version: 1 Effective Date: 15th September 1989 Issued Date: 15th September 1989 Revocation Date: 5th October 2000 Discharge Type: Trade Effluent Discharge: Freshwater Stream/River Environment: Receiving Water: River Thames Status: Authorisation revokedRevoked Positional Accuracy: Located by supplier to within 100m	A13SW (SW)	208	3	528300 187300
2	Local Authority Pollution Prevention and Controls Name: John Nichol Service Station Location: 31-33 North Road, LONDON, N6 4BE Authority: London Borough of Haringey, Planning and Environmental Health Permit Reference: PV-11 Dated: 17th April 2001 Process Type: Local Authority Air Pollution Control Description: PG1/14 Petrol filling station Status: Authorised Positional Accuracy: Manually positioned to the address or location	A13NW (NW)	122	4	528296 187611
3	Local Authority Pollution Prevention and Controls Name: First Choice Location: 5 Highgate High Street, London, N6 5jr Authority: London Borough of Camden, Pollution Projects Team Permit Reference: PPC/DC3 Dated: 12th January 2007 Process Type: Local Authority Pollution Prevention and Control Description: PG6/46 Dry cleaning Status: Permitted Positional Accuracy: Located by supplier to within 10m	A13SE (SE)	213	5	528575 187336
4	Local Authority Pollution Prevention and Controls Name: Highgate Dry Cleaners & Laundry Location: 246 Archway Road, Highgate, London, N6 5ax Authority: London Borough of Haringey, Planning and Environmental Health Permit Reference: DC59 Dated: Not Supplied Process Type: Local Authority Pollution Prevention and Control Description: PG6/46 Dry cleaning Status: Permitted Positional Accuracy: Manually positioned to the address or location	A14NW (NE)	411	4	528857 187839
5	Local Authority Pollution Prevention and Controls Name: Archway Dry Cleaners Location: 194 Archway Road, London, N6 5bb Authority: London Borough of Haringey, Planning and Environmental Health Permit Reference: DC05 Dated: Not Supplied Process Type: Local Authority Pollution Prevention and Control Description: PG6/46 Dry cleaning Status: Permitted Positional Accuracy: Manually positioned to the address or location	A14NW (E)	447	4	528968 187662
6	Local Authority Pollution Prevention and Controls Name: Prestige Dry Cleaners Location: 289 Archway Road, London, N6 5aa Authority: London Borough of Haringey, Planning and Environmental Health Permit Reference: DC39 Dated: Not Supplied Process Type: Local Authority Pollution Prevention and Control Description: PG6/46 Dry cleaning Status: Permitted Positional Accuracy: Manually positioned to the address or location	A18SE (N)	483	4	528581 188078
	Nearest Surface Water Feature	A8NE (S)	339	-	528574 187201

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
12	Water Industry Act Referrals Name: J Bull Location: 265 Archway Road, 265 Archway Road, LONDON, London, N6 5BS Authority: Environment Agency, Thames Region Permit Reference: AR7670 Dated: 26th May 1995 Process Type: Permissions or amendments to discharge under the Water Industry Act 1991 Description: Processes which result in the discharge of Special Category effluents under The Trade Effluents (Prescribed Processes and Substances) Regulations Status: Application received by the EA but is not yet authorisedNot Yet Authorised Positional Accuracy: Automatically positioned to the address	A18SE (NE)	444	3	528687 188012
	Groundwater Vulnerability Soil Classification: Soils of High Leaching Potential (U) - Soil information for restored mineral workings and urban areas is based on fewer observations than elsewhere. A worst case vulnerability classification (H) assumed, until proved otherwise Map Sheet: Sheet 39 West London Scale: 1:100,000	A13SW (NW)	0	3	528454 187545
	Drift Deposits None				
	Bedrock Aquifer Designations Aquifer Designation: Secondary Aquifer - A	A13SW (NW)	0	2	528454 187545
	Superficial Aquifer Designations No Data Available				
	Extreme Flooding from Rivers or Sea without Defences None				
	Flooding from Rivers or Sea without Defences None				
	Areas Benefiting from Flood Defences None				
	Flood Water Storage Areas None				
	Flood Defences None				
	Detailed River Network Lines None				
	Detailed River Network Offline Drainage None				

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Local Authority Landfill Coverage Name: London Borough of Haringey - Has supplied landfill data		0	7	528454 187545
	Local Authority Landfill Coverage Name: London Borough of Camden - Has no landfill data to supply		64	8	528412 187405
	Local Authority Landfill Coverage Name: London Borough of Islington - Has no landfill data to supply		460	9	528840 187216

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS 1:625,000 Solid Geology Description: Barton, Bracklesham and Bagshot Beds	A13SW (NW)	0	2	528454 187545
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic: no data Concentration: Cadmium: no data Concentration: Chromium: no data Concentration: Lead Concentration: no data Nickel: no data Concentration:	A13SW (NW)	0	2	528454 187545
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic: no data Concentration: Cadmium: no data Concentration: Chromium: no data Concentration: Lead Concentration: no data Nickel: no data Concentration:	A13SE (E)	0	2	528456 187545
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic: no data Concentration: Cadmium: no data Concentration: Chromium: no data Concentration: Lead Concentration: no data Nickel: no data Concentration:	A13SE (SE)	249	2	528577 187266
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic: no data Concentration: Cadmium: no data Concentration: Chromium: no data Concentration: Lead Concentration: no data Nickel: no data Concentration:	A12SE (W)	376	2	528000 187545
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic: no data Concentration: Cadmium: no data Concentration: Chromium: no data Concentration: Lead Concentration: no data Nickel: no data Concentration:	A18SE (N)	402	2	528477 188000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic: no data Concentration: Cadmium: no data Concentration: Chromium: no data Concentration: Lead Concentration: no data Nickel: no data Concentration:	A18SW (N)	404	2	528454 188000

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic: no data Concentration: Cadmium: no data Concentration: Chromium: no data Concentration: Lead Concentration: no data Nickel: no data Concentration:	A8NE (SE)	414	2	528656 187152
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic: no data Concentration: Cadmium: no data Concentration: Chromium: no data Concentration: Lead Concentration: no data Nickel: no data Concentration:	A14NW (E)	460	2	528960 187746
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic: no data Concentration: Cadmium: no data Concentration: Chromium: no data Concentration: Lead Concentration: no data Nickel: no data Concentration:	A14SW (E)	467	2	529000 187545
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic: no data Concentration: Cadmium: no data Concentration: Chromium: no data Concentration: Lead Concentration: no data Nickel: no data Concentration:	A14SW (E)	475	2	529000 187470
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic: no data Concentration: Cadmium: no data Concentration: Chromium: no data Concentration: Lead Concentration: no data Nickel: no data Concentration:	A14NW (E)	480	2	529000 187670
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic: no data Concentration: Cadmium: no data Concentration: Chromium: no data Concentration: Lead Concentration: no data Nickel: no data Concentration:	A8NW (S)	493	2	528454 187000

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic no data Concentration: Cadmium no data Concentration: Chromium no data Concentration: Lead Concentration: no data Nickel no data Concentration:	A7NE (SW)	723	2	527805 187049
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic no data Concentration: Cadmium no data Concentration: Chromium no data Concentration: Lead Concentration: no data Nickel no data Concentration:	A9NW (SE)	728	2	529000 187000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic no data Concentration: Cadmium no data Concentration: Chromium no data Concentration: Lead Concentration: no data Nickel no data Concentration:	A7NE (SW)	755	2	527804 187000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic no data Concentration: Cadmium no data Concentration: Chromium no data Concentration: Lead Concentration: no data Nickel no data Concentration:	A17NE (NW)	948	2	528000 188420
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: London Arsenic no data Concentration: Cadmium no data Concentration: Chromium no data Concentration: Lead Concentration: no data Nickel no data Concentration:	A11NE (W)	999	2	527383 187598
	BGS Measured Urban Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Grid: 528316, 187756 Soil Sample Type: Topsoil Sample Area: London Arsenic Measured 18.00 mg/kg Concentration: Cadmium Measured 0.80 mg/kg Concentration: Chromium Measured 80.00 mg/kg Concentration: Lead Measured 762.00 mg/kg Concentration: Nickel Measured 31.00 mg/kg Concentration:	A13NW (NW)	218	2	528316 187756

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Measured Urban Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Grid: 528776, 187704 Soil Sample Type: Topsoil Sample Area: London Arsenic Measured 16.00 mg/kg Concentration: Cadmium Measured 1.00 mg/kg Concentration: Chromium Measured 75.00 mg/kg Concentration: Lead Measured 263.00 mg/kg Concentration: Nickel Measured 27.00 mg/kg Concentration:	A13NE (NE)	274	2	528776 187704
	BGS Measured Urban Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Grid: 528213, 187266 Soil Sample Type: Topsoil Sample Area: London Arsenic Measured 22.00 mg/kg Concentration: Cadmium Measured 0.30 mg/kg Concentration: Chromium Measured 84.00 mg/kg Concentration: Lead Measured 382.00 mg/kg Concentration: Nickel Measured 22.00 mg/kg Concentration:	A13SW (SW)	279	2	528213 187266
	BGS Measured Urban Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Grid: 528669, 187173 Soil Sample Type: Topsoil Sample Area: London Arsenic Measured 13.00 mg/kg Concentration: Cadmium Measured 0.30 mg/kg Concentration: Chromium Measured 72.00 mg/kg Concentration: Lead Measured 149.00 mg/kg Concentration: Nickel Measured 13.00 mg/kg Concentration:	A8NE (SE)	401	2	528669 187173
	BGS Measured Urban Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Grid: 527819, 187616 Soil Sample Type: Topsoil Sample Area: London Arsenic Measured 12.00 mg/kg Concentration: Cadmium Measured 0.30 mg/kg Concentration: Chromium Measured 95.00 mg/kg Concentration: Lead Measured 201.00 mg/kg Concentration: Nickel Measured 14.00 mg/kg Concentration:	A12NE (W)	568	2	527819 187616
	BGS Measured Urban Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Grid: 528226, 188231 Soil Sample Type: Topsoil Sample Area: London Arsenic Measured 26.00 mg/kg Concentration: Cadmium Measured 0.30 mg/kg Concentration: Chromium Measured 107.00 mg/kg Concentration: Lead Measured 207.00 mg/kg Concentration: Nickel Measured 17.00 mg/kg Concentration:	A18NW (N)	683	2	528226 188231

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Measured Urban Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Grid: 529294, 187146 Soil Sample Type: Topsoil Sample Area: London Arsenic Measured Concentration: 20.00 mg/kg Cadmium Measured Concentration: 0.80 mg/kg Chromium Measured Concentration: 81.00 mg/kg Lead Measured Concentration: 367.00 mg/kg Nickel Measured Concentration: 32.00 mg/kg	A9NE (SE)	866	2	529294 187146
	BGS Measured Urban Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Grid: 529275, 188132 Soil Sample Type: Topsoil Sample Area: London Arsenic Measured Concentration: 17.00 mg/kg Cadmium Measured Concentration: 0.30 mg/kg Chromium Measured Concentration: 77.00 mg/kg Lead Measured Concentration: 1787.00 mg/kg Nickel Measured Concentration: 38.00 mg/kg	A19SE (NE)	922	2	529275 188132
	BGS Urban Soil Chemistry Averages Source: British Geological Survey, National Geoscience Information Service Sample Area: London Count Id: 7189 Arsenic Minimum Concentration: 1.00 mg/kg Arsenic Average Concentration: 17.00 mg/kg Arsenic Maximum Concentration: 161.00 mg/kg Cadmium Minimum Concentration: 0.30 mg/kg Cadmium Average Concentration: 0.90 mg/kg Cadmium Maximum Concentration: 165.20 mg/kg Chromium Minimum Concentration: 13.00 mg/kg Chromium Average Concentration: 79.00 mg/kg Chromium Maximum Concentration: 2094.00 mg/kg Lead Minimum Concentration: 11.00 mg/kg Lead Average Concentration: 280.00 mg/kg Lead Maximum Concentration: 10000.00 mg/kg Nickel Minimum Concentration: 2.00 mg/kg Nickel Average Concentration: 28.00 mg/kg Nickel Maximum Concentration: 506.00 mg/kg	A13SW (NW)	0	2	528454 187545
	Coal Mining Affected Areas In an area that might not be affected by coal mining				
	Non Coal Mining Areas of Great Britain No Hazard				
	Potential for Collapsible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SW (NW)	0	2	528454 187545
	Potential for Compressible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13SW (NW)	0	2	528454 187545

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Potential for Ground Dissolution Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13SW (NW)	0	2	528454 187545
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SW (NW)	0	2	528454 187545
	Potential for Landslide Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13SE (E)	0	2	528456 187545
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13SW (NW)	0	2	528454 187545
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SE (E)	0	2	528456 187545
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A13SE (E)	0	2	528456 187545
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13SW (NW)	0	2	528454 187545
	Radon Potential - Radon Protection Measures Protection Measure: No radon protective measures are necessary in the construction of new dwellings or extensions Source: British Geological Survey, National Geoscience Information Service	A13SW (NW)	0	2	528454 187545
	Radon Potential - Radon Affected Areas Affected Area: The property is in a lower probability radon area, as less than 1% of homes are above the action level Source: British Geological Survey, National Geoscience Information Service	A13SW (NW)	0	2	528454 187545

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
13	Contemporary Trade Directory Entries Name: Walter Castellazzo Designs Location: 84, Highgate High Street, London, N6 5HX Classification: Homefurnishings - Manufacturers Status: Active Positional Accuracy: Automatically positioned to the address	A13SW (SW)	74	-	528397 187422
13	Contemporary Trade Directory Entries Name: Cleaners Of Highgate Location: 39 Highgate High St, London, N6 5LA Classification: Carpet, Curtain & Upholstery Cleaners Status: Active Positional Accuracy: Manually positioned within the geographical locality	A13SW (S)	101	-	528393 187394
13	Contemporary Trade Directory Entries Name: A Man With A Van Highgate Location: 47, Highgate High Street, London, N6 5JX Classification: Rubbish Clearance Status: Active Positional Accuracy: Automatically positioned to the address	A13SW (S)	107	-	528408 187390
14	Contemporary Trade Directory Entries Name: Smart Line Location: 67, Highgate High Street, London, N6 5JX Classification: Dry Cleaners Status: Active Positional Accuracy: Automatically positioned to the address	A13SW (SW)	77	-	528340 187425
14	Contemporary Trade Directory Entries Name: Bonsucro Location: 20, Pond Square, London, N6 6BA Classification: Sugar Refiners & Suppliers Status: Active Positional Accuracy: Automatically positioned to the address	A13SW (SW)	90	-	528324 187419
15	Contemporary Trade Directory Entries Name: John Nichol (Cars) Ltd Location: 33, North Road, London, N6 4BE Classification: Car Dealers Status: Active Positional Accuracy: Automatically positioned to the address	A13NW (NW)	131	-	528292 187620
16	Contemporary Trade Directory Entries Name: Vagabond Bags Ltd Location: 7, Broadbent Close, London, N6 5JW Classification: Bags, Belts & Accessories - Manufacturers & Suppliers Status: Inactive Positional Accuracy: Automatically positioned to the address	A13SE (SE)	144	-	528551 187402
16	Contemporary Trade Directory Entries Name: Sally Poppy Location: 4, Broadbent Close, London, N6 5JW Classification: Lingerie Manufacturers & Wholesalers Status: Inactive Positional Accuracy: Automatically positioned to the address	A13SE (SE)	150	-	528569 187406
16	Contemporary Trade Directory Entries Name: Highgate Motors Location: 9, Broadbent Close, London, N6 5JW Classification: Garage Services Status: Active Positional Accuracy: Automatically positioned to the address	A13SE (SE)	156	-	528587 187410
17	Contemporary Trade Directory Entries Name: Highgate Scaffolding Location: 8 South Gr, London, N6 6BS Classification: Scaffolding & Work Platforms Status: Active Positional Accuracy: Manually positioned within the geographical locality	A13SW (S)	154	-	528444 187351
17	Contemporary Trade Directory Entries Name: Highgate Cleaners Location: 37, Highgate High Street, London, N6 5JT Classification: Carpet, Curtain & Upholstery Cleaners Status: Active Positional Accuracy: Automatically positioned to the address	A13SE (S)	166	-	528478 187352
17	Contemporary Trade Directory Entries Name: Cleaners Highgate Location: 37, Highgate High Street, London, N6 5JT Classification: Cleaning Services - Domestic Status: Inactive Positional Accuracy: Automatically positioned to the address	A13SE (S)	166	-	528478 187352

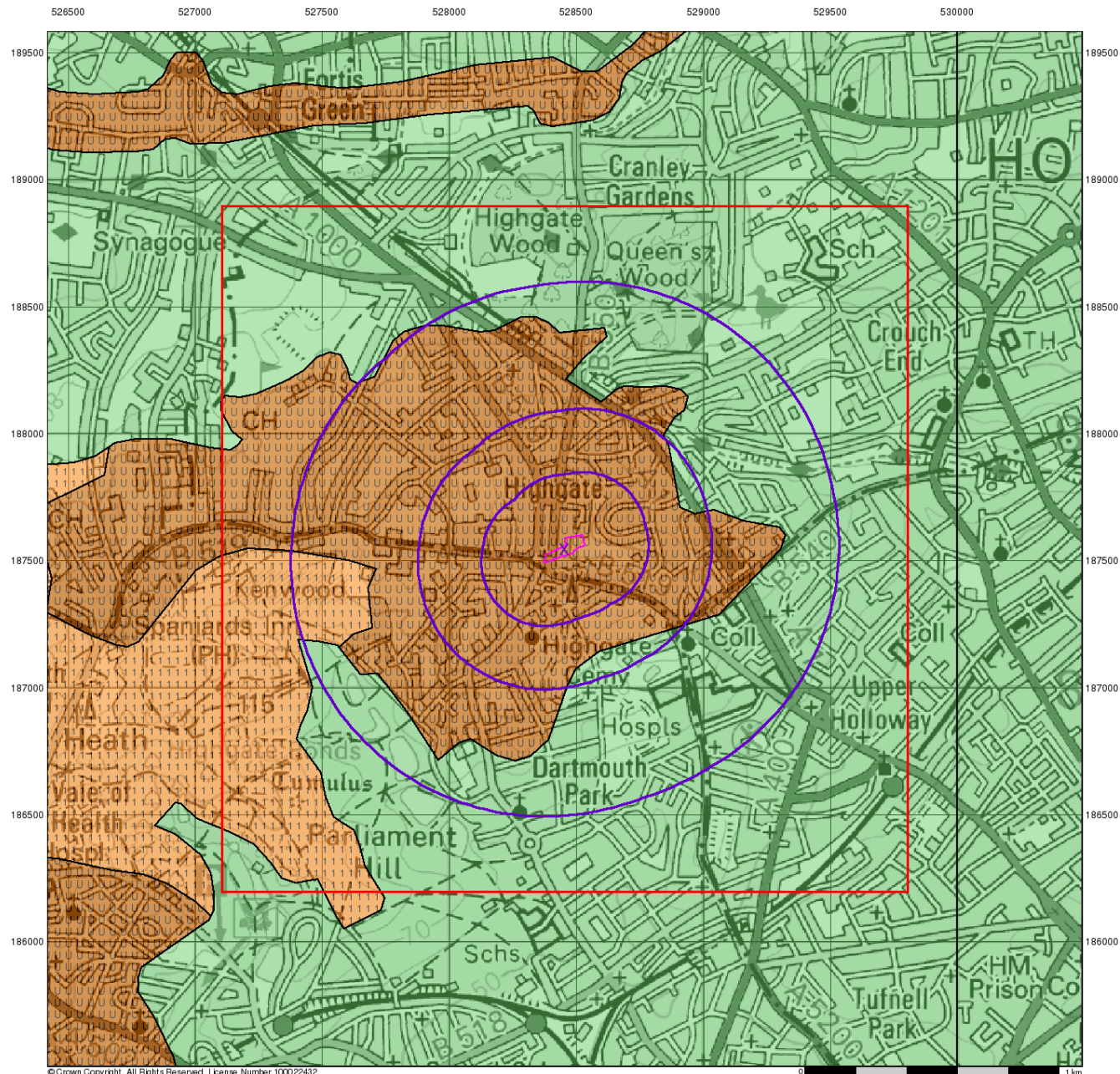
Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
17	Contemporary Trade Directory Entries Name: Cleaning Services Highgate Location: 29, Highgate High Street, London, N6 5JT Classification: Cleaning Services - Domestic Status: Active Positional Accuracy: Automatically positioned to the address	A13SE (S)	178	-	528487 187342
18	Contemporary Trade Directory Entries Name: Southwood Hospital Location: Southwood Lane, London, N6 5SP Classification: Hospitals Status: Inactive Positional Accuracy: Automatically positioned to the address	A13NW (N)	198	-	528418 187782
19	Contemporary Trade Directory Entries Name: First Choice Dry Cleaning Location: 5, Highgate High Street, London, N6 5JR Classification: Dry Cleaners Status: Active Positional Accuracy: Automatically positioned to the address	A13SE (SE)	211	-	528574 187337
19	Contemporary Trade Directory Entries Name: Petroleum Development Consultants Location: 4-8, Highgate High Street, London, N6 5JL Classification: Oil & Gas Exploration Supplies & Services Status: Active Positional Accuracy: Automatically positioned to the address	A13SE (SE)	217	-	528617 187358
20	Contemporary Trade Directory Entries Name: Oven Cleaning High Gate Location: 77, Highgate West Hill, London, N6 6BU Classification: Oven cleaning Status: Inactive Positional Accuracy: Automatically positioned to the address	A13SW (SW)	240	-	528258 187284
21	Contemporary Trade Directory Entries Name: Ed Tanner Location: 16, Causton Road, London, N6 5ES Classification: Leather Merchants & Wholesalers Status: Active Positional Accuracy: Automatically positioned to the address	A14NW (NE)	297	-	528802 187702
22	Contemporary Trade Directory Entries Name: Capital Home Help Location: Flat 1, 223, Archway Road, London, N6 5BN Classification: Cleaning Services - Domestic Status: Inactive Positional Accuracy: Automatically positioned to the address	A14NW (NE)	370	-	528793 187853
22	Contemporary Trade Directory Entries Name: Nssb Location: 246, Archway Road, London, N6 5AX Classification: Dry Cleaners Status: Active Positional Accuracy: Automatically positioned to the address	A14NW (NE)	411	-	528857 187838
22	Contemporary Trade Directory Entries Name: Lavengro Print Centre Ltd Location: 252, Archway Road, London, N6 5AX Classification: Printers Status: Inactive Positional Accuracy: Automatically positioned to the address	A14NW (NE)	412	-	528849 187852
22	Contemporary Trade Directory Entries Name: Mr Clutch Location: 260-268, Archway Road, London, N6 5AX Classification: Brake & Clutch Service Centres Status: Inactive Positional Accuracy: Automatically positioned to the address	A14NW (NE)	414	-	528830 187877
22	Contemporary Trade Directory Entries Name: Mr Clutch Location: 260-268, Archway Road, London, N6 5AX Classification: Brake & Clutch Service Centres Status: Inactive Positional Accuracy: Automatically positioned to the address	A14NW (NE)	414	-	528830 187877
22	Contemporary Trade Directory Entries Name: Archway Exhaust & Tyres Location: 274, Archway Road, London, N6 5AU Classification: Tyre Dealers Status: Inactive Positional Accuracy: Automatically positioned to the address	A19SW (NE)	433	-	528814 187920

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
32	Contemporary Trade Directory Entries Name: The Stained Glass Works Location: 188, Archway Road, London, N6 5BB Classification: Stained Glass Designers & Producers Status: Active Positional Accuracy: Automatically positioned to the address	A14NW (E)	454	-	528978 187648
32	Contemporary Trade Directory Entries Name: Changing Curtains Location: 186, Archway Road, London, N6 5BB Classification: Blinds, Awnings & Canopies Status: Inactive Positional Accuracy: Automatically positioned to the address	A14NW (E)	455	-	528980 187642
33	Contemporary Trade Directory Entries Name: Highgate Launderette Location: 176, Archway Road, London, N6 5BB Classification: Laundries & Launderettes Status: Active Positional Accuracy: Automatically positioned to the address	A14NW (E)	467	-	528997 187615
33	Contemporary Trade Directory Entries Name: Highgate Launderette Location: 176, Archway Road, London, N6 5BB Classification: Laundries & Launderettes Status: Inactive Positional Accuracy: Automatically positioned to the address	A14NW (E)	467	-	528997 187615
33	Contemporary Trade Directory Entries Name: Pax Guns Ltd Location: 166, Archway Road, London, N6 5BB Classification: Gunsmiths Status: Inactive Positional Accuracy: Automatically positioned to the address	A14NW (E)	480	-	529012 187588
33	Contemporary Trade Directory Entries Name: Amano Ltd Location: 164, Archway Road, London, N6 5BB Classification: Knitwear Manufacturers & Wholesalers Status: Inactive Positional Accuracy: Automatically positioned to the address	A14NW (E)	482	-	529015 187582
34	Contemporary Trade Directory Entries Name: Prestige Dry Cleaners Uk Ltd Location: 289, Archway Road, London, N6 5AA Classification: Dry Cleaners Status: Active Positional Accuracy: Automatically positioned to the address	A18SE (N)	483	-	528580 188078
34	Contemporary Trade Directory Entries Name: Stantons Location: 297, Archway Road, London, N6 5AA Classification: Cleaning Materials & Equipment Status: Active Positional Accuracy: Automatically positioned to the address	A18SE (N)	487	-	528572 188083
34	Contemporary Trade Directory Entries Name: Tilley's London Castings Location: 305, Archway Road, London, N6 5AA Classification: Metal Workers Status: Inactive Positional Accuracy: Manually positioned to the address or location	A18SE (N)	491	-	528562 188088
35	Fuel Station Entries Name: John Nichol Cars Location: 31-33 North Road, Highgate, London, Greater London, N6 4BE Brand: Total Premises Type: Petrol Station Status: Open Positional Accuracy: Manually positioned to the address or location	A13NW (NW)	120	-	528305 187616

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
36	Local Nature Reserves Name: Parkland Walk Multiple Area: Y Area (m2): 143103.6 Source: Natural England Designation Date: 28th March 2012	A18SE (NE)	479	6	528756 188018
37	Local Nature Reserves Name: Queen'S Wood Multiple Area: N Area (m2): 210717.42 Source: Natural England Designation Date: 28th March 2012	A18NE (N)	718	6	528706 188292

Contact	Name and Address	Contact Details
2	British Geological Survey - Enquiry Service British Geological Survey, Kingsley Dunham Centre, Keyworth, Nottingham, Nottinghamshire, NG12 5GG	Telephone: 0115 936 3143 Fax: 0115 936 3276 Email: enquiries@bgs.ac.uk Website: www.bgs.ac.uk
3	Environment Agency - National Customer Contact Centre (NCCC) PO Box 544, Templeborough, Rotherham, S60 1BY	Telephone: 08708 506 506 Email: enquiries@environment-agency.gov.uk
4	London Borough of Haringey - Planning and Environmental Health 639 High Road, Tottenham, London, N17 8BD	Telephone: 0208 489 5183 Fax: 0208 489 5117 Website: www.haringey.gov.uk
5	London Borough of Camden - Pollution Projects Team Seventh Floor, Town Hall Extension, Argyle Street, London, WC1H 8EQ	Telephone: 020 7278 4444 Fax: 020 7860 5713 Website: www.camden.gov.uk
6	Natural England Suite D, Unex House, Bourges Boulevard, Peterborough, Cambridgeshire, PE1 1NG	Telephone: 0845 600 3078 Email: enquiries@naturalengland.org.uk Website: www.naturalengland.org.uk
7	London Borough of Haringey - Planning Department Civic Centre, 639 High Road, Tottenham, London, N17 8BD	Website: www.haringey.gov.uk
8	London Borough of Camden Town Hall, Judd Street, London, WC1H 9JE	Telephone: 020 7974 4444 Fax: 020 7974 6866 Email: info@camden.gov.uk Website: www.camden.gov.uk
9	London Borough of Islington - Environmental Health Department 159 Upper Street, Islington, London, N1 1RE	Telephone: 020 7527 2000 Fax: 020 7477 3057 Website: www.islington.gov.uk
-	Public Health England - Radon Survey, Centre for Radiation, Chemical and Environmental Hazards Chilton, Didcot, Oxfordshire, OX11 0RQ	Telephone: 01235 822622 Fax: 01235 833891 Email: radon@phe.gov.uk Website: www.ukradon.org
-	Landmark Information Group Limited Imperium, Imperial Way, Reading, Berkshire, RG2 0TD	Telephone: 0844 844 9952 Fax: 0844 844 9951 Email: customerservices@landmarkinfo.co.uk Website: www.landmarkinfo.co.uk

Please note that the Environment Agency / Natural Resources Wales / SEPA have a charging policy in place for enquiries.



Groundwater Vulnerability

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

Geological Classes

Major Aquifer (Highly Permeable)

Minor Aquifer (Variably Permeable)

Non Aquifer (Negligibly Permeable)

Water or Sea

Drift Deposit

Soil Classes

High (H) 1, 2, 3, U

Intermediate (I) 1, 2

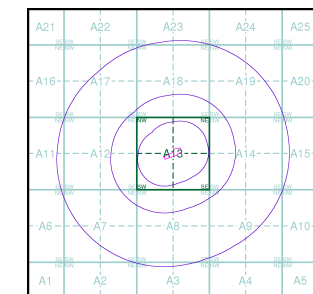
Low

High (H) 1, 2, 3, U

Intermediate (I) 1, 2

Low

Site Sensitivity Context Map - Slice A

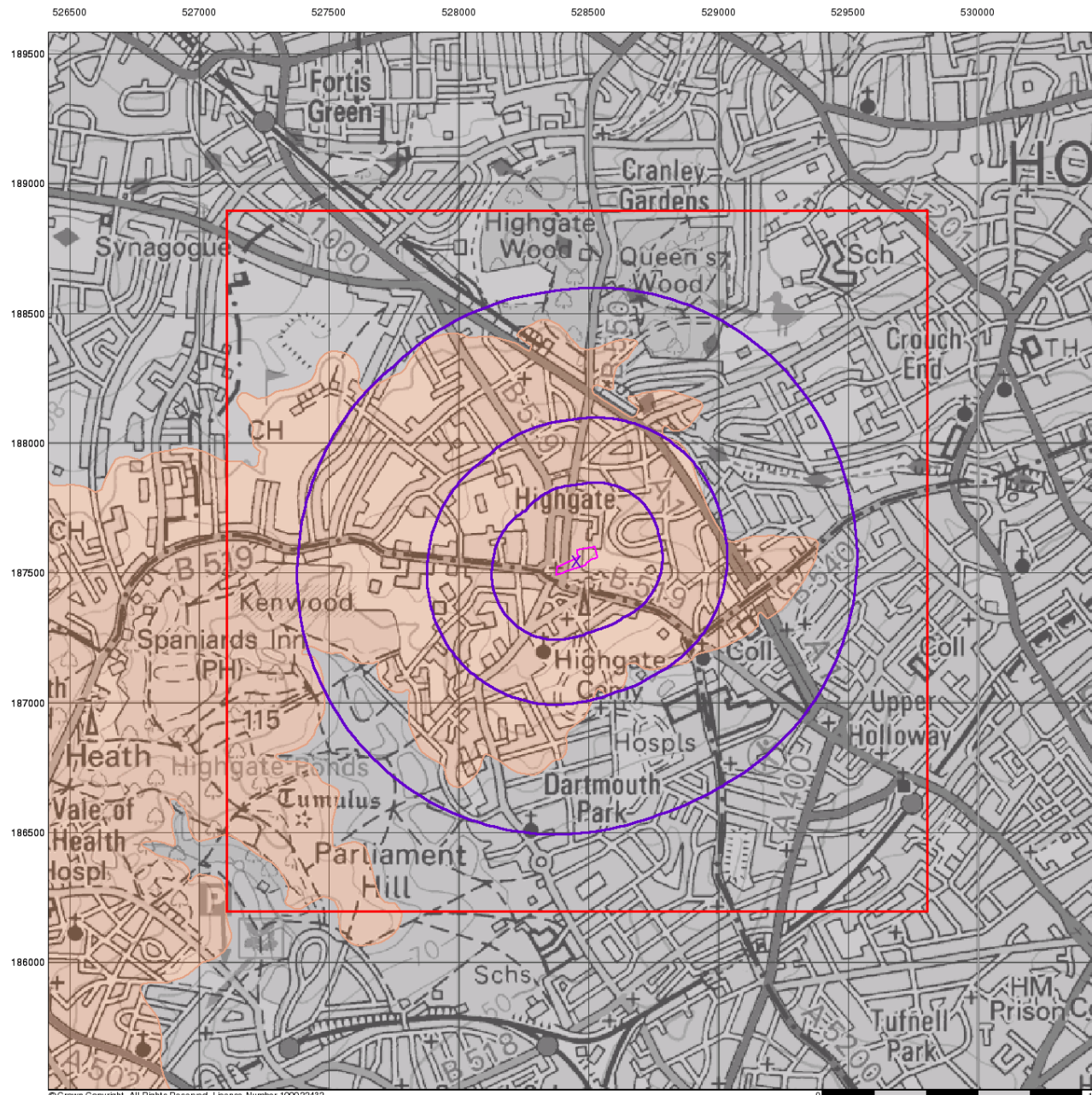


Order Details

Order Number: 66091368_1_1
 Customer Ref: J15093
 National Grid Reference: 528450, 187540
 Slice: A
 Site Area (Ha): 0.68
 Search Buffer (m): 1000

Site Details

Highgate School, Highgate, LONDON, N6 5EE



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Bedrock Aquifer Designation

General

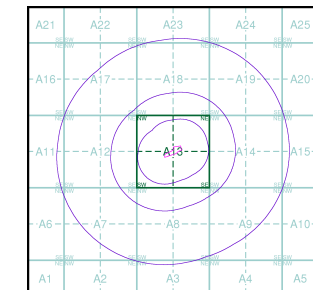
- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown

Site Sensitivity Context Map - Slice A

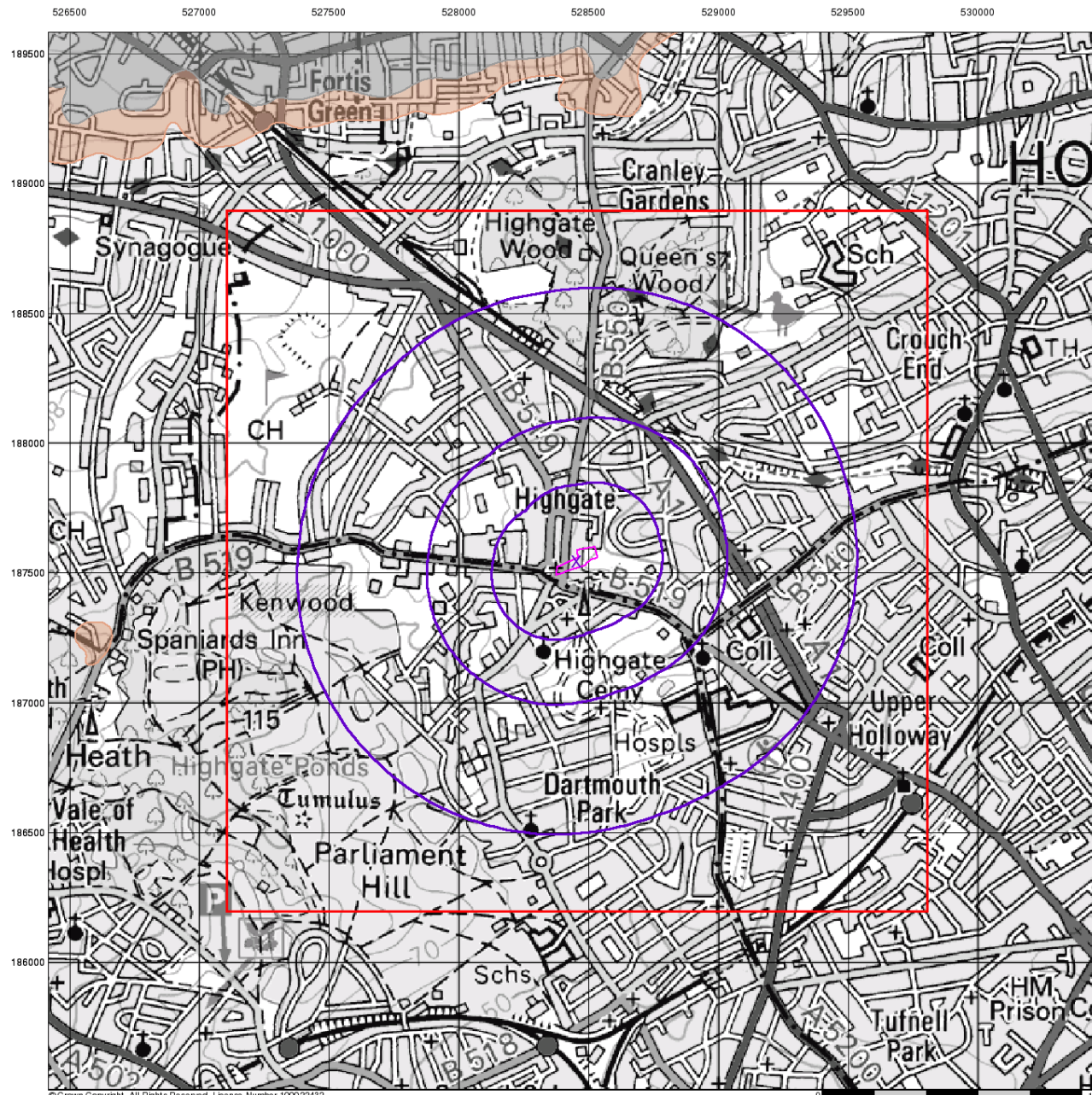


Order Details

Order Number: 66091368_1_1
Customer Ref: J15093
National Grid Reference: 528450, 187540
Slice: A
Site Area (Ha): 0.68
Search Buffer (m): 1000

Site Details

Highgate School, Highgate, LONDON, N6 5EE



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Superficial Aquifer Designation

General

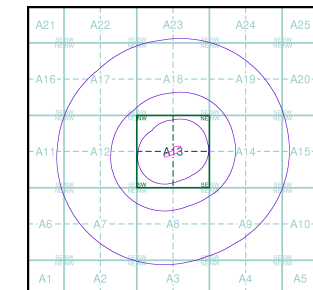
- ✱ Specified Site ○ Specified Buffer(s) ✕ Bearing Reference Point
- Slice ⊠ Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown

Site Sensitivity Context Map - Slice A

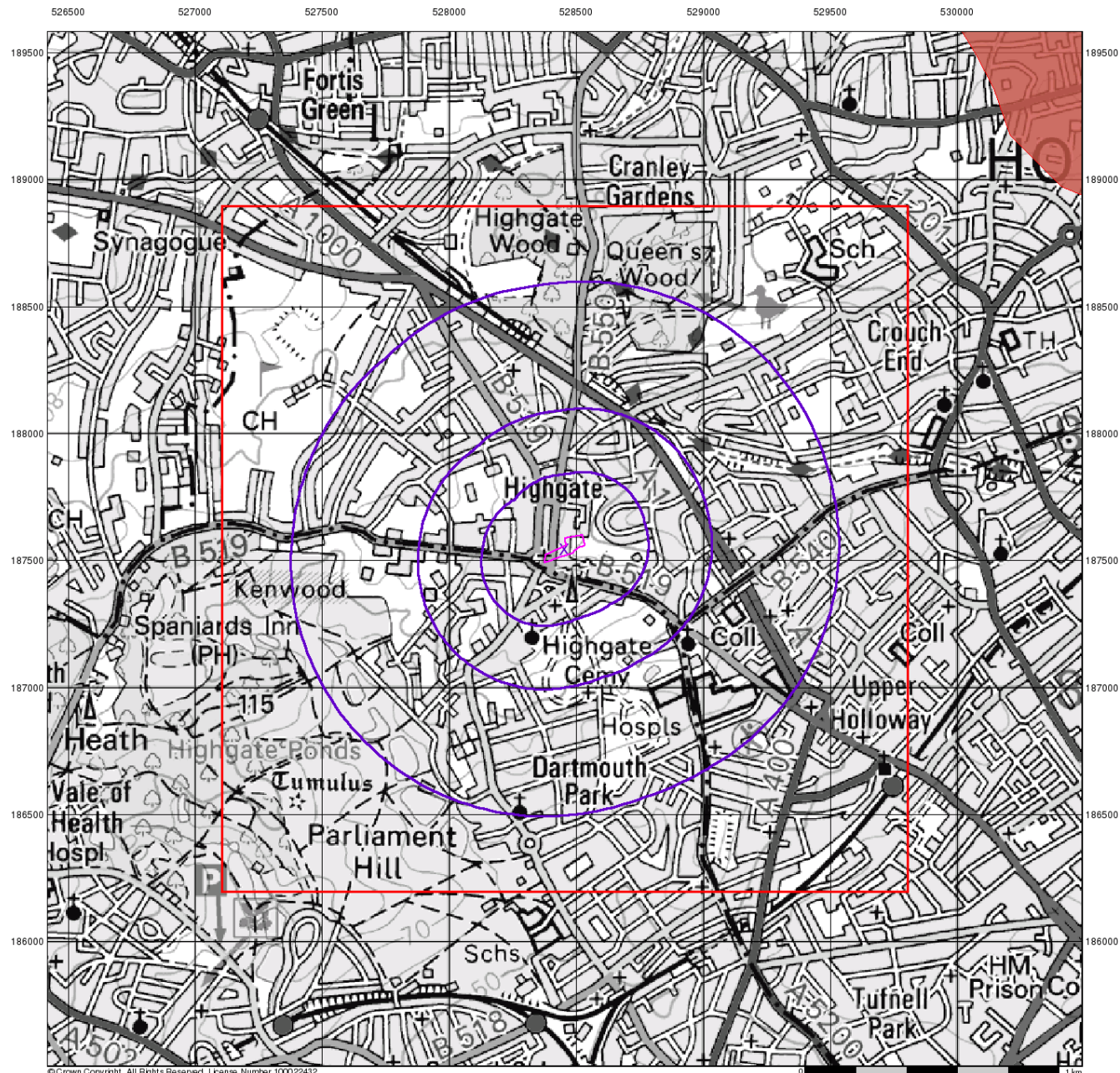


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Site Details

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Source Protection Zones

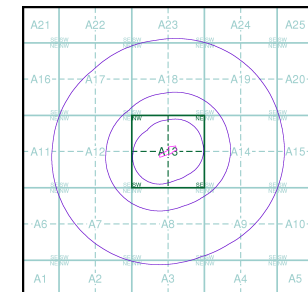
General

- ✕ Specified Site ○ Specified Buffer(s) ✕ Bearing Reference Point
- Slice 8 Map ID

Agency and Hydrological

- Inner zone (Zone 1)
- ▨ Inner zone - subsurface activity only (Zone 1c)
- Outer zone (Zone 2)
- ▨ Outer zone - subsurface activity only (Zone 2c)
- Total catchment (Zone 3)
- ▨ Total catchment - subsurface activity only (Zone 3c)
- Special interest (Zone 4)
- Source Protection Zone Borehole

Site Sensitivity Context Map - Slice A

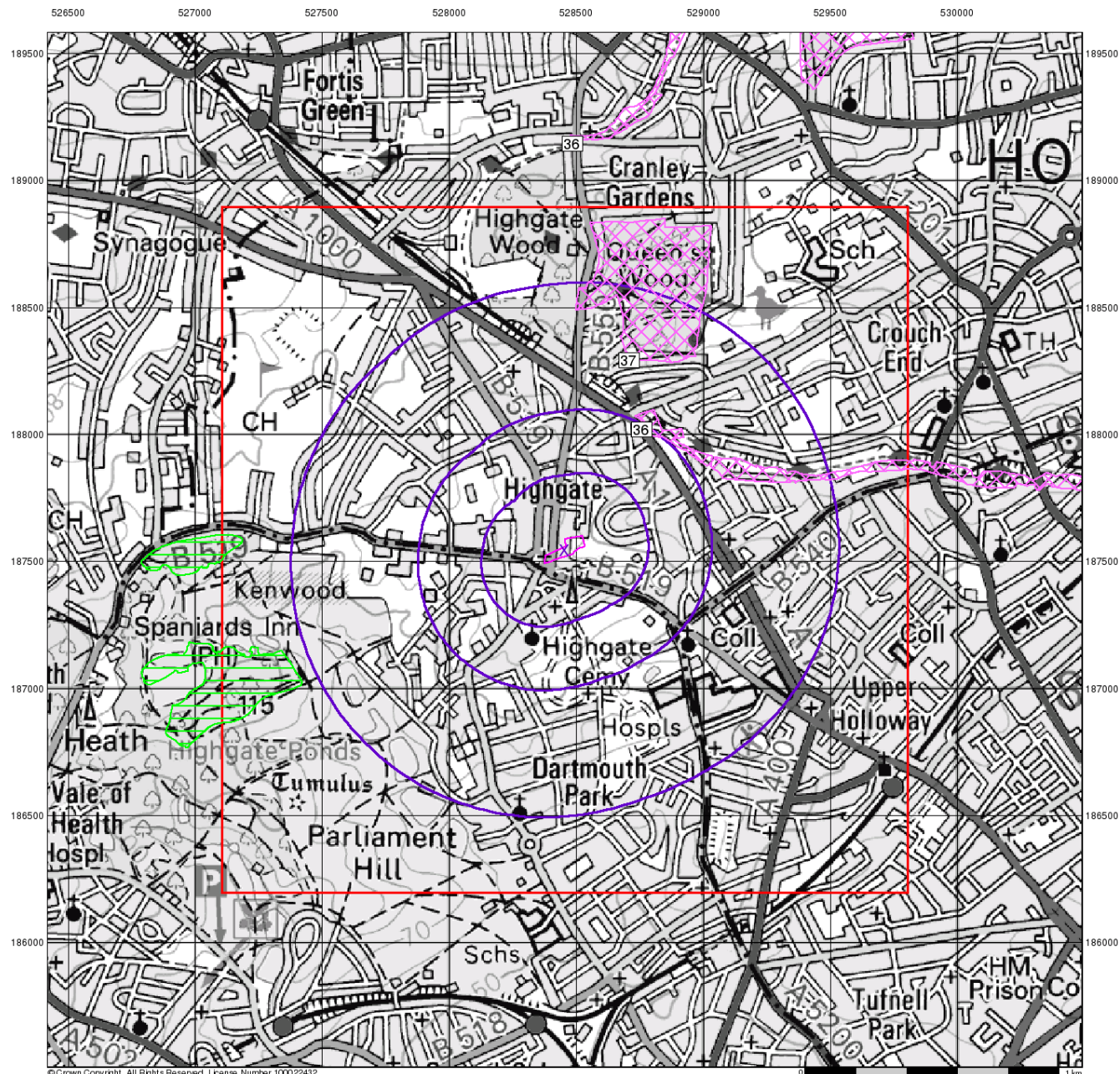


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 National Grid Reference: 528450, 187540
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 Site Area (Ha): 0.68
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Site Details

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Sensitive Land Uses

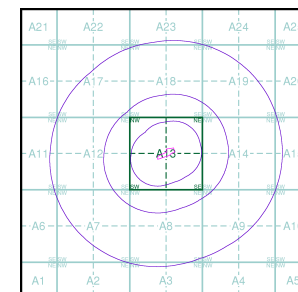
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Sensitive Land Uses

- Area of Adopted Green Belt
- Area of Unadopted Green Belt
- Area of Outstanding Natural Beauty
- Environmentally Sensitive Area
- Forest Park
- Local Nature Reserve
- Marine Nature Reserve
- National Nature Reserve
- National Park
- Nitrate Sensitive Area
- Nitrate Vulnerable Zone
- Ramsar Site
- Site of Special Scientific Interest
- Special Area of Conservation
- Special Protection Area

Site Sensitivity Context Map - Slice A



Order Details

Order Number: 66091368_1_1
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