

**13 Kemplay Road, Hampstead,  
London, NW3  
Basement Impact Assessment  
July 2016  
112131**



**CONTROL SHEET**




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**PROJECT TITLE: 13 Kemplay Road, Hampstead, London, NW3**

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	Checked by	Heather Bourne			20/11/2015
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## 1.0 Introduction

The purpose of this assessment is to consider the effects of a proposed basement construction on the local hydrology, geology and hydrogeology at the proposed new-build residential property at 13 Kemplay Road, London, NW3 1TA. For this assessment a representative of FairhurstGGA visited the property on 16th November 2015.

A Basement Impact Assessment (BIA) was previously carried out by Site Analytical Services Limited (SASL Report Reference 15/24032-1 dated August 2015) but comprised screening and scoping phases only; there was no formal impact assessment or ground investigation.

A revised BIA was then carried out by FairhurstGGA in November 2015 which provided a review of the SASL report, reported on site specific ground investigation works, and was produced specifically to meet the requirements set out by Camden Planning Guidance – Basements and Lightwells (CPG4).

A report comprising an audit of the above BIA was then produced by Campbell Reith Consulting Engineers (CRCE) in April 2016 (Project Reference 12336-35) which raised specific queries about the project and which required further input. This revised BIA aims to satisfy each of the issued raised by CRCE and a summary of the issues raised and a link to the chapter/appendix in the revised BIA is provided in Table 1 below.

**Table 1. Summary of Amendments**

Query No (CRCE)	Query	Relevant Chapter in Revised BIA
1	Works Programme not included in BIA and details of the proposed underpinning is not presented	Chapter 5
2	Measures to deal with potential groundwater in long term including waterproofing proposals for the permanent case are not included in the BIA	Chapter 5 and Section 6.1.2
3	Sewer Flooding has not been adequately addressed	Section 6.1.2
4	Neighbouring property foundations have been not determined and therefore the maximum differential depth needs to be assumed	Section 5
5	A Revised Ground Movement Assessment. Supporting analyses should consider vertical and horizontal movements from the underpinning and heave from the excavation together with resulting estimated movements for No 15 are requested	Section 6.1.4
6	An identification of the presence of any basements in immediate vicinity of the site is required	Section 2.4
7	The number of trees to be removed should be confirmed together with an assessment of impact on any nearby shallow foundations	Section 2.5 and Figure 2
8	Movement Monitoring proposals not provided	Chapter 5 and Section 6.2



## 1.1 Data Sources

This section provides the baseline data used to complete the BIA in relation to the proposed development. Reference information used for this purpose is outlined below:

- Barton N (1992) The Lost Rivers of London. Historical Publications Ltd, London;
- British Geological Survey – 1:50,000 Geological Sheet 256, North London (Solid & Drift) (Ref 13.16);
- British Geological Survey borehole archive records;
- Campbell Reith Basement Impact Assessment Audit. Project Number 12336-35. April 2016.
- Greenlink Ecology Limited. 13 Kemplay Road, Hampstead, Tree Survey Report. 1<sup>st</sup> March 2016.
- London Borough of Camden who were contacted to obtain the most up to date guidance for completing Basement Impact Assessments.
- London Borough of Camden. Strategic Flood Risk Assessment July 2014. URS.
- Environment Agency Groundwater Vulnerability Mapping (1:100,000 series) Sheet 40, Thames;
- Environment Agency Internet database ([www.environment-agency.gov.uk](http://www.environment-agency.gov.uk));
- River Basin Management Plan (RBMP). Thames River Basin District (2009);
- Site reconnaissance survey and groundwater monitoring completed by FairhurstGGA (November 2015);
- Site Analytical Services Limited (SASL) Basement Impact Assessment (Report Reference 15/24032-1 dated August 2015). Included as Appendix B to this report;
- Site Analytical Services Limited (SASL) Report on a Phase One Risk Assessment (Report Reference 15/24032 dated August 2015). Available on LBC Planning Portal
- Archers Stevenage drawings No. 5085 P 100, 101, 102, 103, 104, 201, 202, 203, 204, 205 and 300;

## 1.2 Guidance and Frameworks

The proposed basement is located in the London Borough of Camden (LBC) and as such will be required to developed in accordance with the guidance and policies outlined in the following documents:

- LBC (Nov 2010). Camden geological, hydrogeological and hydrological study. Guidance for subterranean development (produced by Arup Consulting).
- LBC. Camden Planning Guidance. Basements and Lightwells (CPG 4) (July 2015).
- Development Policy (DP) 27 Basements and Lightwells

## 1.3 BIA Approach

The BIA approach prescribed by LBC in the relevant guidance documents referenced above comprises the following elements:

- Screening;
- Scoping;
- Site Investigation and study (divided into desk study, field investigation, monitoring, reporting & interpretation);

- Impact Assessment; and
- Review & Decision Making (completed by LBC).

The screening, scoping and desk study elements have been considered previously within the BIA completed by SASL. This report re-assesses these based on the most up to date proposals for the site. In addition, the baseline conditions in relation to the geological and groundwater environment are summarised in Section 2.0 of this Document.

#### 1.4 Qualifications

The qualifications required by Camden are fulfilled as documented in Table 2 below. All assessors meet the qualification requirements of the Council guidance.

**Table 2 – Qualification Summary**

Subject	Qualifications Required by CPG4	Relevant person(s) in Fairhurst
Surface flow and flooding	<p>A hydrologist or a Civil Engineer specialising in flood risk management and surface water drainage, with either:</p> <p>The 'CEng' (Chartered Engineer) qualification from the Engineering Council; or a Member of the Institution of Civil Engineers ('MICE')</p> <p>The CWEM (Chartered Water and Environmental Manager) qualification from the Chartered Institution of Water and Environmental Management</p>	<p>Mr Andrew Smith BSc(Hons) FGS MCIWEM</p> <p>Mr Alan Connell BSc (Hons) CEng MICE</p>
Subterranean (groundwater flow)	A hydrogeologist with the 'CGeol' (Chartered Geologist) qualification from the Geological Society of London	Mr Phil Brown BSc (Hons) FGS CGeol
Land Stability	A Civil Engineer with the 'CEng' (Chartered Engineer) qualification from the Engineering Council	Mr Alan Connell BSc (Hons) CEng MICE

## 2.0 Baseline Conditions

### 2.1 Site Description

The site is located to the south of Kemplay Road in Hampstead, North London, NW3 1TA and comprises a 1960s two storey end of terrace residential property with a front driveway and rear garden area.

The site covers an area of approximately 0.03 hectares and the general area is under the authority of the London Borough of Camden. The site lies within the Hampstead Conservation Area.

The property is bound by Kemplay Road to the north, with residential properties to the west and the Rosslyn Hill Chapel with associated car park to the east and south.

There is a slight slope in topographic gradient measured along Kemplay Road from around 90mOD at the western end of the road to 85mOD at the eastern end. This equates to around a 4-5° slope angle. The wider general area slopes to the south east.

There are mature trees present on the site's northern boundary and adjacent to the site's eastern boundary in the neighbouring Rosslyn Hill Chapel car park as detailed in Figure 2. There are no Tree Preservation Orders (TPO) associated with the site, although the site is within a Conservation Area (CA).

### 2.2 Site Environmental Setting

Relevant information relating to the sites environmental setting, using literature information and in the context of this assessment is summarised in Table 3 below:

**Table 3 – Environmental Setting**

<b>Geology &amp; Aquifer Designations</b>	Reference to the data sources detailed in section 1.1 indicates that the site is underlain by the Claygate Member, which is designated as a Secondary (A) Aquifer.  The Claygate Member forms the upper unit of low permeability London Clay Formation which is designated, overall as an Unproductive Strata.
<b>Hydrology</b>	The closest surface water features are the Hampstead Ponds, located 463m north-east of the site. According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011) the site is not within 100m of any of the old river systems  Reference to the UK Hydrometric Register indicates that the annual average rainfall for the Thames region is 710mm.
<b>Resource Potential &amp; Ecological Sensitivity</b>	The Secondary (A) Aquifer of the Claygate Member is not included within the relevant River Basin Management Plan (RBMP). However, it is considered to have some potential as a local scale resource and to provide an element of base flow to local surface water features.  No local surface features (within 1km of the site) are included within the relevant RBMP.  The Claygate Member has been assigned a moderate ecological quality and fails the chemical quality. Neither of these quality ratings are predicted to alter following the next cycle of RBMP in 2015.

### 2.3 Proposed development

From the development plans provided and review of the planning application (ref 2015/4373/P), it is understood that the existing two storey residential building is to be

demolished, and redeveloped with a new detached 2 storey residential property, with a basement. The development proposals indicate that the basement will extend to approximately 3.0m below the groundfloor footprint, and extend out from the front of the property by approximately 3.8m. The basement development is to house further residential areas, including a kitchen, utility room, bedroom, gym, shower and family room.

Whilst the existing building of the site had an external gross building footprint of 40.7msq, the proposed scheme has a building footprint of 86.6msq.

## 2.4 Existing and Proposed Basement Structures

From the site walkover it is apparent that neither No. 13 Kemplay Road nor the neighbouring properties along the terrace at No 15, 17 and 19 have existing basements.

A review of the LBC planning portal for Kemplay Road (1995 to present) indicates that the following proposed basement developments exist along the road:

**Table 4 – Proposed basement Development for Kemplay Road**

Address	Planning Decision
5	Granted – December 2014
23/25	Granted – August 2008
4a	Granted – July 2007
1	Granted – July 2006
2	Granted – August 1995

## 2.5 Results of Basement Impact Assessment Screening

A screening process was undertaken by SASL in August 2015 (Report Reference 15/24032 included as Appendix B to this report). The screening process has been reviewed by FairhurstGGA in accordance with the most recent guidance from LBC (CPG 4, 2015) and the findings are described below.

*Subterranean (Groundwater) flow*

Question	Response	Details
1a. Is the site located directly above an aquifer.	Yes	Reference to the data sources detailed in section 1.1 indicates that the site is underlain by the Claygate Member, which is designated as a Secondary (A) Aquifer.
1b. Will the proposed basement extend beneath the water table surface.	Unknown	To be confirmed by ground investigation and groundwater monitoring
2. Is the site within 100m of a watercourse, well (used / disused) or potential spring line.	No	The nearest surface water feature is the Hampstead Heath Ponds located 463m north-east of the site. According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011), the site is not within 100m of a former river or watercourse.
3. Is the site within the catchment of the pond chains on Hampstead Heath?	No	The site is over 250m south west from these features
4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas.	Yes	The existing building of the site had an external gross building footprint of 40.7msq. The proposed scheme has a building footprint of 86.6msq therefore increasing the amount of hardstanding on the site by 45.9msq.
5. As part of site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS).	No	Soakaways are not considered appropriate to the site, due to the sub-soil conditions, and therefore no surface water will be discharged to ground as part of the site drainage.
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.	No	The nearest surface water feature is the Hampstead Heath Ponds located 463m north-east of the site. According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011), the site is not within 100m of a former river or watercourse.

*Slope stability*

Question	Response	Details
1. Does the existing site include slopes, natural or man-made greater than 7 degrees (approximately 1 in 8).	No	The site does not contain slopes
2. Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7 degrees (approximately 1 in 8).	No	Re-profiling of landscaping at the site is not proposed
3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately 1 in 8).	No	There is a slope measured along Kemplay Road from around 90mOD at the western end of the road to 85mOD at the eastern end. This equates to around a 4-5° slope angle.
4. Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately 1 in 8).	No	There is a general slope to the south but this is less than 7 degrees.
5. Is the London Clay the shallowest strata at the site.	No	Reference to the data sources referenced indicates that the site is underlain by the Claygate Member
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	According to the Tree Survey Report for the site (Greenlink Ecology Limited, March 2016) and with reference to Figure 2 of this report, the on-site Sycamore (T2) will be removed to enable the proposed development
7. Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site.	Yes	The Claygate Beds have cohesive layers which can be prone to shrinking and swelling.
8. Is the site within 100m of a watercourse or a potential spring line.	No	The nearest surface water feature is the Hampstead Heath Ponds located 463m north-east of the site. According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011), the site is not within 100m of a former

		river or watercourse.
9. Is the site within an area of previously worked ground.	No	The site is not in the vicinity of any recorded areas of worked ground, the nearest recorded on the geological map are close to Finchley Road and to the south of West Heath Road.
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 & Unknown	To be confirmed by ground investigation and groundwater monitoring
11. Is the site within 50m of the Hampstead Heath Ponds	No	The site is over 250m from these features
12. Is the site within 5m of a highway or pedestrian right of way.	Yes	The site is within 5m of Kemplay Road
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties.	Yes	The development will increase the foundation depth of the property relative to No. 15.
14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines.	No	LUL have been contacted as part of this survey and confirmed they do not have any assets below the site. Reference to google maps and internal maps at Fairhurst shows Network Rail owned tunnels are at least 250m south of the site

### Surface Water and Flooding

Question	Response	Details
1. Is the site within the catchment of the ponds chains on Hampstead Heath	No	With reference to the Camden Geological, Hydrogeological and Hydrological Study, the site is not within the catchment of the pond chains on Hampstead, nor the Golder's Hill Chain
2. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route.	No	On completion of the development the surface water flows will be routed similarly to the existing condition, with rainwater run-off collected in a surface water drainage system and discharged to a combined sewer. Any groundwater flows will not be impeded by the basement.
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas.	Yes	The existing building of the site had an external gross building footprint of 40.7msq. The proposed scheme has a building footprint of 86.6msq therefore increasing the amount of hardstanding on the site by 45.9msq.
4. Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses.	No	All surface water for the site will be contained within the site boundaries and collected as described above; hence there will be no change from the development on the quantity or quality of surface water being received by adjoining sites.
5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses.	No	All surface water for the site will be contained within the site boundaries and collected as described above; hence there will be no change from the development on the quantity or quality of surface water being received by adjoining sites.
6. 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	Kemplay Road did not flood during either the 1975 or the 2002 flood events in Camden. Also according to modelling by the Environment Agency, there is a 'Very Low' risk of surface water flooding (the lowest category for the national background level of risk) for No.13 and the surrounding area.  However with reference to Camden's Strategic Flood Risk Assessment and Figure 3 and 4 of this report the property lies in an area at risk of internal and external sewer flooding.



## 2.6 Non-Technical Summary of Chapter 2.0

The site is located to the south of Kemplay Road in Hampstead, North London, NW3 1TA and comprises a two storey end of terrace residential property with front and rear garden areas. It is proposed to construct a partially buried swimming pool in the rear garden, partially within the footprint of the existing building. It is also proposed to construct a new lightwell towards the front of the property. The property is constructed on gently sloping ground to the south of less than 7 degrees.

The 1:50,000 Geological Survey of Great Britain (England and Wales) covering the area indicates the site to be underlain by the Claygate Member with the London Clay Formation at depth. The Claygate Member is generally of low permeability but has lenses of sand capable of storing and transmitting groundwater and is therefore considered to be a Secondary A Aquifer; The underlying London Clay Formation is classed as unproductive strata or a non-aquifer.

The nearest surface water feature is the Hampstead Heath Ponds located 463m north-east of the site. According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011), the site is not within 100m of a former river or watercourse.

With reference to Camden's Strategic Flood Risk Assessment the property lies in an area at risk of internal and external sewer flooding.

The scheme will result in an increase in impermeable areas by 45.9msq.

Based on SASL's findings and the review from FairhurstGGA the following have been identified as being the potential issues which will be carried forward to the Scoping Phase in this report:

### *Subterranean Groundwater Flow*

- Is the site located directly above an aquifer
- Will the proposed basement extend beneath the water table surface
- Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas.

### *Slope Stability*

- 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.
- Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site.
- Is the site within an aquifer. If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction.
- Is the site within 5m of a highway or pedestrian right of way.
- Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?
- Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas.

### *Surface Water and Flooding*

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

### 3.0 Scoping Phase

This purpose of the scoping phase is to assess in more detail the factors to be investigated in the impact assessment. Potential impacts are assessed for each of the identified impact factors and recommendations are stated. This process was carried out by SASL but has been reviewed and updated by FairhurstGGA based on the most recent guidance from LBC.

A conceptual ground model is usually compiled at the scoping stage. However, because the ground investigation has already been undertaken for this project, the conceptual ground model including the findings of the ground investigation is described under Chapter 4.0.

#### *Subterranean (Groundwater Flow)*

Screening Question		Potential impacts and actions
1a	Is the site located directly above an aquifer	<b>Potential impact:</b> Infiltration could be reduced. <b>Action:</b> Ground Investigation required, then review.
1b	Will the proposed basement extend beneath the water table surface?	<b>Potential impact:</b> Local restriction of groundwater flows (perched groundwater or below groundwater table). <b>Action:</b> Ground investigation required, then review.
4.	Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas.	<b>Potential impact:</b> May increase flow rates to sewer, and thus increase the risk of flooding <b>Action:</b> Assess net change in hard surfaced/paved areas and, if required, recommend appropriate types of SuDS for use as site-specific mitigation.

#### *Slope Stability*

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?	<b>Potential Impact:</b> Ground movements will occur during and after the basement construction. <b>Action:</b> Following the results of the ground investigation an approved Arboriculturalist should be appointed.
7	Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?	<b>Potential Impact:</b> Ground movements will occur during and after the basement construction. <b>Action:</b> Ground investigation required, then review.
10	Is the site within an aquifer. If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction.	<b>Potential impact:</b> Infiltration could be reduced. <b>Action:</b> Ground Investigation required, then review.
12	Is the site within 5m of a highway or a pedestrian right of way?	<b>Potential impact:</b> Excavation of basement causes loss of support to footway/highway and damage to the services beneath them. <b>Action:</b> Ensure adequate temporary and permanent support by use of best practice working methods.
13	Will the proposed basement substantially increase the differential depth of foundations relative to neighbouring properties?	<b>Potential impact:</b> Loss of support to the ground beneath the new foundations to neighbouring properties if basement excavations are inadequately supported. <b>Action:</b> Ensure adequate temporary and permanent support by use of best practice methods.

*Surface Water and Flooding*

Potential Issue (Screening Question)		Potential impacts and actions
3	Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas.	<b>Potential impact:</b> May increase flow rates to sewer, and thus increase the risk of flooding <b>Action:</b> Assess net change in hard surfaced/paved areas and, if required, recommend appropriate types of SuDS for use as site-specific mitigation.
6	Is the site in an area identified to have surface water flood risk	<b>Potential impact:</b> Flooding occurs during or after the excavation of the basement <b>Action:</b> A groundwater exception test should be carried out prior to any construction works.

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

### 3.1 Non-Technical Summary of Chapter 3.0

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

- A ground investigation is required (which has already been undertaken).
- Review of site's hydrogeology and groundwater control requirements.
- Review flood risk and include appropriate flood resistance and mitigation measures in the scheme's design.

All these actions are covered in Section 4.0 below.

## 4.0 Ground Investigation & monitoring

### 4.1 Records of Site Investigations

A ground investigation has been undertaken by LMB Geosolutions in October to November 2015, which included the following:

- A single borehole using light cable percussive drilling methods to a depth of 10.00m bgl (Borehole 1)
- A single borehole using dynamic sampling drilling to a depth of 6.00m bgl with a continuous percussive hammer (Borehole 2)
- Two hand excavated foundation inspection trial pits adjacent to No. 13 to maximum depths of 1.45m bgl (Trial Pits 1 and 2)
- Installation of two groundwater monitoring wells to depths of 10.00m and 6.00m bgl in Boreholes 1 and 2 respectively.
- Monitoring of groundwater levels on three occasions.

The factual report describing the results of the investigation dated 9<sup>th</sup> November 2015 is contained in Appendix A.

### 4.2 Ground conditions

The boreholes and trial pits revealed ground conditions that were consistent with the geological records and known history of the area. They comprised Made Ground up to 1.30m in thickness resting on deposits of the Claygate Member with the London Clay Formation at depth.

#### 4.2.1 Made Ground

The Made Ground extended down to respective depths of 0.50m and 1.20m bgl in Boreholes 1 and 2 and to 1.20m and 1.30m bgl in Trial Pits 1 and 2. The material generally comprised a surface cover of paving slabs overlying a combination of slightly gravelly clay and silty sand with brick fragments.

#### 4.2.2 Claygate Member

The Claygate Member comprised soft becoming firm silty sandy clay with lenses of clayey silty fine sand which extended to a depth of 5.30m below ground level in Borehole 1 and to the full depths of investigation in Borehole 2 (6.00m bgl), Trial Pit 1 (1.35m bgl) and Trial Pit 2 (1.49m bgl).

#### 4.2.3 London Clay Formation

The London Clay Formation was encountered below the Claygate Member at a depth of 5.3m bgl and consisted of firm becoming stiff silty fissured clay. These deposits extended down to the termination of investigation of 10.00m bgl in Borehole 1.

### 4.3 Groundwater

Groundwater was not encountered in the trial pits and the soils remained essentially dry throughout. Groundwater was encountered in the boreholes as detailed in Table 5 below.

**Table 5. Groundwater Strike Summary**

Exploratory Hole	Depth (m bgl)	Notes	Stratum
BH1	5.30	Slow Seepage	Interface between Claygate Member and London Clay Formation
BH2	4.00	No rise	Claygate Member

Following drilling operations Boreholes 1 and 2 were equipped with water-monitoring piezometers. The response zones were from 4-10m bgl in Borehole 1 and 0.5-6.0m bgl in Borehole 2.

A summary of the groundwater monitoring results is provided below as Table 6.

**Table 6. Monitoring Summary**

Exploratory Hole	Monitoring Date		
	21/10/2015	29/10/2015	09/11/2015
BH1	2.30mbgl	1.87mbgl	2.10mbgl
BH2	2.52mbgl	2.50mbgl	2.10mbgl

The groundwater monitoring data was collected in October and November 2015 and although this does not provide an indication of any seasonal fluctuations it is considered to be reflective of high winter groundwater levels.

#### 4.4 Foundations

Trial Pits 1 and 2 were excavated adjacent to the existing walls of No. 13 in order to expose the existing foundation structures and founding soils. The trial pits showed the property is supported on outstepped concrete foundations on the Claygate Member at depths of between 1.35m and 1.45m below ground level.

#### 4.5 In-Situ and Laboratory Testing

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

##### 4.5.1 Standard Penetration Testing

The results of the Standard Penetration Tests carried out in the natural soils are shown on the exploratory hole records in Appendix A. SPT 'N' values range between 8 and 33.

##### 4.5.2 Undrained Triaxial Compression Tests

Undrained triaxial compression tests were carried out on two selected undisturbed 100mm diameter samples taken from Borehole 1 at 3.50m and 8.50m bgl within the Claygate Member and London Clay Formation respectively. The results show the samples to be of a medium (Claygate Member) and high strength (London Clay Formation) in accordance with BS 5930 (2015).

##### 4.5.3 Classification Tests

Atterberg Limit tests have been conducted on seven selected samples taken from Boreholes 1 and 2, and showed the samples tested to fall into Classes CI, CI/CH and CH according to the British Soil Classification System. These are representative of fine grained silty clay soils of intermediate and high plasticity and as such generally have a medium susceptibility to shrinkage and swelling movements with changes in moisture content, as defined by the NHBC Standards, Chapter 4.2. The results indicated Plasticity Index values of between 25% and 33%.

Particle size distribution tests were carried out on three samples recovered from granular lenses within the Claygate Member in Boreholes 1 and 2. The results are detailed on the appropriate test sheets contained in Appendix A.

#### 4.5.4 Sulphate and pH Analyses

The results of the sulphate and pH analyses conducted on a sample of Made Ground obtained between 0.70m and 0.80m bgl in Borehole 1 show the sample to have a water soluble sulphate content of 0.049g/litre associated with a near neutral pH value.

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

However, segregations of gypsum are common within the London Clay Formation and consequently it is considered that any buried concrete at depth may be attacked by such sulphates in solution. It would therefore be prudent to design any such deep buried concrete in accordance with full Class DS-2.

#### 4.6 Non-Technical Summary of Chapter 4.0

The boreholes and trial pits revealed ground conditions that were consistent with the geological records and known history of the area and comprised Made Ground up to 1.30m in thickness overlying the Claygate Member with the London Clay Formation at depth. Groundwater was encountered at maximum depths of 1.87m bgl and 2.10m bgl in the monitoring piezometers in Boreholes 1 and 2 during a monitoring period of approximately three weeks.

Trial Pits 1 and 2 were excavated adjacent to the existing walls of No. 13 in order to expose the foundations and founding soils. The hand excavated trial pits showed the property is supported on outstepped concrete foundations resting on the Claygate Member at depths of between 1.35m and 1.45m bgl.



## 5.0 Structural Method Statement

At this stage the detail design of the building has not been carried out, but the following assumptions have been made in order to complete this report.

It is proposed to construct the basement as a new reinforced concrete box, with load bearing masonry walls for the superstructure.

The proposed building is an independent building and therefore it is not proposed to underpin the adjoining properties.

The basement slab will be designed as a raft slab, with reinforced concrete walls acting as retaining walls.

The basement excavation will require temporary support during excavation. This will most likely take the form of sheet piling. The sheet piling will require propping during excavation. The sheet piling will prevent any undermining of the adjoining buildings and trees. The design of the of the temporary works and basement will be subject to a party wall award.

We would expect as part of the Party Wall award that a monitoring strategy will be prepared and agreed. Monitoring will be carried out every two weeks during the ground works and then monthly. Monitoring points will be fixed to the adjoining properties and footpaths.

Movement will be recorded by an independent survey company and presented to the Party Wall Surveyors promptly after each survey. The movement is usually controlled by a traffic light system as below.

Category	Allowable movement	Action
Green	Less than 5mm	Proceed
Amber	5-10mm	Increase monitoring
Red	Over 10mm	Stop work and review

The work on site is expected to take approximately 12 months, with the ground works taking about three months to complete.

The waterproofing strategy will be an external tanking membrane with an internal drained cavity as recommend by BSBS 8102, Grade 3 (habitable).

## 6.0 Basement Impact Assessment

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

Impact	Site Investigation Conclusions	Impact sufficiently addressed without further justification?
The site is directly above an aquifer.	The most recent soils investigation has proven that the site is situated above the Claygate Member which are classed as Secondary A Aquifers formerly classified as minor aquifers.	No – see Section 5.1 for further details.
The proposed basement extends beneath the water table surface.	It is proposed to excavate to a maximum depth of approximately 3.0m through Made Ground into clay strata belonging to the Claygate Beds, which are underlain by the London Clay Formation. Observations made in standpipe piezometers installed in Boreholes 1 and 2 indicate maximum groundwater levels of 1.87m bgl in Borehole 1 and 2.10m bgl in Borehole 2. This is higher than the proposed dig level and therefore groundwater ingress will need to be managed during the excavation.	No – see Section 5.1 for further details.
Trees will be felled as part of the development	It is understood that at a Sycamore tree at the front of the site (T2 on Figure 2) will be removed to enable construction of the basement.  The Claygate Member proven below the site in the ground investigation was recorded as having a medium susceptibility to shrinkage and swelling. However, the risk of subsidence to existing shallow foundations below building No's 13 or 15 following the removal of the tree is seen as low as according to the Tree Survey Report for the site (Greenlink Ecology Limited, March 2016) the tree has significant decay at the base and therefore its ability to remove moisture from the ground is likely to already be largely inhibited.	Yes
There a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site.	Desiccation of the shallow soils has also not been found in the investigation and the adjacent land does not have a known history for land instability. Also as the tree is on flat land, its removal will not present a significant negative impact on slope stability.  In terms of the new basement, the base of proposed basement slab will extend well below the potential depth of root action in accordance with guidance from NHBC Standards, Chapter 4.2 and the Tree Survey Report.	
The site is within 5m of a highway or pedestrian right of way.	The proposed basement is not to be extended below Kemplay Road and therefore it is suggested that the impact on these access roads is likely to be minimal. Temporary works to address potential instability are to be incorporated into the design and construction sequence.  There is nothing unusual in the proposed development that would give rise to any concerns with regard to the stability of public highways.	Yes
The proposed basement will significantly increase the differential depth of foundations relative to neighbouring properties.	The development will result in the extension of the foundation depth of the basement relative to neighbouring property (No. 15 Kemplay Road).	No – see Section 5.1 for further details.
The proposed basement development will	There is an increase in impermeable area on site following development, which equates to an increase in the rate of run-	No – see Section 5.1 for further details.

result in a change in the proportion of hard surfaced / paved external areas.	off from the site.	
The site in an area identified to have surface water flood risk	Reference to Camden's Strategic Flood Risk Assessment indicates that the property lies in an area with a risk of internal and external sewer flooding. In addition it is understood that a number of properties in the area have previously been affected by internal and external sewer flooding and given that a basement is proposed, this increases the risk.	No – see Section 5.1 for further details.

## 6.1 Outstanding Risks and Issues

### 6.1.1 Hard surfaced / paved external areas

As identified in the initial screening and scoping stages the scheme will result in a c. 45.9msq increase in impermeable areas. However as at least c. 50% of the garden is to remain after the development. This meets the 'no greater than 50% of garden' standard threshold.

Given the above, no additional SUDS are considered necessary. However, the scheme could incorporate a French drain / swale area adjacent to the proposed rear extension to increase surface water storage on site, but only if this landscaping does not affect the suitability of the surrounding ground.

Given limited scope of the scheme and minimal increase in impermeable areas, the scheme is also considered compliant with the surface water management and flood risk elements of NPPF and Camden policy.

### 6.1.2 Surface Water Flood Risk

Kemplay Road, located immediately to the north of the site, is listed by the Environment Agency as having a 'Very Low Risk' to surface water flooding. In addition, Kemplay Road did not flood during either the 1975 or the 2002 flood events in Camden.

As detailed on Figures 2 and 3 and with reference to Camden's Strategic Flood Risk Assessment (SFRA) the property lies in an area which is at risk of internal and external sewer flooding. From the SFRA it is apparent that four properties located in close proximity to the site have previously been affected by interior sewer flooding whilst one property has been affected by external sewer flooding and given that a basement is proposed, this increases the risk.

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

- Although there will be an increase in impermeable areas, the proposed basement construction meets the 'no greater than 50% of garden' standard threshold. As such, the basement will not have an adverse impact on the site's surface water run-off.
- The development will intrude into the saturated part of the Secondary A Aquifer, but will not obstruct it completely as there is a significant thickness of unsaturated aquifer lying beneath the neighbouring properties. Therefore it is anticipated that existing local groundwater flow paths and groundwater storage will not be significantly affected by the proposals.
- At the time of writing this report, the drainage details had not been finalised; however it is our understanding that the drainage details will incorporate a pumping device at basement floor level to protect the property from sewer flooding.

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

### 6.1.3 Groundwater table

The anticipated formation level for the basement beneath the existing property is approximately 3.00m bgl. Thus, the basement is expected to be founded in the Claygate Member clays.

Based on the groundwater level data reviewed, the proposed basement is likely to intercept the groundwater unit. However, a more permeable silty fine to medium sand unit was recorded below the base of proposed basement at a depth of between 4.00m in BH2. Therefore this unit is likely to be maintained so that the basement will not effectively form an hydraulic 'cut-off' and there should be a pathway for groundwater to flow beneath the basement. This behaviour is acknowledged in the Camden GHHS which noted that even extensive excavations for basements in the City of London have not caused any serious problems in 'damming' groundwater flow, with groundwater simply finding an alternative route (Arup, 2010, paragraph 205).

The proposed basement will be fully waterproofed in order to provide adequate long-term control of moisture ingress from the groundwater. Detailed recommendations for the waterproofing system are detailed in Section 5.0 and the system will be designed in compliance with the requirements of BS8102:2009.

Groundwater is interpreted to flow in a southerly direction and the orientation of the existing property and proposed basement are such that groundwater flow will be oblique rather than perpendicular to the interpreted groundwater flow direction. In addition, the length of basement that will potentially intercept groundwater flow is estimated to be less than 8m.

On this basis the potential rise in groundwater levels up hydraulic gradient of the proposed basement are considered to be minimal.

### 6.1.4 Ground Movement Assessment

#### Introduction

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

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

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

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

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

Ground movements within the area of the proposed excavation have been estimated using Geotechnical Software (PDISP by OASYS) whilst the expected movements in the area around the site have been estimated using an empirical approach that is based on field measurements of movements from a number of basement constructions across London (CIRIA report C580 'Embedded retaining walls guidance for economic design').

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

#### The Adjacent Properties

The property most likely to be affected by the ground movements associated with the proposed basement construction is No. 15 Kemplay Road to the west which will be approximately 0.5m from the new basement construction.

No 15 is constructed in a similar manor to No 13 being two storey terraced residential property with front and rear garden areas. As the depths of the foundations at this property are unknown it is recommended that the maximum differential depth should be assumed for detailed design.

#### Ground Model

For the purposes of the ground movement analyses, the ground stratigraphy can be summarised as follows:

- Made ground to approximately 1.30m bgl;
- Claygate Member to approximately 5.30m bgl;
- London Clay Formation to 10.00m bgl.

Analyses have been carried out for both the short-term (undrained) and long-term (drained) conditions. The adopted soil stiff values are presented in Table 1. These were derived on the following basis;

- For the Made Ground, the Young's Modulus value was taken as 10 MPa and is assumed to be constant with depth
- For the Claygate Member and London Clay Soils the profile suggested by CIRIA publication 143 is used which uses the relationship  $SPT\ N(1.2) = E_u$ . The elastic drained stiffness,  $E'$  of the clay has been estimated to be  $0.75E_u$ .

A plot of  $E_u$  and  $E'$  versus depth is included as Figure 5 to this report.

#### Ground Movements inside the area of the new basement

The vertical ground movements in the area of the site associated with the proposed extension have been calculated using PDISP by OASYS. This approach assumes linear elastic behaviour of the soil and the changes in vertical stresses and settlement/heave have been assessed using the Boussinesq approach. Elastic vertical strains are calculated on the basis of the calculated stress changes and then integrated to obtain vertical movements.

This analysis does not take account of the stiffness of the neighbouring buildings; the result is conservative in this respect.

Three stages of the redevelopment have been modelled as follows:

1. A first stage simulating excavation across the site with unloading due to the removal of soil. Assuming that no delays occur during the construction process, this stage has been simulated using short term soil parameters only (i.e. undrained conditions for the Claygate Member and London Clay Formation). A model for the excavation of the basement to 3.00m bgl is provided as Figure 6.

The proposed excavation will result in a net unloading of around  $60\text{kN/m}^2$  below the property.

2. A second stage simulating the conditions at the end of the construction phase when the site is to be re-loaded with the pressures from the new structures applied at the new foundation level. It is understood that a  $25\text{kN/m}^2$  net loading will be applied at basement level plus the weight of the 300mm thick slab. The model outputs are presented as Figure 7.
3. The third stage simulated a long term condition after construction when the ground has been allowed to consolidate under the new pressures. The model outputs are presented as Figure 8.

Short term analyses have used undrained parameters for the cohesive soils whilst for long term assessments fully drained parameters were used.

The results of the PDISP analysis also indicate the likely impact of the proposed basement construction beyond the site boundaries. The figures are based on an unrestrained excavation as the model is unable to take account of the mitigating effect of the existing structures, which in reality will combine to restrict these movements within the basement excavation. The movements predicted at or just beyond the site boundaries are unlikely to be fully realised and should not therefore have a detrimental impact upon any nearby structures.

#### Ground Movements outside the area of the new basement

##### *Movements due to underpinning*

It is understood that underpins will be installed along the party wall with No. 15 Kemplay Road to allow the construction of the new basement.

No data are presented by CIRIA (C580) for underpinned walls, and no other data are available from other sources for underpin walls. Underpin walls are therefore, as a worst case, assumed to be similar in behaviour to bored pile walls which can cause movement as a consequence of a loss of horizontal support during drilling. The data in CIRIA shown, as Figure 10, can be used to estimate the expected movement.

Records of horizontal movement are limited and very scattered and in practice horizontal movement should be ignored. Adjacent to the underpin wall, vertical ground settlement results from wall installation can be taken to equal 0.04% of wall depth, reducing linearly to zero at a distance of 2 x wall depth (As shown in Figure 9). The above trends rely on good workmanship and adequately-propped, stiff walls. Temporary support of excavations should be designed to BS5975 and BS8002.

For the basement walls of 3.00m depth the expected settlements at the walls are predicted to be approximately 1-2mm.

##### *Movements due to excavation*

During excavation the reduction of lateral support to the excavated walls would induce the ground behind the walls to settle and move towards the excavation as the wall bends.

Figure 10 shows empirical data based on the movements of ground behind retaining walls as a result of excavations into the London Clay (Source CIRIA C580). The movements depend on the propping sequence and on the final depth of the excavation and although there is considerable scattered, the data lies within an envelope which can be used to predict the likely upper limit of movement at any particular distance from the excavation.

Using Figure 10 it is estimated that adjacent to the underpin wall vertical ground settlement resulting from wall deflection can be taken to equal 0.04% of excavation depth, increasing to 0.08% of excavation depth at a distance of 0.6 x excavation depth from the wall, then reducing approximately linearly to zero at a distance of 3 x excavation depth from the wall.

Horizontal ground movements resulting from wall deflection can be taken as being equal to 0.15% of excavation depth, reducing linearly to zero at a distance of 4 x dig depth from the wall.

Assuming that the excavated walls will be fully propped during excavation and overall good workmanship, the data in Figure 10 suggest that the maximum vertical settlements resulting from the 3.00m excavation will be approximately 2-3mm whilst the maximum horizontal settlements will be 4-5mm.

#### Discussion of Results

##### *Movements between short and long term*

The results of the PDISP analysis show at the end of the excavation the ground heaves upwards around 8mm below the property and 4.5mm adjacent to No. 15. The construction of the new structure, with application of new loads, causes settlements that reduce the initial



heave to around 4.5mm within the property and 2.5mm close to the wall with No. 15. The heave is expected to increase over long term conditions to 9mm within the footprint of the property and 5.5mm adjacent to No. 15.

The neighbouring building at No. 15 Kemplay Road is shown to be impacted by the ground movements however movements (both long and short term) are predicted to be less than 5.5mm specifically at the location of the boundary wall so it is not predicted to experience any significant change. In addition, based on the nature of the calculations, PDISP will tend to overestimate these values so in real terms they are unlikely to approach the numbers stated. Monitoring should however be in place during works (see section 6.2).

#### *Effects of ground movements on No. 13 and neighbouring structures*

The potential damage of the predicted ground movements on No. 13 and the neighbouring properties around the site can be estimated as suggested in CIRIA C580 by correlating the horizontal strains with the deflection ratio, which is the ratio between the maximum distortion of a structure and its length.

Ignoring the effects of underpin installation and using guidance from CIRIA C580, the deflection at No's 13 and 15 Kemplay Road is in the order of 0.05%, which, in combination of horizontal strains of about 0.05% is likely to cause a damage to the structures that can be classified as Category 0 to Category 1 in the Category of Damage Chart (CIRIA C580) shown in this document as Figure 11 (Negligible to very slight).

Tilting and deflections of No's 13 and 15 Kemplay Road would be restricted by the fact that the properties are part of a terrace. They are unlikely to experience significant horizontal strains and would be expected to experience only shearing of the walls as a result of mostly vertical movements caused by the excavation of the basement.

#### *Ground Movement Assessment Conclusions*

The movements associated with the proposed basement extension at No 13 Kemplay Road have been estimated using linear analyses and empirical methods.

The excavated area will be subjected to upward movements caused by heaves of the ground due to the net load changes following the basement excavation. The design of the basement foundation should be carried out considering these load changes and the associated movements.

Providing that good workmanship and construction sequences are used and that full support and propping is provided during excavations, the basement construction at No. 13 Kemplay Road is likely to cause settlements and horizontal strains that would induce limited damage on the existing building and surrounding structures. The properties at No 15 Kemplay Road would be affected by ground movements that could create damage classified as Category 0 to Category 1 in the Category of Damage Chart (CIRIA C580) (negligible to very slight).

In addition to the above, based on direct experience with respect to the construction of underpinned retaining walls, ground movements should remain typically within the range 2mm to 5mm following completion of the works provided that they are installed by a reputable and experience contractor in accordance with the guidelines published by the Association of Specialist Underpinning Contractors (2013).

## **6.2 Advice for Further Work and Monitoring**

The predictions of ground movement based on the ground movement analysis should be checked by monitoring of the adjacent properties and structures. The structures to be monitored during the construction stages should include the neighbouring structures. Condition surveys of the above existing structures should be carried out before and after the proposed works.

The precise monitoring strategy will be developed at a later stage and it will be subject to discussions and agreements with the owners of the adjacent properties and structures.

Contingency measures will be implemented if movements of the adjacent structures exceed predefined trigger levels. Both contingency measures and trigger levels will need to be developed within a future monitoring specification for the works to be agreed as part of Party Wall awards.

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

The chosen contractor should also have a contingency plan in place to deal with any perched groundwater inflows as a precautionary measure which are considered to be able to be managed through a conventional sump pump system.

Trial excavations to the proposed basement depth could be carried out by the main contractor to confirm the depth of Made Ground and stability of the soil specifically at the locations of the excavations and to further investigate the presence of any groundwater inflows.

### **6.3 Non-technical Summary of Chapter 6.0**

Given good workmanship, the basement to No 13 Kemplay Road can be constructed without imposing more than very slight damage on the existing building and adjoining property at No. 15. As a precautionary measure, movement monitoring of the boundary wall to the neighbouring building (No. 15) is recommended during the construction stage and trigger levels should be set in order to protect the adjoining property.

The proposed basement will need to be fully waterproofed in order to provide adequate long-term control of moisture ingress from the groundwater. The waterproofing system will be designed in compliance with the requirements of BS8102:2009.

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

It would be prudent to continue to monitor the groundwater standpipes for as long as possible in order to determine the average groundwater level and the extent of any seasonal variations. The chosen contractor should also have a contingency plan in place to deal with any perched groundwater inflows as a precautionary measure. Trial excavations to the proposed basement depth could be carried out by the main contractor to confirm the composition and stability of the soil and to further investigate the presence of any groundwater inflows.

Figure 1. Site Location Plan

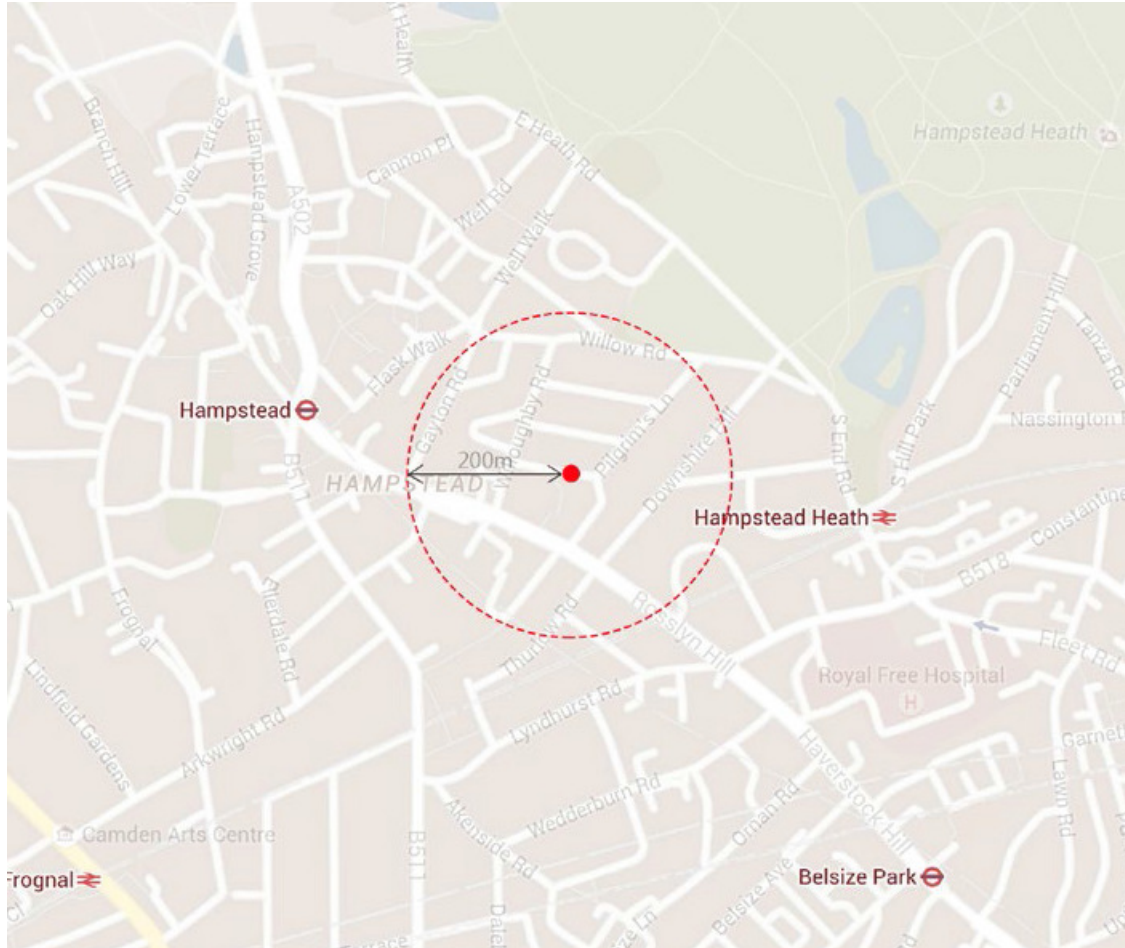
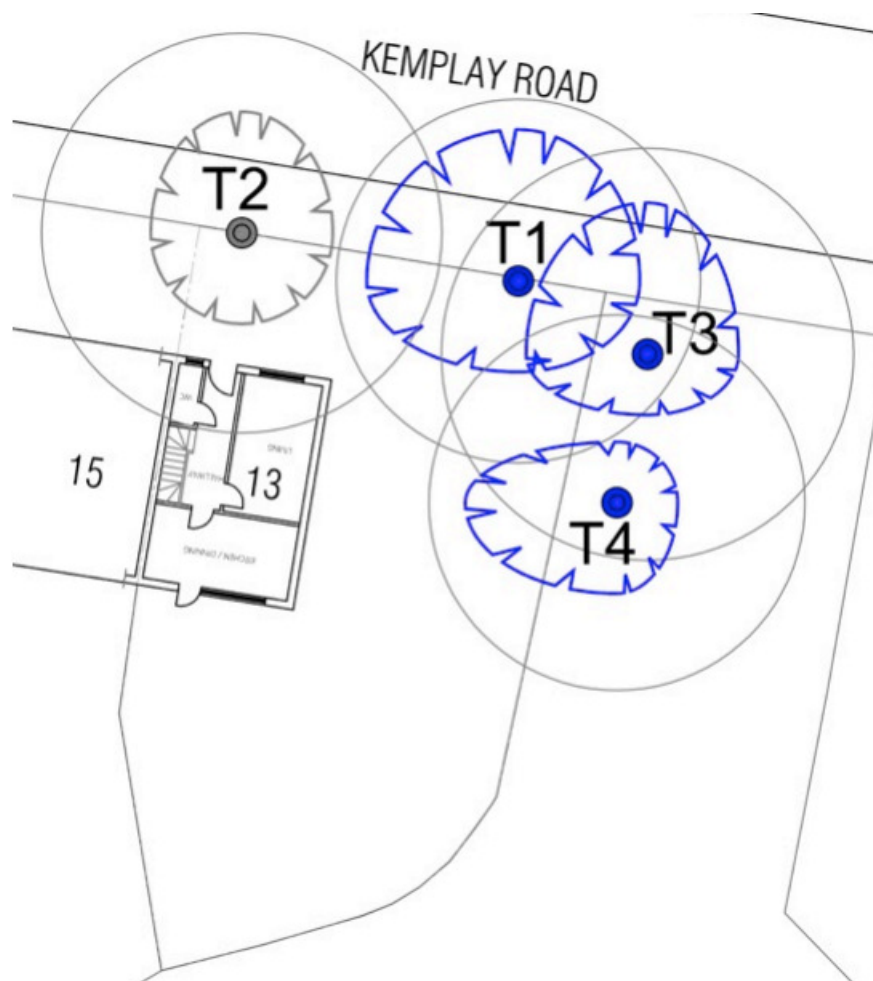


Figure 2 – Tree Constraints Plan Produced by Greenlink Ecology Limited (March 2016)



KEY

- T1 – On Site Sycamore (B)
- T2 – On Site Sycamore (C) (Significant Decay)
- T3 – Off Site Lime (B)
- T4 – Off Site Lime (B)

13 Kemplay Road, Hampstead  
Basement Impact Assessment

Figure 3. Internal Sewer Flooding Areas (reproduced from London Borough of Camden's SFRA, 2014)

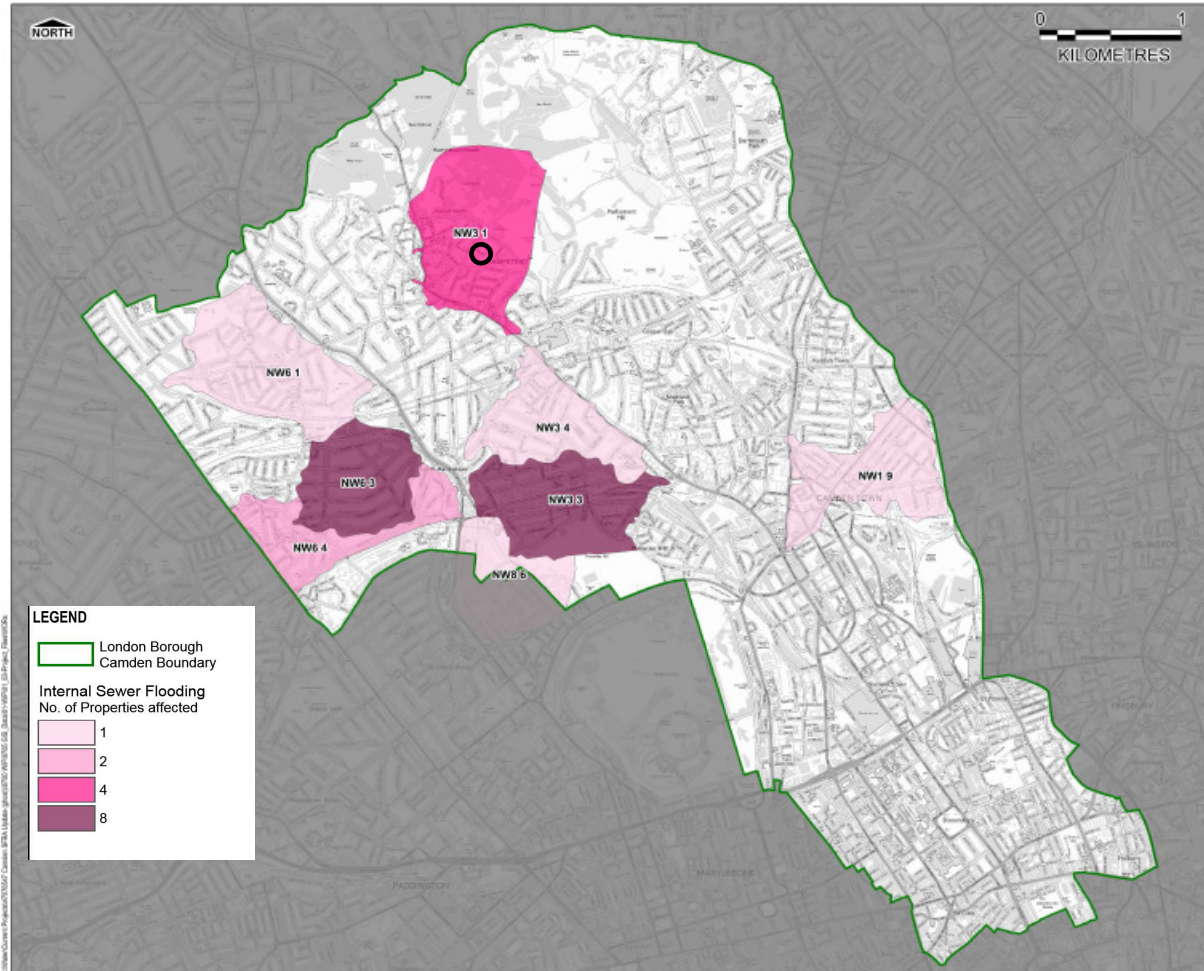
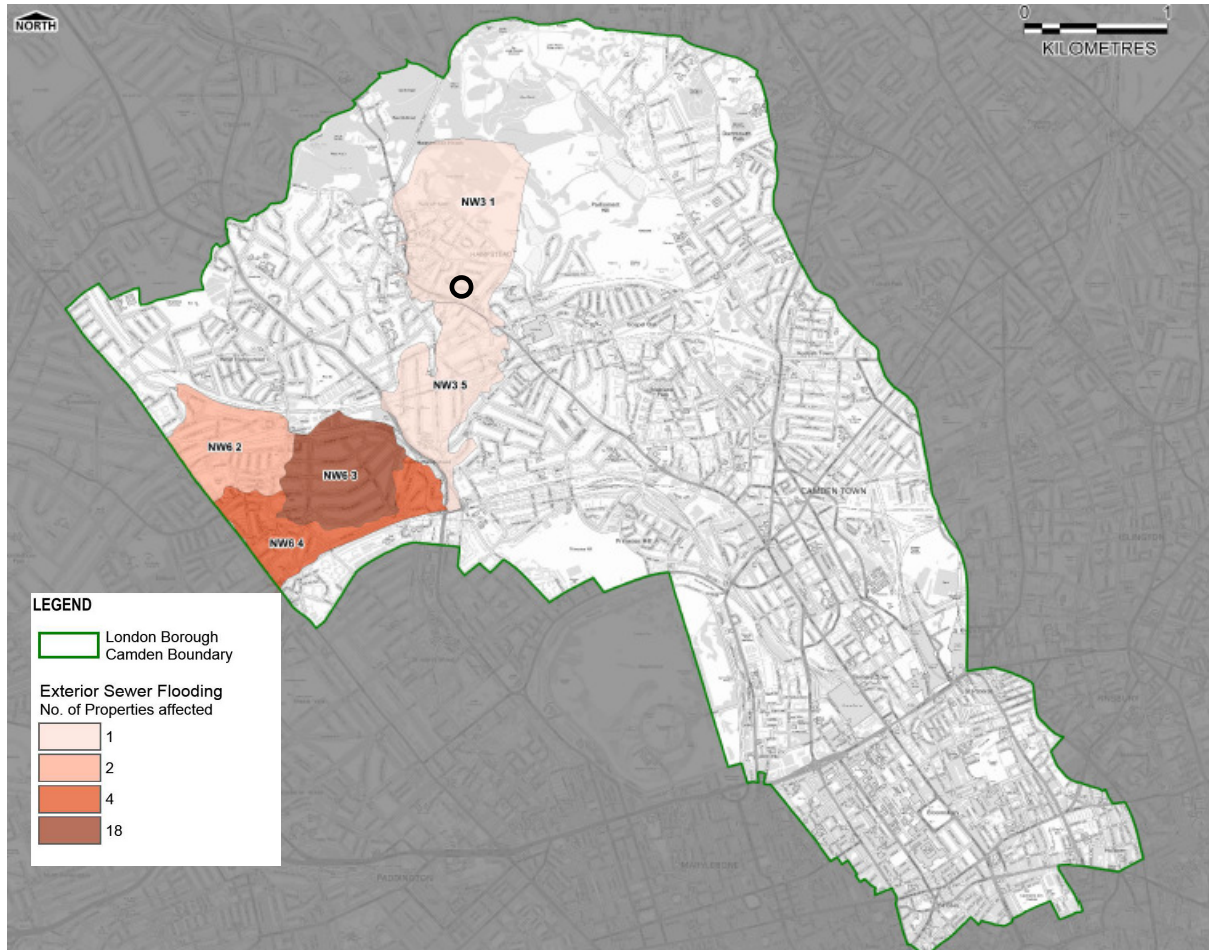


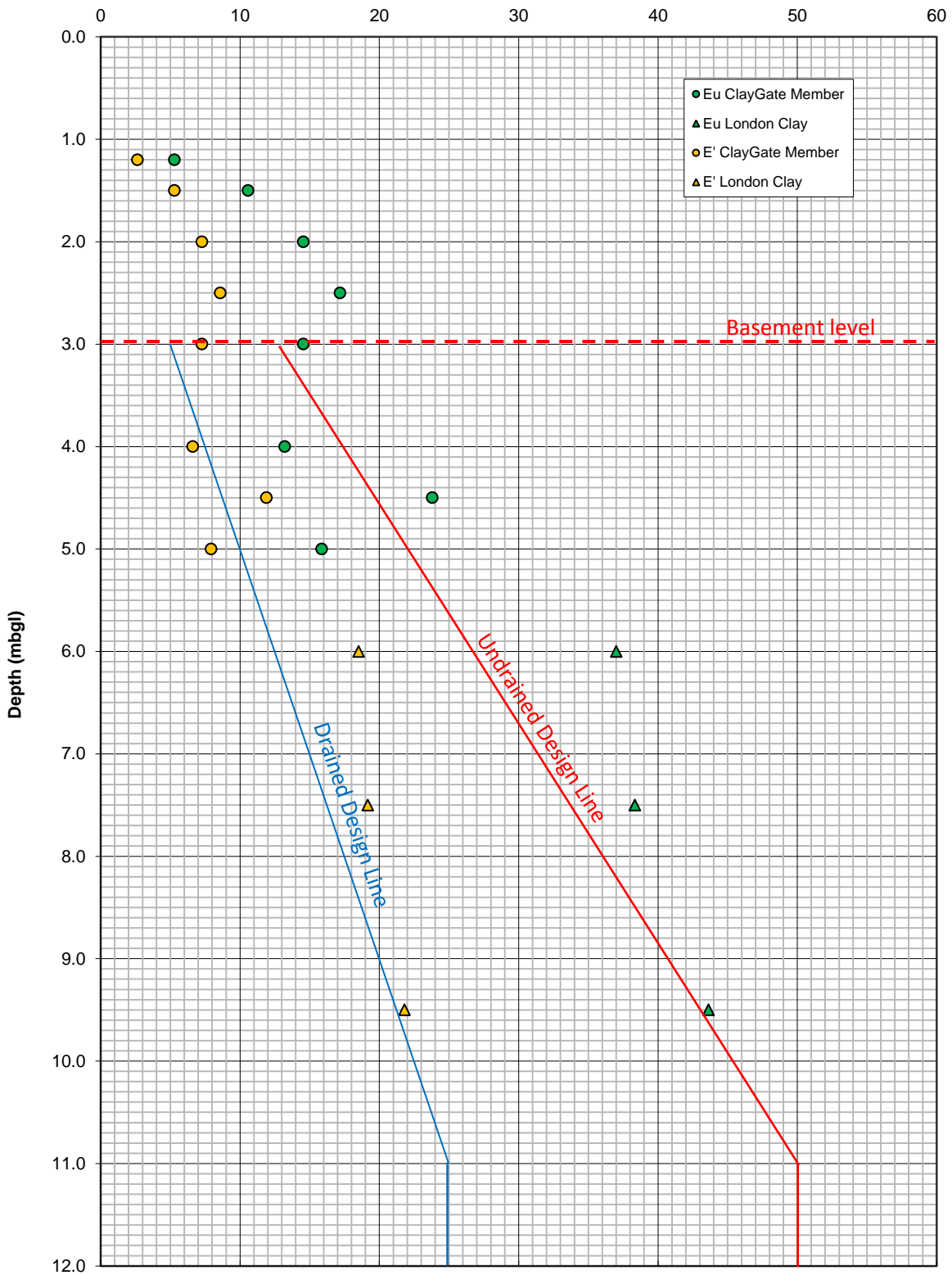


Figure 4. External Sewer Flooding Areas (reproduced from London Borough of Camden's SFRA, 2014)





SPT correlated Undrained and Drained Young's Modulus ( $E_u/E'$ ) MN/m<sup>2</sup>



PROJECT TITLE:-  
13 Kemplay Road

SKETCH / FIG TITLE:-  
Ground movement analysis  
Young's modulus vs Depth Plot

ORIGINATOR:-

**FAIRHURST**

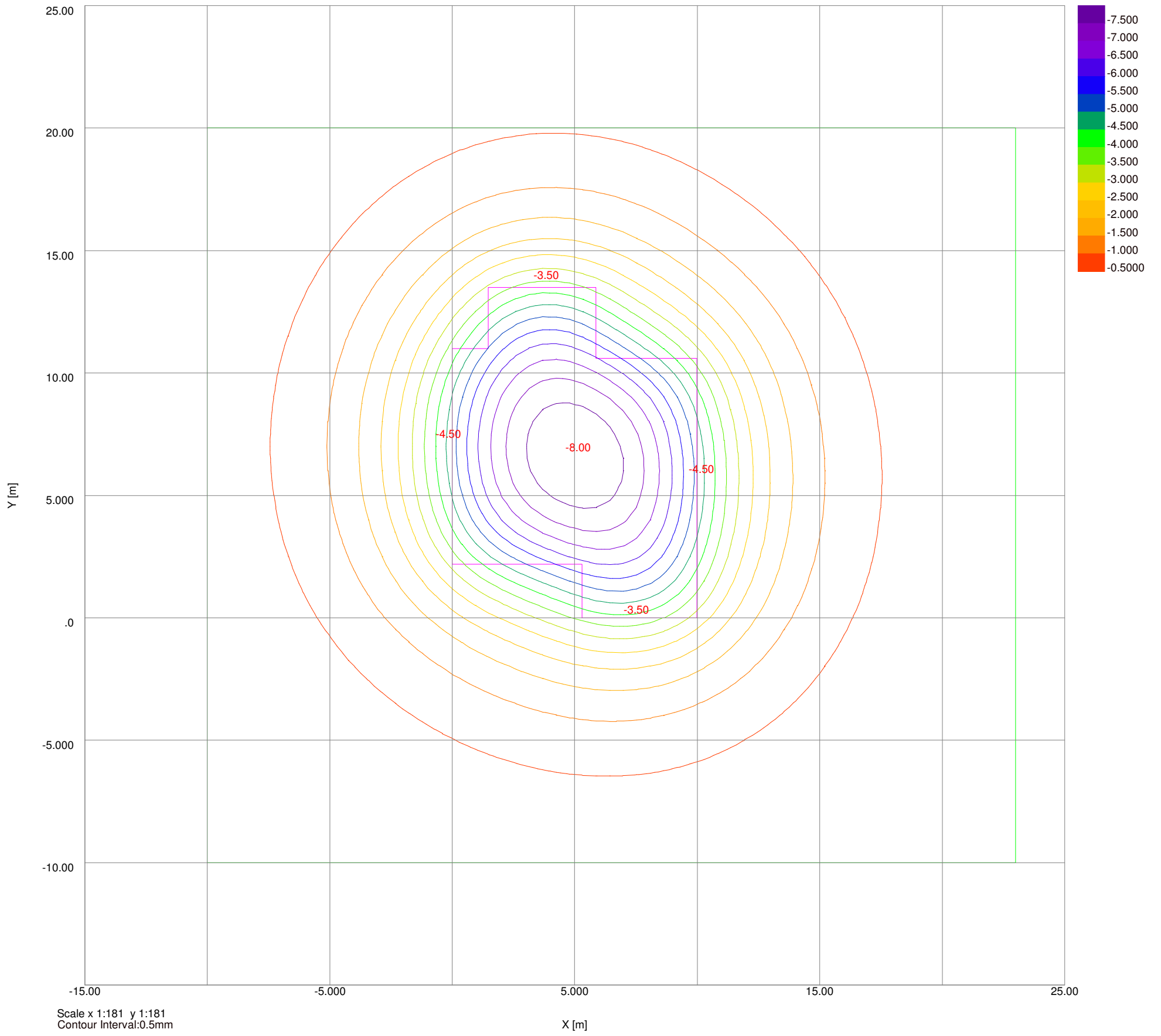
SKETCH / FIG No.:-  
Figure 5

REPORT No.:-  
112131

DATE:-  
May-2016

Job No.	Sheet No.	Rev.
112131		
Drg. Ref.		
Made by	Date	Checked

Settlement Contours : Grid 1 at -3.0000m



Scale x 1:181 y 1:181  
Contour Interval:0.5mm

Table with Job No. 112131, Sheet No., Rev., Drg. Ref., Made by, Date, Checked.

Warnings

The following displacement locations lie wide of all soil zones. The first soil profile will be used.

Table with columns: Displacement Data, Index (m). Contains numerical values for various locations.

List of displacement values: -3.000, -10.0, -9.5, -9.0, -8.5, -8.0, -7.5, -7.0, -6.5, -6.0, -5.5, -5.0, -4.5, -4.0, -3.5, -3.0, -2.5, -2.0, -1.5, -1.0, -0.5, 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0, 10.5, 11.0, 11.5, 12.0, 12.5, 13.0, 13.5, 14.0, 14.5, 15.0, 15.5, 16.0, 16.5, 17.0, 17.5, 18.0, 18.5, 19.0, 19.5, 20.0.

The applies to other displacement points. Only 25 are listed here.

RESULTS FOR GRIDS

Analysis: Boussinesq Global Poisson's ratio: 0.20 Horizontal rigid boundary level: -15.00 [m OD] The maximum displacement difference between Boussinesq method = -5. mm and Mindlin method = -5. mm occurs at point X=8. m Y=2. m Level -3. m OD and is: 0.004 mm

Large table with columns: Name, Location (X, Y, Z), Stresses (Calc Level, Vert Stress, Sum Princ, Vert Strain). Contains data for various grid points.













Table with columns: Name, X [m], Location Y [m], Z [Level] [mGD], Z [mm], Calc Level [mGD], Vert Stress [kN/m²], Sum Princ [kN/m²], Vert Strain [-]. The table contains multiple rows of data for different points (e.g., 0.4, 1.0, 1.5, 2.1, 2.6) and depths.

















Job No. 112131, Sheet No., Rev., Drg. Ref., Made by, Date, Checked

Main data table with columns: Name, Location (X, Y, Z), Calc Level, Vert Stress, Sum Princ, Vert Strain. Contains multiple rows of numerical data for different points.



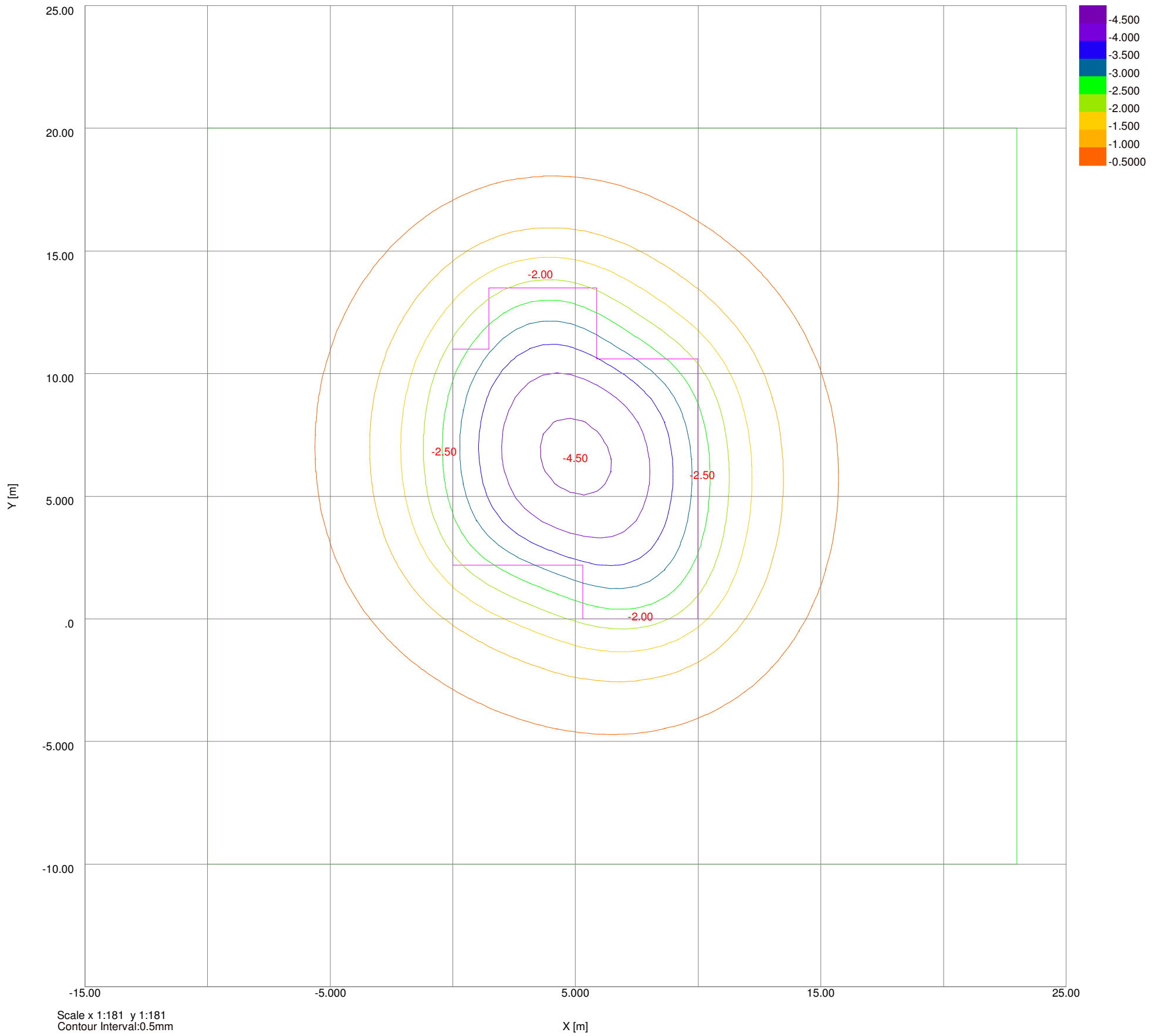






Job No.	Sheet No.	Rev.
112131		
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Made by	Date	Checked

Settlement Contours : Grid 1 at -3.0000m













W A FAIRHURST AND PARTNERS - GLASGOW

13 Kempley road
Ground movement analysis

Table with 3 columns: Job No., Sheet No., Rev.
112131
Drg. Ref.
Made by, Date, Checked

Main data table with columns: Name, Location (X, Y, Z), Stresses (Calc Level, Vert Stress, Sum Princ, Vert Strain). Contains multiple rows of numerical data for different points.



Table with columns: Name, Location (X, Y, Z), Calc Level, Stresses (Vert Stress, Sum Princ), and Vert Strain. Contains data for various points across the site.



























Job No.	Sheet No.	Rev.
112131		
Drg. Ref.		
Made by	Date	Checked

Settlement Contours : Grid 1 at -3.0000m

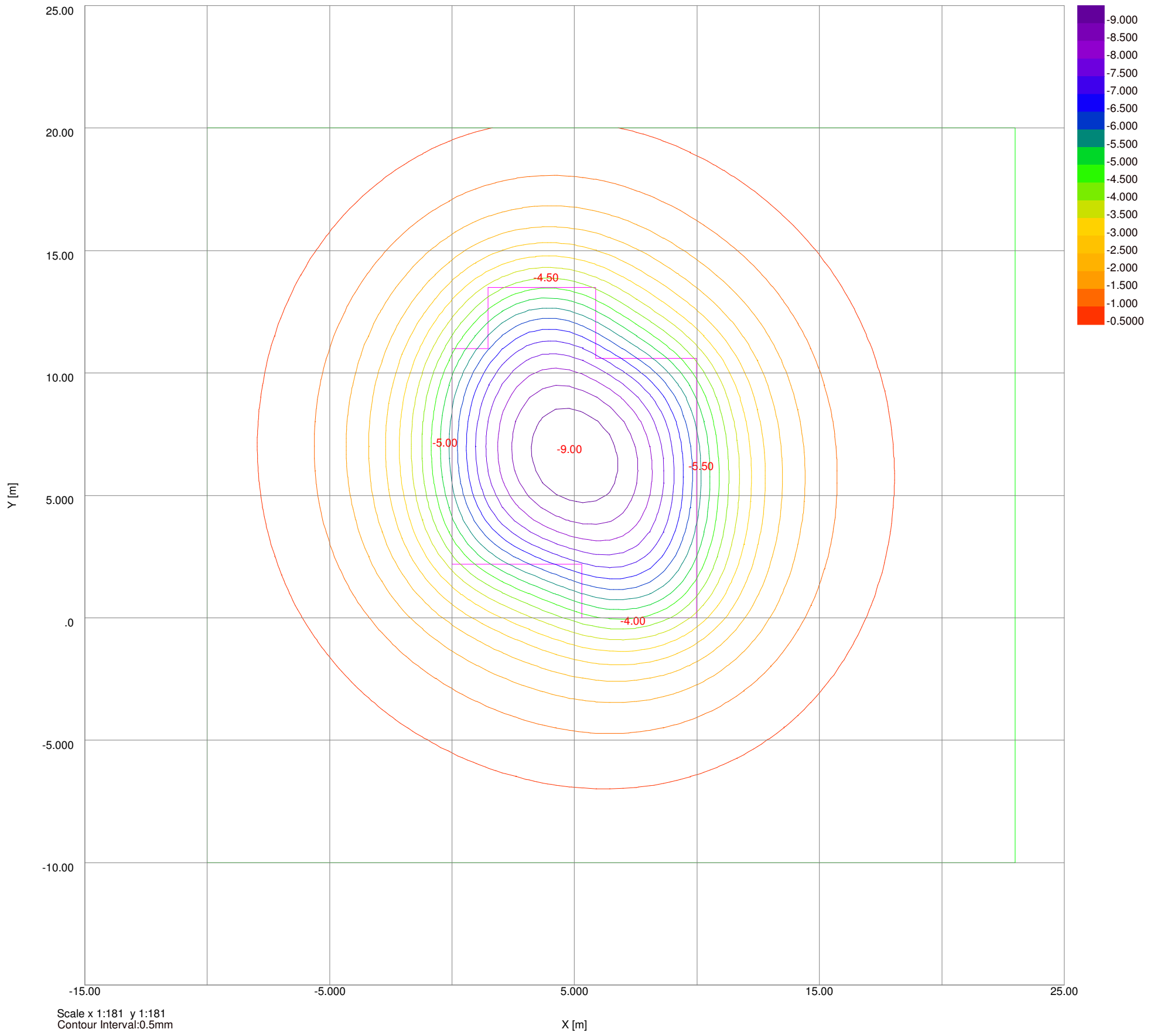


Table with Job No. (112131), Sheet No., Rev., Drg. Ref., Made by, Date, and Checked.

Warnings

1 The following displacement locations lie wide of all soil zones. The first soil profile will be used.

Table with columns: Displacement Data, Index (m), and a grid of values for various points.

The maximum displacement difference between Boussinesq method = -6. mm and Mindlin method = -6. mm occurs at point X=8. m Y=2. m Level -3. m OD and is: 0.005 mm

RESULTS FOR GRIDS

Analysis: Boussinesq Global Poisson's ratio: 0.20 Horizontal rigid boundary level: -15.00 [m OD]

Large table with columns: Name, Location (X, Y, Z), Stresses (Calc Level, Vert Stress, Sum Princ, Vert Strain).



















W A FAIRHURST AND PARTNERS - GLASGOW

13 Kempley road Ground movement analysis

Job No. 112131, Sheet No., Rev., Drg. Ref., Made by, Date, Checked

Main data table with columns: Name, X [m], Y [m], Z [Level] [mOD], Z [mm], Calc Level [mOD], Vert Stress [kN/m^2], Sum Princ [kN/m^2], Vert Strain [-]. Rows 1-64.





Job No.	Sheet No.	Rev.
112131		
Drg. Ref.		
Made by	Date	Checked

Name	X [m]	Location Y [m]	Z [Level] [mOD]	Z [mm]	Calc Level [mOD]	Vert Stress [kN/m <sup>2</sup> ]	Sum Princ [kN/m <sup>2</sup> ]	Vert Strain [-]
8.1	13.0	-3.0	-3.0	-3.0	-3.0	-6.0	-10.0	-300.E-6
8.1	13.5	-3.0	-3.0	-3.0	-3.0	-4.0	-10.0	-200.E-6
8.1	14.0	-3.0	-3.0	-3.0	-3.0	-3.0	-10.0	-200.E-6
8.1	14.5	-3.0	-3.0	-3.0	-3.0	-2.0	-10.0	-200.E-6
8.1	15.0	-3.0	-3.0	-3.0	-3.0	-2.0	-8.0	-80.E-6
8.1	15.5	-3.0	-3.0	-3.0	-3.0	-2.0	-7.0	-50.E-6
8.1	16.0	-3.0	-3.0	-3.0	-3.0	-1.0	-6.0	-30.E-6
8.1	16.5	-3.0	-3.0	-3.0	-3.0	-1.0	-5.0	-20.E-6
8.1	17.0	-3.0	-3.0	-3.0	-3.0	-0.8	-4.0	-6.E-6
8.1	17.5	-3.0	-3.0	-3.0	-3.0	-0.6	-4.0	1.E-6
8.1	18.0	-3.0	-3.0	-3.0	-3.0	-0.5	-3.0	6.E-6
8.1	18.5	-3.0	-3.0	-3.0	-3.0	-0.4	-3.0	9.E-6
8.1	19.0	-3.0	-3.0	-3.0	-3.0	-0.3	-3.0	10.E-6
8.1	19.5	-3.0	-3.0	-3.0	-3.0	-0.3	-2.0	10.E-6
8.1	20.0	-3.0	-3.0	-3.0	-3.0	-0.2	-2.0	10.E-6
8.6	-10.0	-3.0	-3.0	-3.0	-3.0	-0.07	-1.0	10.E-6
8.6	-9.5	-3.0	-3.0	-3.0	-3.0	-0.09	-1.0	10.E-6
8.6	-9.0	-3.0	-3.0	-3.0	-3.0	-0.1	-1.0	10.E-6
8.6	-8.5	-3.0	-3.0	-3.0	-3.0	-0.1	-2.0	10.E-6
8.6	-8.0	-3.0	-3.0	-3.0	-3.0	-0.2	-2.0	10.E-6
8.6	-7.5	-3.0	-3.0	-3.0	-3.0	-0.2	-2.0	10.E-6
8.6	-7.0	-3.0	-3.0	-3.0	-3.0	-0.2	-2.0	10.E-6
8.6	-6.5	-3.0	-3.0	-3.0	-3.0	-0.3	-2.0	10.E-6
8.6	-6.0	-3.0	-3.0	-3.0	-3.0	-0.4	-3.0	8.E-6
8.6	-5.5	-3.0	-3.0	-3.0	-3.0	-0.5	-3.0	4.E-6
8.6	-5.0	-3.0	-3.0	-3.0	-3.0	-0.6	-4.0	-2.E-6
8.6	-4.5	-3.0	-3.0	-3.0	-3.0	-0.8	-4.0	-10.E-6
8.6	-4.0	-3.0	-3.0	-3.0	-3.0	-1.0	-5.0	-30.E-6
8.6	-3.5	-3.0	-3.0	-3.0	-3.0	-1.0	-6.0	-50.E-6
8.6	-3.0	-3.0	-3.0	-3.0	-3.0	-2.0	-7.0	-80.E-6
8.6	-2.5	-3.0	-3.0	-3.0	-3.0	-3.0	-8.0	-100.E-6
8.6	-2.0	-3.0	-3.0	-3.0	-3.0	-4.0	-10.0	-200.E-6
8.6	-1.5	-3.0	-3.0	-3.0	-3.0	-5.0	-10.0	-300.E-6
8.6	-1.0	-3.0	-3.0	-3.0	-3.0	-7.0	-10.0	-500.E-6
8.6	-0.5	-3.0	-3.0	-3.0	-3.0	-10.0	-20.0	-600.E-6
8.6	0.0	-3.0	-3.0	-3.0	-3.0	-10.0	-20.0	-800.E-6
8.6	0.5	-3.0	-3.0	-3.0	-3.0	-10.0	-20.0	-0.001
8.6	1.0	-3.0	-3.0	-3.0	-3.0	-10.0	-20.0	-0.001
8.6	1.5	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
8.6	2.0	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
8.6	2.5	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.002
8.6	3.0	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.002
8.6	3.5	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.002
8.6	4.0	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.002
8.6	4.5	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.002
8.6	5.0	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.002
8.6	5.5	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.002
8.6	6.0	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.002
8.6	6.5	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.002
8.6	7.0	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.002
8.6	7.5	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.002
8.6	8.0	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.002
8.6	8.5	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.002
8.6	9.0	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
8.6	9.5	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
8.6	10.0	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
8.6	10.5	-3.0	-3.0	-3.0	-3.0	-10.0	-20.0	-0.001
8.6	11.0	-3.0	-3.0	-3.0	-3.0	-10.0	-20.0	-800.E-6
8.6	11.5	-3.0	-3.0	-3.0	-3.0	-10.0	-20.0	-600.E-6
8.6	12.0	-3.0	-3.0	-3.0	-3.0	-8.0	-20.0	-400.E-6
8.6	12.5	-3.0	-3.0	-3.0	-3.0	-6.0	-10.0	-300.E-6
8.6	13.0	-3.0	-3.0	-3.0	-3.0	-5.0	-10.0	-200.E-6
8.6	13.5	-3.0	-3.0	-3.0	-3.0	-4.0	-10.0	-200.E-6
8.6	14.0	-3.0	-3.0	-3.0	-3.0	-3.0	-9.0	-100.E-6
8.6	14.5	-3.0	-3.0	-3.0	-3.0	-2.0	-8.0	-80.E-6
8.6	15.0	-3.0	-3.0	-3.0	-3.0	-2.0	-7.0	-60.E-6
8.6	15.5	-3.0	-3.0	-3.0	-3.0	-1.0	-6.0	-40.E-6
8.6	16.0	-3.0	-3.0	-3.0	-3.0	-1.0	-5.0	-20.E-6
8.6	16.5	-3.0	-3.0	-3.0	-3.0	-0.9	-5.0	-9.E-6
8.6	17.0	-3.0	-3.0	-3.0	-3.0	-0.7	-4.0	-1.E-6
8.6	17.5	-3.0	-3.0	-3.0	-3.0	-0.6	-4.0	4.E-6
8.6	18.0	-3.0	-3.0	-3.0	-3.0	-0.4	-3.0	8.E-6
8.6	18.5	-3.0	-3.0	-3.0	-3.0	-0.4	-3.0	10.E-6
8.6	19.0	-3.0	-3.0	-3.0	-3.0	-0.3	-3.0	10.E-6
8.6	19.5	-3.0	-3.0	-3.0	-3.0	-0.2	-2.0	10.E-6
8.6	20.0	-3.0	-3.0	-3.0	-3.0	-0.2	-2.0	10.E-6
9.2	-10.0	-3.0	-3.0	-3.0	-3.0	-0.07	-1.0	10.E-6
9.2	-9.5	-3.0	-3.0	-3.0	-3.0	-0.08	-1.0	10.E-6
9.2	-9.0	-3.0	-3.0	-3.0	-3.0	-0.1	-1.0	10.E-6
9.2	-8.5	-3.0	-3.0	-3.0	-3.0	-0.1	-1.0	10.E-6
9.2	-8.0	-3.0	-3.0	-3.0	-3.0	-0.1	-2.0	10.E-6
9.2	-7.5	-3.0	-3.0	-3.0	-3.0	-0.2	-2.0	10.E-6
9.2	-7.0	-3.0	-3.0	-3.0	-3.0	-0.2	-2.0	10.E-6
9.2	-6.5	-3.0	-3.0	-3.0	-3.0	-0.3	-2.0	10.E-6
9.2	-6.0	-3.0	-3.0	-3.0	-3.0	-0.4	-3.0	8.E-6
9.2	-5.5	-3.0	-3.0	-3.0	-3.0	-0.5	-3.0	5.E-6
9.2	-5.0	-3.0	-3.0	-3.0	-3.0	-0.6	-3.0	0.0
9.2	-4.5	-3.0	-3.0	-3.0	-3.0	-0.8	-4.0	-10.E-6
9.2	-4.0	-3.0	-3.0	-3.0	-3.0	-1.0	-5.0	-20.E-6
9.2	-3.5	-3.0	-3.0	-3.0	-3.0	-1.0	-5.0	-40.E-6
9.2	-3.0	-3.0	-3.0	-3.0	-3.0	-2.0	-6.0	-80.E-6
9.2	-2.5	-3.0	-3.0	-3.0	-3.0	-2.0	-8.0	-100.E-6
9.2	-2.0	-3.0	-3.0	-3.0	-3.0	-4.0	-9.0	-200.E-6
9.2	-1.5	-3.0	-3.0	-3.0	-3.0	-5.0	-10.0	-300.E-6
9.2	-1.0	-3.0	-3.0	-3.0	-3.0	-7.0	-10.0	-400.E-6
9.2	-0.5	-3.0	-3.0	-3.0	-3.0	-9.0	-10.0	-600.E-6
9.2	0.0	-3.0	-3.0	-3.0	-3.0	-10.0	-20.0	-700.E-6
9.2	0.5	-3.0	-3.0	-3.0	-3.0	-10.0	-20.0	-900.E-6
9.2	1.0	-3.0	-3.0	-3.0	-3.0	-10.0	-20.0	-0.001
9.2	1.5	-3.0	-3.0	-3.0	-3.0	-10.0	-20.0	-0.001
9.2	2.0	-3.0	-3.0	-3.0	-3.0	-10.0	-20.0	-0.001
9.2	2.5	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
9.2	3.0	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
9.2	3.5	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
9.2	4.0	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
9.2	4.5	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
9.2	5.0	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
9.2	5.5	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
9.2	6.0	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
9.2	6.5	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
9.2	7.0	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
9.2	7.5	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
9.2	8.0	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
9.2	8.5	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
9.2	9.0	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
9.2	9.5	-3.0	-3.0	-3.0	-3.0	-10.0	-30.0	-0.001
9.2	10.0	-3.0	-3.0	-3.0	-3.0	-10.0	-20.0	-0.001
9.2	10.5	-3.0	-3.0	-3.0	-3.0	-10.0	-20.0	-800.E-6
9.2	11.0	-3.0	-3.0	-3.0	-3.0	-10.0	-20.0	-700.E-6
9.2	11.5	-3.0	-3.0	-3.0	-3.0	-8.0	-20.0	-500.E-6
9.2	12.0	-3.0	-3.0	-3.0	-3.0	-6.0	-10.0	-400.E-6
9.2	12.5	-3.0	-3.0	-3.0	-3.0	-5.0	-10.0	-300.E-6
9.2	13.0	-3.0	-3.0	-3.0	-3.0	-4.0	-10.0	-200.E-6
9.2	13.5	-3.0	-3.0	-3.0	-3.0	-3.0	-10.0	-100.E-6
9.2	14.0	-3.0	-3.0	-3.0	-3.0	-2.0	-8.0	-90.E-6
9.2	14.5	-3.0	-3.0	-3.0	-3.0	-2.0	-7.0	-60.E-6
9.2	15.0	-3.0	-3.0	-3.0	-3.0	-1.0	-6.0	-40.E-6
9.2	15.5	-3.0	-3.0	-3.0	-3.0	-1.0	-6.0	-20.E-6
9.2	16.0	-3.0	-3.0	-3.0	-3.0	-0.9	-5.0	-10.E-6
9.2	16.5	-3.0	-3.0	-3.0	-3.0	-0.8	-4.0	-3.E-6
9.2	17.0	-3.0	-3.0	-3.0	-3.0	-0.6	-4.0	3.E-6
9.2	17.5	-3.0	-3.0	-3.0	-3.0	-0.5	-3.0	7.E-6
9.2	18.0	-3.0	-3.0	-3.0	-3.0	-0.4	-3.0	10.E-6
9.2	18.5	-3.0	-3.0	-3.0	-3.0	-0.3	-3.0	10.E-6
9.2	19.0	-3.0	-3.0	-3.0	-3.0	-0.3	-2.0	10.E-6
9.2	19.5	-3.0	-3.0	-3.0	-3.0	-0.2	-2.0	10.E-6
9.2	20.0	-3.0	-3.0	-3.0	-3.0	-0.2	-2.0	10.E-6
9.7	-10.0	-3.0	-3.0	-3.0	-3.0	-0.07	-1.0	10.E-6
9.7	-9.5	-3.0	-3.0	-3.0	-3.0	-0.08	-1.0	10.E-6
9.7	-9.0	-3.0	-3.0	-3.0	-3.0	-0.1	-1.0	10.E-6
9.7	-8.5	-3.0	-3.0	-3.0	-3.0	-0.1	-1.0	10.E-6
9.7	-8.0	-3.0	-3.0	-3.0	-3.0	-0.1	-2.0	10.E-6
9.7	-7.5	-3.0	-3.0	-3.0	-3.0	-0.2	-2.0	10.E-6
9.7	-7.0	-3.0	-3.0	-3.0	-3.0	-0.2	-2.0	10.E-6
9.7	-6.5	-3.0	-3.0	-3.0	-3.0	-0.3	-2.0	10.E-6
9.7	-6.0	-3.0	-3.0	-3.0	-3.0	-0.3	-3.0	9.E-6
9.7	-5.5	-3.0	-3.0	-3.0	-3.0	-0.4	-3.0	6.E-6
9.7	-5.0	-3.0	-3.0	-3.0	-3.0	-0.6	-3.0	0.0
9.7	-4.5	-3.0	-3.0	-3.0	-3.0	-0.9		

Name	Location X [m]	Location Y [m]	Z [Level] [mGD]	Z [mm]	Calc Level [mGD]	Vert Stress [kN/m <sup>2</sup> ]	Stresses Sum Princ [kN/m <sup>2</sup> ]	Vert Strain [-]
10.3	-2.5	-3.0	-2.0	-3.0	-3.0	-2.0	-7.0	-80.E-6
10.3	-2.0	-3.0	-2.0	-3.0	-3.0	-3.0	-8.0	-100.E-6
10.3	-1.5	-3.0	-2.0	-3.0	-3.0	-4.0	-9.0	-200.E-6
10.3	-1.0	-3.0	-2.0	-3.0	-3.0	-5.0	-10.0	-300.E-6
10.3	-0.5	-3.0	-2.0	-3.0	-3.0	-6.0	-10.0	-400.E-6
10.3	0.0	-3.0	-2.0	-3.0	-3.0	-7.0	-10.0	-500.E-6
10.3	0.5	-3.0	-2.0	-3.0	-3.0	-8.0	-10.0	-600.E-6
10.3	1.0	-3.0	-2.0	-3.0	-3.0	-9.0	-10.0	-700.E-6
10.3	1.5	-3.0	-2.0	-3.0	-3.0	-10.0	-10.0	-800.E-6
10.3	2.0	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-800.E-6
10.3	2.5	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-900.E-6
10.3	3.0	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-900.E-6
10.3	3.5	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-900.E-6
10.3	4.0	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-900.E-6
10.3	4.5	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-900.E-6
10.3	5.0	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-900.E-6
10.3	5.5	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-900.E-6
10.3	6.0	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-900.E-6
10.3	6.5	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-900.E-6
10.3	7.0	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-900.E-6
10.3	7.5	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-900.E-6
10.3	8.0	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-900.E-6
10.3	8.5	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-800.E-6
10.3	9.0	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-800.E-6
10.3	9.5	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-700.E-6
10.3	10.0	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-600.E-6
10.3	10.5	-3.0	-2.0	-3.0	-3.0	-8.0	-20.0	-500.E-6
10.3	11.0	-3.0	-2.0	-3.0	-3.0	-7.0	-10.0	-400.E-6
10.3	11.5	-3.0	-2.0	-3.0	-3.0	-6.0	-10.0	-300.E-6
10.3	12.0	-3.0	-2.0	-3.0	-3.0	-4.0	-10.0	-200.E-6
10.3	12.5	-3.0	-2.0	-3.0	-3.0	-3.0	-10.0	-200.E-6
10.3	13.0	-3.0	-2.0	-3.0	-3.0	-2.0	-9.0	-100.E-6
10.3	13.5	-3.0	-2.0	-3.0	-3.0	-2.0	-8.0	-70.E-6
10.3	14.0	-3.0	-2.0	-3.0	-3.0	-2.0	-7.0	-50.E-6
10.3	14.5	-3.0	-2.0	-3.0	-3.0	-1.0	-6.0	-30.E-6
10.3	15.0	-3.0	-2.0	-3.0	-3.0	-1.0	-5.0	-20.E-6
10.3	15.5	-3.0	-2.0	-3.0	-3.0	-0.8	-5.0	-6.E-6
10.3	16.0	-3.0	-2.0	-3.0	-3.0	-0.7	-4.0	0.0
10.3	16.5	-3.0	-2.0	-3.0	-3.0	-0.6	-4.0	5.E-6
10.3	17.0	-3.0	-2.0	-3.0	-3.0	-0.5	-3.0	8.E-6
10.3	17.5	-3.0	-2.0	-3.0	-3.0	-0.4	-3.0	10.E-6
10.3	18.0	-3.0	-2.0	-3.0	-3.0	-0.3	-3.0	10.E-6
10.3	18.5	-3.0	-2.0	-3.0	-3.0	-0.3	-2.0	10.E-6
10.3	19.0	-3.0	-2.0	-3.0	-3.0	-0.2	-2.0	10.E-6
10.3	19.5	-3.0	-2.0	-3.0	-3.0	-0.2	-2.0	10.E-6
10.3	20.0	-3.0	-2.0	-3.0	-3.0	-0.1	-2.0	10.E-6
10.8	-10.0	-3.0	-2.0	-3.0	-3.0	-0.06	-1.0	10.E-6
10.8	-9.5	-3.0	-2.0	-3.0	-3.0	-0.07	-1.0	10.E-6
10.8	-9.0	-3.0	-2.0	-3.0	-3.0	-0.09	-1.0	10.E-6
10.8	-8.5	-3.0	-2.0	-3.0	-3.0	-0.1	-1.0	10.E-6
10.8	-8.0	-3.0	-2.0	-3.0	-3.0	-0.1	-2.0	10.E-6
10.8	-7.5	-3.0	-2.0	-3.0	-3.0	-0.2	-2.0	10.E-6
10.8	-7.0	-3.0	-2.0	-3.0	-3.0	-0.2	-2.0	10.E-6
10.8	-6.5	-3.0	-2.0	-3.0	-3.0	-0.2	-2.0	10.E-6
10.8	-6.0	-3.0	-2.0	-3.0	-3.0	-0.3	-2.0	10.E-6
10.8	-5.5	-3.0	-2.0	-3.0	-3.0	-0.4	-3.0	8.E-6
10.8	-5.0	-3.0	-2.0	-3.0	-3.0	-0.5	-3.0	4.E-6
10.8	-4.5	-3.0	-2.0	-3.0	-3.0	-0.6	-3.0	0.0
10.8	-4.0	-3.0	-2.0	-3.0	-3.0	-0.7	-4.0	-9.E-6
10.8	-3.5	-3.0	-2.0	-3.0	-3.0	-1.0	-4.0	-20.E-6
10.8	-3.0	-3.0	-2.0	-3.0	-3.0	-1.0	-5.0	-40.E-6
10.8	-2.5	-3.0	-2.0	-3.0	-3.0	-1.0	-6.0	-60.E-6
10.8	-2.0	-3.0	-2.0	-3.0	-3.0	-2.0	-7.0	-100.E-6
10.8	-1.5	-3.0	-2.0	-3.0	-3.0	-3.0	-8.0	-100.E-6
10.8	-1.0	-3.0	-2.0	-3.0	-3.0	-4.0	-9.0	-200.E-6
10.8	-0.5	-3.0	-2.0	-3.0	-3.0	-5.0	-10.0	-300.E-6
10.8	0.0	-3.0	-2.0	-3.0	-3.0	-6.0	-10.0	-300.E-6
10.8	0.5	-3.0	-2.0	-3.0	-3.0	-7.0	-10.0	-400.E-6
10.8	1.0	-3.0	-2.0	-3.0	-3.0	-8.0	-10.0	-500.E-6
10.8	1.5	-3.0	-2.0	-3.0	-3.0	-9.0	-20.0	-600.E-6
10.8	2.0	-3.0	-2.0	-3.0	-3.0	-9.0	-20.0	-600.E-6
10.8	2.5	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-600.E-6
10.8	3.0	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-700.E-6
10.8	3.5	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-700.E-6
10.8	4.0	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-700.E-6
10.8	4.5	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-700.E-6
10.8	5.0	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-700.E-6
10.8	5.5	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-700.E-6
10.8	6.0	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-700.E-6
10.8	6.5	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-700.E-6
10.8	7.0	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-700.E-6
10.8	7.5	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-700.E-6
10.8	8.0	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-600.E-6
10.8	8.5	-3.0	-2.0	-3.0	-3.0	-10.0	-20.0	-600.E-6
10.8	9.0	-3.0	-2.0	-3.0	-3.0	-9.0	-20.0	-600.E-6
10.8	9.5	-3.0	-2.0	-3.0	-3.0	-8.0	-20.0	-500.E-6
10.8	10.0	-3.0	-2.0	-3.0	-3.0	-7.0	-10.0	-400.E-6
10.8	10.5	-3.0	-2.0	-3.0	-3.0	-6.0	-10.0	-400.E-6
10.8	11.0	-3.0	-2.0	-3.0	-3.0	-5.0	-10.0	-300.E-6
10.8	11.5	-3.0	-2.0	-3.0	-3.0	-4.0	-10.0	-200.E-6
10.8	12.0	-3.0	-2.0	-3.0	-3.0	-3.0	-10.0	-200.E-6
10.8	12.5	-3.0	-2.0	-3.0	-3.0	-2.0	-9.0	-100.E-6
10.8	13.0	-3.0	-2.0	-3.0	-3.0	-2.0	-8.0	-80.E-6
10.8	13.5	-3.0	-2.0	-3.0	-3.0	-2.0	-7.0	-50.E-6
10.8	14.0	-3.0	-2.0	-3.0	-3.0	-1.0	-6.0	-30.E-6
10.8	14.5	-3.0	-2.0	-3.0	-3.0	-1.0	-5.0	-20.E-6
10.8	15.0	-3.0	-2.0	-3.0	-3.0	-0.9	-5.0	-8.E-6
10.8	15.5	-3.0	-2.0	-3.0	-3.0	-0.7	-4.0	0.0
10.8	16.0	-3.0	-2.0	-3.0	-3.0	-0.6	-4.0	5.E-6
10.8	16.5	-3.0	-2.0	-3.0	-3.0	-0.5	-3.0	8.E-6
10.8	17.0	-3.0	-2.0	-3.0	-3.0	-0.4	-3.0	10.E-6
10.8	17.5	-3.0	-2.0	-3.0	-3.0	-0.3	-3.0	10.E-6
10.8	18.0	-3.0	-2.0	-3.0	-3.0	-0.3	-2.0	10.E-6
10.8	18.5	-3.0	-2.0	-3.0	-3.0	-0.2	-2.0	10.E-6
10.8	19.0	-3.0	-2.0	-3.0	-3.0	-0.2	-2.0	10.E-6
10.8	19.5	-3.0	-2.0	-3.0	-3.0	-0.2	-2.0	10.E-6
10.8	20.0	-3.0	-2.0	-3.0	-3.0	-0.1	-2.0	10.E-6
11.4	-10.0	-3.0	-2.0	-3.0	-3.0	+0.06	-1.0	10.E-6
11.4	-9.5	-3.0	-2.0	-3.0	-3.0	-0.07	-1.0	10.E-6
11.4	-9.0	-3.0	-2.0	-3.0	-3.0	-0.08	-1.0	10.E-6
11.4	-8.5	-3.0	-2.0	-3.0	-3.0	-0.1	-1.0	10.E-6
11.4	-8.0	-3.0	-2.0	-3.0	-3.0	-0.1	-1.0	10.E-6
11.4	-7.5	-3.0	-2.0	-3.0	-3.0	-0.1	-2.0	10.E-6
11.4	-7.0	-3.0	-2.0	-3.0	-3.0	-0.2	-2.0	10.E-6
11.4	-6.5	-3.0	-2.0	-3.0	-3.0	-0.2	-2.0	10.E-6
11.4	-6.0	-3.0	-2.0	-3.0	-3.0	-0.3	-2.0	10.E-6
11.4	-5.5	-3.0	-2.0	-3.0	-3.0	-0.3	-2.0	9.E-6
11.4	-5.0	-3.0	-2.0	-3.0	-3.0	-0.4	-3.0	6.E-6
11.4	-4.5	-3.0	-2.0	-3.0	-3.0	-0.5	-3.0	2.E-6
11.4	-4.0	-3.0	-2.0	-3.0	-3.0	-0.6	-4.0	-4.E-6
11.4	-3.5	-3.0	-2.0	-3.0	-3.0	-0.8	-4.0	-10.E-6
11.4	-3.0	-3.0	-2.0	-3.0	-3.0	-1.0	-5.0	-30.E-6
11.4	-2.5	-3.0	-2.0	-3.0	-3.0	-1.0	-5.0	-40.E-6
11.4	-2.0	-3.0	-2.0	-3.0	-3.0	-2.0	-6.0	-70.E-6
11.4	-1.5	-3.0	-2.0	-3.0	-3.0	-2.0	-7.0	-100.E-6
11.4	-1.0	-3.0	-2.0	-3.0	-3.0	-3.0	-8.0	-100.E-6
11.4	-0.5	-3.0	-2.0	-3.0	-3.0	-4.0	-9.0	-200.E-6
11.4	0.0	-3.0	-2.0	-3.0	-3.0	-4.0	-10.0	-200.E-6
11.4	0.5	-3.0	-2.0	-3.0	-3.0	-5.0	-10.0	-300.E-6
11.4	1.0	-3.0	-2.0	-3.0	-3.0	-6.0	-10.0	-300.E-6
11.4	1.5	-3.0	-2.0	-3.0	-3.0	-7.0	-10.0	-400.E-6
11.4	2.0	-3.0	-2.0	-3.0	-3.0	-7.0	-10.0	-400.E-6
11.4	2.5	-3.0	-2.0	-3.0	-3.0	-7.0	-10.0	-400.E-6
11.4	3.0	-3.0	-2.0	-3.0	-3.0	-8.0	-20.0	-500.E-6
11.4	3.5	-3.0	-2.0	-3.0	-3.0	-8.0	-20.0	-500.E-6
11.4	4.0	-3.0	-2.0	-3.0	-3.0	-8.0	-20.0	-500.E-6
11.4	4.5	-3.0	-2.0	-3.0	-3.0	-8.0	-20.0	-500.E-6
11.4	5.0	-3.0	-2.0	-3.0	-3.0	-8.0	-20.0	-500.E-6
11.4	5.5	-3.0	-2.0	-3.0	-3.0	-8.0	-20.0	-500.E-6
11.4	6.0	-3.0	-2.0	-3.0	-3.0	-8.0	-20.0	-500.E-6
11.4	6.5	-3.0	-2.0	-3.0	-3.0	-8.0	-20.0	-500.E-6
11.4	7.0	-3.0	-2.0	-3.0	-3.0	-8.0	-20.0	-500.E-6
11.4	7.5	-3.0	-2.0	-3.0	-3.0	-8.0	-20.0	-500.E-6
11.4	8.0	-3.0	-2.0	-3.0	-3.0	-7.0	-10.0	-400.E-6
11.4	8.5	-3.0	-2.0	-3.0	-3.0	-7.0	-10.0	-400.E-6
11.4	9.0	-3.0	-2.0	-3.0	-3.0	-7.0	-10.0	-400.E-6
11.4	9.5</							

Name	X [m]	Location Y [m]	Z [Level] [mOD]	Z [mm]	Calc Level [mOD]	Vert Stress [kN/m <sup>2</sup> ]	Stresses Sum Princ [kN/m <sup>2</sup> ]	Vert Strain [-]
	11.9	12.5	-3.0	-2.1	-3.0	-2.1	-7.1	-50.E-6
	11.9	13.0	-3.0	-1.1	-3.0	-1.1	-6.1	-30.E-6
	11.9	13.5	-3.0	-1.1	-3.0	-1.1	-5.1	-20.E-6
	11.9	14.0	-3.0	-1.1	-3.0	-1.1	-4.1	-10.E-6
	11.9	14.5	-3.0	-1.1	-3.0	-1.1	-3.1	-2.E-6
	11.9	15.0	-3.0	-0.9	-3.0	-0.9	-4.1	3.E-6
	11.9	15.5	-3.0	-0.8	-3.0	-0.8	-4.1	7.E-6
	11.9	16.0	-3.0	-0.8	-3.0	-0.8	-4.1	10.E-6
	11.9	16.5	-3.0	-0.7	-3.0	-0.7	-3.1	10.E-6
	11.9	17.0	-3.0	-0.6	-3.0	-0.6	-3.1	10.E-6
	11.9	17.5	-3.0	-0.5	-3.0	-0.5	-2.1	10.E-6
	11.9	18.0	-3.0	-0.5	-3.0	-0.5	-2.1	10.E-6
	11.9	18.5	-3.0	-0.4	-3.0	-0.4	-2.1	10.E-6
	11.9	19.0	-3.0	-0.4	-3.0	-0.4	-2.1	10.E-6
	11.9	19.5	-3.0	-0.3	-3.0	-0.3	-2.1	10.E-6
	11.9	20.0	-3.0	-0.3	-3.0	-0.3	-1.1	10.E-6
	12.5	-10.0	-3.0	-0.1	-3.0	-0.05	-0.9	9.E-6
	12.5	-9.5	-3.0	-0.2	-3.0	-0.06	-1.1	10.E-6
	12.5	-9.0	-3.0	-0.2	-3.0	-0.07	-1.1	10.E-6
	12.5	-8.5	-3.0	-0.2	-3.0	-0.08	-1.1	10.E-6
	12.5	-8.0	-3.0	-0.2	-3.0	-0.1	-1.1	10.E-6
	12.5	-7.5	-3.0	-0.3	-3.0	-0.1	-1.1	10.E-6
	12.5	-7.0	-3.0	-0.3	-3.0	-0.1	-2.1	10.E-6
	12.5	-6.5	-3.0	-0.4	-3.0	-0.2	-2.1	10.E-6
	12.5	-6.0	-3.0	-0.4	-3.0	-0.2	-2.1	10.E-6
	12.5	-5.5	-3.0	-0.5	-3.0	-0.2	-2.1	10.E-6
	12.5	-5.0	-3.0	-0.5	-3.0	-0.3	-2.1	9.E-6
	12.5	-4.5	-3.0	-0.4	-3.0	-0.4	-3.1	7.E-6
	12.5	-4.0	-3.0	-0.7	-3.0	-0.5	-3.1	4.E-6
	12.5	-3.5	-3.0	-0.8	-3.0	-0.6	-3.1	-1.E-6
	12.5	-3.0	-3.0	-0.9	-3.0	-0.7	-4.1	-8.E-6
	12.5	-2.5	-3.0	-0.9	-3.0	-0.9	-4.1	-10.E-6
	12.5	-2.0	-3.0	-1.1	-3.0	-1.1	-5.1	-30.E-6
	12.5	-1.5	-3.0	-1.1	-3.0	-1.1	-5.1	-40.E-6
	12.5	-1.0	-3.0	-1.1	-3.0	-2.1	-6.1	-60.E-6
	12.5	-0.5	-3.0	-2.1	-3.0	-2.1	-7.1	-80.E-6
	12.5	0.0	-3.0	-2.1	-3.0	-2.1	-7.1	-100.E-6
	12.5	0.5	-3.0	-2.1	-3.0	-3.1	-8.1	-100.E-6
	12.5	1.0	-3.0	-2.1	-3.0	-3.1	-9.1	-100.E-6
	12.5	1.5	-3.0	-2.1	-3.0	-3.1	-9.1	-200.E-6
	12.5	2.0	-3.0	-2.1	-3.0	-3.1	-10.1	-200.E-6
	12.5	2.5	-3.0	-2.1	-3.0	-4.1	-10.1	-200.E-6
	12.5	3.0	-3.0	-3.1	-3.0	-4.1	-10.1	-200.E-6
	12.5	3.5	-3.0	-3.1	-3.0	-4.1	-10.1	-200.E-6
	12.5	4.0	-3.0	-3.1	-3.0	-4.1	-10.1	-200.E-6
	12.5	4.5	-3.0	-3.1	-3.0	-4.1	-10.1	-200.E-6
	12.5	5.0	-3.0	-3.1	-3.0	-4.1	-10.1	-200.E-6
	12.5	5.5	-3.0	-3.1	-3.0	-4.1	-10.1	-200.E-6
	12.5	6.0	-3.0	-3.1	-3.0	-4.1	-10.1	-200.E-6
	12.5	6.5	-3.0	-3.1	-3.0	-4.1	-10.1	-200.E-6
	12.5	7.0	-3.0	-3.1	-3.0	-4.1	-10.1	-200.E-6
	12.5	7.5	-3.0	-3.1	-3.0	-4.1	-10.1	-200.E-6
	12.5	8.0	-3.0	-3.1	-3.0	-4.1	-10.1	-200.E-6
	12.5	8.5	-3.0	-3.1	-3.0	-4.1	-10.1	-200.E-6
	12.5	9.0	-3.0	-2.1	-3.0	-3.1	-10.1	-200.E-6
	12.5	9.5	-3.0	-2.1	-3.0	-3.1	-9.1	-100.E-6
	12.5	10.0	-3.0	-2.1	-3.0	-3.1	-9.1	-100.E-6
	12.5	10.5	-3.0	-2.1	-3.0	-3.1	-8.1	-100.E-6
	12.5	11.0	-3.0	-2.1	-3.0	-2.1	-8.1	-80.E-6
	12.5	11.5	-3.0	-2.1	-3.0	-2.1	-7.1	-60.E-6
	12.5	12.0	-3.0	-2.1	-3.0	-2.1	-6.1	-50.E-6
	12.5	12.5	-3.0	-1.1	-3.0	-1.1	-6.1	-30.E-6
	12.5	13.0	-3.0	-1.1	-3.0	-1.1	-5.1	-20.E-6
	12.5	13.5	-3.0	-1.1	-3.0	-0.9	-5.1	-10.E-6
	12.5	14.0	-3.0	-0.9	-3.0	-0.7	-4.1	-2.E-6
	12.5	14.5	-3.0	-0.9	-3.0	-0.6	-4.1	3.E-6
	12.5	15.0	-3.0	-0.8	-3.0	-0.5	-4.1	7.E-6
	12.5	15.5	-3.0	-0.8	-3.0	-0.4	-3.1	10.E-6
	12.5	16.0	-3.0	-0.7	-3.0	-0.4	-3.1	10.E-6
	12.5	16.5	-3.0	-0.6	-3.0	-0.3	-3.1	10.E-6
	12.5	17.0	-3.0	-0.5	-3.0	-0.3	-2.1	10.E-6
	12.5	17.5	-3.0	-0.5	-3.0	-0.2	-2.1	10.E-6
	12.5	18.0	-3.0	-0.4	-3.0	-0.2	-2.1	10.E-6
	12.5	18.5	-3.0	-0.4	-3.0	-0.2	-2.1	10.E-6
	12.5	19.0	-3.0	-0.3	-3.0	-0.1	-2.1	10.E-6
	12.5	19.5	-3.0	-0.3	-3.0	-0.1	-2.1	10.E-6
	13.0	-10.0	-3.0	-0.1	-3.0	-0.05	-0.9	9.E-6
	13.0	-9.5	-3.0	-0.1	-3.0	-0.06	-1.1	10.E-6
	13.0	-9.0	-3.0	-0.1	-3.0	-0.06	-1.1	10.E-6
	13.0	-8.5	-3.0	-0.2	-3.0	-0.08	-1.1	10.E-6
	13.0	-8.0	-3.0	-0.2	-3.0	-0.09	-1.1	10.E-6
	13.0	-7.5	-3.0	-0.3	-3.0	-0.1	-1.1	10.E-6
	13.0	-7.0	-3.0	-0.3	-3.0	-0.1	-2.1	10.E-6
	13.0	-6.5	-3.0	-0.3	-3.0	-0.1	-2.1	10.E-6
	13.0	-6.0	-3.0	-0.4	-3.0	-0.2	-2.1	10.E-6
	13.0	-5.5	-3.0	-0.4	-3.0	-0.2	-2.1	10.E-6
	13.0	-5.0	-3.0	-0.4	-3.0	-0.3	-2.1	10.E-6
	13.0	-4.5	-3.0	-0.6	-3.0	-0.3	-2.1	9.E-6
	13.0	-4.0	-3.0	-0.6	-3.0	-0.4	-3.1	6.E-6
	13.0	-3.5	-3.0	-0.7	-3.0	-0.5	-3.1	3.E-6
	13.0	-3.0	-3.0	-0.6	-3.0	-0.6	-3.1	-1.E-6
	13.0	-2.5	-3.0	-0.9	-3.0	-0.7	-4.1	-7.E-6
	13.0	-2.0	-3.0	-1.1	-3.0	-0.9	-4.1	-10.E-6
	13.0	-1.5	-3.0	-1.1	-3.0	-1.1	-5.1	-20.E-6
	13.0	-1.0	-3.0	-1.1	-3.0	-1.1	-5.1	-30.E-6
	13.0	-0.5	-3.0	-1.1	-3.0	-1.1	-6.1	-50.E-6
	13.0	0.0	-3.0	-1.1	-3.0	-2.1	-6.1	-60.E-6
	13.0	0.5	-3.0	-2.1	-3.0	-2.1	-7.1	-70.E-6
	13.0	1.0	-3.0	-2.1	-3.0	-2.1	-7.1	-80.E-6
	13.0	1.5	-3.0	-2.1	-3.0	-2.1	-8.1	-100.E-6
	13.0	2.0	-3.0	-2.1	-3.0	-2.1	-8.1	-100.E-6
	13.0	2.5	-3.0	-2.1	-3.0	-3.1	-8.1	-100.E-6
	13.0	3.0	-3.0	-2.1	-3.0	-3.1	-9.1	-100.E-6
	13.0	3.5	-3.0	-2.1	-3.0	-3.1	-9.1	-100.E-6
	13.0	4.0	-3.0	-2.1	-3.0	-3.1	-9.1	-100.E-6
	13.0	4.5	-3.0	-2.1	-3.0	-3.1	-9.1	-100.E-6
	13.0	5.0	-3.0	-2.1	-3.0	-3.1	-9.1	-100.E-6
	13.0	5.5	-3.0	-2.1	-3.0	-3.1	-10.1	-100.E-6
	13.0	6.0	-3.0	-2.1	-3.0	-3.1	-10.1	-100.E-6
	13.0	6.5	-3.0	-2.1	-3.0	-3.1	-9.1	-100.E-6
	13.0	7.0	-3.0	-2.1	-3.0	-3.1	-9.1	-100.E-6
	13.0	7.5	-3.0	-2.1	-3.0	-3.1	-9.1	-100.E-6
	13.0	8.0	-3.0	-2.1	-3.0	-3.1	-9.1	-100.E-6
	13.0	8.5	-3.0	-2.1	-3.0	-3.1	-9.1	-100.E-6
	13.0	9.0	-3.0	-2.1	-3.0	-2.1	-8.1	-100.E-6
	13.0	9.5	-3.0	-2.1	-3.0	-2.1	-8.1	-90.E-6
	13.0	10.0	-3.0	-2.1	-3.0	-2.1	-7.1	-70.E-6
	13.0	10.5	-3.0	-2.1	-3.0	-2.1	-7.1	-60.E-6
	13.0	11.0	-3.0	-2.1	-3.0	-2.1	-6.1	-50.E-6
	13.0	11.5	-3.0	-1.1	-3.0	-1.1	-6.1	-40.E-6
	13.0	12.0	-3.0	-1.1	-3.0	-1.1	-6.1	-30.E-6
	13.0	12.5	-3.0	-1.1	-3.0	-1.1	-5.1	-20.E-6
	13.0	13.0	-3.0	-0.9	-3.0	-0.9	-5.1	-8.E-6
	13.0	13.5	-3.0	-1.1	-3.0	-0.7	-4.1	-2.E-6
	13.0	14.0	-3.0	-0.9	-3.0	-0.6	-4.1	3.E-6
	13.0	14.5	-3.0	-0.8	-3.0	-0.5	-4.1	7.E-6
	13.0	15.0	-3.0	-0.8	-3.0	-0.4	-3.1	10.E-6
	13.0	15.5	-3.0	-0.7	-3.0	-0.4	-3.1	10.E-6
	13.0	16.0	-3.0	-0.6	-3.0	-0.3	-3.1	10.E-6
	13.0	16.5	-3.0	-0.5	-3.0	-0.3	-2.1	10.E-6
	13.0	17.0	-3.0	-0.5	-3.0	-0.2	-2.1	10.E-6
	13.0	17.5	-3.0	-0.4	-3.0	-0.2	-2.1	10.E-6
	13.0	18.0	-3.0	-0.4	-3.0	-0.2	-2.1	10.E-6
	13.0	18.5	-3.0	-0.3	-3.0	-0.1	-2.1	10.E-6
	13.0	19.0	-3.0	-0.3	-3.0	-0.1	-2.1	10.E-6
	13.0	19.5	-3.0	-0.3	-3.0	-0.1	-1.1	10.E-6
	13.0	20.0	-3.0	-0.2	-3.0	-0.09	-1.1	10.E-6
	13.6	-10.0	-3.0	-0.1	-3.0	-0.04	-0.8	9.E-6
	13.6	-9.5	-3.0	-0.1	-3.0	-0.05	-0.9	9.E-6
	13.6	-9.0	-3.0	-0.2	-3.0	-0.06	-1.1	10.E-6
	13.6	-8.5	-3.0	-0.2	-3.0	-0.07	-1.1	10.E-6
	13.6	-8.0	-3.0	-0.2	-3.0	-0.08	-1.1	10.E-6
	13.6	-7.5	-3.0	-0.2	-3.0	-0.1	-1.1	10.E-6
	13.6	-7.0	-3.0	-0.3	-3.0	-0.1	-1.1	10.E-6
	13.6	-6.5	-3.0	-0.3	-3.0	-0.1	-2.1	10.E-6
	13.6	-6.0	-3.0	-0.3	-3.0	-0.2	-2.1	10.E-6
	13.6	-5.5	-3.0	-0.4	-3.0	-0.2	-2.1	10.E-6
	13.6	-5.0	-3.0	-0.4	-3.0	-0.2	-2.1	10.E-6
	13.6	-4.5	-3.0	-0.5	-3.0	-0.3	-2.1	10.E-6
	13.6	-4.0	-3.0	-0.6	-3.0	-0.3	-3.1	8.E-6
	13.6	-3.5	-3.0	-0.6	-3.0	-0.4	-3.1	6.E-6
	13.6	-3.0	-3.0	-0.7	-3.0	-0.5	-3.1	4.E-6
	13.6	-2.5	-3.0	-0.8	-3.0	-0.6	-3.1	0.0
	13.6	-2.0	-3.0	-0.9	-3.0	-0.7	-4.1	-5.E-6
	13.6	-1.5	-3.0	-1.1	-3.0	-0.8	-4.1	-10.E-6
	13.6	-1.0	-3.0	-1.1</				

Name	X [m]	Location Y [m]	Z [Level] [mOD]	Z [mm]	Calc Level [mOD]	Vert Stress [kN/m <sup>2</sup> ]	Stresses Sum Princ [kN/m <sup>2</sup> ]	Vert Strain [-]
14.1	-3.0	-3.0	-3.0	-0.6	-3.0	-0.4	-3.0	7.E-6
14.1	-2.5	-3.0	-3.0	-0.7	-3.0	-0.5	-3.0	5.E-6
14.1	-2.0	-3.0	-3.0	-0.8	-3.0	-0.5	-3.0	2.E-6
14.1	-1.5	-3.0	-3.0	-0.8	-3.0	-0.6	-3.0	-2.E-6
14.1	-1.0	-3.0	-3.0	-0.9	-3.0	-0.7	-4.0	-6.E-6
14.1	-0.5	-3.0	-3.0	-1.0	-3.0	-0.8	-4.0	-10.E-6
14.1	0.0	-3.0	-3.0	-1.1	-3.0	-0.9	-5.0	-10.E-6
14.1	0.5	-3.0	-3.0	-1.1	-3.0	-1.0	-5.0	-20.E-6
14.1	1.0	-3.0	-3.0	-1.1	-3.0	-1.1	-5.0	-20.E-6
14.1	1.5	-3.0	-3.0	-1.1	-3.0	-1.1	-5.0	-30.E-6
14.1	2.0	-3.0	-3.0	-1.1	-3.0	-1.1	-6.0	-30.E-6
14.1	2.5	-3.0	-3.0	-1.1	-3.0	-1.1	-6.0	-30.E-6
14.1	3.0	-3.0	-3.0	-1.1	-3.0	-1.1	-6.0	-40.E-6
14.1	3.5	-3.0	-3.0	-1.1	-3.0	-1.1	-6.0	-40.E-6
14.1	4.0	-3.0	-3.0	-1.1	-3.0	-1.1	-6.0	-40.E-6
14.1	4.5	-3.0	-3.0	-1.1	-3.0	-1.1	-6.0	-40.E-6
14.1	5.0	-3.0	-3.0	-1.1	-3.0	-1.1	-6.0	-40.E-6
14.1	5.5	-3.0	-3.0	-1.1	-3.0	-1.1	-6.0	-40.E-6
14.1	6.0	-3.0	-3.0	-1.1	-3.0	-1.1	-6.0	-40.E-6
14.1	6.5	-3.0	-3.0	-1.1	-3.0	-1.1	-6.0	-40.E-6
14.1	7.0	-3.0	-3.0	-1.1	-3.0	-1.1	-6.0	-40.E-6
14.1	7.5	-3.0	-3.0	-1.1	-3.0	-1.1	-6.0	-40.E-6
14.1	8.0	-3.0	-3.0	-1.1	-3.0	-1.1	-6.0	-30.E-6
14.1	8.5	-3.0	-3.0	-1.1	-3.0	-1.1	-6.0	-30.E-6
14.1	9.0	-3.0	-3.0	-1.1	-3.0	-1.1	-6.0	-30.E-6
14.1	9.5	-3.0	-3.0	-1.1	-3.0	-1.1	-6.0	-20.E-6
14.1	10.0	-3.0	-3.0	-1.1	-3.0	-1.1	-5.0	-20.E-6
14.1	10.5	-3.0	-3.0	-1.1	-3.0	-1.1	-5.0	-10.E-6
14.1	11.0	-3.0	-3.0	-1.1	-3.0	-0.9	-5.0	-10.E-6
14.1	11.5	-3.0	-3.0	-1.1	-3.0	-0.8	-4.0	-5.E-6
14.1	12.0	-3.0	-3.0	-1.1	-3.0	-0.7	-4.0	-1.E-6
14.1	12.5	-3.0	-3.0	-0.9	-3.0	-0.6	-4.0	2.E-6
14.1	13.0	-3.0	-3.0	-0.9	-3.0	-0.5	-4.0	6.E-6
14.1	13.5	-3.0	-3.0	-0.8	-3.0	-0.5	-3.0	8.E-6
14.1	14.0	-3.0	-3.0	-0.7	-3.0	-0.4	-3.0	10.E-6
14.1	14.5	-3.0	-3.0	-0.7	-3.0	-0.3	-3.0	10.E-6
14.1	15.0	-3.0	-3.0	-0.6	-3.0	-0.3	-3.0	10.E-6
14.1	15.5	-3.0	-3.0	-0.5	-3.0	-0.3	-2.0	10.E-6
14.1	16.0	-3.0	-3.0	-0.5	-3.0	-0.2	-2.0	10.E-6
14.1	16.5	-3.0	-3.0	-0.4	-3.0	-0.2	-2.0	10.E-6
14.1	17.0	-3.0	-3.0	-0.4	-3.0	-0.2	-2.0	10.E-6
14.1	17.5	-3.0	-3.0	-0.4	-3.0	-0.1	-2.0	10.E-6
14.1	18.0	-3.0	-3.0	-0.3	-3.0	-0.1	-2.0	10.E-6
14.1	18.5	-3.0	-3.0	-0.3	-3.0	-0.1	-1.0	10.E-6
14.1	19.0	-3.0	-3.0	-0.3	-3.0	-0.09	-1.0	10.E-6
14.1	19.5	-3.0	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6
14.1	20.0	-3.0	-3.0	-0.2	-3.0	-0.07	-1.0	10.E-6
14.7	-10.0	-3.0	-3.0	-0.04	-3.0	-0.04	0.8	9.E-6
14.7	-9.5	-3.0	-3.0	-0.1	-3.0	-0.04	0.8	9.E-6
14.7	-9.0	-3.0	-3.0	-0.1	-3.0	-0.05	0.9	9.E-6
14.7	-8.5	-3.0	-3.0	-0.2	-3.0	-0.06	1.0	10.E-6
14.7	-8.0	-3.0	-3.0	-0.2	-3.0	-0.07	1.0	10.E-6
14.7	-7.5	-3.0	-3.0	-0.2	-3.0	-0.08	1.0	10.E-6
14.7	-7.0	-3.0	-3.0	-0.2	-3.0	-0.09	1.0	10.E-6
14.7	-6.5	-3.0	-3.0	-0.3	-3.0	-0.1	1.0	10.E-6
14.7	-6.0	-3.0	-3.0	-0.3	-3.0	-0.1	1.0	10.E-6
14.7	-5.5	-3.0	-3.0	-0.3	-3.0	-0.1	2.0	10.E-6
14.7	-5.0	-3.0	-3.0	-0.4	-3.0	-0.2	2.0	10.E-6
14.7	-4.5	-3.0	-3.0	-0.4	-3.0	-0.2	2.0	10.E-6
14.7	-4.0	-3.0	-3.0	-0.4	-3.0	-0.2	2.0	10.E-6
14.7	-3.5	-3.0	-3.0	-0.5	-3.0	-0.3	2.0	10.E-6
14.7	-3.0	-3.0	-3.0	-0.6	-3.0	-0.3	2.0	9.E-6
14.7	-2.5	-3.0	-3.0	-0.6	-3.0	-0.4	3.0	8.E-6
14.7	-2.0	-3.0	-3.0	-0.7	-3.0	-0.4	3.0	6.E-6
14.7	-1.5	-3.0	-3.0	-0.7	-3.0	-0.5	3.0	4.E-6
14.7	-1.0	-3.0	-3.0	-0.8	-3.0	-0.5	3.0	2.E-6
14.7	-0.5	-3.0	-3.0	-0.9	-3.0	-0.6	4.0	0.0
14.7	0.0	-3.0	-3.0	-0.9	-3.0	-0.7	4.0	-4.E-6
14.7	0.5	-3.0	-3.0	-1.0	-3.0	-0.8	4.0	-6.E-6
14.7	1.0	-3.0	-3.0	-1.0	-3.0	-0.8	4.0	-9.E-6
14.7	1.5	-3.0	-3.0	-1.1	-3.0	-0.9	5.0	-10.E-6
14.7	2.0	-3.0	-3.0	-1.1	-3.0	-1.0	5.0	-10.E-6
14.7	2.5	-3.0	-3.0	-1.1	-3.0	-1.1	5.0	-20.E-6
14.7	3.0	-3.0	-3.0	-1.1	-3.0	-1.1	5.0	-20.E-6
14.7	3.5	-3.0	-3.0	-1.1	-3.0	-1.1	5.0	-20.E-6
14.7	4.0	-3.0	-3.0	-1.1	-3.0	-1.1	5.0	-20.E-6
14.7	4.5	-3.0	-3.0	-1.1	-3.0	-1.1	6.0	-20.E-6
14.7	5.0	-3.0	-3.0	-1.1	-3.0	-1.1	6.0	-20.E-6
14.7	5.5	-3.0	-3.0	-1.1	-3.0	-1.1	6.0	-20.E-6
14.7	6.0	-3.0	-3.0	-1.1	-3.0	-1.1	6.0	-20.E-6
14.7	6.5	-3.0	-3.0	-1.1	-3.0	-1.1	6.0	-20.E-6
14.7	7.0	-3.0	-3.0	-1.1	-3.0	-1.1	6.0	-20.E-6
14.7	7.5	-3.0	-3.0	-1.1	-3.0	-1.1	6.0	-20.E-6
14.7	8.0	-3.0	-3.0	-1.1	-3.0	-1.1	6.0	-20.E-6
14.7	8.5	-3.0	-3.0	-1.1	-3.0	-1.1	6.0	-20.E-6
14.7	9.0	-3.0	-3.0	-1.1	-3.0	-1.1	6.0	-20.E-6
14.7	9.5	-3.0	-3.0	-1.1	-3.0	-0.9	5.0	-9.E-6
14.7	10.0	-3.0	-3.0	-1.1	-3.0	-0.8	5.0	-6.E-6
14.7	10.5	-3.0	-3.0	-1.1	-3.0	-0.8	4.0	-3.E-6
14.7	11.0	-3.0	-3.0	-1.1	-3.0	-0.7	4.0	0.0
14.7	11.5	-3.0	-3.0	-0.9	-3.0	-0.6	4.0	3.E-6
14.7	12.0	-3.0	-3.0	-0.9	-3.0	-0.5	4.0	5.E-6
14.7	12.5	-3.0	-3.0	-0.8	-3.0	-0.5	3.0	7.E-6
14.7	13.0	-3.0	-3.0	-0.7	-3.0	-0.4	3.0	9.E-6
14.7	13.5	-3.0	-3.0	-0.7	-3.0	-0.4	3.0	10.E-6
14.7	14.0	-3.0	-3.0	-0.6	-3.0	-0.3	3.0	10.E-6
14.7	14.5	-3.0	-3.0	-0.6	-3.0	-0.3	3.0	10.E-6
14.7	15.0	-3.0	-3.0	-0.5	-3.0	-0.2	2.0	10.E-6
14.7	15.5	-3.0	-3.0	-0.5	-3.0	-0.2	2.0	10.E-6
14.7	16.0	-3.0	-3.0	-0.4	-3.0	-0.2	2.0	10.E-6
14.7	16.5	-3.0	-3.0	-0.4	-3.0	-0.2	2.0	10.E-6
14.7	17.0	-3.0	-3.0	-0.4	-3.0	-0.1	2.0	10.E-6
14.7	17.5	-3.0	-3.0	-0.3	-3.0	-0.1	2.0	10.E-6
14.7	18.0	-3.0	-3.0	-0.3	-3.0	-0.1	2.0	10.E-6
14.7	18.5	-3.0	-3.0	-0.3	-3.0	-0.09	1.0	10.E-6
14.7	19.0	-3.0	-3.0	-0.2	-3.0	-0.08	1.0	10.E-6
14.7	19.5	-3.0	-3.0	-0.2	-3.0	-0.07	1.0	10.E-6
14.7	20.0	-3.0	-3.0	-0.2	-3.0	-0.06	1.0	10.E-6
15.2	-10.0	-3.0	-3.0	-0.09	-3.0	-0.03	0.7	8.E-6
15.2	-9.5	-3.0	-3.0	-0.1	-3.0	-0.04	0.8	8.E-6
15.2	-9.0	-3.0	-3.0	-0.1	-3.0	-0.05	0.9	9.E-6
15.2	-8.5	-3.0	-3.0	-0.1	-3.0	-0.05	0.9	9.E-6
15.2	-8.0	-3.0	-3.0	-0.2	-3.0	-0.06	1.0	10.E-6
15.2	-7.5	-3.0	-3.0	-0.2	-3.0	-0.07	1.0	10.E-6
15.2	-7.0	-3.0	-3.0	-0.2	-3.0	-0.08	1.0	10.E-6
15.2	-6.5	-3.0	-3.0	-0.3	-3.0	-0.09	1.0	10.E-6
15.2	-6.0	-3.0	-3.0	-0.3	-3.0	-0.1	1.0	10.E-6
15.2	-5.5	-3.0	-3.0	-0.3	-3.0	-0.1	1.0	10.E-6
15.2	-5.0	-3.0	-3.0	-0.3	-3.0	-0.1	2.0	10.E-6
15.2	-4.5	-3.0	-3.0	-0.4	-3.0	-0.2	2.0	10.E-6
15.2	-4.0	-3.0	-3.0	-0.4	-3.0	-0.2	2.0	10.E-6
15.2	-3.5	-3.0	-3.0	-0.4	-3.0	-0.2	2.0	10.E-6
15.2	-3.0	-3.0	-3.0	-0.5	-3.0	-0.3	2.0	10.E-6
15.2	-2.5	-3.0	-3.0	-0.5	-3.0	-0.3	2.0	10.E-6
15.2	-2.0	-3.0	-3.0	-0.6	-3.0	-0.3	3.0	9.E-6
15.2	-1.5	-3.0	-3.0	-0.6	-3.0	-0.4	3.0	8.E-6
15.2	-1.0	-3.0	-3.0	-0.7	-3.0	-0.4	3.0	7.E-6
15.2	-0.5	-3.0	-3.0	-0.7	-3.0	-0.5	3.0	5.E-6
15.2	0.0	-3.0	-3.0	-0.8	-3.0	-0.5	3.0	3.E-6
15.2	0.5	-3.0	-3.0	-0.9	-3.0	-0.6	4.0	2.E-6
15.2	1.0	-3.0	-3.0	-0.9	-3.0	-0.6	4.0	0.0
15.2	1.5	-3.0	-3.0	-1.0	-3.0	-0.7	4.0	-1.E-6
15.2	2.0	-3.0	-3.0	-1.0	-3.0	-0.7	4.0	-2.E-6
15.2	2.5	-3.0	-3.0	-1.1	-3.0	-0.8	4.0	-3.E-6
15.2	3.0	-3.0	-3.0	-1.1	-3.0	-0.8	4.0	-4.E-6
15.2	3.5	-3.0	-3.0	-1.1	-3.0	-0.8	5.0	-5.E-6
15.2	4.0	-3.0	-3.0	-1.1	-3.0	-0.8	5.0	-6.E-6
15.2	4.5	-3.0	-3.0	-1.1	-3.0	-0.9	5.0	-6.E-6
15.2	5.0	-3.0	-3.0	-1.1	-3.0	-0.9	5.0	-6.E-6
15.2	5.5	-3.0	-3.0	-1.1	-3.0	-0.9	5.0	-6.E-6
15.2	6.0	-3.0	-3.0	-1.1	-3.0	-0.9	5.0	-6.E-6
15.2	6.5	-3.0	-3.0	-1.1	-3.0	-0.9	5.0	-5.E-6
15.2	7.0	-3.0	-3.0	-1.1	-3.0	-0.8	5.0	-5.E-6
15.2	7.5	-3.0	-3.0	-1.1	-3.0	-0.8	5.0	-4.E-6
15.2	8.0	-3.0	-3.0	-1.1	-3.0	-0.8	5.0	-3.E-6
15.2	8.5	-3.0	-3.0	-1.1	-3.0	-0.8	4.0	-2.E-6
15.2	9.0	-3.0	-3.0	-1.1	-3.0	-0.7	4.0	0.0
15.2	9.5	-3.0	-3.0	-1.1	-3.0	-0.7	4.0	1.E-6
15.2	10.							

Job No.	Sheet No.	Rev.
112131		
Drg. Ref.		
Made by	Date	Checked

Name	X [m]	Location Y [m]	Z [Level] [mGD]	Z [mm]	Calc Level [mGD]	Vert Stress [kN/m <sup>2</sup> ]	Stresses Sum Princ [kN/m <sup>2</sup> ]	Vert Strain [-]
	15.8	12.0	-3.0	-0.6	-3.	-0.3	-3.	10.E-6
	15.8	12.5	-3.0	-0.6	-3.	-0.3	-3.	10.E-6
	15.8	13.0	-3.0	-0.6	-3.	-0.3	-3.	10.E-6
	15.8	13.5	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
	15.8	14.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
	15.8	14.5	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
	15.8	15.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
	15.8	15.5	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
	15.8	16.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
	15.8	16.5	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
	15.8	17.0	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
	15.8	17.5	-3.0	-0.3	-3.	-0.09	-1.	10.E-6
	15.8	18.0	-3.0	-0.2	-3.	-0.08	-1.	10.E-6
	15.8	18.5	-3.0	-0.2	-3.	-0.07	-1.	10.E-6
	15.8	19.0	-3.0	-0.2	-3.	-0.06	-1.	10.E-6
	15.8	19.5	-3.0	-0.2	-3.	-0.06	-1.	10.E-6
	15.8	20.0	-3.0	-0.1	-3.	-0.05	-1.	10.E-6
	16.3	-10.0	-3.0	-0.08	-3.	-0.03	-0.7	8.E-6
	16.3	-9.5	-3.0	-0.09	-3.	-0.03	-0.7	8.E-6
	16.3	-9.0	-3.0	-0.1	-3.	-0.04	-0.8	8.E-6
	16.3	-8.5	-3.0	-0.1	-3.	-0.04	-0.8	9.E-6
	16.3	-8.0	-3.0	-0.1	-3.	-0.05	-0.9	9.E-6
	16.3	-7.5	-3.0	-0.1	-3.	-0.05	-0.9	9.E-6
	16.3	-7.0	-3.0	-0.2	-3.	-0.06	-1.	10.E-6
	16.3	-6.5	-3.0	-0.2	-3.	-0.07	-1.	10.E-6
	16.3	-6.0	-3.0	-0.2	-3.	-0.08	-1.	10.E-6
	16.3	-5.5	-3.0	-0.2	-3.	-0.09	-1.	10.E-6
	16.3	-5.0	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
	16.3	-4.5	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
	16.3	-4.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
	16.3	-3.5	-3.0	-0.3	-3.	-0.2	-2.	10.E-6
	16.3	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
	16.3	-2.5	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
	16.3	-2.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
	16.3	-1.5	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
	16.3	-1.0	-3.0	-0.5	-3.	-0.3	-2.	10.E-6
	16.3	-0.5	-3.0	-0.6	-3.	-0.3	-2.	10.E-6
	16.3	0.0	-3.0	-0.6	-3.	-0.3	-3.	10.E-6
	16.3	0.5	-3.0	-0.6	-3.	-0.3	-3.	10.E-6
	16.3	1.0	-3.0	-0.7	-3.	-0.4	-3.	10.E-6
	16.3	1.5	-3.0	-0.7	-3.	-0.4	-3.	9.E-6
	16.3	2.0	-3.0	-0.7	-3.	-0.4	-3.	9.E-6
	16.3	2.5	-3.0	-0.8	-3.	-0.4	-3.	9.E-6
	16.3	3.0	-3.0	-0.8	-3.	-0.5	-3.	8.E-6
	16.3	3.5	-3.0	-0.8	-3.	-0.5	-3.	8.E-6
	16.3	4.0	-3.0	-0.8	-3.	-0.5	-3.	8.E-6
	16.3	4.5	-3.0	-0.8	-3.	-0.5	-3.	8.E-6
	16.3	5.0	-3.0	-0.8	-3.	-0.5	-4.	8.E-6
	16.3	5.5	-3.0	-0.8	-3.	-0.5	-4.	8.E-6
	16.3	6.0	-3.0	-0.8	-3.	-0.5	-4.	8.E-6
	16.3	6.5	-3.0	-0.8	-3.	-0.5	-4.	8.E-6
	16.3	7.0	-3.0	-0.8	-3.	-0.5	-3.	9.E-6
	16.3	7.5	-3.0	-0.8	-3.	-0.5	-3.	9.E-6
	16.3	8.0	-3.0	-0.8	-3.	-0.5	-3.	9.E-6
	16.3	8.5	-3.0	-0.8	-3.	-0.4	-3.	10.E-6
	16.3	9.0	-3.0	-0.8	-3.	-0.4	-3.	10.E-6
	16.3	9.5	-3.0	-0.7	-3.	-0.4	-3.	10.E-6
	16.3	10.0	-3.0	-0.7	-3.	-0.4	-3.	10.E-6
	16.3	10.5	-3.0	-0.7	-3.	-0.4	-3.	10.E-6
	16.3	11.0	-3.0	-0.6	-3.	-0.3	-3.	10.E-6
	16.3	11.5	-3.0	-0.6	-3.	-0.3	-3.	10.E-6
	16.3	12.0	-3.0	-0.6	-3.	-0.3	-2.	10.E-6
	16.3	12.5	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
	16.3	13.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
	16.3	13.5	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
	16.3	14.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
	16.3	14.5	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
	16.3	15.0	-3.0	-0.4	-3.	-0.1	-2.	10.E-6
	16.3	15.5	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
	16.3	16.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
	16.3	16.5	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
	16.3	17.0	-3.0	-0.2	-3.	-0.09	-1.	10.E-6
	16.3	17.5	-3.0	-0.2	-3.	-0.08	-1.	10.E-6
	16.3	18.0	-3.0	-0.2	-3.	-0.07	-1.	10.E-6
	16.3	18.5	-3.0	-0.2	-3.	-0.06	-1.	10.E-6
	16.3	19.0	-3.0	-0.2	-3.	-0.06	-1.	10.E-6
	16.3	19.5	-3.0	-0.1	-3.	-0.05	-1.	10.E-6
	16.3	20.0	-3.0	-0.1	-3.	-0.05	-0.9	10.E-6
	16.8	-10.0	-3.0	-0.07	-3.	-0.03	-0.6	7.E-6
	16.8	-9.5	-3.0	-0.08	-3.	-0.03	-0.7	8.E-6
	16.8	-9.0	-3.0	-0.09	-3.	-0.03	-0.7	8.E-6
	16.8	-8.5	-3.0	-0.1	-3.	-0.04	-0.8	8.E-6
	16.8	-8.0	-3.0	-0.1	-3.	-0.04	-0.8	9.E-6
	16.8	-7.5	-3.0	-0.1	-3.	-0.05	-0.9	9.E-6
	16.8	-7.0	-3.0	-0.1	-3.	-0.05	-0.9	9.E-6
	16.8	-6.5	-3.0	-0.2	-3.	-0.06	-1.	10.E-6
	16.8	-6.0	-3.0	-0.2	-3.	-0.07	-1.	10.E-6
	16.8	-5.5	-3.0	-0.2	-3.	-0.08	-1.	10.E-6
	16.8	-5.0	-3.0	-0.2	-3.	-0.09	-1.	10.E-6
	16.8	-4.5	-3.0	-0.2	-3.	-0.1	-1.	10.E-6
	16.8	-4.0	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
	16.8	-3.5	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
	16.8	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
	16.8	-2.5	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
	16.8	-2.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
	16.8	-1.5	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
	16.8	-1.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
	16.8	-0.5	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
	16.8	0.0	-3.0	-0.5	-3.	-0.3	-2.	10.E-6
	16.8	0.5	-3.0	-0.5	-3.	-0.3	-2.	10.E-6
	16.8	1.0	-3.0	-0.6	-3.	-0.3	-3.	10.E-6
	16.8	1.5	-3.0	-0.6	-3.	-0.3	-3.	10.E-6
	16.8	2.0	-3.0	-0.6	-3.	-0.3	-3.	10.E-6
	16.8	2.5	-3.0	-0.6	-3.	-0.3	-3.	10.E-6
	16.8	3.0	-3.0	-0.7	-3.	-0.4	-3.	10.E-6
	16.8	3.5	-3.0	-0.7	-3.	-0.4	-3.	10.E-6
	16.8	4.0	-3.0	-0.7	-3.	-0.4	-3.	10.E-6
	16.8	4.5	-3.0	-0.7	-3.	-0.4	-3.	10.E-6
	16.8	5.0	-3.0	-0.7	-3.	-0.4	-3.	10.E-6
	16.8	5.5	-3.0	-0.7	-3.	-0.4	-3.	10.E-6
	16.8	6.0	-3.0	-0.7	-3.	-0.4	-3.	10.E-6
	16.8	6.5	-3.0	-0.7	-3.	-0.4	-3.	10.E-6
	16.8	7.0	-3.0	-0.7	-3.	-0.4	-3.	10.E-6
	16.8	7.5	-3.0	-0.7	-3.	-0.4	-3.	10.E-6
	16.8	8.0	-3.0	-0.7	-3.	-0.4	-3.	10.E-6
	16.8	8.5	-3.0	-0.7	-3.	-0.4	-3.	10.E-6
	16.8	9.0	-3.0	-0.6	-3.	-0.3	-3.	10.E-6
	16.8	9.5	-3.0	-0.6	-3.	-0.3	-3.	10.E-6
	16.8	10.0	-3.0	-0.6	-3.	-0.3	-3.	10.E-6
	16.8	10.5	-3.0	-0.6	-3.	-0.3	-3.	10.E-6
	16.8	11.0	-3.0	-0.5	-3.	-0.3	-2.	10.E-6
	16.8	11.5	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
	16.8	12.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
	16.8	12.5	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
	16.8	13.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
	16.8	13.5	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
	16.8	14.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
	16.8	14.5	-3.0	-0.4	-3.	-0.1	-2.	10.E-6
	16.8	15.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
	16.8	15.5	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
	16.8	16.0	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
	16.8	16.5	-3.0	-0.3	-3.	-0.09	-1.	10.E-6
	16.8	17.0	-3.0	-0.2	-3.	-0.08	-1.	10.E-6
	16.8	17.5	-3.0	-0.2	-3.	-0.07	-1.	10.E-6
	16.8	18.0	-3.0	-0.2	-3.	-0.06	-1.	10.E-6
	16.8	18.5	-3.0	-0.2	-3.	-0.06	-1.	10.E-6
	16.8	19.0	-3.0	-0.1	-3.	-0.05	-1.	10.E-6
	16.8	19.5	-3.0	-0.1	-3.	-0.05	-0.9	10.E-6
	16.8	20.0	-3.0	-0.1	-3.	-0.04	-0.9	9.E-6
	17.4	-10.0	-3.0	-0.07	-3.	-0.03	-0.6	7.E-6
	17.4	-9.5	-3.0	-0.07	-3.	-0.03	-0.6	7.E-6
	17.4	-9.0	-3.0	-0.08	-3.	-0.03	-0.7	8.E-6
	17.4	-8.5	-3.0	-0.09	-3.	-0.03	-0.7	8.E-6
	17.4	-8.0	-3.0	-0.1	-3.	-0.04	-0.8	8.E-6
	17.4	-7.5	-3.0	-0.1	-3.	-0.04	-0.8	9.E-6
	17.4	-7.0	-3.0	-0.1	-3.	-0.05	-0.9	9.E-6
	17.4	-6.5	-3.0	-0.1	-3.	-0.05	-0.9	9.E-6
	17.4	-6.0	-3.0	-0.2	-3.	-0.06	-1.	10.E-6
	17.4	-5.5	-3.0	-0.2	-3.	-0.07	-1.	10.E-6
	17.4	-5.0	-3.0	-0.2	-3.	-0.08	-1.	10.E-6
	17.4	-4.5	-3.0	-0.2	-3.	-0.08	-1.	10.E-6
	17.4	-4.0	-3.0	-0.2	-3.	-0.09	-1.	10.E-6
	17.4	-3.5	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
	17.4	-3.0	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
	17.4	-2.5	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
	17.4	-2.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
	17.4	-1.5	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
	17.4	-1.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
	17.4	-0.5	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
	17.4	0.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
	17.4	0.5	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
	17.4	1.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
	17.4	1.5	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
	17.4	2.0	-3.0	-0.5	-3.	-0.3	-2.	10.E-

Name	X [m]	Location Y [m]	Z [Level] [mOD]	Z [mm]	Calc Level [mOD]	Vert Stress [kN/m <sup>2</sup> ]	Stresses Sum Princ [kN/m <sup>2</sup> ]	Vert Strain [-]
17.9	-3.5	-3.0	-3.0	-0.2	-3.	-0.09	-1.	10.E-6
17.9	-3.0	-3.0	-3.0	-0.2	-3.	-0.1	-1.	10.E-6
17.9	-2.5	-3.0	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
17.9	-2.0	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
17.9	-1.5	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
17.9	-1.0	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
17.9	-0.5	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
17.9	0.0	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
17.9	0.5	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
17.9	1.0	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
17.9	1.5	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
17.9	2.0	-3.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
17.9	2.5	-3.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
17.9	3.0	-3.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
17.9	3.5	-3.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
17.9	4.0	-3.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
17.9	4.5	-3.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
17.9	5.0	-3.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
17.9	5.5	-3.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
17.9	6.0	-3.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
17.9	6.5	-3.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
17.9	7.0	-3.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
17.9	7.5	-3.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
17.9	8.0	-3.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
17.9	8.5	-3.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
17.9	9.0	-3.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
17.9	9.5	-3.0	-3.0	-0.5	-3.	-0.2	-2.	10.E-6
17.9	10.0	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
17.9	10.5	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
17.9	11.0	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
17.9	11.5	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
17.9	12.0	-3.0	-3.0	-0.4	-3.	-0.1	-2.	10.E-6
17.9	12.5	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
17.9	13.0	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
17.9	13.5	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
17.9	14.0	-3.0	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
17.9	14.5	-3.0	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
17.9	15.0	-3.0	-3.0	-0.2	-3.	-0.09	-1.	10.E-6
17.9	15.5	-3.0	-3.0	-0.2	-3.	-0.08	-1.	10.E-6
17.9	16.0	-3.0	-3.0	-0.2	-3.	-0.07	-1.	10.E-6
17.9	16.5	-3.0	-3.0	-0.2	-3.	-0.07	-1.	10.E-6
17.9	17.0	-3.0	-3.0	-0.2	-3.	-0.06	-1.	10.E-6
17.9	17.5	-3.0	-3.0	-0.2	-3.	-0.05	-1.	10.E-6
17.9	18.0	-3.0	-3.0	-0.1	-3.	-0.05	-0.8	9.E-6
17.9	18.5	-3.0	-3.0	-0.1	-3.	-0.04	-0.9	10.E-6
17.9	19.0	-3.0	-3.0	-0.1	-3.	-0.04	-0.8	9.E-6
17.9	19.5	-3.0	-3.0	-0.1	-3.	-0.04	-0.8	9.E-6
17.9	20.0	-3.0	-3.0	-0.09	-3.	-0.03	-0.8	9.E-6
18.5	-10.0	-3.0	-3.0	-0.05	-3.	-0.02	-0.5	6.E-6
18.5	-9.5	-3.0	-3.0	-0.06	-3.	-0.02	-0.6	7.E-6
18.5	-9.0	-3.0	-3.0	-0.06	-3.	-0.02	-0.6	7.E-6
18.5	-8.5	-3.0	-3.0	-0.07	-3.	-0.03	-0.7	8.E-6
18.5	-8.0	-3.0	-3.0	-0.08	-3.	-0.03	-0.7	8.E-6
18.5	-7.5	-3.0	-3.0	-0.09	-3.	-0.03	-0.7	8.E-6
18.5	-7.0	-3.0	-3.0	-0.1	-3.	-0.04	-0.8	9.E-6
18.5	-6.5	-3.0	-3.0	-0.1	-3.	-0.04	-0.8	9.E-6
18.5	-6.0	-3.0	-3.0	-0.1	-3.	-0.05	-0.9	9.E-6
18.5	-5.5	-3.0	-3.0	-0.1	-3.	-0.05	-0.9	9.E-6
18.5	-5.0	-3.0	-3.0	-0.2	-3.	-0.06	-1.	10.E-6
18.5	-4.5	-3.0	-3.0	-0.2	-3.	-0.06	-1.	10.E-6
18.5	-4.0	-3.0	-3.0	-0.2	-3.	-0.07	-1.	10.E-6
18.5	-3.5	-3.0	-3.0	-0.2	-3.	-0.08	-1.	10.E-6
18.5	-3.0	-3.0	-3.0	-0.2	-3.	-0.08	-1.	10.E-6
18.5	-2.5	-3.0	-3.0	-0.2	-3.	-0.09	-1.	10.E-6
18.5	-2.0	-3.0	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
18.5	-1.5	-3.0	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
18.5	-1.0	-3.0	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
18.5	-0.5	-3.0	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
18.5	0.0	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
18.5	0.5	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
18.5	1.0	-3.0	-3.0	-0.4	-3.	-0.1	-2.	10.E-6
18.5	1.5	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
18.5	2.0	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
18.5	2.5	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
18.5	3.0	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
18.5	3.5	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
18.5	4.0	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
18.5	4.5	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
18.5	5.0	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
18.5	5.5	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
18.5	6.0	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
18.5	6.5	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
18.5	7.0	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
18.5	7.5	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
18.5	8.0	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
18.5	8.5	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
18.5	9.0	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
18.5	9.5	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
18.5	10.0	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
18.5	10.5	-3.0	-3.0	-0.4	-3.	-0.1	-2.	10.E-6
18.5	11.0	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
18.5	11.5	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
18.5	12.0	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
18.5	12.5	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
18.5	13.0	-3.0	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
18.5	13.5	-3.0	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
18.5	14.0	-3.0	-3.0	-0.2	-3.	-0.09	-1.	10.E-6
18.5	14.5	-3.0	-3.0	-0.2	-3.	-0.08	-1.	10.E-6
18.5	15.0	-3.0	-3.0	-0.2	-3.	-0.07	-1.	10.E-6
18.5	15.5	-3.0	-3.0	-0.2	-3.	-0.07	-1.	10.E-6
18.5	16.0	-3.0	-3.0	-0.2	-3.	-0.06	-1.	10.E-6
18.5	16.5	-3.0	-3.0	-0.2	-3.	-0.06	-1.	10.E-6
18.5	17.0	-3.0	-3.0	-0.1	-3.	-0.05	-1.	10.E-6
18.5	17.5	-3.0	-3.0	-0.1	-3.	-0.05	-0.9	9.E-6
18.5	18.0	-3.0	-3.0	-0.1	-3.	-0.04	-0.9	9.E-6
18.5	18.5	-3.0	-3.0	-0.1	-3.	-0.04	-0.8	9.E-6
18.5	19.0	-3.0	-3.0	-0.1	-3.	-0.03	-0.8	9.E-6
18.5	19.5	-3.0	-3.0	-0.09	-3.	-0.03	-0.7	8.E-6
18.5	20.0	-3.0	-3.0	-0.08	-3.	-0.03	-0.7	8.E-6
19.0	-10.0	-3.0	-3.0	-0.04	-3.	-0.02	-0.5	6.E-6
19.0	-9.5	-3.0	-3.0	-0.05	-3.	-0.02	-0.5	6.E-6
19.0	-9.0	-3.0	-3.0	-0.06	-3.	-0.02	-0.6	7.E-6
19.0	-8.5	-3.0	-3.0	-0.06	-3.	-0.02	-0.6	7.E-6
19.0	-8.0	-3.0	-3.0	-0.07	-3.	-0.03	-0.6	7.E-6
19.0	-7.5	-3.0	-3.0	-0.08	-3.	-0.03	-0.7	8.E-6
19.0	-7.0	-3.0	-3.0	-0.09	-3.	-0.03	-0.7	8.E-6
19.0	-6.5	-3.0	-3.0	-0.1	-3.	-0.04	-0.8	8.E-6
19.0	-6.0	-3.0	-3.0	-0.1	-3.	-0.04	-0.8	9.E-6
19.0	-5.5	-3.0	-3.0	-0.1	-3.	-0.04	-0.9	9.E-6
19.0	-5.0	-3.0	-3.0	-0.1	-3.	-0.05	-0.9	9.E-6
19.0	-4.5	-3.0	-3.0	-0.1	-3.	-0.05	-1.	10.E-6
19.0	-4.0	-3.0	-3.0	-0.2	-3.	-0.06	-1.	10.E-6
19.0	-3.5	-3.0	-3.0	-0.2	-3.	-0.06	-1.	10.E-6
19.0	-3.0	-3.0	-3.0	-0.2	-3.	-0.07	-1.	10.E-6
19.0	-2.5	-3.0	-3.0	-0.2	-3.	-0.08	-1.	10.E-6
19.0	-2.0	-3.0	-3.0	-0.2	-3.	-0.08	-1.	10.E-6
19.0	-1.5	-3.0	-3.0	-0.2	-3.	-0.09	-1.	10.E-6
19.0	-1.0	-3.0	-3.0	-0.2	-3.	-0.1	-1.	10.E-6
19.0	-0.5	-3.0	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
19.0	0.0	-3.0	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
19.0	0.5	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
19.0	1.0	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
19.0	1.5	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
19.0	2.0	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
19.0	2.5	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
19.0	3.0	-3.0	-3.0	-0.4	-3.	-0.1	-2.	10.E-6
19.0	3.5	-3.0	-3.0	-0.4	-3.	-0.1	-2.	10.E-6
19.0	4.0	-3.0	-3.0	-0.4	-3.	-0.1	-2.	10.E-6
19.0	4.5	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
19.0	5.0	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
19.0	5.5	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
19.0	6.0	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
19.0	6.5	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
19.0	7.0	-3.0	-3.0	-0.4	-3.	-0.2	-2.	10.E-6
19.0	7.5	-3.0	-3.0	-0.4	-3.	-0.1	-2.	10.E-6
19.0	8.0	-3.0	-3.0	-0.4	-3.	-0.1	-2.	10.E-6
19.0	8.5	-3.0	-3.0	-0.4	-3.	-0.1	-2.	10.E-6
19.0	9.0	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
19.0	9.5	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
19.0	10.0	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
19.0	10.5	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
19.0	11.0	-3.0	-3.0	-0.3	-3.	-0.1	-2.	10.E-6
19.0	11.5	-3.0	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
19.0	12.0	-3.0	-3.0	-0.3	-3.	-0.1	-1.	10.E-6
19.0	12.5	-3.0	-3.0	-0.3	-3.	-0.09		

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112131		
Drg. Ref.		
Made by	Date	Checked

Name	X [m]	Location Y [m]	Z [Level] [mGD]	Z [mm]	Calc Level [mGD]	Stresses		Vert Strain [-]
						Vert Stress [kN/m <sup>2</sup> ]	Sum Princ [kN/m <sup>2</sup> ]	
19.6	11.5	-3.0	-0.2	-3.0	-0.09	-1.0	10.E-6	
19.6	12.0	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
19.6	12.5	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
19.6	13.0	-3.0	-0.2	-3.0	-0.07	-1.0	10.E-6	
19.6	13.5	-3.0	-0.2	-3.0	-0.07	-1.0	10.E-6	
19.6	14.0	-3.0	-0.2	-3.0	-0.06	-1.0	10.E-6	
19.6	14.5	-3.0	-0.2	-3.0	-0.06	-1.0	10.E-6	
19.6	15.0	-3.0	-0.1	-3.0	-0.05	-1.0	10.E-6	
19.6	15.5	-3.0	-0.1	-3.0	-0.05	-1.0	10.E-6	
19.6	16.0	-3.0	-0.1	-3.0	-0.04	-0.9	10.E-6	
19.6	16.5	-3.0	-0.1	-3.0	-0.04	-0.9	9.E-6	
19.6	17.0	-3.0	-0.1	-3.0	-0.04	-0.8	9.E-6	
19.6	17.5	-3.0	-0.09	-3.0	-0.03	-0.8	9.E-6	
19.6	18.0	-3.0	-0.08	-3.0	-0.03	-0.7	8.E-6	
19.6	18.5	-3.0	-0.08	-3.0	-0.03	-0.7	8.E-6	
19.6	19.0	-3.0	-0.07	-3.0	-0.03	-0.7	8.E-6	
19.6	19.5	-3.0	-0.07	-3.0	-0.03	-0.7	8.E-6	
19.6	20.0	-3.0	-0.06	-3.0	-0.02	-0.6	7.E-6	
20.1	-10.0	-3.0	-0.03	-3.0	-0.02	-0.5	6.E-6	
20.1	-9.5	-3.0	-0.04	-3.0	-0.02	-0.5	6.E-6	
20.1	-9.0	-3.0	-0.04	-3.0	-0.02	-0.5	6.E-6	
20.1	-8.5	-3.0	-0.05	-3.0	-0.02	-0.5	6.E-6	
20.1	-8.0	-3.0	-0.05	-3.0	-0.02	-0.6	7.E-6	
20.1	-7.5	-3.0	-0.06	-3.0	-0.02	-0.6	7.E-6	
20.1	-7.0	-3.0	-0.07	-3.0	-0.03	-0.6	7.E-6	
20.1	-6.5	-3.0	-0.08	-3.0	-0.03	-0.7	8.E-6	
20.1	-6.0	-3.0	-0.08	-3.0	-0.03	-0.7	8.E-6	
20.1	-5.5	-3.0	-0.09	-3.0	-0.03	-0.7	8.E-6	
20.1	-5.0	-3.0	-0.1	-3.0	-0.04	-0.8	8.E-6	
20.1	-4.5	-3.0	-0.1	-3.0	-0.04	-0.8	9.E-6	
20.1	-4.0	-3.0	-0.1	-3.0	-0.04	-0.9	9.E-6	
20.1	-3.5	-3.0	-0.1	-3.0	-0.05	-0.9	9.E-6	
20.1	-3.0	-3.0	-0.1	-3.0	-0.05	-0.9	10.E-6	
20.1	-2.5	-3.0	-0.2	-3.0	-0.05	-1.0	10.E-6	
20.1	-2.0	-3.0	-0.2	-3.0	-0.06	-1.0	10.E-6	
20.1	-1.5	-3.0	-0.2	-3.0	-0.06	-1.0	10.E-6	
20.1	-1.0	-3.0	-0.2	-3.0	-0.07	-1.0	10.E-6	
20.1	-0.5	-3.0	-0.2	-3.0	-0.07	-1.0	10.E-6	
20.1	0.0	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.1	0.5	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.1	1.0	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.1	1.5	-3.0	-0.2	-3.0	-0.09	-1.0	10.E-6	
20.1	2.0	-3.0	-0.2	-3.0	-0.09	-1.0	10.E-6	
20.1	2.5	-3.0	-0.2	-3.0	-0.09	-1.0	10.E-6	
20.1	3.0	-3.0	-0.3	-3.0	-0.1	-1.0	10.E-6	
20.1	3.5	-3.0	-0.3	-3.0	-0.1	-1.0	10.E-6	
20.1	4.0	-3.0	-0.3	-3.0	-0.1	-1.0	10.E-6	
20.1	4.5	-3.0	-0.3	-3.0	-0.1	-1.0	10.E-6	
20.1	5.0	-3.0	-0.3	-3.0	-0.1	-1.0	10.E-6	
20.1	5.5	-3.0	-0.3	-3.0	-0.1	-1.0	10.E-6	
20.1	6.0	-3.0	-0.3	-3.0	-0.1	-1.0	10.E-6	
20.1	6.5	-3.0	-0.3	-3.0	-0.1	-1.0	10.E-6	
20.1	7.0	-3.0	-0.3	-3.0	-0.1	-1.0	10.E-6	
20.1	7.5	-3.0	-0.3	-3.0	-0.1	-1.0	10.E-6	
20.1	8.0	-3.0	-0.3	-3.0	-0.1	-1.0	10.E-6	
20.1	8.5	-3.0	-0.3	-3.0	-0.09	-1.0	10.E-6	
20.1	9.0	-3.0	-0.2	-3.0	-0.09	-1.0	10.E-6	
20.1	9.5	-3.0	-0.2	-3.0	-0.09	-1.0	10.E-6	
20.1	10.0	-3.0	-0.2	-3.0	-0.09	-1.0	10.E-6	
20.1	10.5	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.1	11.0	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.1	11.5	-3.0	-0.2	-3.0	-0.07	-1.0	10.E-6	
20.1	12.0	-3.0	-0.2	-3.0	-0.07	-1.0	10.E-6	
20.1	12.5	-3.0	-0.2	-3.0	-0.07	-1.0	10.E-6	
20.1	13.0	-3.0	-0.2	-3.0	-0.06	-1.0	10.E-6	
20.1	13.5	-3.0	-0.2	-3.0	-0.06	-1.0	10.E-6	
20.1	14.0	-3.0	-0.2	-3.0	-0.05	-1.0	10.E-6	
20.1	14.5	-3.0	-0.1	-3.0	-0.05	-1.0	10.E-6	
20.1	15.0	-3.0	-0.1	-3.0	-0.05	-0.9	10.E-6	
20.1	15.5	-3.0	-0.1	-3.0	-0.04	-0.9	10.E-6	
20.1	16.0	-3.0	-0.1	-3.0	-0.04	-0.9	9.E-6	
20.1	16.5	-3.0	-0.1	-3.0	-0.04	-0.8	9.E-6	
20.1	17.0	-3.0	-0.1	-3.0	-0.03	-0.8	9.E-6	
20.1	17.5	-3.0	-0.09	-3.0	-0.03	-0.7	8.E-6	
20.1	18.0	-3.0	-0.08	-3.0	-0.03	-0.7	8.E-6	
20.1	18.5	-3.0	-0.07	-3.0	-0.03	-0.7	8.E-6	
20.1	19.0	-3.0	-0.07	-3.0	-0.03	-0.6	7.E-6	
20.1	19.5	-3.0	-0.06	-3.0	-0.02	-0.6	7.E-6	
20.1	20.0	-3.0	-0.05	-3.0	-0.02	-0.6	7.E-6	
20.7	-10.0	-3.0	-0.03	-3.0	-0.01	-0.4	5.E-6	
20.7	-9.5	-3.0	-0.03	-3.0	-0.01	-0.4	5.E-6	
20.7	-9.0	-3.0	-0.04	-3.0	-0.02	-0.5	6.E-6	
20.7	-8.5	-3.0	-0.04	-3.0	-0.02	-0.5	6.E-6	
20.7	-8.0	-3.0	-0.05	-3.0	-0.02	-0.5	6.E-6	
20.7	-7.5	-3.0	-0.05	-3.0	-0.02	-0.6	7.E-6	
20.7	-7.0	-3.0	-0.06	-3.0	-0.02	-0.6	7.E-6	
20.7	-6.5	-3.0	-0.07	-3.0	-0.03	-0.6	7.E-6	
20.7	-6.0	-3.0	-0.07	-3.0	-0.03	-0.7	7.E-6	
20.7	-5.5	-3.0	-0.08	-3.0	-0.03	-0.7	8.E-6	
20.7	-5.0	-3.0	-0.09	-3.0	-0.03	-0.7	8.E-6	
20.7	-4.5	-3.0	-0.1	-3.0	-0.03	-0.8	8.E-6	
20.7	-4.0	-3.0	-0.1	-3.0	-0.04	-0.8	9.E-6	
20.7	-3.5	-3.0	-0.1	-3.0	-0.04	-0.8	9.E-6	
20.7	-3.0	-3.0	-0.1	-3.0	-0.04	-0.9	9.E-6	
20.7	-2.5	-3.0	-0.1	-3.0	-0.05	-0.9	9.E-6	
20.7	-2.0	-3.0	-0.1	-3.0	-0.05	-0.9	10.E-6	
20.7	-1.5	-3.0	-0.1	-3.0	-0.05	-1.0	10.E-6	
20.7	-1.0	-3.0	-0.2	-3.0	-0.06	-1.0	10.E-6	
20.7	-0.5	-3.0	-0.2	-3.0	-0.06	-1.0	10.E-6	
20.7	0.0	-3.0	-0.2	-3.0	-0.06	-1.0	10.E-6	
20.7	0.5	-3.0	-0.2	-3.0	-0.07	-1.0	10.E-6	
20.7	1.0	-3.0	-0.2	-3.0	-0.07	-1.0	10.E-6	
20.7	1.5	-3.0	-0.2	-3.0	-0.07	-1.0	10.E-6	
20.7	2.0	-3.0	-0.2	-3.0	-0.07	-1.0	10.E-6	
20.7	2.5	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.7	3.0	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.7	3.5	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.7	4.0	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.7	4.5	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.7	5.0	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.7	5.5	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.7	6.0	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.7	6.5	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.7	7.0	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.7	7.5	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.7	8.0	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.7	8.5	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.7	9.0	-3.0	-0.2	-3.0	-0.08	-1.0	10.E-6	
20.7	9.5	-3.0	-0.2	-3.0	-0.07	-1.0	10.E-6	
20.7	10.0	-3.0	-0.2	-3.0	-0.07	-1.0	10.E-6	
20.7	10.5	-3.0	-0.2	-3.0	-0.07	-1.0	10.E-6	
20.7	11.0	-3.0	-0.2	-3.0	-0.07	-1.0	10.E-6	
20.7	11.5	-3.0	-0.2	-3.0	-0.06	-1.0	10.E-6	
20.7	12.0	-3.0	-0.2	-3.0	-0.06	-1.0	10.E-6	
20.7	12.5	-3.0	-0.2	-3.0	-0.06	-1.0	10.E-6	
20.7	13.0	-3.0	-0.2	-3.0	-0.05	-1.0	10.E-6	
20.7	13.5	-3.0	-0.1	-3.0	-0.05	-1.0	10.E-6	
20.7	14.0	-3.0	-0.1	-3.0	-0.05	-0.9	10.E-6	
20.7	14.5	-3.0	-0.1	-3.0	-0.04	-0.9	10.E-6	
20.7	15.0	-3.0	-0.1	-3.0	-0.04	-0.9	9.E-6	
20.7	15.5	-3.0	-0.1	-3.0	-0.04	-0.8	9.E-6	
20.7	16.0	-3.0	-0.1	-3.0	-0.04	-0.8	9.E-6	
20.7	16.5	-3.0	-0.09	-3.0	-0.03	-0.8	8.E-6	
20.7	17.0	-3.0	-0.08	-3.0	-0.03	-0.7	8.E-6	
20.7	17.5	-3.0	-0.08	-3.0	-0.03	-0.7	8.E-6	
20.7	18.0	-3.0	-0.07	-3.0	-0.03	-0.7	8.E-6	
20.7	18.5	-3.0	-0.06	-3.0	-0.02	-0.6	7.E-6	
20.7	19.0	-3.0	-0.06	-3.0	-0.02	-0.6	7.E-6	
20.7	19.5	-3.0	-0.05	-3.0	-0.02	-0.6	7.E-6	
20.7	20.0	-3.0	-0.05	-3.0	-0.02	-0.5	6.E-6	
21.2	-10.0	-3.0	-0.02	-3.0	-0.01	-0.4	5.E-6	
21.2	-9.5	-3.0	-0.03	-3.0	-0.01	-0.4	5.E-6	
21.2	-9.0	-3.0	-0.03	-3.0	-0.01	-0.5	6.E-6	
21.2	-8.5	-3.0	-0.04	-3.0	-0.02	-0.5	6.E-6	
21.2	-8.0	-3.0	-0.04	-3.0	-0.02	-0.5	6.E-6	
21.2	-7.5	-3.0	-0.04	-3.0	-0.02	-0.5	6.E-6	
21.2	-7.0	-3.0	-0.05	-3.0	-0.02	-0.6	7.E-6	
21.2	-6.5	-3.0	-0.06	-3.0	-0.02	-0.6	7.E-6	
21.2	-6.0	-3.0	-0.06	-3.0	-0.02	-0.6	7.E-6	
21.2	-5.5	-3.0	-0.07	-3.0	-0.03	-0.6	7.E-6	
21.2	-5.0	-3.0	-0.07	-3.0	-0.03	-0.7	8.E-6	
21.2	-4.5	-3.0	-0.08	-3.0	-0.03	-0.7	8.E-6	
21.2	-4.0	-3.0	-0.09	-3.0	-0.03	-0.7	8.E-6	
21.2	-3.5	-3.0	-0.1	-3.0	-0.04	-0.8	8.E-6	
21.2	-3.0	-3.0	-0.1	-3.0	-0.04	-0.8	9.E-6	
21.2	-2.5	-3.0	-0.1	-3.0	-0.04	-0.8	9.E-6	
21.2	-2.0	-3.0	-0.1	-3.0	-0.04	-0.9	9.E-6	
21.2	-1.5	-3.0	-0.1	-3.0	-0.05	-0.9	9.E-6	
21.2	-1.0	-3.0	-0.1	-3.0	-0.05	-0.9	10.E-6	
21.2	-0.5	-3.0	-0.1	-3.0	-0.05	-0.9	10.E-6	
21.2	0.0	-3.0	-0.1	-3.0	-0.05	-1.0	10.E-6	
21.2	0.5	-3.0	-0.2	-3.0	-0.06	-1.0	10.E-6	
21.2	1.0	-3.0	-0.2	-3.0				

Name	X [m]	Location Y [m]	Z [Level] [mOD]	Z [mm]	Calc Level [mOD]	Vert Stress [kN/m <sup>2</sup> ]	Stresses Sum Princ [kN/m <sup>2</sup> ]	Vert Strain [-]
21.8	-4.0	-3.0	-0.08	-3.0	-3.0	-0.03	-0.7	8.E-6
21.8	-3.5	-3.0	-0.08	-3.0	-3.0	-0.03	-0.7	8.E-6
21.8	-3.0	-3.0	-0.09	-3.0	-3.0	-0.03	-0.7	8.E-6
21.8	-2.5	-3.0	-0.1	-3.0	-3.0	-0.03	-0.8	9.E-6
21.8	-2.0	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	9.E-6
21.8	-1.5	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	9.E-6
21.8	-1.0	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	9.E-6
21.8	-0.5	-3.0	-0.1	-3.0	-3.0	-0.04	-0.9	9.E-6
21.8	0.0	-3.0	-0.1	-3.0	-3.0	-0.05	-0.9	9.E-6
21.8	0.5	-3.0	-0.1	-3.0	-3.0	-0.05	-0.9	10.E-6
21.8	1.0	-3.0	-0.1	-3.0	-3.0	-0.05	-0.9	10.E-6
21.8	1.5	-3.0	-0.1	-3.0	-3.0	-0.05	-1.0	10.E-6
21.8	2.0	-3.0	-0.1	-3.0	-3.0	-0.05	-1.0	10.E-6
21.8	2.5	-3.0	-0.2	-3.0	-3.0	-0.05	-1.0	10.E-6
21.8	3.0	-3.0	-0.2	-3.0	-3.0	-0.06	-1.0	10.E-6
21.8	3.5	-3.0	-0.2	-3.0	-3.0	-0.06	-1.0	10.E-6
21.8	4.0	-3.0	-0.2	-3.0	-3.0	-0.06	-1.0	10.E-6
21.8	4.5	-3.0	-0.2	-3.0	-3.0	-0.06	-1.0	10.E-6
21.8	5.0	-3.0	-0.2	-3.0	-3.0	-0.06	-1.0	10.E-6
21.8	5.5	-3.0	-0.2	-3.0	-3.0	-0.06	-1.0	10.E-6
21.8	6.0	-3.0	-0.2	-3.0	-3.0	-0.06	-1.0	10.E-6
21.8	6.5	-3.0	-0.2	-3.0	-3.0	-0.06	-1.0	10.E-6
21.8	7.0	-3.0	-0.2	-3.0	-3.0	-0.06	-1.0	10.E-6
21.8	7.5	-3.0	-0.2	-3.0	-3.0	-0.06	-1.0	10.E-6
21.8	8.0	-3.0	-0.2	-3.0	-3.0	-0.06	-1.0	10.E-6
21.8	8.5	-3.0	-0.2	-3.0	-3.0	-0.06	-1.0	10.E-6
21.8	9.0	-3.0	-0.2	-3.0	-3.0	-0.05	-1.0	10.E-6
21.8	9.5	-3.0	-0.1	-3.0	-3.0	-0.05	-1.0	10.E-6
21.8	10.0	-3.0	-0.1	-3.0	-3.0	-0.05	-1.0	10.E-6
21.8	10.5	-3.0	-0.1	-3.0	-3.0	-0.05	-0.9	10.E-6
21.8	11.0	-3.0	-0.1	-3.0	-3.0	-0.05	-0.9	10.E-6
21.8	11.5	-3.0	-0.1	-3.0	-3.0	-0.05	-0.9	10.E-6
21.8	12.0	-3.0	-0.1	-3.0	-3.0	-0.04	-0.9	9.E-6
21.8	12.5	-3.0	-0.1	-3.0	-3.0	-0.04	-0.9	9.E-6
21.8	13.0	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	9.E-6
21.8	13.5	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	9.E-6
21.8	14.0	-3.0	-0.1	-3.0	-3.0	-0.03	-0.8	9.E-6
21.8	14.5	-3.0	-0.09	-3.0	-3.0	-0.03	-0.8	8.E-6
21.8	15.0	-3.0	-0.09	-3.0	-3.0	-0.03	-0.7	8.E-6
21.8	15.5	-3.0	-0.09	-3.0	-3.0	-0.03	-0.7	8.E-6
21.8	16.0	-3.0	-0.07	-3.0	-3.0	-0.03	-0.7	8.E-6
21.8	16.5	-3.0	-0.07	-3.0	-3.0	-0.03	-0.6	8.E-6
21.8	17.0	-3.0	-0.06	-3.0	-3.0	-0.02	-0.6	7.E-6
21.8	17.5	-3.0	-0.06	-3.0	-3.0	-0.02	-0.6	7.E-6
21.8	18.0	-3.0	-0.05	-3.0	-3.0	-0.02	-0.6	7.E-6
21.8	18.5	-3.0	-0.05	-3.0	-3.0	-0.02	-0.6	7.E-6
21.8	19.0	-3.0	-0.04	-3.0	-3.0	-0.02	-0.5	6.E-6
21.8	19.5	-3.0	-0.04	-3.0	-3.0	-0.02	-0.5	6.E-6
21.8	20.0	-3.0	-0.03	-3.0	-3.0	-0.02	-0.5	6.E-6
21.8	20.5	-3.0	-0.03	-3.0	-3.0	-0.02	-0.5	6.E-6
22.3	-10.0	-3.0	-0.02	-3.0	-3.0	-0.01	-0.4	5.E-6
22.3	-9.5	-3.0	-0.02	-3.0	-3.0	-0.01	-0.4	5.E-6
22.3	-9.0	-3.0	-0.02	-3.0	-3.0	-0.01	-0.4	5.E-6
22.3	-8.5	-3.0	-0.02	-3.0	-3.0	-0.01	-0.4	5.E-6
22.3	-8.0	-3.0	-0.03	-3.0	-3.0	-0.01	-0.4	6.E-6
22.3	-7.5	-3.0	-0.03	-3.0	-3.0	-0.02	-0.5	6.E-6
22.3	-7.0	-3.0	-0.04	-3.0	-3.0	-0.02	-0.5	6.E-6
22.3	-6.5	-3.0	-0.04	-3.0	-3.0	-0.02	-0.5	6.E-6
22.3	-6.0	-3.0	-0.05	-3.0	-3.0	-0.02	-0.5	6.E-6
22.3	-5.5	-3.0	-0.05	-3.0	-3.0	-0.02	-0.6	7.E-6
22.3	-5.0	-3.0	-0.05	-3.0	-3.0	-0.02	-0.6	7.E-6
22.3	-4.5	-3.0	-0.06	-3.0	-3.0	-0.02	-0.6	7.E-6
22.3	-4.0	-3.0	-0.06	-3.0	-3.0	-0.02	-0.6	7.E-6
22.3	-3.5	-3.0	-0.07	-3.0	-3.0	-0.03	-0.6	7.E-6
22.3	-3.0	-3.0	-0.08	-3.0	-3.0	-0.03	-0.7	8.E-6
22.3	-2.5	-3.0	-0.08	-3.0	-3.0	-0.03	-0.7	8.E-6
22.3	-2.0	-3.0	-0.09	-3.0	-3.0	-0.03	-0.7	8.E-6
22.3	-1.5	-3.0	-0.09	-3.0	-3.0	-0.03	-0.7	8.E-6
22.3	-1.0	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	8.E-6
22.3	-0.5	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	9.E-6
22.3	0.0	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	9.E-6
22.3	0.5	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	9.E-6
22.3	1.0	-3.0	-0.1	-3.0	-3.0	-0.04	-0.9	9.E-6
22.3	1.5	-3.0	-0.1	-3.0	-3.0	-0.04	-0.9	9.E-6
22.3	2.0	-3.0	-0.1	-3.0	-3.0	-0.04	-0.9	9.E-6
22.3	2.5	-3.0	-0.1	-3.0	-3.0	-0.05	-0.9	10.E-6
22.3	3.0	-3.0	-0.1	-3.0	-3.0	-0.05	-0.9	10.E-6
22.3	3.5	-3.0	-0.1	-3.0	-3.0	-0.05	-0.9	10.E-6
22.3	4.0	-3.0	-0.1	-3.0	-3.0	-0.05	-0.9	10.E-6
22.3	4.5	-3.0	-0.1	-3.0	-3.0	-0.05	-0.9	10.E-6
22.3	5.0	-3.0	-0.1	-3.0	-3.0	-0.05	-0.9	10.E-6
22.3	5.5	-3.0	-0.1	-3.0	-3.0	-0.05	-1.0	10.E-6
22.3	6.0	-3.0	-0.1	-3.0	-3.0	-0.05	-1.0	10.E-6
22.3	6.5	-3.0	-0.1	-3.0	-3.0	-0.05	-1.0	10.E-6
22.3	7.0	-3.0	-0.1	-3.0	-3.0	-0.05	-0.9	10.E-6
22.3	7.5	-3.0	-0.1	-3.0	-3.0	-0.05	-0.9	10.E-6
22.3	8.0	-3.0	-0.1	-3.0	-3.0	-0.05	-0.9	10.E-6
22.3	8.5	-3.0	-0.1	-3.0	-3.0	-0.05	-0.9	10.E-6
22.3	9.0	-3.0	-0.1	-3.0	-3.0	-0.05	-0.9	10.E-6
22.3	9.5	-3.0	-0.1	-3.0	-3.0	-0.04	-0.9	10.E-6
22.3	10.0	-3.0	-0.1	-3.0	-3.0	-0.04	-0.9	9.E-6
22.3	10.5	-3.0	-0.1	-3.0	-3.0	-0.04	-0.9	9.E-6
22.3	11.0	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	9.E-6
22.3	11.5	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	9.E-6
22.3	12.0	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	9.E-6
22.3	12.5	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	9.E-6
22.3	13.0	-3.0	-0.09	-3.0	-3.0	-0.03	-0.8	9.E-6
22.3	13.5	-3.0	-0.09	-3.0	-3.0	-0.03	-0.7	8.E-6
22.3	14.0	-3.0	-0.08	-3.0	-3.0	-0.03	-0.7	8.E-6
22.3	14.5	-3.0	-0.08	-3.0	-3.0	-0.03	-0.7	8.E-6
22.3	15.0	-3.0	-0.07	-3.0	-3.0	-0.03	-0.7	8.E-6
22.3	15.5	-3.0	-0.07	-3.0	-3.0	-0.03	-0.7	8.E-6
22.3	16.0	-3.0	-0.06	-3.0	-3.0	-0.02	-0.6	7.E-6
22.3	16.5	-3.0	-0.06	-3.0	-3.0	-0.02	-0.6	7.E-6
22.3	17.0	-3.0	-0.05	-3.0	-3.0	-0.02	-0.6	7.E-6
22.3	17.5	-3.0	-0.05	-3.0	-3.0	-0.02	-0.6	7.E-6
22.3	18.0	-3.0	-0.04	-3.0	-3.0	-0.02	-0.5	6.E-6
22.3	18.5	-3.0	-0.04	-3.0	-3.0	-0.02	-0.5	6.E-6
22.3	19.0	-3.0	-0.04	-3.0	-3.0	-0.02	-0.5	6.E-6
22.3	19.5	-3.0	-0.03	-3.0	-3.0	-0.01	-0.5	6.E-6
22.3	20.0	-3.0	-0.03	-3.0	-3.0	-0.01	-0.5	6.E-6
22.9	-10.0	-3.0	-0.01	-3.0	-3.0	-0.009	-0.4	5.E-6
22.9	-9.5	-3.0	-0.01	-3.0	-3.0	-0.01	-0.4	5.E-6
22.9	-9.0	-3.0	-0.02	-3.0	-3.0	-0.01	-0.4	5.E-6
22.9	-8.5	-3.0	-0.02	-3.0	-3.0	-0.01	-0.4	5.E-6
22.9	-8.0	-3.0	-0.02	-3.0	-3.0	-0.01	-0.4	5.E-6
22.9	-7.5	-3.0	-0.03	-3.0	-3.0	-0.01	-0.4	5.E-6
22.9	-7.0	-3.0	-0.03	-3.0	-3.0	-0.01	-0.5	6.E-6
22.9	-6.5	-3.0	-0.03	-3.0	-3.0	-0.02	-0.5	6.E-6
22.9	-6.0	-3.0	-0.04	-3.0	-3.0	-0.02	-0.5	6.E-6
22.9	-5.5	-3.0	-0.04	-3.0	-3.0	-0.02	-0.5	6.E-6
22.9	-5.0	-3.0	-0.05	-3.0	-3.0	-0.02	-0.5	6.E-6
22.9	-4.5	-3.0	-0.05	-3.0	-3.0	-0.02	-0.6	7.E-6
22.9	-4.0	-3.0	-0.05	-3.0	-3.0	-0.02	-0.6	7.E-6
22.9	-3.5	-3.0	-0.06	-3.0	-3.0	-0.02	-0.6	7.E-6
22.9	-3.0	-3.0	-0.06	-3.0	-3.0	-0.02	-0.6	7.E-6
22.9	-2.5	-3.0	-0.07	-3.0	-3.0	-0.03	-0.6	7.E-6
22.9	-2.0	-3.0	-0.07	-3.0	-3.0	-0.03	-0.7	8.E-6
22.9	-1.5	-3.0	-0.08	-3.0	-3.0	-0.03	-0.7	8.E-6
22.9	-1.0	-3.0	-0.08	-3.0	-3.0	-0.03	-0.7	8.E-6
22.9	-0.5	-3.0	-0.09	-3.0	-3.0	-0.03	-0.7	8.E-6
22.9	0.0	-3.0	-0.09	-3.0	-3.0	-0.03	-0.7	8.E-6
22.9	0.5	-3.0	-0.1	-3.0	-3.0	-0.03	-0.8	8.E-6
22.9	1.0	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	9.E-6
22.9	1.5	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	9.E-6
22.9	2.0	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	9.E-6
22.9	2.5	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	9.E-6
22.9	3.0	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	9.E-6
22.9	3.5	-3.0	-0.1	-3.0	-3.0	-0.04	-0.8	9.E-6
22.9	4.0	-3.0	-0.1	-3.0	-3.0	-0.04	-0.9	9.E-6
22.9	4.5	-3.0	-0.1	-3.0	-3.0	-0.04	-0.9	9.E-6
22.9	5.0	-3.0	-0.1	-3.0	-3.0	-0.04	-0.9	9.E-6
22.9	5.5	-3.0	-0.1	-3.0	-3.0	-0.04	-0.9	9.E-6
22.9	6.0	-3.0	-0.1	-3.0	-3.0	-0.04	-0.9	9.E-6
22.9	6.5	-3.0	-0.1	-3.0	-3.0	-0.04	-0.9	9.E-6
22.9	7.0	-3.0	-0.1	-3.0	-3.0	-0.04	-	



Figure 9 – Measurements of ground movements due to bored pile wall installation in stiff clay  
 (Reproduced from CIRIA C580, Figure 2.8a and b)

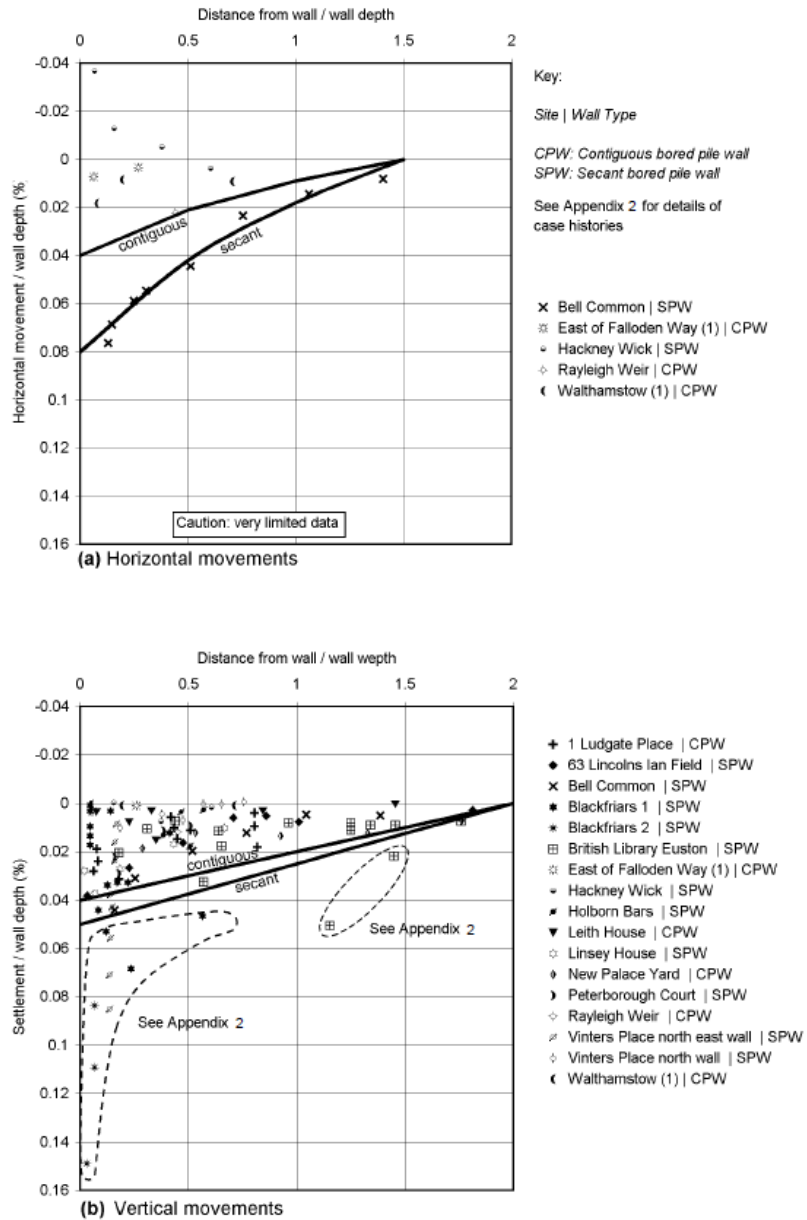


Figure 10 - Measurements of ground movements due to excavation in front of wall in stiff clay  
(Reproduced from CIRIA C580, Figure 2.11 a and b)

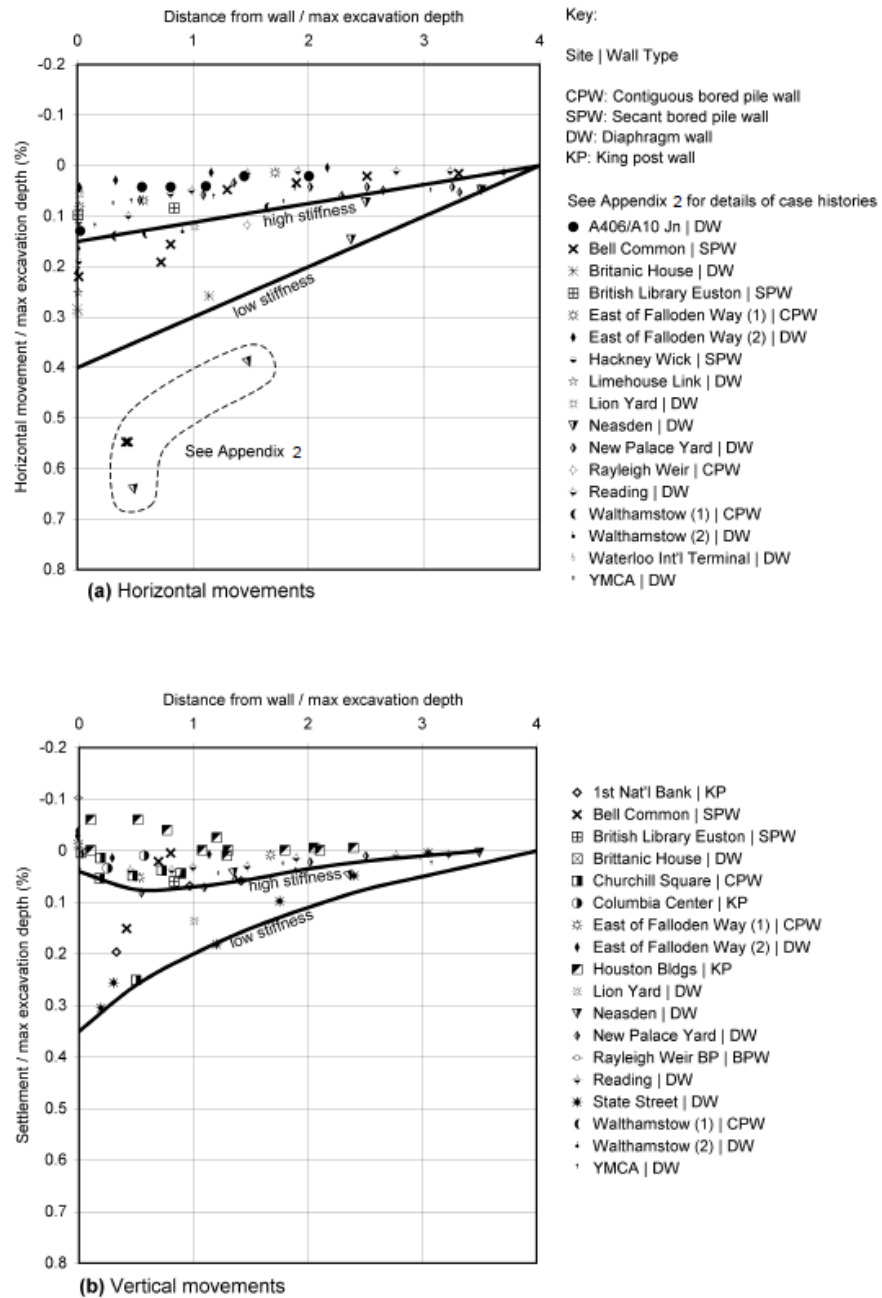


Figure 11 - Damage Classification Chart (Reproduced from CIRIA C580, Table 2.5)

Category of damage	Description of typical damage (ease of repair is underlined)	Approximate crack width (mm)	Limiting tensile strain $\epsilon_{lim}$ (per cent)
0 Negligible	Hairline cracks of less than about 0.1 mm are classed as negligible.	< 0.1	0.0–0.05
1 Very slight	<u>Fine cracks that can easily be treated during normal decoration.</u> Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection.	< 1	0.05–0.075
2 Slight	<u>Cracks easily filled. Redecoration probably required.</u> Several slight fractures showing inside of building. Cracks are visible externally and <u>some repointing may be required externally</u> to ensure weathertightness. Doors and windows may stick slightly.	< 5	0.075–0.15
3 Moderate	<u>The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable linings. Repointing of external brickwork and possibly a small amount of brickwork to be replaced.</u> Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired.	5–15 or a number of cracks > 3	0.15–0.3
4 Severe	<u>Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows.</u> Windows and frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Service pipes disrupted.	15–25 but also depends on number of cracks	> 0.3
5 Very severe	<u>This requires a major repair involving partial or complete rebuilding.</u> Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion. Danger of instability.	usually > 25 but depends on number of cracks.	

Notes

1. In assessing the degree of damage, account must be taken of its location in the building or structure.
2. Crack width is only one aspect of damage and should not be used on its own as a direct measure of it.

13 Kemplay Road, Hampstead  
Basement Impact Assessment



**Appendix A - Factual Report by LMB Geosolutions Limited dated 9<sup>th</sup> November 2015**



# LMB GEOSOLUTIONS LTD

FACTUAL REPORT FOR

GROUND INVESTIGATION

13 KEMPLAY ROAD, LONDON NW3

*November 2015*

**DOCUMENT RECORD**

Document Title	Factual Report for Ground Investigation
Site	13 Kemplay Road, London NW3 1TA
Document Date	9 <sup>th</sup> November 2015
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LMB Geosolutions Ltd  
28 Dresden Road  
London  
N19 3BD

Tel: +44 (0) 20 7272 3351

Company No. 8303397  
[www.lmbgeosolutions.com](http://www.lmbgeosolutions.com)

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# INTRODUCTION

## Introduction

### AUTHORISATION

LMB Geosolutions Ltd (LMB) was instructed by Kemplay Road Ltd (the Client) in October 2015 to undertake ground investigation works in relation to the proposed development at 13 Kemplay Road, London NW3 1TA (the Site).

### PROJECT AND SITE DETAILS

<b>Site Address</b>	13 Kemplay Road. London NW3 1TA A Site Location Plan is provided as <b>Figure 1</b> .
<b>Site Area</b>	<0.5 hectares
<b>Proposed Development</b>	It is understood that the Client wishes to demolish the existing terrace property and develop the site to include a new residential property that includes a single storey basement.

### SCOPE OF WORKS

The scope of works was agreed between LMB and Fairhurst GGA (Consulting Engineers) and included the following:

- Completion of a service avoidance survey at proposed exploratory hole locations;
- Completion of 1No. cable percussive boreholes to a maximum depth of 10.0m bgl with insitu SPT testing and collection of disturbed and undisturbed samples for laboratory testing.
- Completion of 1no. dynamic (windowless) sampler borehole to a depth of 10.0m bgl with insitu STP and DP testing and collection of disturbed samples for laboratory testing;
- Completion of 2no. hand excavated trial pits to help observe and record existing foundations and shallow ground conditions;
- Supervision and geological logging of the soil arisings in general accordance with BS5930 by an appropriately experienced geo-environmental engineer;
- Installation of 2no. monitoring wells to 10.0m and 6.0m below ground level (bgl) and return monitoring of ground gas and groundwater levels on 3no. occasions;
- Geotechnical laboratory testing of the soil samples for an appropriate suite of determinands (including pH, sulphate, triaxial testing, atterberg limits, moisture content, bulk density, hydrometer testing and soil organic matter);
- Chemical analysis of soil samples for an appropriate suite of determinands, including heavy metals, petroleum hydrocarbons and Waste Acceptance Criteria (WAC);
- Completion of a factual report that will include;
  - A summary of the fieldworks completed'



# INTRODUCTION

- A summary of the ground and groundwater conditions encountered.
- Schematic sections detailing the existing ground floor slabs and foundations.
- Geological logs in AGS format.
- Presentation of chemical analytical results.
- Presentation of geotechnical laboratory testing results.
- Presentation of the monitoring results.

## PUBLISHED GEOLOGY

Reference to the relevant British Geological Survey map for the area (Sheet 256, Solid and Drift) indicates that the site is located on the Claygate Member of the London Clay Formation (typically silty and clayey sands) overlying the London Clay Formation (typically silty clay).

## LIMITATIONS

LMB has prepared this report solely for the use of the named Client and those parties with whom a warranty agreement and/or assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from LMB and the Client.

LMB accepts no responsibility or liability for:

- a) the consequences of this document being used for any purpose or project other than for which it was commissioned, and
- b) issue of this document to any third party with whom an agreement has not been executed.

The data and opinions provided, among other things, take in to consideration currently available guidance and best available techniques relating to soil properties, acceptable contamination concentrations and interpretation of these values. No liability can be accepted for the retrospective effects of any future changes or amendments to these value.

# GROUND INVESTIGATION

## Ground Investigation

### INTRODUCTION

The ground investigation works were completed on 19<sup>th</sup> October 2015 and comprised the progression of 1no. cable percussive boreholes, 1no. dynamic (windowless) sampler borehole and 2no. hand excavated trial pits with sampling of soils.

Three rounds of groundwater and ground gas monitoring were completed on 21<sup>st</sup> and 29<sup>th</sup> October and 9<sup>th</sup> November 2015.

Details of the ground investigation completed along with the findings of the investigation are provided in the following sections. The exploratory hole logs and laboratory results are presented in **Appendix A, B and C** respectively.

### Guidance Documents

Details of the best practice guidance documents and reference information used in undertaking the ground investigation and assessment are provided at the end of this report (see REFERENCES & GUIDANCE).

### INVESTIGATION STRATEGY

The ground investigation was designed based on discussions between LMB and the Consultant Engineers. All works and exploratory holes were supervised and logged by an appropriately experienced chartered geologist.

### Cable Percussive Boreholes

A single borehole was completed using light cable percussive drilling methods to a depth of 10.00m bgl.

Disturbed and/or bulk samples were generally collected at 0.50m intervals with Standard Penetration Tests (SPTs) completed at 1.0m intervals in the upper 5m and at 1.5m intervals thereafter.

Undisturbed samples were collected at depths of 3.50m and 8.50m bgl.

### Dynamic (windowless) Sampler Boreholes

A single borehole was completed using dynamic sampling drilling methods to a depth of 10.00m bgl with a continuous percussive hammer. SPTs were completed at 1.0m intervals in the upper 6.0m and continuous Dynamic Probing (DP) was undertaken from 6.0m to 10.0m bgl.

Disturbed samples were collected from environmental and geotechnical laboratory testing.

# GROUND INVESTIGATION

## Hand Excavated Trial Pits

Two hand excavated trial pits were completed adjacent to the existing property to a maximum depth of 1.45m bgl.

An exploratory hole location plan is presented as **Figure 2**.

## Soil Chemical Analysis & Laboratory Testing

Soil samples were submitted to the UKAS and MCERTS accredited laboratories of i2 Analytical for chemical analysis.

Geotechnical testing of soil samples was undertaken at the UKAS accredited laboratories of K4 soils. All testing was undertaken in accordance with BS 1377:1990 'Methods of test for soils for civil engineering purposes' or other current best practice standards, as appropriate.

## SUMMARY OF GROUND CONDITIONS

### Ground Conditions

The table below provides a summary of ground conditions encountered with full descriptions provided in the associated exploratory hole logs provided in **Appendix A**:

Strata	Depth Range to Top (m bgl)	Depth Range to (Base (m bgl)
Made Ground	Ground Level	0.50 - 1.45
Claygate Member	0.50 - 1.45	4.45 - 5.30
London Clay Formation	4.45 - 5.30	10.00 <sup>(1)</sup>

(1) Base of unit not determined.

### Groundwater Observations

During the cable percussive drilling a slow seepage was recorded at approximately 5.30m bgl in BH1 and a groundwater strike was recorded at approximately 4.00m bgl in BH2 which did not rise over a 20-minute period.

Details are provided on the exploratory hole logs presented in **Appendix A**.

## MONITORING AND INSTRUMENTATION

Dual ground gas and groundwater monitoring wells were installed in BH1 and BH2 on completion. The monitoring well in BH1 was installed to 10.0m bgl and in BH2 it was installed to 6.0m bgl.

## GROUND INVESTIGATION

Details of the monitoring well installations can be viewed in **Appendix A**, with the groundwater and ground gas monitoring results presented in **Appendix D**.

## REFERENCES & GUIDANCE

### REFERENCES & GUIDANCE

1. Environment Agency/Defra (2002). Model procedures for the Management of Land Contamination (CLR 11)
2. Environment Agency/Defra.. Contaminated Land Statutory Guidance (April 2012)
3. BS 10175 (2011) Investigation of Potentially Contaminated Sites. Code of Practice.
4. BS5930 (2007) Code of Practice for Site Investigations.
5. BS 5667-11:2009. Water quality sampling. Part 11: Guidance on sampling of groundwaters.
6. BS 8002 (1994) Code of Practice for Earth Retaining Structures
7. Tomlinson, M.J. (1986) Foundation Design and Construction.
8. Department of the Environment Industry Profiles.
9. Environment Agency/Defra (2002). Sampling strategies for contaminated land (CLR4)<sup>1</sup>
10. Environment Agency/Defra (2002). Priority Contaminants for the Assessment of Land (CLR8)<sup>2</sup>
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<sup>1</sup> This document has been withdrawn but is considered to remain useful in proving technical background for designing ground investigation works.

<sup>2</sup> This document has been withdrawn but is considered to remain useful in proving technical background for designing ground investigation works.

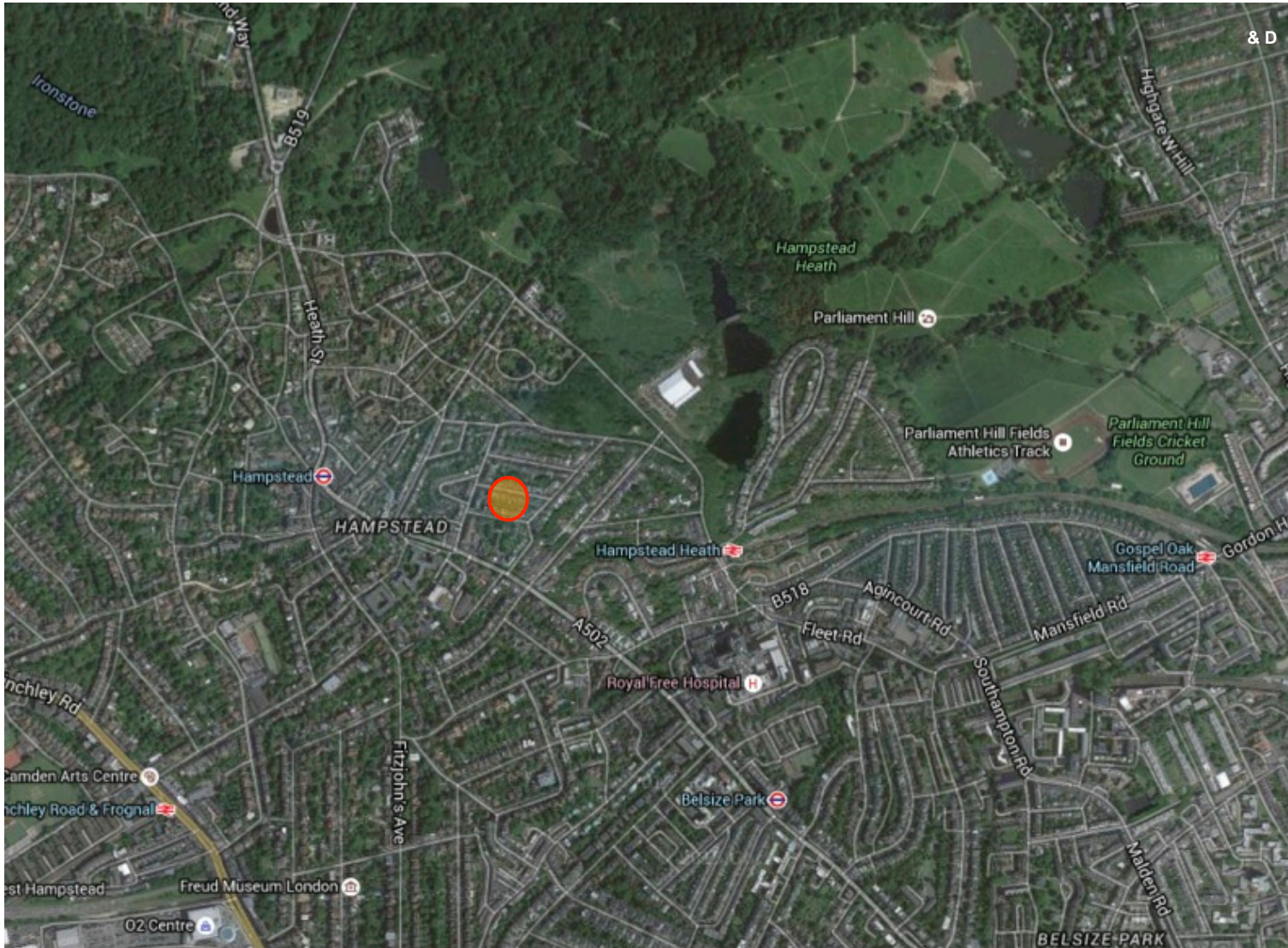
## REFERENCES & GUIDANCE

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## FIGURES

## FIGURES





**Key:**



Approximate site location.

**IMPORTANT – Please Read**

This drawing is for illustrative purposes only and is for use only in conjunction with associated reports relating to the project details below. LMB accepts no liability for the mis-interpretation or use of this illustration by any other parties.



*Ground Investigation  
Land Contamination  
Hydrogeology  
Engineering Geology*

**Site:**  
13 Kemplay Road, London SW3

**Figure Number:** Figure 1

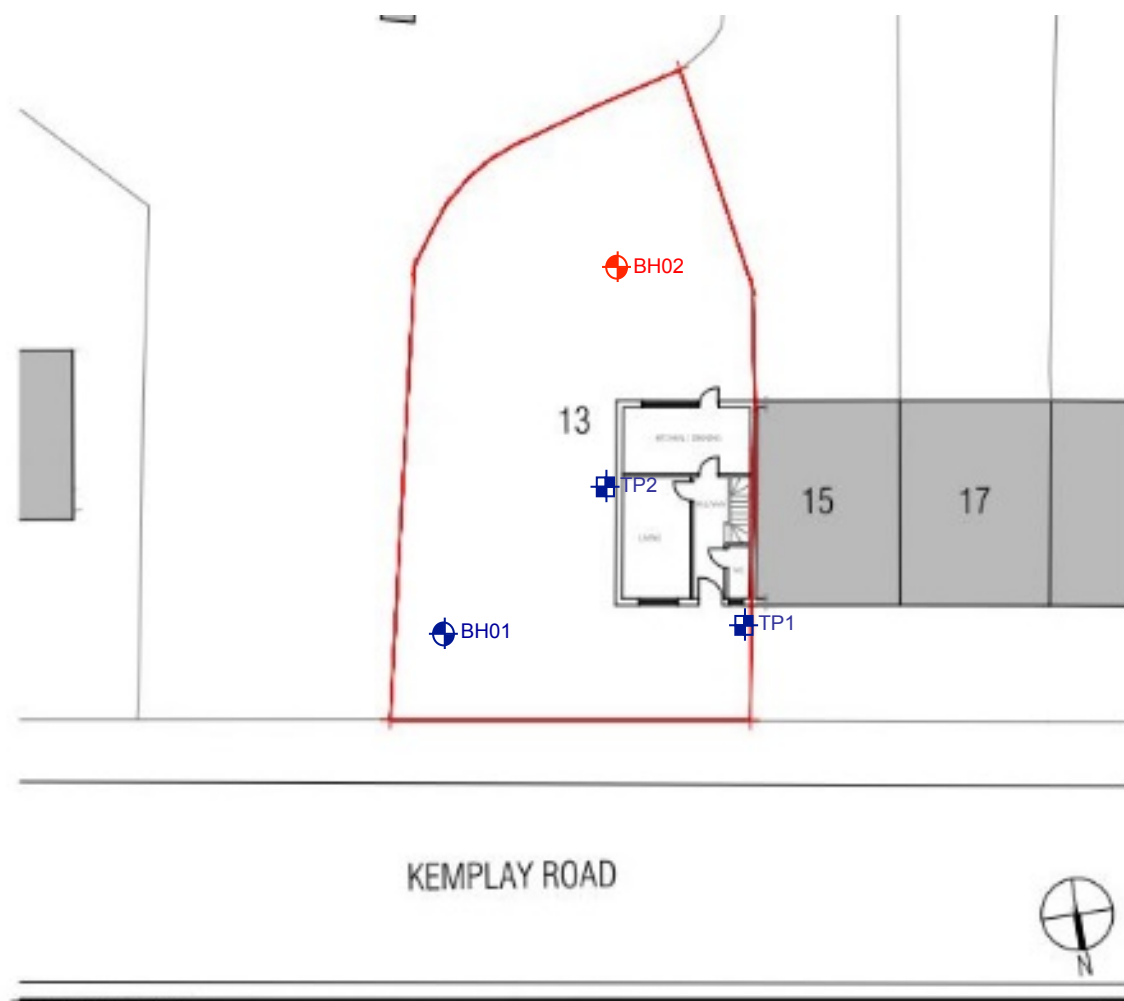
**Title:** Site Location Plan

<b>Project No:</b>	<b>Created By:</b> PIL	<b>Date:</b> Nov 2015
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**Client:** Fairhurst GGA







**Key:**

-  **BH** Cable percussive borehole.
-  **BH** Dynamic (windowless) sampler borehole.
-  **TP** Hand excavated trial pits.

**IMPORTANT – Please Read**

This drawing is for illustrative purposes only and is for use only in conjunction with associated reports relating to the project details below. LMB accepts no liability for the mis-interpretation or use of this illustration by any other parties.



*Ground Investigation  
Land Contamination  
Hydrogeology  
Engineering Geology*

**Site:**  
13 Kemplay Road, London SW3

**Figure Number:** Figure 2

**Title:** Exploratory Hole Location Plan

<b>Project No:</b>	<b>Created By:</b> PIL	<b>Date:</b> Nov 2015
--------------------	---------------------------	--------------------------

**Client:** Fairhurst GGA

# APPENDICES

## Appendices

### APPENDIX A EXPLORATORY HOLE LOGS

# Borehole Log

Borehole No.

**BH1**

Sheet 1 of 1

Project Name: Kemplay Road, London NW3	Project No. LMB_Kemplay	Co-ords: -	Hole Type CP
Location: Hampstead, London NW3 1TA	Level:		Scale 1:50
Client: Kemplay Road Ltd	Dates: 19/10/2015 - 19/10/2015		Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.04			0.04		Paving slabs.	
		0.10			0.10		MADE GROUND: orange/brown sand (sub-base).	
		0.50	D		0.50		MADE GROUND: brown to yellow/brown sandy clay with rootlets.	
		1.00	D				Loose brown to orange/brown silty fine SAND. (CLAYGATE MEMBER).	
		1.20	D		1.20			
		1.50		N=8 (1,1/2,1,2,3)			Soft becoming firm brown to orange/brown with grey mottling sandy CLAY. (CLAYGATE MEMBER).	
		2.00	D					
		2.50	D					
		2.50		N=13 (1,1/2,3,4,4)			clay becomes firm.	
		3.00	D					
		3.50	U					
		4.00	D					
		4.50		N=18 (4,4/3,5,5,5)				
		5.00	D				clay becomes stiff.	
		5.30	D		5.30		Firm becoming stiff dark grey CLAY. Very closely fissured. (LONDON CLAY).	
		6.00	D					
		6.00		N=28 (5,6/6,8,7,7)				
	6.50	D						
	7.00	D						
	7.50	D						
	7.50		N=29 (6,6/8,7,7,7)					
	8.00	D						
	8.50	U						
	9.50		N=33 (7,8/9,8,8,8)					
	10.00	D		10.00			End of borehole at 10.00 m	

Remarks

# Borehole Log

Borehole No.

**BH2**

Sheet 1 of 1

Project Name: Kemplay Road, London NW3

Project No.  
LMB\_Kemplay

Co-ords: -

Hole Type  
WLS

Location: Hampstead, London NW3

Level:

Scale  
1:50

Client: Kemplay Rd Ltd

Dates: 19/10/2015 - 19/10/2015

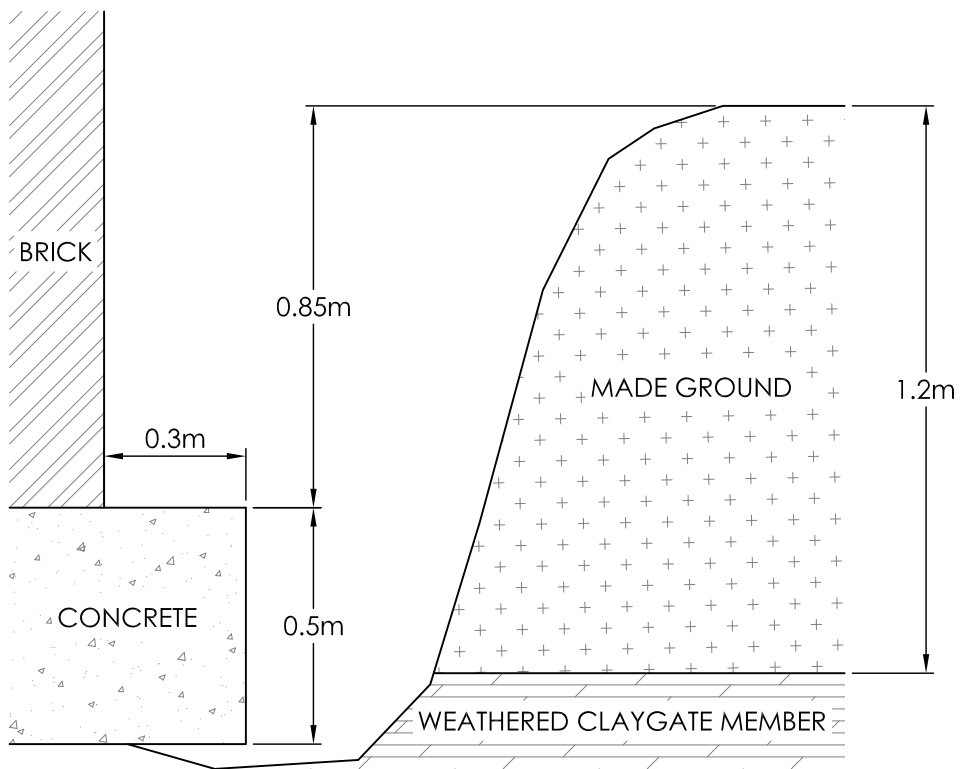
Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.15			0.15		Grass over brown sandy clay with rootlets. MADE GROUND: brown slightly gravelly clay. Gravel sub-angular brick and flint.	1 2 3 4 5 6 7 8 9 10	
		0.70 - 0.80	ES		0.50 0.60 0.70		MADE GROUND: orange/brown medium sand. MADE GROUND: brown slightly gravelly clay. Gravel sub-angular brick and flint.		
		1.20		N=4 (1,1/1,1,1,1)	1.00 1.20		MADE GROUND: brown/black slightly sandy slightly gravelly clay. Gravel sub-angular to rounded flint and occasional brick. MADE GROUND: brown slightly gravelly clay. Gravel sub-angular fine to medium brick.		
		2.00	D	N=11 (1,2/2,3,3,3)	1.60 2.20		Soft brown sandy CLAY. (CLAYGATE MEMBER). Firm brown to orange/brown CLAY with grey mottling. (CLAYGATE MEMBER).		
		3.00	D	N=11 (2,2/2,3,3,3)	2.00 3.00		Firm brown to orange/brown with grey mottling slightly sandy CLAY. Relict root traces observed. (CLAYGATE MEMBER). <i>sub-rounded to rounded medium flint gravel.</i>		
		4.00	D	N=10 (2,2/2,2,3,3)	4.00 4.40		Brown clayey silty fine SAND. (CLAYGATE MEMBER). Firm brown to orange/brown with grey mottling slightly sandy CLAY. (CLAYGATE MEMBER).		
		5.00	D	N=12 (2,3/3,3,3,3)	5.00 5.00				
		6.00			6.00				

End of borehole at 10.00 m

Remarks



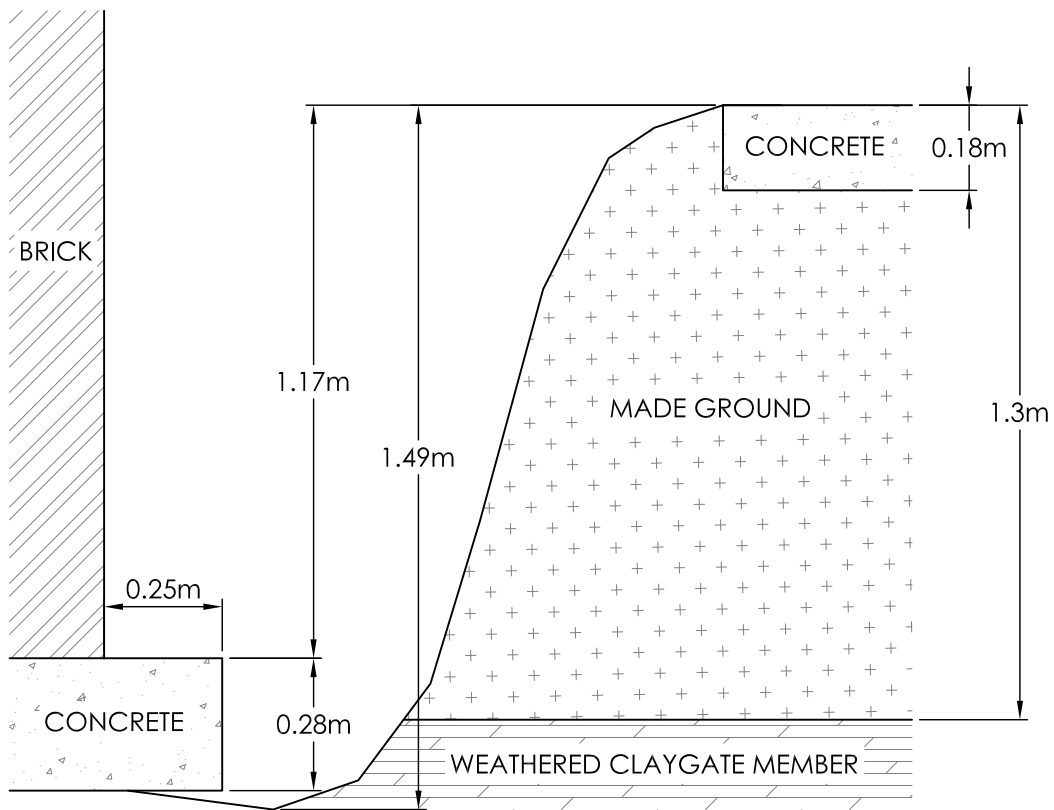


TRIAL PIT 1  
SCALE 1:16



PLATE 1: EXCAVATION





TRIAL PIT 2  
SCALE 1:16



PLATE 1: EXCAVATION

# APPENDICES

## APPENDIX B GEOTECHNICAL LABORATORY RESULTS



Unit A2  
Windmill Road  
Ponswood Industrial Estate  
St Leonards on Sea  
East Sussex  
TN38 9BY  
Telephone: (01424) 718618  
Facsimile: (01424) 729911  
[info@elab-uk.co.uk](mailto:info@elab-uk.co.uk)

---

**THE ENVIRONMENTAL LABORATORY LTD**

---

**Analytical Report Number:** 15-04437

**Issue:** 1

**Date of Issue:** 06/11/2015

**Contact:** James Phaure

**Customer Details:** K4 Soils Laboratory Ltd  
Unit 8  
Watford  
Hertfordshire WD18 9RU

**Quotation No:** Q15-00248

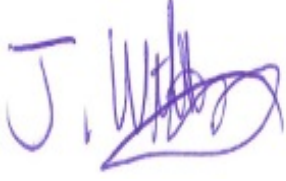
**Order No:** 19718

**Customer Reference:** 19718

**Date Received:** 04/11/2015

**Date Approved:** 06/11/2015

**Details:** Kemplay Road, London, NW3

**Approved by:** 

John Wilson, Operations Manager

---

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683)

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## Sample Summary

Report No.: 15-04437

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
44369	BH01 D 6.50	Not Provided	04/11/2015	Clayey loam	ac
44370	BH02 D 3.00	Not Provided	04/11/2015	Clayey loam	ac



# Results Summary

Report No.: 15-04437

ELAB Reference	44369	44370
Customer Reference	D	D
Sample ID		
Sample Type	SOIL	SOIL
Sample Location	BH01	BH02
Sample Depth (m)	6.50	3.00
Sampling Date		

Determinand	Codes	Units	LOD		
<b>Miscellaneous</b>					
Soil Organic Matter	U	%	0.1	c 1.3	c 0.4



## Method Summary

Report No.: 15-04437

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
<b>Soil</b>					
Soil organic matter	U	Air dried sample	06/11/2015	BS1377:P3	Titrimetry



## Report Information

Report No.: 15-04437

### Key

---

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
*	UKAS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"

Soil sample results are expressed on an air dried basis

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

PCB congener results may include any coeluting PCBs

Uncertainty of measurement for the determinands tested are available upon request

### Deviation Codes

- 
- |   |  |
|---|--|
| a | No date of sampling supplied                             |
| b | No time of sampling supplied (Waters Only)               |
| c | Sample not received in appropriate containers            |
| d | Sample not received in cooled condition                  |
| e | The container has been incorrectly filled                |
| f | Sample age exceeds stability time (sampling to receipt)  |
| g | Sample age exceeds stability time (sampling to analysis) |

Where a sample has a deviation code, the applicable test result may be invalid.

### Sample Retention and Disposal

---

All soil samples will be retained for a period of one month

All water samples will be retained for 7 days following the date of the test report

Charges may apply to extended sample storage



## Summary of Classification Test Results

Job No. 19718	Project Name Kemplay Rd, London NW3	Programme	
		Samples received	21/10/2015
Project No. -	Client LMB Geosolutions	Schedule received	21/10/2015
		Project started	22/10/2015
		Testing Started	04/11/2015

Hole No.	Sample				Soil Description	NMC %	Passing 425µm %	LL %	PL %	PI %	Remarks
	Ref	Top	Base	Type							
BH01		1.20		D	Brown slightly mottled blue grey slightly sandy silty CLAY with rootlets	17					
BH01		2.50		D	Brown slightly mottled blue grey slightly sandy silty CLAY	24					
BH01		3.00		D	Brown sandy silty CLAY	28	100	46	20	26	
BH01		4.00		D	Dark brown sandy silty CLAY	26	100	50	23	27	
BH01		4.50		D	Dark brown sandy silty CLAY	29	100	44	19	25	
BH01		6.00		D	Grey slightly sandy silty CLAY with occasional shell fragments	23	99	54	21	33	
BH01		7.00		D	Dark grey slightly sandy silty CLAY	24					
BH01		10.00		D	Dark grey silty CLAY	28					
BH02		2.00		D	Brown and occasional orange and pale grey slightly sandy silty CLAY	22	98	46	19	27	
BH02		3.00		D	Brown slightly mottled blue grey slightly sandy silty CLAY	26					
BH02		4.00		D	Brown and occasional grey slightly sandy silty CLAY with sand pockets	28	100	50	20	30	
BH02		5.00		D	Grey sandy silty CLAY	28	100	47	21	26	

<b>Test Methods: BS1377: Part 2: 1990:</b> Natural Moisture Content : clause 3.2 Atterberg Limits: clause 4.3 and 5.0	<b>Test Report by K4 SOILS LABORATORY</b> Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU  Tel: 01923 711 288 Email: <a href="mailto:James@k4soils.com">James@k4soils.com</a>	<b>Checked and Approved</b>  Initials     J.P  Date:        06/11/2015
2519 Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)		MSF-5-R1(a) -Rev. 0



Summary of Classification Test Results

Job Ref. 19718	Project Name Kemplay Rd, London NW3
Project ID -	Client LMB Geosolutions

Hole No.	Sample				Soil Description	Density bulk dry Mg/m3	NMC %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Remarks
	Ref	Top	Base	Type									
BH01		4.00		D	Dark brown sandy silty CLAY	1.92	1.52	26					
BH01		7.00		D	Dark grey slightly sandy silty CLAY	1.97	1.59	24					
BH02		3.00		D	Brown slightly mottled blue grey slightly sandy silty CLAY	1.93	1.53	26					

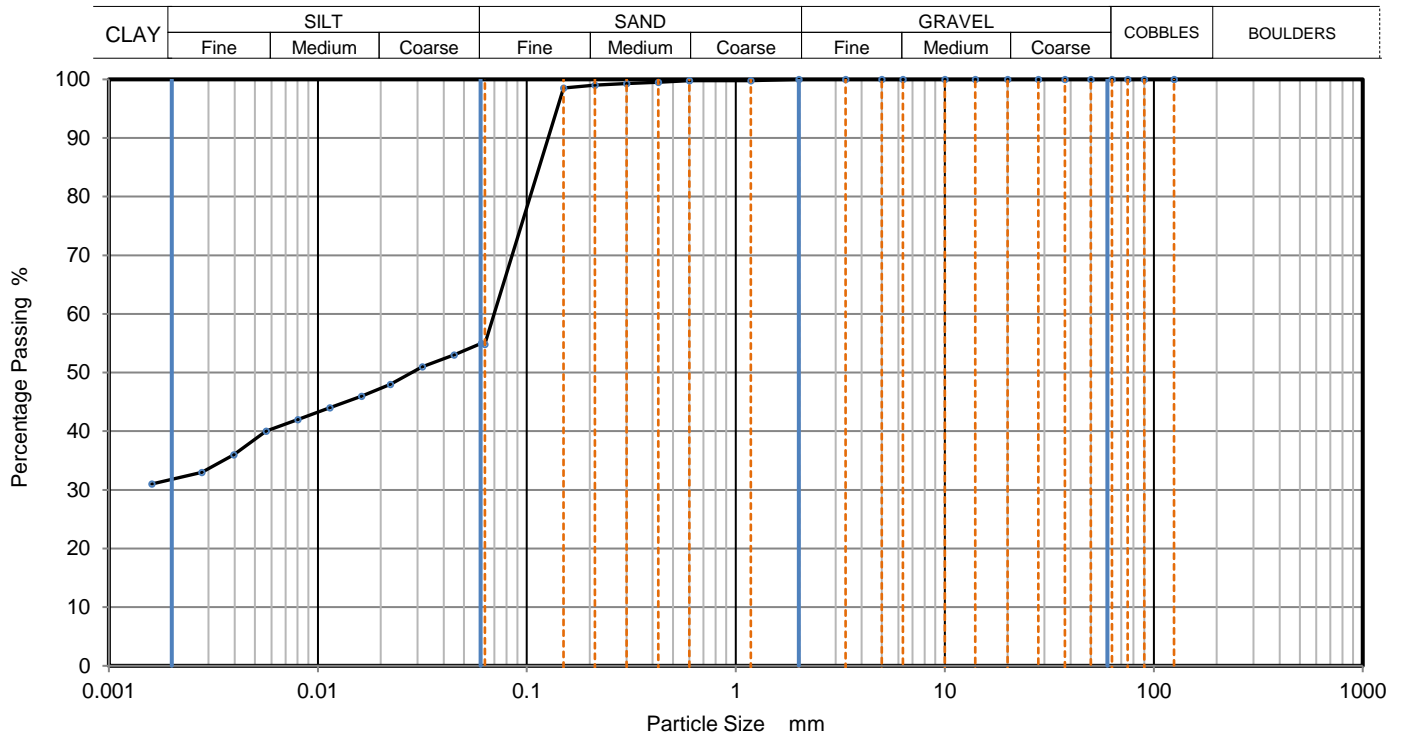
 <b>2519</b>	<b>Test Methods: BS1377: Part 2: 1990:</b> Natural Moisture Content : clause 3.2 Atterberg Limits: clause 4.3 and 5.0 Particle Density: (gas jar) clause 8.2 (pycnometer) 8.3 Density: (linear) clause 7.2 (immersion) clause 7.3	<b>Test Report by K4 SOILS LABORATORY</b> Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU  Tel: 01923 711 288 Email: James@k4soils.com	<b>Checked and Approved</b>  Initials <b>J.P</b>  Date: 06/11/2015
	Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)		MSF-5-R1(a)-Rev. 0



# PARTICLE SIZE DISTRIBUTION

Job Ref	19718
Borehole/Pit No.	BH01
Sample No.	
Depth	3.00 m
Sample Type	D
Samples received	21/10/2015
Schedules received	21/10/2015
Project started	22/10/2015
Date tested	05/11/2015

Site Name	Kemplay Rd, London NW3		
Project No.	-	Client	LMB Geosolutions
Soil Description	Brown sandy silty CLAY		
Test Method	BS1377:Part 2: 1990, clause 9.0		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0605	55
90	100	0.0448	53
75	100	0.0316	51
63	100	0.0222	48
50	100	0.0162	46
37.5	100	0.0114	44
28	100	0.0080	42
20	100	0.0056	40
14	100	0.0040	36
10	100	0.0028	33
6.3	100	0.0016	31
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100	Particle density (assumed)	
0.425	100	2.70	Mg/m <sup>3</sup>
0.3	99		
0.212	99		
0.15	99		
0.063	55		

Dry Mass of sample, g 20

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	45
Silt	23
Clay	32

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks  
Preparation and testing in accordance with BS1377 unless noted below



**K4 Soils Laboratory**  
 Unit 8, Olds Close, Watford, Herts, WD18 9RU  
 Email: james@k4soils.com  
 Tel: 01923 711288

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

Checked and Approved  
 Initials: **J.P**  
 Date: 06/11/2015

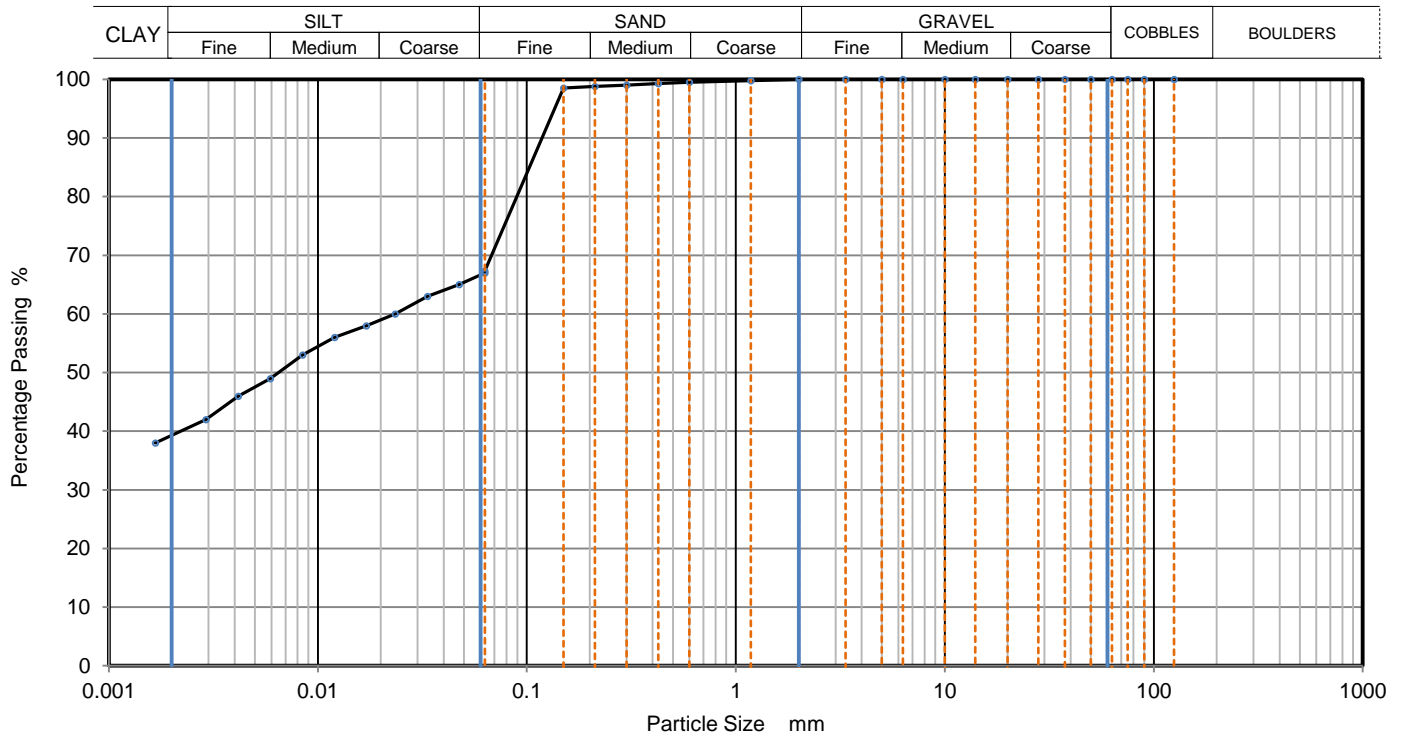
MSF-5-R3 (Rev.0)



# PARTICLE SIZE DISTRIBUTION

Job Ref	19718
Borehole/Pit No.	BH01
Sample No.	
Depth	6.50 m
Sample Type	D
Samples received	21/10/2015
Schedules received	21/10/2015
Project started	22/10/2015
Date tested	05/11/2015

Site Name	Kemplay Rd, London NW3		
Project No.	-	Client	LMB Geosolutions
Soil Description	Dark grey slightly sandy silty CLAY		
Test Method	BS1377:Part 2: 1990, clause 9.0		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	67
90	100	0.0474	65
75	100	0.0334	63
63	100	0.0235	60
50	100	0.0171	58
37.5	100	0.0120	56
28	100	0.0084	53
20	100	0.0059	49
14	100	0.0042	46
10	100	0.0029	42
6.3	100	0.0017	38
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100	Particle density (assumed)	
0.425	99	2.70	Mg/m <sup>3</sup>
0.3	99		
0.212	99		
0.15	99		
0.063	67		

Dry Mass of sample, g 15

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	33
Silt	28
Clay	40

Grading Analysis		
D100	mm	
D60	mm	0.0235
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks  
Preparation and testing in accordance with BS1377 unless noted below



**K4 Soils Laboratory**  
 Unit 8, Olds Close, Watford, Herts, WD18 9RU  
 Email: james@k4soils.com  
 Tel: 01923 711288

Checked and Approved  
 Initials: **J.P**  
 Date: 06/11/2015

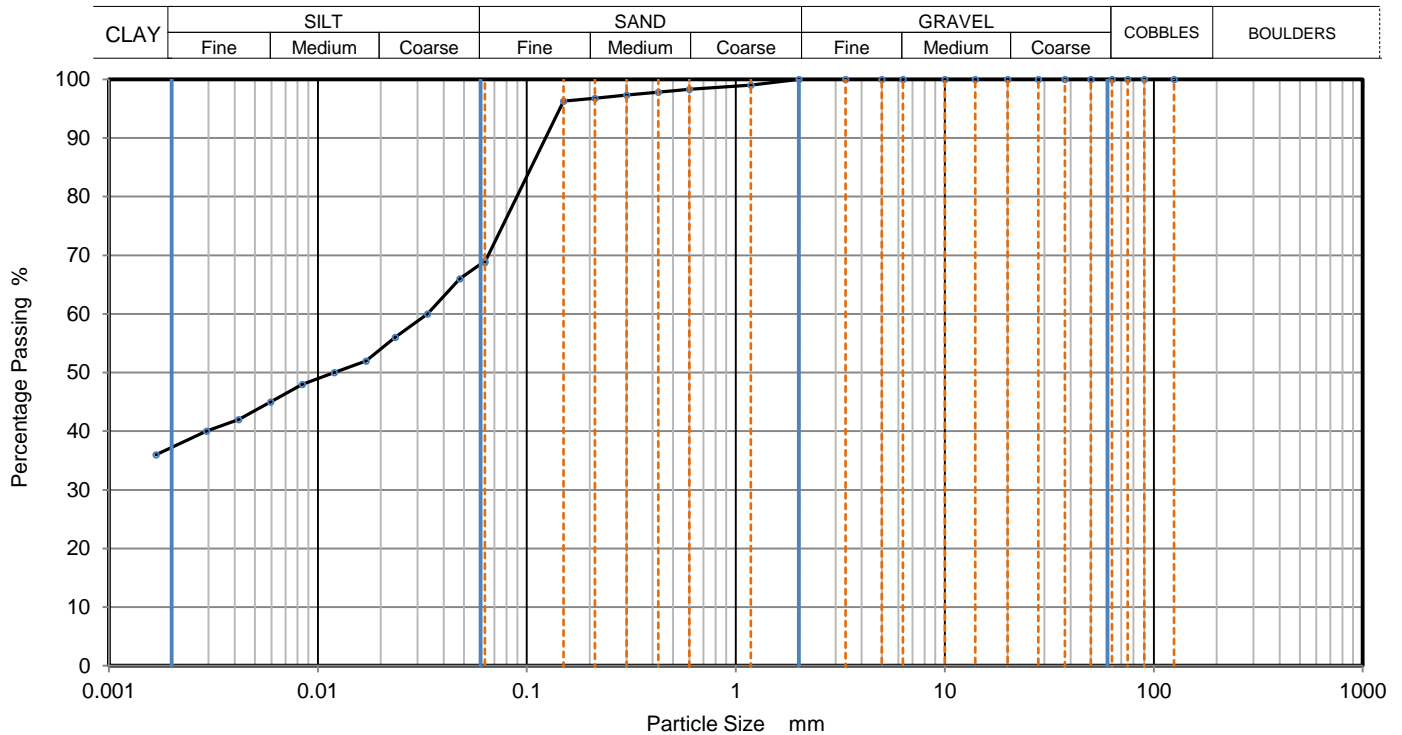




# PARTICLE SIZE DISTRIBUTION

Job Ref	19718
Borehole/Pit No.	BH02
Sample No.	
Depth	2.00 m
Sample Type	D
Samples received	21/10/2015
Schedules received	21/10/2015
Project started	22/10/2015
Date tested	05/11/2015

Site Name	Kemplay Rd, London NW3		
Project No.	-	Client	LMB Geosolutions
Soil Description	Brown and occasional orange and pale grey slightly sandy silty CLAY		
Test Method	BS1377:Part 2: 1990, clause 9.0		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	69
90	100	0.0478	66
75	100	0.0334	60
63	100	0.0235	56
50	100	0.0170	52
37.5	100	0.0120	50
28	100	0.0084	48
20	100	0.0059	45
14	100	0.0042	42
10	100	0.0029	40
6.3	100	0.0017	36
5	100		
3.35	100		
2	100		
1.18	99		
0.6	98	Particle density (assumed) 2.70 Mg/m <sup>3</sup>	
0.425	98		
0.3	97		
0.212	97		
0.15	96		
0.063	69		

Dry Mass of sample, g 14

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	31
Silt	32
Clay	37

Grading Analysis		
D100	mm	
D60	mm	0.0342
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks  
Preparation and testing in accordance with BS1377 unless noted below



**K4 Soils Laboratory**  
 Unit 8, Olds Close, Watford, Herts, WD18 9RU  
 Email: james@k4soils.com  
 Tel: 01923 711288

Checked and Approved  
 Initials: **J.P**  
 Date: 06/11/2015



**Sulphate Content (Gravimetric Method) for 2:1 Soil: Water Extract and pH Value - Summary of Results**  
**Tested in accordance with BS1377 : Part 3 : 1990, clause 5.3 and clause 9**

Job No. 19718	Project Name Kemplay Rd, London NW3	Programme	
		Samples received	21/10/2015
Project No. -	Client LMB Geosolutions	Schedule received	21/10/2015
		Project started	22/10/2015
		Testing Started	04/11/2015

Hole No.	Sample				Soil description	Dry Mass passing 2mm %	SO3 Content g/l	SO4 Content g/l	pH	Remarks
	Ref	Top	Base	Type						
BH01		2.50		D	Brown slightly mottled blue grey slightly sandy silty CLAY	100	0.36	0.43	3.53	
BH01		5.00		D	Brown fine sandy silty CLAY	100	0.32	0.38	7.38	
BH02		2.00		D	Brown and occasional orange and pale grey slightly sandy silty CLAY	100	0.32	0.38	6.81	

	<b>Test Report by K4 SOILS LABORATORY</b> Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU Tel: 01923 711 288 Email: James@k4soils.com	<b>Checked and Approved</b> Initials        J.P Date:         06/11/2015
	2519	Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

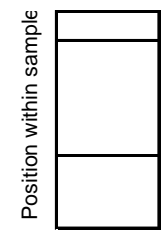


**Unconsolidated Undrained Triaxial  
Compression Test without measurement of  
pore pressure - single specimen**

Job Ref	19718	
Borehole/Pit No.	BH01	
Sample No.	-	
Depth	3.50	m
Sample Type	U	
Samples received	21/10/2015	
Schedules received	21/10/2015	
Date of test	04/11/2015	

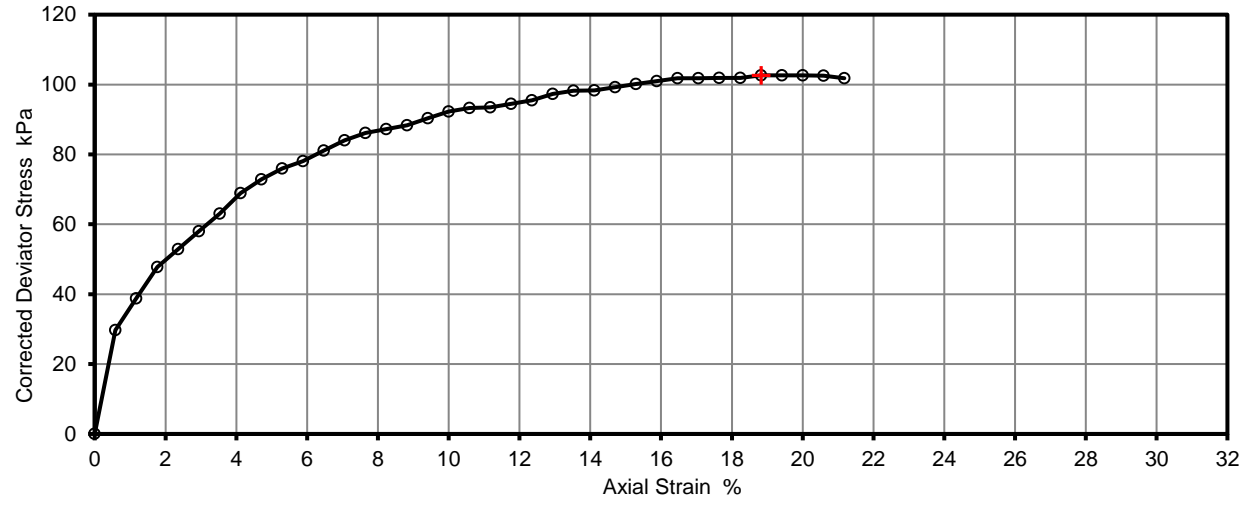
Site Name	Kemplay Rd, London NW3		
Project No.		Client	LMB Geosolutions
Soil Description	Medium strength brown slightly sandy silty CLAY with pockets of orange brown fine sand		
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen		

**Remarks**

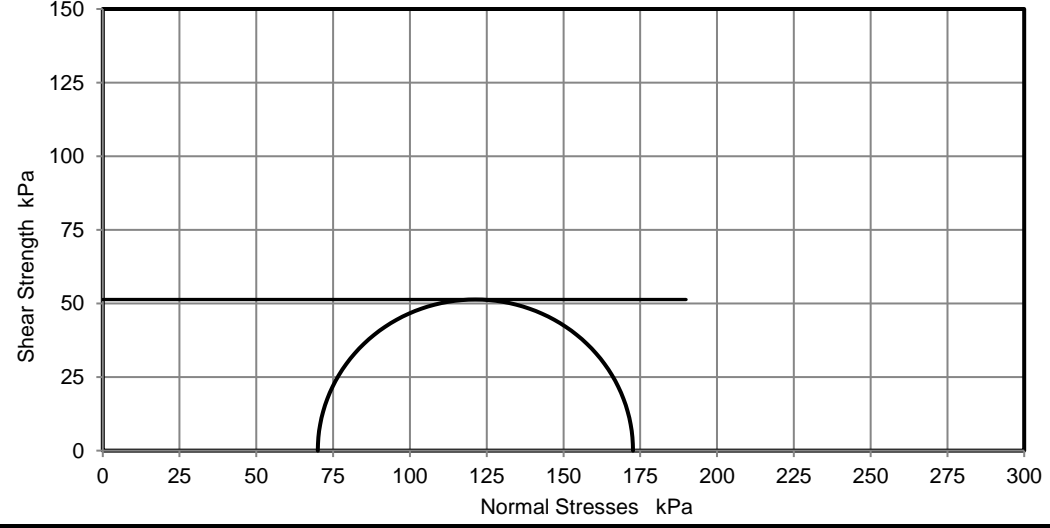


Test Number	1	
Length	170.0	mm
Diameter	102.0	mm
Bulk Density	1.89	Mg/m3
Moisture Content	29	%
Dry Density	1.47	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	70	kPa
Axial Strain	18.8	%
Deviator Stress, ( $\sigma_1 - \sigma_3$ ) f	103	kPa
Undrained Shear Strength, cu	51	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)$ f
Mode of Failure	Plastic	

**Deviator Stress v Axial Strain**



**Mohr Circles**



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.



**Test Report by K4 SOILS LABORATORY**  
 Unit 8 Olds Close Olds Approach  
 Watford Herts WD18 9RU  
 Tel: 01923 711 288  
 Email: James@k4soils.com

**Checked and Approved**  
 Initials: J.P  
 Date 06/11/2015  
 MSF-5 R7 (Rev.0)

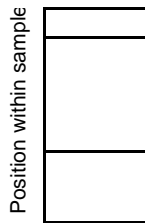


**Unconsolidated Undrained Triaxial  
Compression Test without measurement of  
pore pressure - single specimen**

Job Ref	19718
Borehole/Pit No.	BH01
Sample No.	-
Depth	8.50 m
Sample Type	U
Samples received	21/10/2015
Schedules received	21/10/2015
Date of test	03/11/2015

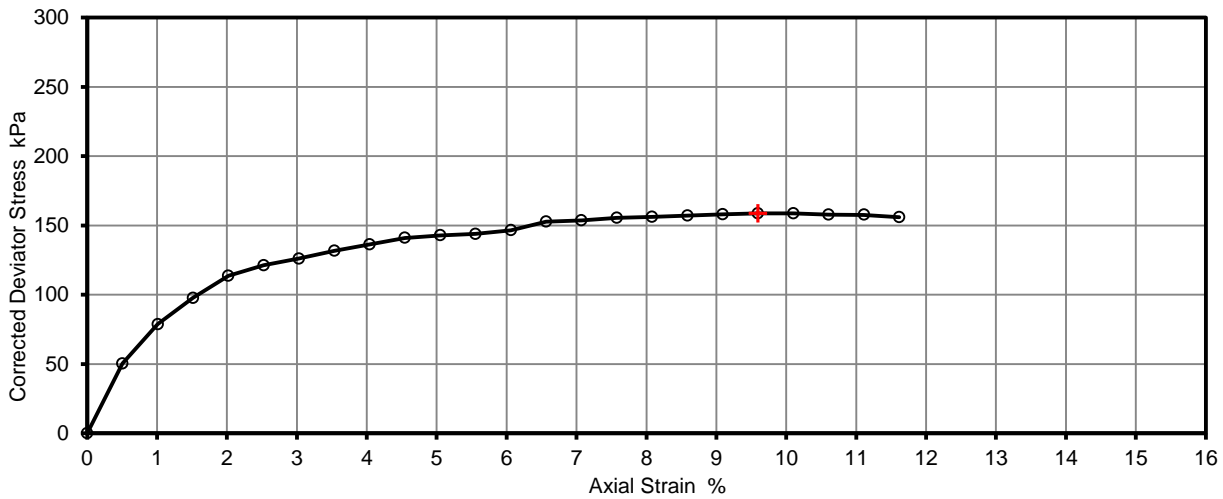
Site Name	Kemplay Rd, London NW3		
Project No.		Client	LMB Geosolutions
Soil Description	High strength dark grey slightly sandy CLAY		
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen		

**Remarks**

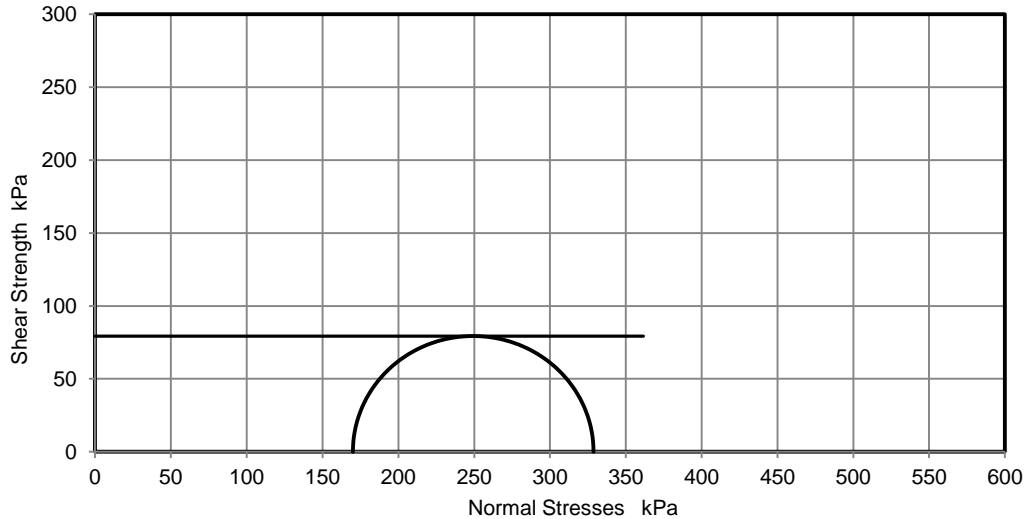


Test Number	1
Length	198.0 mm
Diameter	102.0 mm
Bulk Density	2.01 Mg/m3
Moisture Content	28 %
Dry Density	1.56 Mg/m3
Rate of Strain	2.0 %/min
Cell Pressure	170 kPa
Axial Strain	9.6 %
Deviator Stress, $(\sigma_1 - \sigma_3) f$	159 kPa
Undrained Shear Strength, $c_u$	79 kPa $\frac{1}{2}(\sigma_1 - \sigma_3) f$
Mode of Failure	Compound

**Deviator Stress v Axial Strain**



**Mohr Circles**



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.



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Test Report by K4 SOILS LABORATORY  
Unit 8 Olds Close Olds Approach  
Watford Herts WD18 9RU  
Tel: 01923 711 288  
Email: James@k4soils.com

Checked and Approved  
Initials: J.P  
Date 06/11/2015  
MSF-5 R7 (Rev.0)

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)



**Unconsolidated Undrained Triaxial Compression tests without measurement of pore pressure  
Summary of Results**

**Tests carried out in accordance with BS1377:Part 7 : 1990 clause 8 or 9 as appropriate to test**

Job No. 19718	Project Name Kemplay Rd, London NW3	Programme	
		Samples received	21/10/2015
		Schedule received	21/10/2015
Project No. -	Client LMB Geosolutions	Project started	22/10/2015
		Testing Started	04/11/2015

Hole No.	Sample				Soil Description	Test Type	Density		w %	Length mm	Diameter mm	$\sigma_3$ kPa	At failure				Remarks
	Ref	Top	Base	Type			bulk Mg/m3	dry					Axial strain %	$\sigma_1 - \sigma_3$ kPa	CU kPa	Mode	
BH01		3.50		U	Medium strength brown slightly silty CLAY with pockets of orange brown fine sand	UU	1.89	1.47	29	170	102	70	18.8	103	51	P	
BH01		8.50		U	High strength dark grey slightly silty CLAY	UU	2.01	1.56	28	198	102	170	9.6	159	79	C	

Legend	UU - single stage test (single and multiple specimens)	$\sigma_3$ Cell pressure	Mode of failure ;	B - Brittle
	UUM - Multistage test on a single specimen	$\sigma_1 - \sigma_3$ Maximum corrected deviator stress		P - Plastic
	suffix R - remoulded or recompacted	cu Undrained shear strength, $\frac{1}{2}(\sigma_1 - \sigma_3)$		C - Compound

 2519	<b>Test Report by K4 SOILS LABORATORY</b> Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU Tel: 01923 711 288 Email: james@k4soils.com	<b>Checked and Approved</b> Initials: J.P Date: 06/11/2015
	Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)	MSF-5-R7b (Rev. 0)

# APPENDICES

## APPENDIX C CHEMICAL LABORATORY TESTING RESULTS



**Philip Lewis**  
LMB Geosolutions Ltd  
28 Dresden Road  
London  
N19 3BD

i2 Analytical Ltd.  
7 Woodshots Meadow,  
Croxley Green  
Business Park,  
Watford,  
Herts,  
WD18 8YS

**t:** 01923 225404  
**f:** 01923 237404  
**e:** reception@i2analytical.com

**e:** philip@lmbgeosolutions.com

## **Analytical Report Number : 15-80960**

<b>Project / Site name:</b>	Kemplay Rd, London NW3	<b>Samples received on:</b>	20/10/2015
<b>Your job number:</b>		<b>Samples instructed on:</b>	20/10/2015
<b>Your order number:</b>		<b>Analysis completed by:</b>	29/10/2015
<b>Report Issue Number:</b>	1	<b>Report issued on:</b>	29/10/2015
<b>Samples Analysed:</b>	3 soil samples		

**Signed:**

Rexona Rahman  
Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

**Signed:**

Emma Winter  
Assistant Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

Other office located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting  
leachates - 2 weeks from reporting  
waters - 2 weeks from reporting  
asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Analytical Report Number: 15-80960

Project / Site name: Kemplay Rd, London NW3

Lab Sample Number	497888	497889	497890		
Sample Reference	BH02	BH01	BH01		
Sample Number	None Supplied	None Supplied	None Supplied		
Depth (m)	0.70-0.80	0.50	1.00		
Date Sampled	19/10/2015	19/10/2015	19/10/2015		
Time Taken	None Supplied	None Supplied	None Supplied		
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	16	8.5
Total mass of sample received	kg	0.001	NONE	0.96	1.3

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	-
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**General Inorganics**

pH	pH Units	N/A	MCERTS	6.7	-	-
Water Soluble Sulphate (Soil Equivalent)	g/kg	0.0025	MCERTS	0.097	-	-
Water Soluble Sulphate as SO <sub>4</sub> (2:1)	mg/kg	2.5	MCERTS	97	-	-
Water Soluble SO <sub>4</sub> (BRE SD 2:1 Leach Equivalent)	g/l	0.00125	MCERTS	0.049	-	-

**Heavy Metals / Metalloids**

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	24	5.0	6.8
Boron (water soluble)	mg/kg	0.2	MCERTS	3.1	1.0	0.7
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	25	27	27
Copper (aqua regia extractable)	mg/kg	1	MCERTS	81	15	15
Lead (aqua regia extractable)	mg/kg	1	MCERTS	150	130	150
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	21	14	13
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	150	58	54

**Monoaromatics**

Benzene	µg/kg	1	MCERTS	< 1.0	-	-
Toluene	µg/kg	1	MCERTS	< 1.0	-	-
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	-
p & m-xylene	µg/kg	1	MCERTS	< 1.0	-	-
o-xylene	µg/kg	1	MCERTS	< 1.0	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	-

**Petroleum Hydrocarbons**

TPH1 (C10 - C40)	mg/kg	10	MCERTS	-	-	110
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TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	2.6	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	32	-	-
<b>TPH-CWG - Aliphatic (EC5 - EC35)</b>	mg/kg	10	MCERTS	35	-	-

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	17	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	54	-	-
<b>TPH-CWG - Aromatic (EC5 - EC35)</b>	mg/kg	10	MCERTS	72	-	-





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Environmental Science

Analytical Report Number: 15-80960

Project / Site name: Kemplay Rd, London NW3

<b>Lab Sample Number</b>	497888			497889	497890		
<b>Sample Reference</b>	BH02			BH01	BH01		
<b>Sample Number</b>	None Supplied			None Supplied	None Supplied		
<b>Depth (m)</b>	0.70-0.80			0.50	1.00		
<b>Date Sampled</b>	19/10/2015			19/10/2015	19/10/2015		
<b>Time Taken</b>	None Supplied			None Supplied	None Supplied		
<b>Analytical Parameter (Soil Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>				

**VOCs**

Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	497888	497889	497890	
Chloromethane	µg/kg	1	ISO 17025	< 1.0	-	-	
Chloroethane	µg/kg	1	ISO 17025	< 1.0	-	-	
Bromomethane	µg/kg	1	ISO 17025	< 1.0	-	-	
Vinyl Chloride	µg/kg	1	ISO 17025	< 1.0	-	-	
Trichlorofluoromethane	µg/kg	1	ISO 17025	< 1.0	-	-	
1,1-Dichloroethene	µg/kg	1	MCERTS	< 1.0	-	-	
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	< 1.0	-	-	
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	< 1.0	-	-	
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	-	
1,1-Dichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	
2,2-Dichloropropane	µg/kg	1	NONE	< 1.0	-	-	
Trichloromethane	µg/kg	1	MCERTS	< 1.0	-	-	
1,1,1-Trichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	
1,2-Dichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	
1,1-Dichloropropene	µg/kg	1	NONE	< 1.0	-	-	
Trans-1,2-dichloroethene	µg/kg	1	NONE	< 1.0	-	-	
Benzene	µg/kg	1	MCERTS	< 1.0	-	-	
Tetrachloromethane	µg/kg	1	MCERTS	< 1.0	-	-	
1,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	-	-	
Trichloroethene	µg/kg	1	MCERTS	< 1.0	-	-	
Dibromomethane	µg/kg	1	MCERTS	< 1.0	-	-	
Bromodichloromethane	µg/kg	1	NONE	< 1.0	-	-	
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	-	-	
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	-	-	
Toluene	µg/kg	1	MCERTS	< 1.0	-	-	
1,1,2-Trichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	
1,3-Dichloropropane	µg/kg	1	ISO 17025	< 1.0	-	-	
Dibromochloromethane	µg/kg	1	ISO 17025	< 1.0	-	-	
Tetrachloroethene	µg/kg	1	MCERTS	< 1.0	-	-	
1,2-Dibromoethane	µg/kg	1	ISO 17025	< 1.0	-	-	
Chlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	
1,1,1,2-Tetrachloroethane	µg/kg	1	NONE	< 1.0	-	-	
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	
p & m-Xylene	µg/kg	1	MCERTS	< 1.0	-	-	
Styrene	µg/kg	1	MCERTS	< 1.0	-	-	
Tribromomethane	µg/kg	1	MCERTS	< 1.0	-	-	
o-Xylene	µg/kg	1	MCERTS	< 1.0	-	-	
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	-	-	
Isopropylbenzene	µg/kg	1	NONE	< 1.0	-	-	
Bromobenzene	µg/kg	1	MCERTS	< 1.0	-	-	
n-Propylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-	
2-Chlorotoluene	µg/kg	1	NONE	< 1.0	-	-	
4-Chlorotoluene	µg/kg	1	NONE	< 1.0	-	-	
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-	
tert-Butylbenzene	µg/kg	1	NONE	< 1.0	-	-	
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-	
sec-Butylbenzene	µg/kg	1	NONE	< 1.0	-	-	
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	< 1.0	-	-	
p-Isopropyltoluene	µg/kg	1	ISO 17025	< 1.0	-	-	
1,2-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	
1,4-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	
Butylbenzene	µg/kg	1	NONE	< 1.0	-	-	
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	< 1.0	-	-	
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	
Hexachlorobutadiene	µg/kg	1	NONE	< 1.0	-	-	
1,2,3-Trichlorobenzene	µg/kg	1	NONE	< 1.0	-	-	



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Environmental Science

Analytical Report Number: 15-80960

Project / Site name: Kemplay Rd, London NW3

<b>Lab Sample Number</b>	497888			497889	497890		
<b>Sample Reference</b>	BH02			BH01	BH01		
<b>Sample Number</b>	None Supplied			None Supplied	None Supplied		
<b>Depth (m)</b>	0.70-0.80			0.50	1.00		
<b>Date Sampled</b>	19/10/2015			19/10/2015	19/10/2015		
<b>Time Taken</b>	None Supplied			None Supplied	None Supplied		
<b>Analytical Parameter (Soil Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>				

SVOCs							
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	497888	497889	497890	
Aniline	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	
Phenol	mg/kg	0.2	ISO 17025	< 0.2	< 0.2	< 0.2	
2-Chlorophenol	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	
2-Methylphenol	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	
Hexachloroethane	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	
Nitrobenzene	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	
4-Methylphenol	mg/kg	0.2	NONE	< 0.2	< 0.2	< 0.2	
Isophorone	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	
2-Nitrophenol	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	
4-Chloroaniline	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	
Hexachlorobutadiene	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	
2-Methylnaphthalene	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	
2-Chloronaphthalene	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	
Dimethylphthalate	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	
Acenaphthylene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	
Dibenzofuran	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	< 0.3	< 0.3	< 0.3	
Diethyl phthalate	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	
4-Nitroaniline	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	
Fluorene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	
Azobenzene	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	
Hexachlorobenzene	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	
Phenanthrene	mg/kg	0.1	MCERTS	1.8	0.30	0.81	
Anthracene	mg/kg	0.1	MCERTS	0.44	< 0.10	0.13	
Carbazole	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	
Dibutyl phthalate	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	
Anthraquinone	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	
Fluoranthene	mg/kg	0.1	MCERTS	4.1	0.50	1.7	
Pyrene	mg/kg	0.1	MCERTS	3.5	0.42	1.4	
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	< 0.3	< 0.3	< 0.3	
Benzo(a)anthracene	mg/kg	0.1	MCERTS	2.4	0.27	0.87	
Chrysene	mg/kg	0.05	MCERTS	1.8	0.21	0.60	
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	2.3	0.26	0.88	
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	2.2	0.15	0.35	
Benzo(a)pyrene	mg/kg	0.1	MCERTS	2.0	0.23	0.73	
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	1.3	< 0.10	0.30	
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.4	< 0.05	0.29	

Iss No 15-80960-1

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The results included within the report are representative of the samples submitted for analysis.

Page 4 of 6



**Analytical Report Number : 15-80960**

**Project / Site name: Kemplay Rd, London NW3**

\* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
497888	BH02	None Supplied	0.70-0.80	Black loam and clay with brick.
497889	BH01	None Supplied	0.50	Light brown sandy loam with gravel and vegetation.
497890	BH01	None Supplied	1.00	Light brown sandy loam with gravel and vegetation.



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Environmental Science

**Analytical Report Number : 15-80960****Project / Site name: Kemplay Rd, London NW3****Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)**

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073S-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds in soil by extraction in dichloromethane and hexane followed by GC-MS.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
TPH1 (Soil)	Determination of TPH by GC-MS/GC-FID).	In-house method	L064/076PL	D	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L076-PL	W	MCERTS
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073S-PL	W	MCERTS

**For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.****For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.****Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.**



**Philip Lewis**  
LMB Geosolutions Ltd  
28 Dresden Road  
London  
N19 3BD

i2 Analytical Ltd.  
7 Woodshots Meadow,  
Croxley Green  
Business Park,  
Watford,  
Herts,  
WD18 8YS

**t:** 01923 225404  
**f:** 01923 237404  
**e:** reception@i2analytical.com

**e:** philip@lmbgeosolutions.com

## **Analytical Report Number : 15-81520**

<b>Project / Site name:</b>	Holloway Road, London N19	<b>Samples received on:</b>	28/10/2015
<b>Your job number:</b>		<b>Samples instructed on:</b>	29/10/2015
<b>Your order number:</b>		<b>Analysis completed by:</b>	06/11/2015
<b>Report Issue Number:</b>	1	<b>Report issued on:</b>	06/11/2015
<b>Samples Analysed:</b>	2 bulk samples - 2 soil samples		

**Signed:** \_\_\_\_\_

Rexona Rahman  
Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

**Signed:** \_\_\_\_\_

Emma Winter  
Assistant Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

Other office located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting  
leachates - 2 weeks from reporting  
waters - 2 weeks from reporting  
asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Analytical Report Number: 15-81520

Project / Site name: Holloway Road, London N19

Lab Sample Number	501089	501090					
Sample Reference	BH1	BH2					
Sample Number	None Supplied	None Supplied					
Depth (m)	0.40	0.50					
Date Sampled	26/10/2015	27/10/2015					
Time Taken	None Supplied	None Supplied					
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Stone Content	%	0.1	NONE	< 0.1	< 0.1		
Moisture Content	%	N/A	NONE	21	9.9		
Total mass of sample received	kg	0.001	NONE	1.0	1.2		

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected		

#### General Inorganics

pH	pH Units	N/A	MCERTS	8.9	-		
Water Soluble SO4 (BRE SD 2:1 Leach Equivalent)	g/l	0.00125	MCERTS	0.38	-		

#### Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	-	0.27		
Acenaphthylene	mg/kg	0.1	MCERTS	-	0.18		
Acenaphthene	mg/kg	0.1	MCERTS	-	0.22		
Fluorene	mg/kg	0.1	MCERTS	-	0.18		
Phenanthrene	mg/kg	0.1	MCERTS	-	2.3		
Anthracene	mg/kg	0.1	MCERTS	-	0.35		
Fluoranthene	mg/kg	0.1	MCERTS	-	2.2		
Pyrene	mg/kg	0.1	MCERTS	-	1.8		
Benzo(a)anthracene	mg/kg	0.1	MCERTS	-	0.96		
Chrysene	mg/kg	0.05	MCERTS	-	0.90		
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	-	0.92		
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	-	0.56		
Benzo(a)pyrene	mg/kg	0.1	MCERTS	-	0.72		
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	-	0.46		
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	-	< 0.10		
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	0.60		

#### Total PAH

Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	-	12.6		

#### Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	12	-		
Boron (water soluble)	mg/kg	0.2	MCERTS	2.0	-		
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	-		
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	45	-		
Copper (aqua regia extractable)	mg/kg	1	MCERTS	25	-		
Lead (aqua regia extractable)	mg/kg	1	MCERTS	170	-		
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-		
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	33	-		
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-		
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	81	-		

#### Petroleum Hydrocarbons

TPH1 (C10 - C40)	mg/kg	10	MCERTS	16	-		



**Analytical Report Number: 15-81520**

**Project / Site name: Holloway Road, London N19**

<b>Lab Sample Number</b>				501091	501092			
<b>Sample Reference</b>				BH2	BH2			
<b>Sample Number</b>				None Supplied	None Supplied			
<b>Depth (m)</b>				0.40	0.50			
<b>Date Sampled</b>				27/10/2015	27/10/2015			
<b>Time Taken</b>				None Supplied	None Supplied			
<b>Analytical Parameter (Bulk Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>					
Asbestos Identification Name	Type	N/A	ISO 17025	Chrysotile, Amosite-Hard/cement type material	Chrysotile-Hard/cement type material			

**Analytical Report Number : 15-81520**

**Project / Site name: Holloway Road, London N19**

\* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
501089	BH1	None Supplied	0.40	Light brown clay and sand.
501090	BH2	None Supplied	0.50	Light brown loam and sand with gravel.



**Analytical Report Number : 15-81520**

**Project / Site name: Holloway Road, London N19**

**Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)**

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Bulks	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
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Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
TPH1 (Soil)	Determination of TPH by GC-MS/GC-FID).	In-house method	L064/076PL	D	MCERTS

**For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.**

**For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.**

**Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.**

# APPENDICES

## APPENDIX D MONITORING RESULTS







13 Kemplay Road, Hampstead  
Basement Impact Assessment



**Appendix B – Basement Impact Assessment by Site Analytical Services Limited  
(Reference 15/24032) dated August 2015**



Units 14 + 15, River Road Business Park,  
33 River Road, Barking, Essex IG11 0EA

Directors: J. S. Warren, M.R.S.C., P. C. Warren, J. I. Pattinson, BSc (Hons), MSc  
Consultants: G. Evans, BSc., M.Sc., P.G. Dip., FGS., MEnvSc. A. J. Kingston, BSc C.Eng. MIMM  
F. J. Gibbs, F.I.B.M.S. F.I.F.S.T., F.R.S.H. K. J. Blanchette

Tel: 0208 594 8134  
Fax: 0208 594 8072  
E-Mail: [services@siteanalytical.co.uk](mailto:services@siteanalytical.co.uk)

Your Ref:

Our Ref:

**15/24032-1**  
**August 2015**

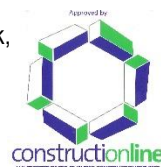
**13 KEMPLAY ROAD**  
**LONDON, NW3 1TA**

## **BASEMENT IMPACT ASSESSMENT**

**Prepared for**  
**Kemplay Road Limited**



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





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## **1.0 INTRODUCTION**

### **1.1 Project Objectives**

At the request of Kemplay Road Limited, a Basement Impact Assessment has been carried out at the above site in support of a planning application.

The purpose of this assessment is to consider the effects of a proposed basement construction on the local slope stability, surface water and groundwater regime at the existing residential property.

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

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

### **1.2 Planning Policy Context**

The information contained within this BIA has been produced to meet the requirements set out by Camden Planning Guidance – Basements and Lightwells (CPG4) including Camden Development Policies DP27 – Basements and Lightwells (Ref 1) in order to assist London Borough of Camden with their decision making process.

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

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

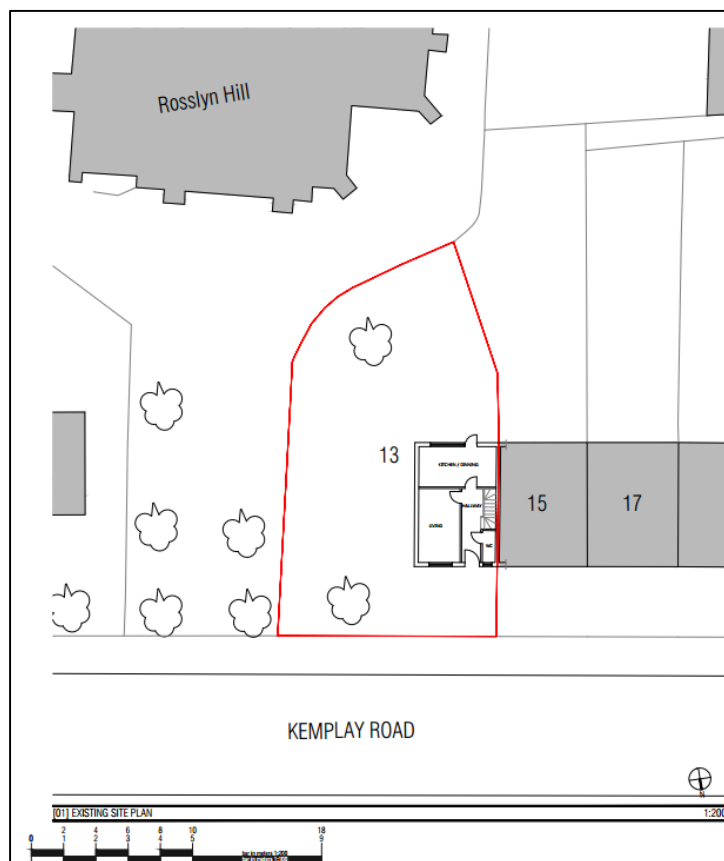
## **2.0 SITE DETAILS**

**(National Grid Reference: 526752, 185675)**

### **2.1 Site Location**

The site is located to the south of Kemplay Road in Hampstead, North London, NW3 1TA and comprises a two storey end of terrace residential property with front and rear garden areas.

The site covers an area of approximately 0.03 hectares and the general area is under the authority of the London Borough of Camden.



**Figure 1. Site Location Plan**

## 2.2 Site Layout and History

The site was attended on 30<sup>th</sup> July 2015 for the purposes of conducting the site walkover.

The site is accessed from Kemplay Road located to the north and comprises of a two storey end of terrace residential property with front and rear garden areas.

The property is bound by Kemplay Road to the north, with residential properties to the west and the Rosslyn Hill Chapel to the east and south.

There was a slight slope measured along Kemplay Road from around 90mOD at the western end of the road to 85mOD at the eastern end. This equates to around a 4-5° slope angle. The general area also slopes to the east and south-east.

There is a slight step up from the road to the front of the property, but this is less than 0.5m in height.

There are two large trees within the property grounds, one to the front and one to the rear of the property. There are also multiple large trees within the church grounds to the east and south.

From historical map evidence it would appear that the current property was built between 1954 and 1966 and has remained on-site unchanged since its initial construction. The surrounding area has been predominantly residential throughout its history.

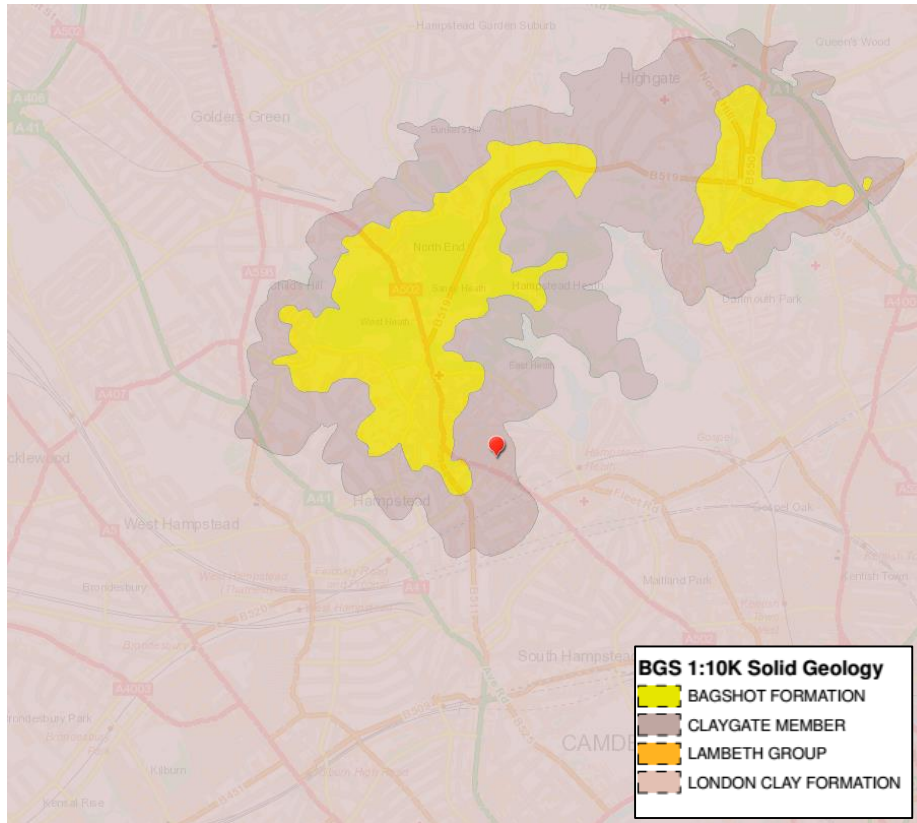
## 2.3 Previous Reports

A Phase 1 Preliminary Risk Assessment (PRA) (SAS Report Ref: 15/24032) was conducted by Site Analytical Services Limited in August 2015 and the results are discussed in this BIA.

## 2.4 Geology

The 1:50000 Geological Survey of Great Britain (England and Wales) covering the area is detailed in Figure 1 below and indicates the site to be underlain by the Claygate Member with the London Clay Formation at depth. Deposits of the overlying Bagshot Formation are indicated to be approximately 210m to the west of the site, whilst the boundary to the underlying London Clay Formation is approximately 120m to the east.

- Claygate Member: The Claygate Member (or Claygate Beds) are classed as a member of the London Clay Formation and described as silty and fine-grained sands which have an average thickness of approximately 16m in the London area.
- London Clay Formation: The London Clay Formation comprises clay, silt and sand and at this site location a thickness of between 70m and 100m is likely.
- Deeper strata is not of interest for this study.



**Figure 2. Geology of the Site (Ref. BGS Geoindex)**

The British Geological Survey maintains an archive of historical exploratory hole logs throughout the UK. SAS has searched the database and have found that there are two relevant boreholes logs within 250m of the site.

The closest (BGS Reference TQ28NE6) is located 107m north-west of the site and details Made Ground down to 2.03m depth followed by the Claygate Member to 12.19m depth with the London Clay Formation to 109m depth. The other historical borehole within 250m of the site (TQ28NE304) is not available to view online with records being held internally by the BGS.

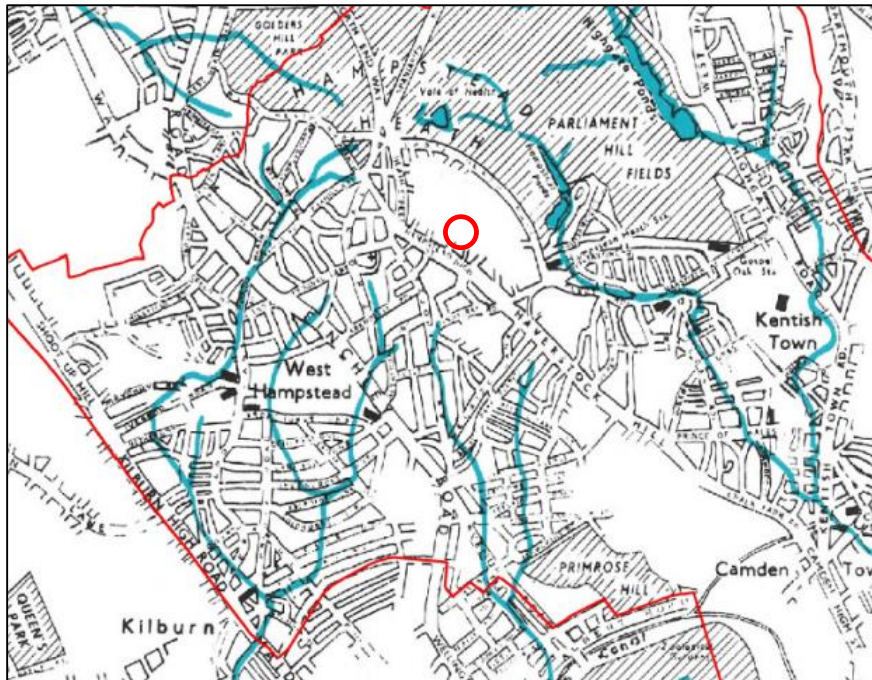
## 2.5 Hydrology and drainage

### 2.5.1 Surface Water

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

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

According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011) the site is not within 100m of any of the old river systems (Figure 3).



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

The closest surface water feature are the Hampstead Ponds, located 463m north-east of the site.

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

Surface drainage from the site is assumed to be directed to drains flowing downhill to the east along Kemplay Road.

## 2.5.2 Flood Risk

### 2.5.2.1 River or Tidal flooding

According to Environment Agency Flood maps the site area does not fall within an area at risk of flooding from rivers, seas or reservoirs. Based on this information a flood risk assessment will not be required.

### 2.4.2.2 Surface water flooding

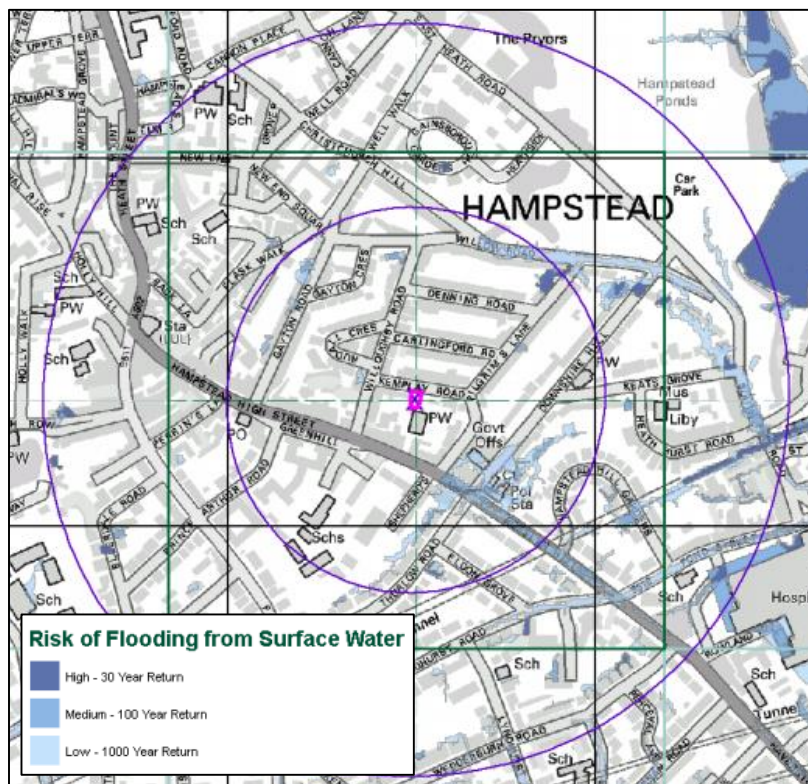
Figure 4 shows that Kemplay Road did not flood during either the 1975 or the 2002 flood events. The closest road to the property which flooded in Willow Road located 250m to the north which flooded in 2002.





**Figure 4. Exact from Figure 15 of the Camden CPG4 (Ref 1) showing roads which flooded in 1975 (light blue), in 2002 (dark blue) and 'areas with potential to be at risk from surface water flooding' (wide light blue bands)**

The risk of surface water flooding to the site is modelled by the Environment Agency and contained within the Envirocheck Report for the site as detailed in Figure 5 below. This modelling shows a very low risk of flooding (the lowest category for the national background level of risk) for No.13 and the surrounding area.



**Figure 5. Extract from the Environment Agency's 'Risk of Flooding from Surface Water'. Ordnance Survey Crown copyright 2015. All rights reserved.**

#### 2.4.2.3 Sewer flooding

The London Regional Flood Risk Appraisal (2009) advises that foul sewer flooding is most likely to occur where properties are connected to the sewer system at a level below the hydraulic level of the sewage flow, which in general are often basement flats or premises in low lying areas. There is no record of sewer flooding having occurred at 13 Kemplay Road and therefore the risk of sewer flooding is considered low.

## 2.6 Hydrogeological setting

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

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

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

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

The presence of interbedded sands, silts and clays of the Claygate Member gives rise to various springs. The direction of groundwater flow within the Claygate Member beneath the site is likely to be controlled by the local topography and is therefore likely to be in a easterly and south easterly direction.

Other hydrogeological data obtained from the Phase 1 Preliminary Risk Assessment (PRA) (SAS Report Ref: 15/24032) for the site include:



- The underlying soil classification of the site is of high leaching potential.
- There are no source protection zones within 1 kilometre site.
- There are no groundwater abstraction licences listed within one kilometre of the site.
- There are no surface water abstraction licences within 1km of the site.
- According to the British Geological Survey there are no historical wells located within 100m of the site.

## **2.7 Proposed Development**

It is proposed to demolish the current end of terrace property and construct a detached two storey residential property with a single storey basement to approximately 3.00m maximum depth and a single storey side garage.

## **2.8 Results of Basement Impact Assessment Screening**

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



**Table 1: Summary of screening results**

Item	Description	Response	Comment
Sub-terranean (Ground water Flow)	1a. Is the site located directly above an aquifer.	Yes	The site lies above the Claygate Member. These deposits have been designated as Secondary A Class; permeable layers capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.
	1b. Will the proposed basement extend beneath the water table surface.	Unknown	Given the presence of an aquifer below the site it is possible that groundwater will be encountered during any excavations for the proposed basement.
	2. Is the site within 100m of a watercourse, well (used / disused) or potential spring line.	No	The nearest surface water feature is the Hampstead Heath Ponds located 463m north-east of the site.  According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011), the site is not within 100m of a former river or watercourse.
	3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas.	No	The amount of hardstanding on-site is not expected to change.
	4. As part of site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS).	No	Existing drainage paths are to be utilised where possible. Whether soakaways/SUDS are used on the proposed development is to be confirmed (beyond the scope of this report). An appropriately qualified engineer should be engaged to ensure mandatory requirements are met.
	5. Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond or spring line.	No	The nearest surface water is recorded is located 463m north-east of the site. There are no wells located within 100m of the site and the site is not within 100m of any geological boundary which can be associated with the formation of springs (for example Claygate Beds and underlying London Clay Formation)



Slope Stability	1. Does the existing site include slopes, natural or man-made greater than 7 degrees (approximately 1 in 8).	No	The site does not contain any slopes and is relatively flat.
	2. Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7 degrees (approximately 1 in 8).	No	Re-profiling of landscaping at the site is not proposed.
	3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately 1 in 8).	No	There was a slight slope measured along Kemplay Road from around 90mOD at the western end of the road to 85mOD at the eastern end. This equates to around a 4-5° slope angle.
	4. Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately 1 in 8).	No	There is a general slope in the area very gently towards the south down to the River Thames but this is less than 7 degrees.
	5. Is the London Clay the shallowest strata at the site.	No	With reference to available BGS records, the soil strata below the site is the Claygate Member. The boundary to the underlying London Clay Formation is 120m to the east and therefore the site is not considered to be close to this stratigraphic boundary.
	6. Will any trees be felled as part of the development and/or are any works proposed within any tree protection zones where trees are to be retained.	No	It is understood that no trees are to be felled as part of the development.
	7. Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site.	Unknown	The Claygate Member has some potential for shrink-swell
	8. Is the site within 100m of a watercourse or a potential spring line.	No	The nearest surface water feature is the Hampstead Heath Ponds located 463m north-east of the site. According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011), the site is not within 100m of a former river or watercourse; The nearest historic surface water is recorded as a tributary to the Westbourne located approximately 500m south-west of the site.
	9. Is the site within an area of previously worked ground.	No	According to the records held by the BGS the site is not underlain by any worked ground, made ground, infilled ground or landscaped ground



	10. Is the site within an aquifer. If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction.	Unknown	Given the presence of an aquifer below the site it is likely that groundwater will be encountered during any excavations for the proposed basement, however this will be confirmed by the ground investigation.
	11. Is the site within 50m of the Hampstead Heath Ponds?	No	The site is away from this area
	12. Is the site within 5m of a highway or pedestrian right of way.	Yes	The site lies within 5m of Kemplay Road.
	13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties.	Yes	The development will increase the depths of foundation at the site, although the foundation depths of the adjacent property (No. 15) are unknown.
	14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines.	Unknown / outside scope of report	A full statutory service search was outside the scope of this report and must be completed prior to any excavations.
Surface Water and Flooding	1. Is the site within the catchment of the pond chains on Hampstead Heath	No	The site is away from this 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	The amount of hardstanding on-site is not changing, therefore surface water will not be impacted by the development.
	3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas.	No	The amount of hardstanding on-site is not expected to increase.
	4. Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses.	No	As no changes are occurring above the ground, surface water will not be impacted by the development.
	5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses.	No	As no changes are occurring above the ground at the location of the basement, surface water will not be impacted by the development.
	6. Is the site in an area known to be at risk from surface water flooding, such as South Hampstead, West Hampstead, Gospel Oak and King's Cross, or is it at risk from flooding, for example because the basement is below the static water level of a nearby water feature	No	Because the site is elevated well above the flood plain of the River Thames at about 95.0mOD, it is shown as being outside Flood Zone as defined on the Environment Agency Flood Zone maps.  According to Environment Agency Surface Water Flood maps (Reference 10) the site itself is not at risk from surface water flooding.



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

*Subterranean Groundwater Flow*

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

*Slope Stability*

- Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site.
- Is the site within an area of previously worked ground.
- 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.
- Is the site within 5m of a highway or pedestrian right of way.
- Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties.

### 3.0 SCOPING PHASE

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

#### **Subterranean (Groundwater Flow)**

<b>Potential Issue (Screening Question)</b>		<b>Potential impacts and actions</b>
1a	Is the site located directly above an aquifer?	<p><b>Potential impact:</b> Infiltration could be reduced.</p> <p><b>Action:</b> Ground Investigation required, then review.</p>
1b	Will the proposed basement extend beneath the water table surface?	<p><b>Potential impact:</b> Local restriction of groundwater flows (perched groundwater or below groundwater table).</p> <p><b>Action:</b> Ground investigation required, then review.</p>

#### **Slope Stability**

7	Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?	<p><b>Potential impact:</b> If a new basement is not excavated 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.</p> <p><b>Action:</b> Ground investigation required, then review</p>
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?	<p><b>Potential impact:</b> Inadequate provision of dewatering can lead to collapse of excavations. Inappropriate dewatering can cause removal of fines and/or unacceptable increases ineffective stress, both of which can cause ground structures to settle.</p> <p><b>Action:</b> Ground investigation required in order to enable a proper assessment of the appropriate forms of groundwater control.</p>
12	Is the site within 5m of a highway or a pedestrian right of way?	<p><b>Potential impact:</b> Excavation of basement causes loss of support to footway/highway and damage to the services beneath them.</p> <p><b>Action:</b> Ensure adequate temporary and permanent support by use of best practice working methods.</p>
13	Will the proposed basement substantially increase the differential depth of foundations relative to neighbouring properties?	<p><b>Potential impact:</b> Loss of support to the ground beneath the foundations to No. 15 if basement excavations are inadequately supported.</p> <p><b>Action:</b> Ensure adequate temporary and permanent support by use of best practice methods.</p>



**p.p. SITE ANALYTICAL SERVICES LIMITED**

A handwritten signature in black ink, appearing to be 'A P Smith', written in a cursive style.

A P Smith BSc (Hons) FGS MCIWEM  
Senior Geologist

A handwritten signature in black ink, appearing to be 'T P Murray', written in a cursive style.

T P Murray MSc BSc (Hons) FGS  
Geotechnical Engineer

## **7.0 REFERENCES**

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2. Environment Agency, 2006. Groundwater levels in the Chalk-Basal Sands Aquifer in the London Basin
3. Tomlinson, M J, 2001. "Foundation Design and Construction", Seventh Edition, Prentice Hall (ISBN 0-13-031180-4).
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10. NHBC Standards, Chapter 4.2, "Building near Trees", April 2010.

## **Appendix C**

### **Responses from London Underground Limited (LUL)**





**London Underground**  
Infrastructure Protection

3<sup>rd</sup> Floor  
Albany House  
55 Broadway  
London SW1H 0BD

[www.tfl.gov.uk/tube](http://www.tfl.gov.uk/tube)

Your ref:  
Our ref: 20403-SI-8-181115

Andrew Smith  
Fairhurst  
[andrew.smith@fairhurst.co.uk](mailto:andrew.smith@fairhurst.co.uk)

18 November 2015

Dear Andrew,

**13 Kemplay Road London NW3 1TA**

Thank you for your communication of 10<sup>th</sup> November 2015.

I can confirm that London Underground has no assets within 50 metres of your site as shown on the plan you provided.

If I can be of further assistance, please contact me.

Yours sincerely

**Shahina Inayathusein**  
Information Manager  
Email: [locationenquiries@tube.tfl.gov.uk](mailto:locationenquiries@tube.tfl.gov.uk)  
Direct line: 020 7918 0016

London Underground Limited  
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55 Broadway  
London SW1H 0BD

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