## Site Analytical Services Ltd.



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

Units 14 + 15, River Road Business Park, 33 River Road, Barking, Essex IG11 DEA 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, MIEN/Sc. A. J. Kingston, BSc C.Eng, MIMM F. J. Gibbs, FI.B.M.S. FI.F.S.T., F.R.S.H., K. J. Blanchette

Your Ref:

Our Ref:

Tel: 0208 594 8134 Fax: 0208 594 8072 E-Mail: services@siteanalytical.co.uk

19/30896-2 November 2019

### 8A FAWLEY ROAD,

#### LONDON, NW6 1SH

#### **BASEMENT IMPACT ASSESSMENT**

**Prepared for** 

Mr Matt Cooper





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





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#### 1.0 NON-TECHNICAL SUMMARY

#### 1.1 **Project Objectives**

At the request of Mr Matt Cooper, a Basement Impact Assessment has been carried out at 8a Fawley Road, London, NW6 1SH in support of a planning application for a proposed development which includes the construction of a single storey basement beneath the current property. It is understood that the proposed basement is at a level of approximately 3.5m below ground level.

#### 1.2 Desk Study Findings

From historical map evidence, it would appear that the current site was first built on between 1896 and 1915 minor changes taking place since construction. The surrounding area was predominantly rural until 1896 where it began to develop residentially. There have been some industrial sites including a button factory and garages present within the area.

#### **1.3 Ground Conditions**

The boreholes and trial pits revealed ground conditions that were consistent with the geological records and known history of the area and comprised Made Ground up to 1.60m in thickness resting on deposits of the London Clay Formation. The Made Ground extended down to depths of between 1.30m and 1.60m and the material generally comprised silty gravelly clay with brick and tile fragments. The London Clay Formation was encountered below the Made Ground and consisted of stiff silty clay with occasional pockets and partings of silty fine sand and scattered gypsum crystals. These deposits extended down to the full depths of investigation of 15.00m below ground level in Boreholes 1 and 2. Following drilling operations groundwater monitoring piezometers were installed in Boreholes 1 and 2 to approximately 5.00m depth.

Groundwater was encountered at respective depths of 4.98m and 2.54m below ground level in Boreholes 1 and 2 after a period of approximately four weeks. Due to the nature of the geology encountered on site, it is likely that this is purely surface water infiltrating into the standpipes and being unable to escape and not true groundwater.

#### 1.4 Recommendations

A monitoring plan should be set out at design stage and should include a monitoring strategy, instrumentation and monitoring plans and action plans. Trigger levels on movements will need to be defined. Precise levelling or reflective survey targets should be installed at the garden walls and neighbouring buildings. It would be prudent to continue to monitor the standpipes for as long as possible in order to determine equilibrium level and the extent of any seasonal variations. The chosen contractor should also have a contingency plan in place to deal with any perched groundwater inflows as a precautionary measure.



#### 2.0 INTRODUCTION

#### 2.1 **Project Objectives**

At the request of Mr Matt Cooper, a Basement Impact Assessment has been carried out at the above site in support of a planning application.

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

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

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

#### 2.2 Planning Policy Context

The information contained within this BIA has been produced to meet the requirements set out by Camden Planning Guidance – 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)



#### 3.0 SITE DETAILS

#### (National Grid Reference: TQ 255 850)

#### 3.1 Site Location

8a Fawley Road is a single storey flat within a two-storey residential property with a loft conversion, located on the southern side of Fawley Road at approximate postcode NW6 1SH. The residential dwelling has three levels of accommodation; ground, first floor and loft conversion, with front and back gardens. The site covers an approximate area of 0.05 Hectares with the general area being under the authority of the London Borough of Camden.

The site is located on the southern side of Fawley Road with residential properties to the south, west and east. The site surrounding areas are predominantly residential.



Figure 1. Site Location Plan

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#### 3.2 Site Layout and History

The site is accessed from Fawley Road located to the north and comprises of a two storey residential property, including rooms at roof level with front and rear garden areas.

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

The property contains a crazy-paved front garden with various shrubs and plants, with a concrete path running up the centre of the rear garden, which is covered predominately in multiple types of plants, tree and vegetation.

The site its relatively flat with no noticeable slope. The slope angle is less than 7 degrees. Also with reference to the Camden Geological, Hydrogeological and Hydrological Study, (Figure 2 below), the neighbouring properties also have slopes less than 7 degrees.



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

The existing ground level in the area of the proposed basement is understood to be approximately 60.0mOD.

From looking at local maps and data, there is no evidence of any underground train lines within 50m of the site.

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From historical map evidence, it would appear that the current site was first built on between 1896 and 1915 minor changes taking place since construction. The surrounding area was predominantly rural until 1896 where it began to develop residentially. There have been some industrial sites including a button factory and garages present within the area.

#### 3.3 **Previous Reports**

A Geotechnical Desk Study (SAS Report Ref: 19/30896) and Site Investigation (SAS Report Ref: 19/30896-1) was undertaken across the site by Site Analytical Services Limited in November 2019 and the results are discussed in this BIA.

#### 3.4 Geology

The 1:50000 Geological Survey of Great Britain (England and Wales) covering the area is detailed in Figure 3 below and indicates the site to be underlain by the London Clay Formation. Deposits of the overlying Claygate Member are indicated to approximately 500m to the north-east of the site.



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

The British Geological Survey's online records indicate there are no boreholes located within 250m of the site.

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#### 3.5 Hydrology and drainage

#### 3.5.1 Surface Water

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

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

With reference to Camden Geological, Hydrogeological and Hydrological Study (1999), Talling (2011) and Barton (1992) springs that sourced tributaries of the 'lost rivers' River Westbourne were located approximately 120m east and 105m west of the site respectively (Figure 4).



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

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The River Westbourne also flowed in a southerly direction, combining with the other tributaries in West Hampstead and then flowing through Kilburn and Paddington before issuing into the Serpentine in Hyde Park. From there the river flowed south through Chelsea before flowing into the River Thames opposite Battersea Park.

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

Envirocheck indicates that there are no surface water features within 1 kilometre of the site.

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

Surface drainage from the site is assumed to be directed to drains flowing downhill to the south along both West end Hill and Crediton Hill.

#### 3.5.2 Flood Risk

#### 3.5.2.1 River or Tidal flooding

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

#### 3.5.2.2 Surface water flooding

Figure 5 shows that Fawley Road didn't flood during either the 1975 or 2002 flood events.



Figure 5. Exact from Figure 15 of the Camden CPG4 showing roads which flooded in 1975 (light blue), in 2002 (dark blue) and 'areas with potential to be at risk from surface water flooding' (wide light blue bands)

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Further modelling of surface water flooding has been undertaken by the Environment Agency and was published on its website in January 2014; an extract from their model is presented in Figure 6. Whilst this map identifies four levels of risk (high, medium, low and very low) it is understood that it is based at least in part on depths of flooding. This modelling shows a 'Very Low' risk of flooding (the lowest category for the national background level of risk) for No.8a and the surrounding area.



Figure 6. Extract from the Environment Agency's 'Risk of Flooding from Surface Water'. Ordnance Survey Crown copyright 2015. All rights reserved.

As detailed in Table 1 below, the scheme will result in a small increase in impermeable areas by 14.0m<sup>2</sup>.

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| Element  | Existing (m <sup>2</sup> ) | Proposed (m <sup>2</sup> ) |  |
|--|----------------------------|----------------------------|--|
| Impermeable (hardstanding - building footprint, concrete areas)                              | 141.2 m2                   | 155.2m2                    |  |
| Permeable (softscaping - grassed areas, (including green roof), permeable and porous paving) | 265.1 m2                   | 251.1 m2                   |  |
| Total (should be the site area and remain the same)  | 406.3 m2                   | 406.3 m2                   |  |

#### Table 1. Existing and Proposed Permeable Areas.

#### 3.5.2.3 Sewer flooding

The London Regional Flood Risk Appraisal (2009) advises that foul sewer flooding is most likely to occur where properties are connected to the sewer system at a level below the hydraulic level of the sewage flow, which in general are often basement flats or premises in low lying areas. There is no record of sewer flooding having occurred at 8a Fawley Road and therefore the risk of sewer flooding is considered low.

#### 3.6 Hydrogeological setting

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

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

Other hydrogeological data obtained from the Phase 1 Preliminary Risk Assessment (PRA) (SAS Report Ref: 19/30896) for the site include:

- The underlying soil classification of the site is of high leaching potential.
- There are no Groundwater Source Protection Zones (SPZ's) within 1 kilometre of the site.
- There are no non-potable water abstraction licences within 1 kilometre of the site.
- There are no potable water abstraction licences within 1 kilometre of the site.

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#### 3.7 Proposed Development

It is proposed to construct a single storey basement beneath the front half of the existing property with a front light well. It is understood that the proposed basement of approximately 3.5m below ground level.

Sections showing the proposed developments are detailed in Figure 7 below.







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#### 3.8 Results of Basement Impact Assessment Screening

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



#### Table 2: Summary of screening results

| Item                                  | Description   | Response  | Comment  |
|---------------------------------------|---|---|--|
| Sub-<br>terranean<br>(Ground<br>water | 1a. Is the site located directly above an aquifer.  | No  | The site has been classified as being situated above an unproductive (negligibly permeable) formation (London Clay) that is generally regarded as containing insignificant quantities of groundwater.  |
| Flow)                                 | 1b. Will the proposed basement extend beneath the water table surface.  | Unknown –<br>to be<br>confirmed by<br>Ground<br>Investigation | Given the presence of a non-aquifer below the site it is unlikely that groundwater will be encountered during any excavations for the proposed basement, however this will be confirmed by the ground investigation.   |
|                                       | 2. Is the site within 100m of a watercourse, well (used / disused) or potential spring line.  | No  | Envirocheck indicates that there are no surface water features within 1 kilometre of the site. According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011) and Stanford (1868) the site is not within 100m of a 'Lost River' with the closest being a tributary to the River Westbourne 105m west (Figure 4).<br>From the British Geological Society 'Geoindex' the nearest water well is |
|                                       |   |   | located over 1 kilometre south-west of the site.   |
|                                       | 3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas.  | Yes   | The amount of hardstanding on-site is expected to increase.  |
|                                       | 4. As part of site drainage, will more surface water (e.g. rainfall<br>and run-off) than at present be discharged to the ground (e.g. via<br>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  | Envirocheck indicates that there are no surface water features within 1 kilometre of the site. According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011) and Stanford (1868) the site is not within 100m of a 'Lost River' with the closest being a tributary to the River Westbourne 105m west (Figure 4).   |
|                                       |   |   | From the British Geological Society 'Geoindex' the nearest water well is located over 1 kilometre south-west of the site.  |



| Slope<br>Stability | 1. Does the existing site include slopes, natural or man-made greater than 7 degrees (approximately 1 in 8).  | No  | There is a slight slope from north to south across the site, but is below 7 degrees.   |
|--------------------|---|-----|--|
|                    | 2. Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7 degrees (approximately 1 in 8).                  | No  | Re-profiling of landscaping at the site is not proposed.   |
|                    | 3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately 1 in 8).                        | No  | The surrounding area drops to the south-east, but from survey information and with reference to Figure 16 from Camden CPG 4, this is at angles of less than 7 degrees.   |
|                    | 4. Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately 1 in 8).   | No  | There is a general slope in the area towards the south down to the south-east,<br>but from survey information and with reference to Figure 16 from Camden<br>CPG 4, this is at angles of less than 7 degrees.  |
|                    | 5. Is the London Clay the shallowest strata at the site.  | Yes | With reference to available BGS records, the London Clay Formation is expected to be encountered from ground level.  |
|                    | 6. Will any trees be felled as part of the development and/or are<br>any works proposed within any tree protection zones where trees<br>are to be retained.         | No  | It is understood that no trees are to be felled as part of the development.  |
|                    | 7. Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site.  | Yes | The site lies above the London Clay Formation well known as having a high tendency to shrink and swell.  |
|                    | 8. Is the site within 100m of a watercourse or a potential spring line.   | No  | Envirocheck indicates that there are no surface water features within 1 kilometre of the site. According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011) and Stanford (1868) the site is not within 100m of a 'Lost River' with the closest being a tributary to the River Westbourne 105m west (Figure 4). |
|                    | 9. Is the site within an area of previously worked ground.  | No  | According to records from the BGS the site is not in the vicinity of any recorded areas of worked ground.  |
|                    | 10. Is the site within an aquifer. If so, will the proposed basement<br>extend beneath the water table such that dewatering may be<br>required during construction. | No  | The site has been classified as being situated above an unproductive (negligibly permeable) formation (London Clay) that is generally regarded as containing insignificant quantities of groundwater.  |



|                                  | 11. Is the site within 50m of the Hampstead Heath Ponds   | No  | With reference to the Camden Geological, Hydrogeological and Hydrological Study, the site is not within the catchment of the pond chains on Hampstead, nor the Golder's Hill Chain.   |
|----------------------------------|---|-----|---|
|                                  | 12. Is the site within 5m of a highway or pedestrian right of way.  | Yes | The site lies within 5m of Fawley 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 adjacent properties are not known.  |
|                                  | 14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines.   | No  | The site is not within 50m of any train lines noted on available sources.   |
| Surface<br>Water and<br>Flooding | 1. Is the site within the catchment of the ponds chains on Hampstead Heath  | No  | With reference to the Camden Geological, Hydrogeological and Hydrological Study, the site is not within the catchment of the pond chains on Hampstead, nor the Golder's Hill Chain.   |
|                                  | 2. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route.  | No  | No – any additional surface water generated from an increased hardstanding area will be attenuated to ensure they are not increased or altered.   |
|                                  | 3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas.   | Yes | Yes, there will be a small change in the area of hard surfacing. The surface permeability will be affected with a slight increase in the footprint of the basement and a small increase in the amount of paved surface in relation to the total site.                                     |
|                                  | 4. Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses.  | No  | All surface water for the site will be contained within the site boundaries and collected as described above; hence there will be no change from the development on the quantity or quality of surface water being received by adjoining sites.   |
|                                  | 5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses.   | No  | The surface water quality will not be affected by the development, as in the permanent condition collected surface water will be generally be from roofs, domestic hard landscaping or collected from beneath the landscaping layer over the basement.                                    |
|                                  | 6. Is the site in an area known to be at risk from surface water<br>flooding, such as South Hampstead, West Hampstead, Gospel Oak<br>and King's Cross, or is it at risk from flooding, for example because<br>the proposed basement is below the static water level of a nearby<br>surface water feature. | No  | Fawley Road did not flood during either the 1975 or 2002 flood event.<br>According to modelling by the Environment Agency, there is a 'Very Low' risk<br>of surface water flooding (the lowest category for the national background<br>level of risk) for No.8a and the surrounding area. |



#### 3.9 Non Technical Summary of Chapter 3.0

8a Fawley Road is a single storey flat within a two-storey residential property with a loft conversion, located on the southern side of Fawley Road at approximate postcode NW6 1SH. The residential dwelling has three levels of accommodation; ground, first floor and loft conversion, with front and back gardens

The 1:50000 Geological Survey of Great Britain (England and Wales) covering the area indicates the site to be underlain by the London Clay Formation. The London Clay Formation is classed as unproductive strata or a non-aquifer.

With reference to Camden Geological, Hydrogeological and Hydrological Study (1999), Talling (2011) and Barton (1992) springs that sourced tributaries of the 'lost rivers' River Westbourne were located approximately 120m east and 105m west of the site respectively.

Envirocheck indicates that there are no surface water features within 1 kilometre of the site.

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

Based on this information a flood risk assessment will be required. Fawley Road did not flood during either of the 1975 and 2002 flood events. Modelling of surface water flooding by the Environment Agency shows a 'Very Low' risk of flooding (the lowest category for the national background level of risk) for No.8a and the surrounding area.

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

#### Subterranean Groundwater Flow

• Will the proposed basement extend beneath the water table surface.

#### Slope Stability

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

#### Surface Water and Flooding

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



#### 4.0 SCOPING PHASE

#### 4.1 Introduction

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.

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

#### Subterranean (Groundwater Flow)

| Potential Issue (Screening Question) |  | Potential impacts and actions   |
|--------------------------------------|--|---|
| 1b                                   | Will the proposed basement extend beneath the water table surface? | <ul><li>Potential impact: Local restriction of groundwater flows (perched groundwater or below groundwater table).</li><li>Action: Ground investigation required, the review.</li></ul> |

#### Slope Stability

| 5  | Is the London Clay the shallowest strata at the site?  | <ul><li>Potential impact: The London Clay is prone to seasonal shrink-swell (subsidence and heave).</li><li>Action: Ground investigation required, the review.</li></ul>  |
|----|--|---|
| 7  | Is there a history of seasonal shrink-swell<br>subsidence in the local area and/or evidence of<br>such effects at the site?        | <ul><li>Potential Impact: Ground movements will occur during and after the basement construction.</li><li>Action: Ground investigation required, then review.</li></ul>   |
| 11 | Is the site within 5m of a highway or a pedestrian right of way?   | <ul> <li>Potential impact: Excavation of basement causes loss of support to footway/highway and damage to the services beneath them.</li> <li>Action: Ensure adequate temporary and permanent support by use of best practice working methods.</li> </ul>                             |
| 12 | Will the proposed basement substantially increase<br>the differential depth of foundations relative to<br>neighbouring properties? | Potential impact: Loss of support to the ground<br>beneath the new foundations to neighbouring<br>properties if basement excavations are<br>inadequately supported.Action:Ensure<br>adequate<br>temporary<br>and<br>permanent<br>support by<br>use of<br>best<br>practice<br>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. | <ul> <li>Potential impact: May increase flow rates to sewer, and thus increase the risk of flooding</li> <li>Action: Assess net change in hard surfaced/paved areas and, if required, recommend appropriate types of SUDS for use as site-specific mitigation.</li> </ul> |

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

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

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

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

All these actions are covered in Stage 4 or Stage 3 for the ground investigation.



#### 5.0 SITE INVESTIGATION DATA

#### 5.1 Records of site investigation

A site-specific ground investigation was undertaken by Site Analytical Services Limited (SAS) in October 2019 and included two continuous flight auger boreholes (Boreholes 1 and 2) drilled to 15m below ground level and two hand dug trial pits (Trial Pits 1 and 2) excavated to 1.5m depth

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

#### 5.2 Ground conditions

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

#### 5.2.1 Made Ground

The Made Ground extended down to depths of between 1.30m to 1.60m and the material generally comprised silty gravelly clay with brick and tile fragments.

#### 5.2.2 London Clay Formation

The London Clay Formation was encountered below the Made ground and consisted of stiff silty clay with occasional pockets and partings of silty fine sand and scattered gypsum crystals. These deposits extended down to the full depths of investigation of 15.00m below ground level in Boreholes 1 and 2.

#### 5.3 Groundwater

Groundwater was not encountered within the boreholes and the trial pits and the soils remained essentially dry throughout.

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

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

Following drilling operations groundwater monitoring piezometers were installed in Boreholes 1 and 2 to approximately 5.00m depth.



Groundwater was encountered at respective depths of 4.98m and 2.45m below ground level in Boreholes 1 and 2 after a period of approximately four weeks. Due to the nature of the geology encountered on site, it is likely that this is purely surface water infiltrating into the standpipes and being unable to escape and not true groundwater.

It should be noted that the comments on groundwater conditions are based on observations made at the time of the investigation (October and November 2019) and that changes in the groundwater level could occur due to seasonal effects and also changes in drainage conditions.

In order to assess the soil infiltration characteristics of the natural superficial soils at the site, in-situ rising head permeability tests were carried out in Borehole 2, using the procedure recommended in BS 5930:1999 (Amendment 3: 2010).

The results of the in-situ permeability test indicated an apparent permeability or soil infiltration rate of  $3.38 \times 10^{-6}$  m/sec within Borehole 1. This soil infiltration rates lie within the range of published data of fissured and weathered clays and are classed as being of low permeability material with good to poor drainage characteristics.

The results are presented on the exploratory hole records, contained in Appendix A.

#### 5.4 Foundations

Trial Pit 1 was excavated adjacent to the wall of the existing property on the site in order to expose the foundations and founding soils. Trial Pits 1 and 2 showed the walls are supported on outstepped brick and concrete foundations resting on the London Clay Formation at a depth of approximately 1.30m below ground level.

#### 5.5 In-Situ and Laboratory Testing

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

#### 5.51 Mackintosh Probe / Hand Vane Tests

Mackintosh Probe tests were made at regular depth increments in order to assess the relative density of the soils encountered in the Made Ground in the boreholes. The results can be interpreted using the generally accepted correlation for Mackintosh Probe Tests which is as follows:

Mackintosh N75 X 0.38 = SPT 'N' Value

or

Mackintosh N300 X 0.1 = SPT 'N' Value

Site Analytical Services Ltd.

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

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

#### 5.5.2 Classification Tests

Atterberg Limit tests have been conducted on four selected samples taken from Boreholes 1 and 2, and showed the samples tested to fall into Class CH according to the British Soil Classification System.

These are fine grained silty clay soils of high plasticity and as such generally have a low permeability and a high 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 43% and 47%, with all of the samples being above the higher 40% boundary between soils assessed as being of medium swelling and shrinkage potential and those assessed as being of high swelling and shrinkage potential.

#### 5.5.3 Sulphate and pH Analyses

The results of the sulphate and pH analyses show the natural soil samples to have water soluble sulphate contents of up to 2.72g/litre associated with near neutral pH values.

#### 5.6 Non-Technical Summary of Chapter 5.0

A site-specific ground investigation was undertaken by Site Analytical Services Limited (SAS) in October 2019 and included two continuous flight auger boreholes (Boreholes 1 and 2) drilled to 15m below ground level and two hand dug trial pits (Trial Pits 1 and 2) excavated to 1.5m depth.

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

Following drilling operations groundwater monitoring piezometers were installed in Boreholes 1 and 2 to approximately 5.00m depth.

Groundwater was encountered at respective depths of 4.98m and 2.54m below ground level in Boreholes 1 and 2 after a period of approximately four weeks. Due to the nature of the geology encountered on site, it is likely that this is purely surface water infiltrating into the standpipes and being unable to escape and not true groundwater.



#### 6.0 FOUNDATION DESIGN

#### 6.1 Introduction

It is proposed to construct a single storey basement beneath the front half of the existing property with a front light well. It is understood that the proposed basement is to be approximately 3.5m below ground level.

#### 6.2 Site Preparation Works

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

#### 6.3 Ground Model

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

- Made Ground extends to depths of between 1.30m to 1.60m depth below ground level.
- The London Clay Formation comprising soft then firm becoming stiff silty sandy clay with gypsum crystals to the full depths of investigation of 15.00m below ground level.
- Groundwater was encountered at respective depths of 4.98m and 2.54m below ground level in Boreholes 1 and 2 after a period of approximately four weeks. Due to the nature of the geology encountered on-site, it is likely that this is purely surface water infiltrating into the standpipes and being unable to escape and not true groundwater. This suggests that the water table is deeper than 5.00m below ground level (i.e. below the base of the standpipe) across the site.

#### 6.4 Basement Excavation

Groundwater is not expected to be encountered in the basement excavation, however it is possible for surface water seepages to enter and it would be prudent for the chosen contractor to have a contingency plan in place to deal with any perched groundwater inflows as a precautionary measure. Trial excavations to the proposed basement depth could be carried by the main contractor to confirm the stability of the soil and to further investigate the presence of any groundwater inflows.



#### 6.5 Conventional Spread Foundations

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

Based on the ground and groundwater conditions encountered in the boreholes and trial pits, it should be possible to support the proposed new development on conventional strip or basement raft foundations taken down below the Made Ground and any weak superficial soils and placed in the natural firm sandy silty clay deposits which occur at depths of between approximately 0.30m and 1.00m below ground level over the site. Foundations should be placed in the natural deposits at a minimum depth of 1.00m below final ground level in order to avoid the zone affected by seasonal moisture content changes.

Using theory from Terzaghi (1943), strip foundations placed within natural soils may be designed to allowable net bearing pressures of approximately 200kN/m<sup>2</sup> at 3.00m depth in order to allow for a factor of safety of 2.5 against general shear failure. The actual allowable bearing pressure applicable will depend on the form of foundation, its geometry and depth in accordance with classical analytical methods, details of which can be obtained from "Foundation Design and Construction", Seventh Edition, 2001 by M J Tomlinson (see references) or similar texts.

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

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

#### 6.6 Piled Foundations

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

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



To achieve the full bearing value a pile should penetrate the bearing stratum by at least five times the pile diameter. Where piles are to be constructed in groups the bearing value of each individual pile should be reduced by a factor of about 0.8 and a calculation made to check the factor of safety against block failure.

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

#### 6.7 Retaining Walls

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

The full design of temporary and permanent retaining structures is beyond the scope of this report. However, the following design parameters for each element of soil recorded in the relevant exploratory holes are provided in Table 3 below to assist the design of these structures.

| Stratum               | Depth to top<br>(mbgl) | Bulk Density (Mg/m3)<br>(ɣ) | Effective Angle of<br>Internal Friction (Φ) |
|-----------------------|------------------------|-----------------------------|---|
| Made Ground           | -                      | 2.00                        | 28  |
| London Clay Formation | 1.30 to 1.60           | 2.00                        | 23  |

#### Table 3. Retaining Wall Design Parameters

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



#### 6.8 Chemical Attack on Buried Concrete

The results of the chemical analyses show the natural soil samples tested to have water soluble sulphate contents of up to 2.72g/litre associated with near neutral pH values.

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

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

#### 6.9 Non-Technical Summary of Chapter 6.0

On the basis of the fieldwork, the ground conditions at the site can be characterised as follows: Made Ground extends to depths of between 1.30m to 1.60m depth below ground level, the London Clay Formation extends to the full depth of investigation of 15.00m below ground level. Groundwater was encountered at respective depths of 4.98m and 2.54m below ground level in Boreholes 1 and 2 after a period of approximately four weeks. Due to the nature of the geology encountered on-site, it is likely that this is purely surface water infiltrating into the standpipes and being unable to escape and not true groundwater.

Groundwater is not expected to be encountered in the basement excavation however it is possible for surface water seepages to enter and it would be prudent for the chosen contractor to have a contingency plan in place to deal with any perched groundwater inflows as a precautionary measure.

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

Based on the water soluble sulphate tests carried out as part of these works, it is considered that deterioration of buried concrete due to sulphate or acid attack is likely to occur. The final design of buried concrete according to Tables C1 and C2 of BRE Special Digest 1:2005 should be in accordance with Class DS-3 conditions.

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



#### 7.0 BASEMENT IMPACT ASSESSMENT

#### 7.1 Summary

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

| Potential Impact   | Site Investigation conclusions   | Impact sufficiently<br>addressed without<br>further justification? |
|--|--|--|
| The proposed basement<br>extends beneath the<br>water table surface.   | Groundwater was encountered at respective depths of<br>4.98m and 2.54m below ground level in Boreholes 1<br>and 2 after a period of approximately four weeks. Due<br>to the nature of the geology encountered on-site, it is<br>likely that this is purely surface water infiltrating into the<br>standpipes and being unable to escape and not true<br>groundwater and therefore the influence of the<br>development on groundwater is expected to be<br>minimal. | Yes  |
| There a history of<br>seasonal shrink-swell<br>subsidence in the local<br>area and/or evidence of<br>such effects at the site.           | The London Clay was proven below the site and was<br>recorded as having a high susceptibility to shrinkage<br>and swelling. However, the base of proposed<br>basement will extend well below the potential depth of<br>root action.  | Yes  |
| The site is within 5m of a<br>highway or pedestrian<br>right of way.   | The proposed basement is not to be extended below<br>Fawley Road and therefore it is suggested that the<br>impact on these access roads is likely to be minimal.<br>There is nothing unusual in the proposed development<br>that would give rise to any concerns with regard to the<br>stability of public highways.   | Yes.   |
| The proposed basement<br>will significantly increase<br>the differential depth of<br>foundations relative to<br>neighbouring properties. | The development will result in the extension of the foundation depth of the basement relative to neighbouring properties.  | No – see below for further details.                                |
| Will the proposed<br>basement development<br>result in a change in the<br>proportion of hard<br>surfaced / paved external<br>areas.      | There is a small increase in impermeable area on-site<br>following development, which equates to a decrease in<br>the rate of run-off from the site.   | No – see below for further details.                                |



#### 7.2 Outstanding risks and issues

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

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

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

A ground movement assessment has carried out at the site by Fairhurst but is not appended to this report and can be read separately.

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

#### Change in paved surfacing and surface water run-off.

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

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



#### 7.3 Advice on Further Work and Monitoring

A monitoring plan should be set out at design stage and should include a monitoring strategy, instrumentation and monitoring plans and action plans. Trigger levels on movements will need to be defined. Precise levelling or reflective survey targets should be installed at the garden walls and neighbouring buildings.

Monitoring should take place in advance of the proposed works as a base-line survey, during the works and for a period following the completion of the works, to understand the long term effects.

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

#### 7.4 Non-Technical Summary of Chapter 7.0

The excavation and construction of the basement at the site has the potential to cause some movements in the surrounding ground if not properly managed. However, it is understood that ground movements and/or instability will be managed through the proper design and construction of mitigation measures during the works. It is not considered that the proposed basement would result in a significant change to the groundwater flow regime in the vicinity of the proposal. Also, given limited scope of the scheme and limited increase in impermeable areas, the scheme is also considered compliant with the surface water management and flood risk elements of NPPF and Camden policy.

The development is not likely to significantly affect the existing local groundwater regime.

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



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- 9. NHBC Standards, Chapter 4.1, "Land Quality managing ground conditions", September 1999.
- 10. NHBC Standards, Chapter 4.2, "Building near Trees", April 2010.



Appendix A. Ground Investigation Factual Report

## Site Analytical Services Ltd.



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

Units 14 + 15, River Road Business Park, 33 River Road, Barking, Essex IG11 OEA Directors: J. S. Warren, M.R.S.C., P. C. Warren, J. I. Pattinson, BSc (Hone), MSc Consultants: G. Evans, BSc, M.S.C. P.G. Dip, FGS, MIEnvSc, A. J. Kingston, BSc C.Eng, MIMM F. J. Globs, FLB.M.S. FLF.ST., F.R.S.H., K. J. Blanchette

Your Ref;

Our Ref:

Tel: 0208 594 8134 Fax: 0208 594 8072 E-Mail: services@siteanalytical.co.uk

Ref: 19/30896-1 November 2019

### 8A FAWLEY ROAD,

### LONDON, NW6 1SH

#### FACTUAL REPORT ON A GROUND INVESTIGATION

**Prepared for** 

#### Mr Matt Cooper





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** Outline and Limitations of Report

At the request of Mr Matt Cooper, a ground investigation was carried out in connection with a proposed residential basement development at the above site. A Geotechnical Desk Study is presented under separate cover in Site Analytical Services Limited Report Reference 19/30896.

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

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

#### 2.0 SITE DETAILS

#### (National Grid Reference: TQ 255 850)

#### 2.1 Site Location

8a Fawley Road is a single storey flat within a two-storey residential property with a loft conversion, located on the southern side of Fawley Road at approximate postcode NW6 1SH. The residential dwelling has three levels of accommodation; ground, first floor and loft conversion, with front and back gardens. The site covers an approximate area of 0.05 Hectares with the general area being under the authority of the London Borough of Camden.

The site is located on the southern side of Fawley Road with residential properties to the south, west and east. The site surrounding areas are predominantly residential.

#### 2.2 Geology

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

The British Geological Survey's (BGS) online records indicate there are no historic boreholes within 250m of the site.

#### 2.3 **Previous Investigations**

A Geotechnical Desk Study (SAS Report Ref: 19/30896, dated November 2019) has been undertaken across the site by Site Analytical Services Limited.



#### 3.0 SCOPE OF WORK

#### 3.1 Site Works

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

- The drilling of two continuous flight auger boreholes to a depth of 15.00m below ground level (Boreholes 1 and 2).
- The excavation of two trial pits to 1.50m maximum depth to expose existing foundations at the site (Trial Pits 1 and 2).
- Sampling and in-situ testing as appropriate to the ground conditions encountered in the boreholes and trial pits.
- Laboratory testing to determine the engineering properties of the soils encountered in the exploratory holes.
- Factual reporting on the results of the investigation.

#### 3.2 Ground Conditions

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

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

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

| Strata                | Depth to top<br>of strata<br>(mbgl) | Depth to<br>base of<br>strata (mbgl) | Description  |
|-----------------------|-------------------------------------|--------------------------------------|--|
| Made Ground           | 0.00                                | 1.30 to 1.60                         | Silty gravelly clay with brick and tile fragments. |
| London Clay Formation | 1.30 to 1.60                        | 15.00 (base of boreholes)            | Stiff silty sandy clay with gypsum crystals        |

#### Table A: Summary of Ground Conditions in Exploratory Holes



#### 3.3 Groundwater

Groundwater was not encountered within the boreholes and trial pits and the soils remained essentially dry throughout.

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

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

Groundwater was encountered at respective depths of 4.98m and 2.54m below ground level in Boreholes 1 and 2 after a period of approximately four weeks. Due to the nature of the geology encountered on-site, it is likely that this is purely surface water infiltrating into the standpipes and being unable to escape and not true groundwater.

It should be noted that the comments on groundwater conditions are based on observations made at the time of the investigation (October and November 2019) and that changes in the groundwater level could occur due to seasonal effects and also changes in drainage conditions.

#### 4.0 IN-SITU TESTING AND LABORATORY TESTS

#### 4.1 Mackintosh Probe / Hand Vane Tests

Mackintosh Probe tests were made at regular depth increments in order to assess the relative density of the soils encountered in the Made Ground in the boreholes. The results can be interpreted using the generally accepted correlation for Mackintosh Probe Tests which is as follows:

Mackintosh N75 X 0.38 = SPT 'N' Value

or

Mackintosh N300 X 0.1 = SPT 'N' Value

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

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



#### 4.2 Classification Tests

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

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

#### 4.3 Sulphate and pH Analyses

The results of the sulphate and pH analyses made on three samples are presented on Table 2, contained in Appendix B.

#### 4.4 In-situ Rising Head Permeability Tests

In order to assess the soil infiltration characteristics of the natural superficial soils at the site, in-situ rising head permeability tests were carried out in Borehole 1, using the procedure recommended in BS 5930:1999 (Amendment 3: 2010).

The results are presented on the exploratory hole records, contained in Appendix B.

#### p.p. SITE ANALYTICAL SERVICES LIMITED

T P Murray MSc BSc (Hons) FGS Geotechnical Engineer



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| Δ   | Site A    | Site Analytical Services Ltd. |         |           |            |  |  |  |  |  |
|-----|-----------|-------------------------------|---------|-----------|------------|--|--|--|--|--|
| SAS | LOCATION: | 8a Fawley Road, London, I     | VW6 1SH |           | FIG: 2     |  |  |  |  |  |
| *   | TITLE:    | Proposed Site Plan            | DATE:   | Nov' 2019 | SCALE: NTS |  |  |  |  |  |



| ٨   | Site A    | nalytical Sei           | vices   | Ltd.      | REF: 19/30896-1 |
|-----|-----------|-------------------------|---------|-----------|-----------------|
| sAs | LOCATION: | 8a Fawley Road, London, | NW6 1SH |           | FIG: 1          |
| *   | TITLE:    | Site Sketch Plan        | DATE:   | Nov' 2019 | SCALE: NTS      |



## APPENDIX `A'

Borehole / Trial Pit Logs

| Site                                   |  | /tic                   | al S                  | Service       |                       | td                         | Site<br>84 FAWLEY ROAD LONDON, NW6 1SH  |                        | Borehole<br>Number       |
|--|--|------------------------|-----------------------|---------------|-----------------------|----------------------------|---|------------------------|--------------------------|
|  |  |                        |                       |               |                       |                            |   |                        | BH1                      |
| CONTINUOL<br>AUGER                     | iod<br>JS FLIGHT                           | Casing<br>10           | Diameter<br>Omm case  | ed to 0.00m   | Ground Le             | evel (mOD)                 | Client<br>MR MATT COOPER  | i                      | Job<br>Number<br>1930896 |
|  |  | Locatio<br>TC          | <b>n</b><br>255850    |               | <b>Dates</b><br>10/10 | 0/2019                     | Engineer<br>MARTIN REDSTON ASSOCIATES   |                        | Sheet<br>1/2             |
| Depth<br>(m)                           | Sample / Tests                             | Casing<br>Depth<br>(m) | Water<br>Depth<br>(m) | Field Records | Level<br>(mOD)        | Depth<br>(m)<br>[hickness) | Description   | L                      | Vater Vater              |
| 0.25                                   | D1   |                        |                       |               |                       | (0.20)<br>0.20             | MADE GROUND: Dark brown black slightly gravelly clayey topsoil containing occasional brick              | y slightly             |                          |
| 0.50                                   | D2   |                        |                       |               |                       | (0.80)                     | MADE GROUND: Soft becoming firm, brown slightly<br>gravelly clay containing occasional brick            | у                      |                          |
| 0.75<br>1.00                           | D3<br>D4                                   |                        |                       |               |                       | - 1.00<br>(0.20)           | MADE GROUND: Brown clay containing crushed br   | rick                   |                          |
| 1.00-1.30                              | M1 89/300                                  |                        |                       |               |                       | (0.40)                     | MADE GROUND: Stiff, brown clay containing occas<br>brick  | sional                 |                          |
| 1.50<br>1.50                           | D5<br>V1 92                                |                        |                       |               |                       | 1.60                       | Stiff, brown silty sandy CLAY   | ×.                     | <u></u>                  |
| 2.00<br>2.00                           | D6<br>V2 109                               |                        |                       |               |                       | _                          |   | ×<br>•<br>•            | ×                        |
| 2.50<br>2.50                           | D7<br>V3 130+                              |                        |                       |               |                       | -                          |   | ו••<br>• ×             | ×                        |
| 3.00<br>3.00                           | D8<br>V4 130+                              |                        |                       |               |                       |                            |   | •.<br>•<br>•<br>•<br>• | × ×                      |
| 3.50<br>3.50                           | D9<br>V5 130+                              |                        |                       |               |                       | -                          |   | ×<br>*<br>•            | × ×                      |
| 4.00<br>4.00                           | D10<br>V6 130+                             |                        |                       |               |                       |                            |   | ×<br>×<br>*.           | ×                        |
| 4.50<br>4.50                           | D11<br>V7 130+                             |                        |                       |               |                       | -                          |   | *                      | ×.                       |
| 5.00<br>5.00                           | D12<br>V8 130+                             |                        |                       |               |                       | (6.60)                     |   | *.                     | × ×                      |
|  |  |                        |                       |               |                       | -                          |   | ×.                     | × ×                      |
| 6.00<br>6.00                           | D13<br>V9 130+                             |                        |                       |               |                       | _                          |   | ×.                     | × ×                      |
|  |  |                        |                       |               |                       | -                          |   | ×<br>×<br>•            | × ×                      |
| 7.00                                   | D14  |                        |                       |               |                       | _                          |   | ×<br>•<br>•            | ×                        |
| 7.00                                   | V10 130                                    |                        |                       |               |                       | _                          |   | *.<br>*<br>*           | × ×                      |
| 8.00                                   | D16  |                        |                       |               |                       | _                          |   | *.                     | ×                        |
| 8.00                                   | V11 130+                                   |                        |                       |               |                       | 8.20                       | Stiff, blue grey silty sandy CLAY with partings of silty<br>grained sand and occasional gypsum crystals | y fine ¥.              | × ×                      |
|  |  |                        |                       |               |                       |                            |   | ×<br>*.                | ×                        |
| 9.00<br>9.00                           | D16<br>V12 130+                            |                        |                       |               |                       | (1.80)                     |   | ×<br>*.<br>•           | × ×                      |
|  |  |                        |                       |               |                       | -                          |   | ×.                     | ×                        |
|  |  |                        |                       |               |                       |                            |   | ×<br>×                 |                          |
| Remarks<br>D= Disturbed<br>M= Makintos | d Sample<br>h Probe-Blows/Pene             | etration (m            | <br>חm)               |               |                       |                            |   | Scale<br>(approx)      | Logged<br>By             |
| Groundwater<br>Excavating fr           | r was not encountere<br>rom 0.00m to 1.00m | ed during<br>for 1 hou | boirng/ex             | cavation      |                       |                            |   | 1:50                   | EW                       |
|  |  |                        |                       |               |                       |                            |   | Figure No.<br>1930896  | 6.BH1                    |

| Site                                 | e Anaiy                                     | /τις            |                      | Servic        | esi            | Lta.         | 8A FAWLEY ROAD, LONDON, NW6 1SH  |                            | BH1                                     |
|--------------------------------------|---|-----------------|----------------------|---------------|----------------|--------------|--|----------------------------|---|
| Boring Met                           | hod<br>DUS FLIGHT                           | Casing<br>10    | Diameter<br>Omm case | ed to 0.00m   | Ground         | Level (mOD)  | Client<br>MR MATT COOPER   |                            | <b>Job<br/>Number</b><br>1930896        |
|                                      |   | Locatio<br>TC   | n<br>2255850         |               | Dates          | )/10/2019    | Engineer<br>MARTIN REDSTON ASSOCIATES  |                            | Sheet<br>2/2                            |
| Depth<br>(m)                         | Sample / Tests                              | Casing<br>Depth | Water<br>Depth       | Field Records | Level<br>(mOD) | Depth<br>(m) | Description  |                            | Yater Pueser                            |
| 10.00<br>10.00                       | D17<br>V13 130+                             | (m)             | (m)                  |               |                |              | Stiff, blue grey silty sandy CLAY with partings of silty fir grained sand and occasional gypsum crystals | ne -                       | × · · · · · · · · · · · · · · · · · · · |
| 11.00<br>11.00                       | D18<br>V14 130+                             |                 |                      |               |                |              |  | -<br>-<br>-<br>-<br>-      | × × × × × × × × × × × × × × × × × × ×   |
| 12.00<br>12.00                       | D19<br>V15 130+                             |                 |                      |               |                | (5.00)       |  | -<br>-<br>-<br>-           | × × ×                                   |
| 13.00<br>13.00                       | D20<br>V16 130+                             |                 |                      |               |                |              |  | -<br>-<br>-<br>-<br>-<br>- | × × × × × × × × × × × × × × × × × × ×   |
| 14.00<br>14.00                       | D21<br>V17 130+                             |                 |                      |               |                |              |  | -<br>-<br>-                | × × · · · · · · · · · · · · · · · · · · |
| 15.00                                | D22<br>V18 130+                             |                 |                      |               |                |              | Complete at 15.00m   |                            |   |
| Remarks<br>D= Disturbe<br>M= Makinto | d Sample<br>sh Probe-Blows/Pen              | etration (n     | nm)                  |               |                |              | S<br>(ap   | icale<br>prox)             | Logged<br>By                            |
| v= Vane Te<br>Groundwate             | st - Results in kPa<br>er was not encounter | ed during       | boirng/exc           | cavation      |                |              | 1  | 1:50                       | EW                                      |
|                                      |   |                 |                      |               |                |              | · · ·  | 19308                      | 96.BH1                                  |

| Site  | Analy  | /tic                   | al S                  | Servic        | es l           | Ltd.  | Site<br>8A FAWLEY ROAD, LONDON, NW6 1SH  | Borehole<br>Number<br>BH2             |
|---|--|------------------------|-----------------------|---------------|----------------|---|--|---------------------------------------|
| Boring Meth<br>CONTINUOU<br>AUGER   | JS FLIGHT  | Casing<br>10           | Diameter<br>0mm case  | ed to 0.00m   | Ground         | Level (mOD  | Client<br>MR MATT COOPER   | Job<br>Number<br>1930896              |
|   |  | Locatio<br>TC          | <b>n</b><br>)255850   |               | Dates          | 9/10/2019   | Engineer<br>MARTIN REDSTON ASSOCIATES  | Sheet<br>1/2                          |
| Depth<br>(m)  | Sample / Tests   | Casing<br>Depth<br>(m) | Water<br>Depth<br>(m) | Field Records | Level<br>(mOD) | Depth<br>(m)<br>(Thickness  | Description  | Legend S                              |
| 0.25<br>0.50<br>0.75<br>1.00<br>1.00-1.30<br>1.50<br>2.00<br>2.50<br>2.50<br>3.00<br>3.00<br>3.50<br>3.50<br>4.00<br>4.00<br>4.50<br>4.50<br>5.00<br>5.00<br>6.00<br>6.00 | D1<br>D2<br>D3<br>D4<br>M1 59/300<br>D5<br>V1 83<br>D6<br>V2 101<br>D7<br>V3 121<br>D8<br>V4 130+<br>D9<br>V5 130+<br>D10<br>V6 130+<br>D11<br>V7 130+<br>D12<br>V8 130+<br>D13<br>V9 130+ |                        |                       |               |                |   | MADE GROUND: Dark brown black silty topsoil containir<br>small roots and occasional brick and concrete<br>MADE GROUND: Soft, mottled brown slightly gravelly silt<br>clay containing brick and tile<br>Stiff, brown silty sandy CLAY | g<br>y                                |
| 7.00<br>7.00  | D14<br>V10 130+  |                        |                       |               |                |   |  | × × ·                                 |
| 8.00<br>8.00  | D15<br>V11 130+  |                        |                       |               |                | 1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1 | Stiff, blue grey silty sandy CLAY with partings of silty fine grained sand and occasional gypsum crystals  |                                       |
| 9.00<br>9.00  | D16<br>V12 130+  |                        |                       |               |                |   |  |                                       |
| Remarks<br>D= Disturbed<br>M= Makintos<br>V= Vane Tes   | t Sample<br>h Probe-Blows/Pene<br>t - Results in kPa   | etration (n            | ım)                   |               |                |   | Sca<br>(appr   | le Logged<br>ox) By                   |
| Groundwater<br>Excavating fr  | r was not encounterer<br>rom 0.00m to 1.00m  | ed during<br>for 1 hou | boirng/exe<br>r.      | cavation      |                |   | 1:50<br>Figu   | ) EW<br>I <b>re No.</b><br>930896.BH2 |

| Si                         | te        | e A                          | nal            | ytic                        | al Servi  | ces  | Lto      | <b>1.</b> (* | <b>Site</b><br>8A FAWLE      | EY ROAL  | D, LONDO   | ON, NW6     | 1SH          |              |                  | Borehole<br>Number<br>BH1              |
|----------------------------|-----------|------------------------------|----------------|-----------------------------|---|--|----------|--------------|------------------------------|----------|------------|-------------|--------------|--------------|------------------|--|
| Installa<br>Single         | lns       | n Type<br>tallation          |                | Dimensi<br>Interna<br>Diame | <b>ons</b><br>al Diameter of Tube [A] = 50<br>ter of Filter Zone = 100 mn | ) mm<br>1  |          | C            | <b>lient</b><br>MR MATT      | COOPE    | R          |             |              |              |                  | <b>Job</b><br><b>Number</b><br>1930896 |
|                            |           |                              |                | Locatior<br>TQ25            | <b>1</b><br>5850  | Ground   | Level (m | iOD) E       | E <b>ngineer</b><br>Martin F | REDSTO   | N ASSO     | CIATES      |              |              |                  | Sheet<br>1/1                           |
| Legend                     | Water     | Instr<br>(A)                 | Level<br>(mOD) | Depth<br>(m)                | Description   |  |          |              | G                            | roundwa  | ater Strik | es Durin    | g Drilling   | 9            |                  |  |
|                            | -         |                              |                |                             |   | Data   | Time     | Depth        | Casing                       | l a fl a |            | Readings    |              |              | Depth            |  |
|                            |           |                              |                |                             | Bentonite Seal  | Date   | Time     | (m)          | (m)                          | Inflo    | w Rate     | 5 min       | 10 min       | 15 min       | 20 min           | i (m)                                  |
|                            |           |                              |                | 1.00                        |   |  |          |              |                              |          |            |             |              |              |                  |  |
|                            |           |                              |                |                             |   |  |          |              |                              |          |            |             |              |              |                  |  |
| × ×                        |           |                              |                |                             |   |  |          |              |                              |          |            |             |              |              |                  |  |
| ××                         |           |                              |                |                             |   |  |          |              |                              |          |            |             |              |              |                  |  |
| ×                          |           |                              |                |                             | Slotted Standpipe   |  |          |              | Gr                           | oundwa   | tor Obso   | rvations    | During C     | rilling      |                  |  |
| × ×                        |           |                              |                |                             |   | Groundwater Observations During  |          |              |                              |          |            |             | , ming       |              |                  |  |
| × ×                        |           |                              |                |                             |   | Start of Shift         End of           Date         Depth         Casing         Water         Water         Depth         Casing |          |              |                              |          |            | End of SI   | nift<br>Wato | r Wator      |                  |  |
| × × ×                      |           |                              |                |                             |   | Time Hole (m) (mOD) (mOD)  |          |              |                              |          |            | Hole<br>(m) | Depth<br>(m) | Deptr<br>(m) | 1 Level<br>(mOD) |  |
| ××                         |           |                              |                | 5.00                        |   |  |          |              |                              |          |            |             |              |              |                  |  |
| ×                          |           | 8.000   8.8%<br>8.000   8.8% |                |                             | Bentonite Seal  |  |          |              |                              |          |            |             |              |              |                  |  |
| × ×                        |           |                              |                | 6.00                        | 5.00  |  |          |              |                              |          |            |             |              |              |                  |  |
| × ×                        |           |                              |                |                             |   |  |          |              |                              |          |            |             |              |              |                  |  |
| ××                         |           |                              |                |                             |   |  |          |              |                              |          |            |             |              |              |                  |  |
| × ×                        |           |                              |                |                             |   |  |          |              | Instru                       | ument G  | roundwa    | iter Obse   | ervations    |              |                  |  |
| ×                          |           |                              |                |                             |   | Inst.  | [A] Type | : Slotted    | l Standpip                   | e        |            |             |              |              |                  |  |
| × <u>×</u><br>× <u>×</u> × |           |                              |                |                             |   |  | Ins      | trument      | [A]                          |          |            |             |              |              |                  |  |
| × ×                        |           |                              |                |                             |   | Date   |          |              |                              |          |            |             | Rem          | arks         |                  |  |
| × ×                        |           |                              |                |                             |   |  | Time     | Depth<br>(m) | Level<br>(mOD)               |          |            |             |              |              |                  |  |
| ××                         |           |                              |                |                             |   |  |          |              |                              |          |            |             |              |              |                  |  |
| ×                          |           |                              |                |                             | General Backfill  |  |          |              |                              |          |            |             |              |              |                  |  |
| × <u>×</u>                 |           |                              |                |                             |   |  |          |              |                              |          |            |             |              |              |                  |  |
| × ×                        |           |                              |                |                             |   |  |          |              |                              |          |            |             |              |              |                  |  |
| ×                          |           |                              |                |                             |   |  |          |              |                              |          |            |             |              |              |                  |  |
| ××                         |           |                              |                |                             |   |  |          |              |                              |          |            |             |              |              |                  |  |
| ××                         |           |                              |                |                             |   |  |          |              |                              |          |            |             |              |              |                  |  |
| ×                          |           |                              |                |                             |   |  |          |              |                              |          |            |             |              |              |                  |  |
| × ×                        |           |                              |                |                             |   |  |          |              |                              |          |            |             |              |              |                  |  |
| ××                         |           |                              |                |                             |   |  |          |              |                              |          |            |             |              |              |                  |  |
| ×                          |           |                              |                |                             |   |  |          |              |                              |          |            |             |              |              |                  |  |
| ×                          |           |                              |                | 15.00                       |   |  |          |              |                              |          |            |             |              |              |                  |  |
| Remar<br>Lockal            | ks<br>ble | cover set                    | in cemen       | t                           |   |  |          |              |                              |          |            |             |              |              |                  |  |

| Site Analytical Servi Boring Method Casing Diameter |                  | Servic                 | es l                  | Ltd.                    | Site<br>8A FAWLEY ROAD, LONDON, NW6 1SH |                            | Boreho<br>Numbe<br>BH2   | ole<br>er<br>2    |   |          |
|---|------------------|------------------------|-----------------------|-------------------------|---|----------------------------|--|-------------------|---|----------|
| Boring Met<br>CONTINUO<br>AUGER                     | hod<br>US FLIGHT | Casing<br>10           | Diamete<br>0mm cas    | <b>r</b><br>ed to 0.00m | Ground                                  | Level (mOE                 | ) Client<br>MR MATT COOPER   |                   | Job<br>Numbe<br>193089                  | ər<br>96 |
|   |                  | Locatio<br>TC          | n<br>)255850          |                         | Dates                                   | 9/10/2019                  | Engineer<br>MARTIN REDSTON ASSOCIATES  |                   | Sheet<br>2/2                            |          |
| Depth<br>(m)  | Sample / Tests   | Casing<br>Depth<br>(m) | Water<br>Depth<br>(m) | Field Records           | Level<br>(mOD)                          | Depth<br>(m)<br>(Thickness | Description  |                   | Legend                                  | Water    |
| 10.00<br>10.00                                      | D17<br>V13 130+  |                        |                       |                         |   | 10.0                       | )<br>Stiff, blue grey silty sandy CLAY with partings of sil<br>grained sand and occasional gypsum crystals | ty fine           | × · · · · · · · · · · · · · · · · · · · |          |
| 11.00<br>11.00                                      | D18<br>V14 130+  |                        |                       |                         |   |                            |  |                   | × · · · × · · · · · · · · · · · · · · · |          |
| 12.00<br>12.00                                      | D19<br>V15 130+  |                        |                       |                         |   | (5.00                      |  |                   | × × × × × × × × × × × × × × × × × × ×   |          |
| 13.00<br>13.00                                      | D20<br>V16 130+  |                        |                       |                         |   |                            |  |                   | × · · · · · · · · · · · · · · · · · · · |          |
| 14.00<br>14.00                                      | D21<br>V17 130+  |                        |                       |                         |   |                            |  |                   | × × × × × × × × × × × × × × × × × × ×   |          |
| 15.00<br>15.00                                      | D22<br>V18 130+  |                        |                       |                         |   |                            | Complete at 15.00m   | 2                 |   |          |
| Remarks   |                  |                        |                       |                         |   |                            |  | Scale<br>(approx) | Logged<br>By                            | d        |
|   |                  |                        |                       |                         |   |                            | -  | 1:50              | EW                                      |          |
|   |                  |                        |                       |                         |   |                            |  | 19308             | 396.BH2                                 |          |

| Si                                      | te          | e A                 | nal            | ytic                        | al Servi  | ces       | Lto                                 | <b>d.</b> [   | <b>Site</b><br>8A FAWLE      | EY ROAI        | D, LONDO       | ON, NW6  | i 1SH         |                 |                | Borehole<br>Number<br>BH2 |  |
|---|-------------|---------------------|----------------|-----------------------------|---|-----------|-------------------------------------|---------------|------------------------------|----------------|----------------|----------|---------------|-----------------|----------------|---------------------------|--|
| Installa<br>Single                      | itio<br>Ins | n Type<br>tallation |                | Dimensi<br>Interna<br>Diame | ons<br>al Diameter of Tube [A] = 50<br>eter of Filter Zone = 100 mn | ) mm<br>າ |                                     | C             | <b>Client</b><br>MR MATT     | COOPE          | R              |          |               |                 |                | Job<br>Number<br>1930896  |  |
|   |             |                     |                | Location<br>TQ25            | <b>1</b><br>5850  | Ground    | Level (m                            | 1OD) E        | E <b>ngineer</b><br>Martin F | REDSTO         | N ASSO         | CIATES   |               |                 |                | Sheet<br>1/1              |  |
| Legend                                  | Vater       | Instr<br>(A)        | Level<br>(mOD) | Depth<br>(m)                | Description   |           |                                     | I             | G                            | roundwa        | ater Strik     | es Durin | ıg Drilling   | 3               | I              |                           |  |
|   | -           |                     | ( - )          |                             |   |           |                                     | Depth         | Casing                       |                |                |          | Read          | Readings        |                | Depth                     |  |
|   |             |                     |                |                             | Bentonite Seal  | Date      | Time                                | Struck<br>(m) | Depth<br>(m)                 | Inflo          | w Rate         | 5 min    | 10 min        | 15 min          | 20 mir         | - Sealed<br>ı (m)         |  |
|   |             |                     |                | 1.00                        |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| × · · · · · · ·                         |             |                     |                |                             |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| × ×                                     |             |                     |                |                             |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| × ×                                     |             |                     |                |                             |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| ××                                      |             |                     |                |                             | Slotted Standpipe   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| ×                                       |             |                     |                |                             |   |           |                                     |               | Gr                           | oundwa         | ter Obse       | rvations | During D      | rilling         |                |                           |  |
| ×                                       |             |                     |                |                             |   |           |                                     |               |                              |                |                |          | ļ             | End of SI       | hift           |                           |  |
| × ×                                     |             |                     |                |                             |   | Date      | Time                                | Depth<br>Hole | Casing<br>Depth              | Water<br>Depth | Water<br>Level | Time     | Depth<br>Hole | Casing<br>Depth | Water<br>Depti | Water<br>Level            |  |
| × × ×                                   |             |                     |                | 5.00                        |   |           |                                     |               |                              | (11)           | (1100)         |          |               | (11)            |                |                           |  |
| ××                                      |             |                     |                | 5.00                        | Bentonite Seal  |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| ×                                       |             |                     |                | 0.00                        |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| × ×                                     |             |                     |                | 6.00                        |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| × × ×                                   |             |                     |                |                             |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| × · · · · · · · · · · · · · · · · · · · |             |                     |                |                             |   |           | Instrument Groundwater Observations |               |                              |                |                |          |               |                 |                |                           |  |
| × ×                                     |             |                     |                |                             |   | Inst.     | [A] Type                            | : Slotted     | d Standpip                   | e              |                |          |               |                 |                |                           |  |
| ××                                      |             |                     |                |                             |   |           | Ins                                 | strument      | [A]                          |                |                |          |               |                 |                |                           |  |
| ×                                       |             |                     |                |                             |   | Date      |                                     |               |                              |                |                |          | Rem           | arks            |                |                           |  |
| ××                                      |             |                     |                |                             |   |           | Time                                | Depth<br>(m)  | Level<br>(mOD)               |                |                |          |               |                 |                |                           |  |
| ×                                       |             |                     |                |                             |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| ×                                       |             |                     |                |                             | General Backfill  |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| × ×                                     |             |                     |                |                             |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| × × ×                                   |             |                     |                |                             |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| ××                                      |             |                     |                |                             |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| ××                                      |             |                     |                |                             |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| × <u>×</u>                              |             |                     |                |                             |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| × ×                                     |             |                     |                |                             |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| ××                                      |             |                     |                |                             |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| ×                                       |             |                     |                |                             |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| × <u>×</u>                              |             |                     |                |                             |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| × × ×                                   |             |                     |                | 15.00                       |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| Remar                                   | ks          |                     |                |                             |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
| Lockal                                  | ble         | cover set           | in cemen       | t                           |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |
|   |             |                     |                |                             |   |           |                                     |               |                              |                |                |          |               |                 |                |                           |  |

| Site   | e Analy                             | ytica                 | al Servic                            | es l           | Ltd.   | Site<br>8A FAWLEY ROAD, LONI  | DON, NW6 1SH   | Trial Pit<br>Number<br>TP1 |
|--|-------------------------------------|-----------------------|--------------------------------------|----------------|--|---|--|----------------------------|
| Excavation<br>HAND EXC                       | Method<br>AVATION                   | Dimensio<br>0.30m(W   | <b>ns</b><br>) x 0.30m(L) x 1.40m(D) | Ground         | Level (mOD)                                      | Client<br>MR MATT COOPER  |  | Job<br>Number<br>1930896   |
|  |                                     | Location              | 55850                                | Dates<br>09    | Dates<br>09/10/2019<br>MARTIN REDSTON ASSOCIATES |   | Sheet<br>1/1   |                            |
| Depth<br>(m)                                 | Sample / Tests                      | Water<br>Depth<br>(m) | Field Records                        | Level<br>(mOD) | Depth<br>(m)<br>(Thickness)                      | D   | escription   | Kater Kater                |
| 0.25<br>0.50<br>0.75<br>1.00<br>1.30<br>1.30 | D1<br>D2<br>D3<br>D4<br>D5<br>V1 87 |                       |                                      |                |  | MADE GROUND: Dark br<br>and occasional brick fragm<br>MADE GROUND: Brown s<br>containing brick fragments<br>MADE GROUND: Stiff, lig<br>fragments<br>Complete at 1.40m | own topsoil containing small<br>hents<br>slightly gravelly silty clay<br>nt brown clay containing bric | roots                      |
|  |                                     |                       |                                      |                |  | D= Disturbed Sample<br>V= Vane Test - Results in kF<br>Groundwater was not encou  | a<br>Intered during boring/excava  | ation                      |
|  |                                     |                       |                                      |                |  |   |  |                            |
|  |                                     |                       |                                      |                |  |   |  |                            |
|  | · ·                                 |                       | · · ·                                |                |  |   |  |                            |
|  |                                     |                       |                                      | • •            | · ·  | Scale (approx)  | Logged By  | Figure No.                 |
|  |                                     |                       |                                      |                |  | 1:50  | EW   | 1930896.TP1                |

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| Site                      | )               | Analy  | tical Service  | es Ltd.                 | Site<br>8A FAWL    | .EY ROAD, L       | -ONDON, I        | NW6 1SH       |                               | Trial Pit<br>Number<br>TP1 |
|---------------------------|-----------------|--|--|-------------------------|--------------------|-------------------|------------------|---------------|-------------------------------|----------------------------|
| Method<br>Trial Pit       |                 |  | Dimensions<br>0.30m(W) x 0.30m(L) x 1.40m(D)   | Ground Level (mOD)      | Client<br>MR MAT   | T COOPER          |                  |               |                               | Job<br>Number<br>1930896   |
| Orientation               |                 | A<br>D B<br>C                                    | Location<br>TQ255850   | Dates<br>09/10/2019     | Engineer<br>MARTIN | REDSTON A         | ASSOCIAT         | ES            |                               | <b>Sheet</b><br>1/1        |
| Depth<br>0.00             |                 | 0.88m Bri<br>0.08m Bri<br>0.08m Bri<br>0.08m Old | rick<br>0.04m<br>0.05m<br>0.05m<br>0.05m<br>0.05m<br>0.05m<br>0.05m<br>0.05m<br>0.06m<br>1d concrete crush | side of foundation for  | und at 1.3         | Om depth          |                  | Level<br>0.00 |                               |                            |
| Strata                    |                 |  |  |                         |                    | Samples           | and Tests        | S             |                               |                            |
| Depth (m)                 | No.             | Description                                      |  |                         |                    | Depth (m)         | Туре             | Field Re      | cords                         |                            |
| 0.00-0.40                 | 1               | MADE GROUNI                                      | ID: Dark brown topsoil containing small ro   | ots and occasional bric | :k                 | 0.25              | D1               |               |                               |                            |
| 0.40-1.10                 | 2               | MADE GROUNI                                      | ID: Brown slightly gravelly silty clay contai  | ning brick fragments    |                    | 0.50              | D2               |               |                               |                            |
| 1.10-1.40                 | 3               | MADE GROUNI                                      | ID: Stiff, light brown clay containing brick f   | fragments               |                    | 1.00<br>1.30      | D3<br>D4<br>D5   |               |                               |                            |
|                           |                 |  |  |                         |                    | 1.30<br>Excavatio | N1 87<br>N Metho | d:            |                               |                            |
|                           |                 |  |  |                         |                    | HAND EXC          | AVATION          |               |                               |                            |
|                           |                 |  |  |                         |                    | Shoring /         | Support          |               |                               |                            |
|                           |                 |  |  |                         |                    | Stability:        |                  |               |                               |                            |
|                           |                 |  |  |                         |                    | N/A               |                  |               |                               |                            |
|                           |                 |  |  |                         |                    | Backfill:         |                  |               |                               |                            |
|                           |                 |  |  |                         |                    | ARISINGS          |                  |               |                               |                            |
|                           |                 |  |  |                         |                    |                   |                  |               |                               |                            |
|                           |                 |  |  |                         |                    |                   |                  |               |                               |                            |
|                           |                 |  |  |                         |                    |                   |                  |               |                               |                            |
|                           |                 |  |  |                         |                    |                   |                  |               |                               |                            |
|                           |                 |  |  |                         |                    |                   |                  |               |                               |                            |
|                           |                 |  |  |                         |                    |                   |                  |               |                               |                            |
|                           |                 |  |  |                         |                    |                   |                  |               |                               |                            |
| Remarks<br>D= Disturbe    | d Sa            | imple  |  |                         |                    |                   |                  |               |                               |                            |
| v= vane les<br>Groundwate | st - F<br>er wa | kesuits in kPa<br>is not encountere              | ed during boring/excavation  |                         |                    |                   |                  |               | Logged By : E<br>Checked By : | W                          |
|                           |                 |  |  |                         |                    |                   |                  |               | Figure No. : 1                | 930896.TP1                 |

| Site  | e Analy                       | /tica                 | al Servic                            | es l           | Ltd.                       | Site<br>8A FAWLEY ROAD, LONE  | DON, NW6 1SH  | Trial Pit<br>Number<br>TP2A |
|---|-------------------------------|-----------------------|--------------------------------------|----------------|----------------------------|---|---|-----------------------------|
| Excavation<br>HAND EXC                                | Method<br>Avation             | Dimensio<br>0.30m(W   | <b>ns</b><br>) x 0.30m(L) x 1.40m(D) | Ground         | Level (mOD                 | Client<br>MR MATT COOPER  |   | Job<br>Number<br>1930896    |
|   |                               | Location<br>TQ25      | 55850                                | Dates          | 9/10/2019                  | Engineer<br>MARTIN REDSTON ASSO   | DCIATES   | <b>Sheet</b> 1/1            |
| Depth<br>(m)  | Sample / Tests                | Water<br>Depth<br>(m) | Field Records                        | Level<br>(mOD) | Depth<br>(m)<br>(Thickness | D   | escription  | Legend                      |
| (m)<br>0.25<br>0.50<br>0.75<br>1.00<br>1.30<br>Plan . | Sample / Tests D1 D2 D3 D4 D5 | - Depth<br>(m)        |                                      | (mOD)          |                            | MADE GROUND: Dark bricontaining brick and concr<br>MADE GROUND: Brown soccasional brick and conc<br>Complete at 1.40m | escription own gravelly silty sandy clar ete slightly gravelly clay contain rete ntered during boring/excav | tegend <u>e</u>             |
|   |                               | ·                     |                                      | •              |                            |   |   |                             |
|   |                               | ·                     |                                      | •              | •••                        |   |   |                             |
| · ·   |                               |                       |                                      | •              | · · ·                      |   |   |                             |
|   |                               |                       |                                      |                |                            | Scale (approx)  | Logged By   | Figure No.                  |
|   |                               |                       |                                      |                |                            | 1:50  | EW  | 1930896.TP2A                |

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| Site                      | )             | Analy                            | tical S                                      | Service  | es Ltd.  | Site<br>8A FAWL    | .EY ROAD, L  | ONDON, I                   | NW6 1SH                               |   | Trial Pit<br>Number<br>TP2A |
|---------------------------|---------------|----------------------------------|--|--|--|--------------------|--|----------------------------|---------------------------------------|---|-----------------------------|
| Method<br>Trial Pit       |               |                                  | Dimensions<br>0.30m(W) x 0.30m               | n(L) x 1.40m(D)  | Ground Level (mOD)                                   | Client<br>MR MAT   | T COOPER   |                            |                                       |   | Job<br>Number<br>1930896    |
| Orientation               |               | A<br>D B<br>C                    | Location<br>TQ255850                         |  | Dates<br>09/10/2019                                  | Engineer<br>MARTIN | REDSTON A  | ASSOCIAT                   | ES                                    |   | Sheet<br>1/1                |
| Depth<br>0.00             |               | 1.00m Br<br>0.08m Br<br>0.22m Ol | rick<br>rick<br>rick                         | Unde   | erside of foundation fo                              | ound at 1.3        | 30m depth  |                            | Level<br>0.00<br><br><br><br><br>1.40 |   |                             |
| Strata                    |               |                                  |  |  |  |                    | Samples a  | and Tests                  | S                                     |   |                             |
| Depth (m)                 | No.           | Description                      |  |  |  |                    | Depth (m)  | Туре                       | Field Red                             | cords                                       |                             |
| 0.00-0.60                 | 1<br>2        | MADE GROUNI                      | D: Dark brown grave<br>D: Brown slightly gra | elly silty sandy clay on the second sec | containing brick and con<br>g occasional brick and c | crete<br>oncrete   | 0.25<br>0.50<br>0.75<br>1.00<br>1.30   | D1<br>D2<br>D3<br>D4<br>D5 |                                       |   |                             |
| Bomerko                   |               |                                  |  |  |  |                    | Excavatio<br>HAND EXC<br>Shoring /<br>GOOD<br>Stability:<br>N/A<br>Backfill:<br>ARISINGS | AVATION<br>Support:        | a:<br>:                               |   |                             |
| D= Disturbe<br>Groundwate | d Sa<br>er wa | Imple<br>Is not encountere       | ed during boring/exca                        | avation  |  |                    |  |                            |                                       | Logged By :<br>Checked By :<br>Figure No. : | EW<br>1930896.TP2A          |

| Site                                 | e Analy                    | /tica                 | I Servic                    | es l           | Ltd.                        | Site<br>8A FAWLEY ROAD, LONE   | DON, NW6 1SH  | Trial Pit<br>Number<br>TP2B |
|--------------------------------------|----------------------------|-----------------------|-----------------------------|----------------|-----------------------------|--|---|-----------------------------|
| Excavation<br>HAND EXC               | Method<br>AVATION          | Dimension<br>0.30m(W) | ns<br>x 0.30m(L) x 1.50m(D) | Ground         | Level (mOD)                 | Client<br>MR MATT COOPER   |   | Job<br>Number<br>1930896    |
|                                      |                            | Location              | 5850                        | Dates          | 9/10/2019                   | Engineer<br>MARTIN REDSTON ASSO  | DCIATES   | Sheet<br>1/1                |
| Depth<br>(m)                         | Sample / Tests             | Water<br>Depth<br>(m) | Field Records               | Level<br>(mOD) | Depth<br>(m)<br>(Thickness) | D  | escription  | Legend S                    |
| 0.25<br>0.50<br>0.75<br>1.00<br>1.50 | D1<br>D2<br>D3<br>D4<br>D5 |                       |                             |                |                             | MADE GROUND: Dark bricontaining brick and control<br>MADE GROUND: Brown soccasional brick and control<br>Complete at 1.50m | own gravelly silty sandy clay<br>slightly gravelly clay contain<br>rete | y<br>ing                    |
|                                      |                            |                       |                             |                |                             | D= Disturbed Sample<br>Groundwater was not encou   | intered during boring/excav   | ation                       |
|                                      |                            | •                     |                             | •              | •••                         |  |   |                             |
|                                      |                            |                       |                             | •              |                             |  |   |                             |
| · ·                                  | · ·                        |                       |                             |                | <br>                        |  |   |                             |
|                                      |                            |                       |                             |                | <u> </u>                    | Scale (approx)   | Logged By   | Figure No.                  |
|                                      |                            |                       |                             |                |                             | 1:50   | EW  | -<br>1930896.TP2B           |

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| Site   | )      | Analy  | ytical   | Servic                   | es Ltd.  | Site<br>8A FAWI    | LEY ROAD, L                          | ONDON, I                   | NW6 1SH                                       |   | Trial Pit<br>Number<br>TP2B |
|--|--------|--|--|--------------------------|--|--------------------|--------------------------------------|----------------------------|---|---|-----------------------------|
| Method<br>Trial Pit  |        |  | Dimensions<br>0.30m(W) x 0.30                    | 0m(L) x 1.50m(D)         | Ground Level (mOD)                                   | Client<br>MR MAT   | T COOPER                             |                            |   |   | Job<br>Number<br>1930896    |
| Orientation  |        | A<br>D E<br>C  | Location<br>TQ255850                             |                          | Dates<br>09/10/2019                                  | Engineer<br>MARTIN | REDSTON A                            | ASSOCIAT                   | ES  |   | <b>Sheet</b> 1/1            |
| Depth<br>0.00<br>-<br>-<br>-<br>1.00 -<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>- |        | 0.82m Br<br>0.08m Br<br>0.08m Br<br>0.08m Br<br>0.08m Ol | rick<br>rick<br>rick<br>rick<br>d concrete crush | 0.05m<br>0.05m           | Underside of founda                                  | tion was r         | not found                            |                            | Level<br>0.00<br><br><br>- 1.00<br><br>- 1.50 |   |                             |
| Strata   |        |  |  |                          |  |                    | Samples                              | and Tests                  | S   |   |                             |
| Depth (m)  | No.    | Description  |  |                          |  |                    | Depth (m)                            | Туре                       | Field Re                                      | cords                                       |                             |
| 0.00-0.60  | 1<br>2 | MADE GROUN   | ND: Dark brown gra<br>ND: Brown slightly g       | velly silty sandy clay o | containing brick and con<br>g occasional brick and c | crete<br>oncrete   | 0.25<br>0.50<br>0.75<br>1.00<br>1.50 | D1<br>D2<br>D3<br>D4<br>D5 |   |   |                             |
|  |        |  |  |                          |  |                    | HAND EXC                             | n Metho<br>Avation         | d:  |   |                             |
|  |        |  |  |                          |  |                    | Shoring /                            | Support                    | :   |   |                             |
|  |        |  |  |                          |  |                    | GOOD<br>Stability:                   |                            |   |   |                             |
|  |        |  |  |                          |  |                    | N/A                                  |                            |   |   |                             |
|  |        |  |  |                          |  |                    | Backfill:<br>ARISINGS                |                            |   |   |                             |
|  |        |  |  |                          |  |                    |                                      |                            |   |   |                             |
|  |        |  |  |                          |  |                    |                                      |                            |   |   |                             |
|  |        |  |  |                          |  |                    |                                      |                            |   |   |                             |
|  |        |  |  |                          |  |                    |                                      |                            |   |   |                             |
|  |        |  |  |                          |  |                    |                                      |                            |   |   |                             |
| Remarks<br>D= Disturbe   | d Sa   | mple   |  |                          |  |                    |                                      |                            |   |   |                             |
| Groundwate   | er Wa  | IS NOT ENCOUNTER   | rea auring boring/ex                             | wavation                 |  |                    |                                      |                            |   | Logged By :<br>Checked By :<br>Figure No. : | EW<br>1930896.TP2B          |

## APPENDIX `B'

In-situ, Laboratory Test & Groundwater Monitoring Data

| Site Analytical Services Ltd.   |   |  |   |            |  | Site<br>8A FAWLEY ROAD, LONDON, NW6 1SH   | Borehole<br>Number<br>BH2 |
|---|---|--|---|------------|--|---|---------------------------|
| In Situ Permeability Type Test No. Rising Head  |   | ə <b>st No.</b><br>1   |   | Ground L   | evel (mOD)   | Client<br>MR MATT COOPER  | Job<br>Number<br>1930896  |
|   | Location                                  |  |   | Dates      |  | Engineer  | Sheet                     |
| TQ2558  |   | 50   |   | 09/10/2019 |  | MARTIN REDSTON ASSOCIATES   | 1/1                       |
| Height of Standpipe above<br>Depth to Base of Filter:<br>Depth to Top of Filter:<br>Depth to equilibrium water<br>Test Length L:<br>Diameter of Test Length D<br>Area of Test Section:<br>Intake Factor F:<br>(after BS 5930, figure 7) | ground level:<br><sup>-</sup> level:<br>: | 0.00<br>5.00<br>1.00<br>2.54<br>4.00<br>0.05<br>0.0020<br>5.6643 | m<br>m bgl<br>m bgl<br>m btoc<br>m<br>m<br>m2 |            | PERMEA<br>Basic Tin<br>The value<br>T = 1<br>k = 3 | BILITY (after Hvorslev, 1951)<br>ne Lag Analysis<br>T when Ht/Ho = 0.37 is the basic time lag, T<br>.71<br>.38E-06 ms-1 |                           |

| Elapsed   | Depth to  | Head of   | Ht  |
|---|---|---|---|
| time  | water   | Water, H  | /   |
| (mins)  | (m btoc)  | (m)   | Ho  |
| time<br>(mins)<br>0.0<br>0.5<br>1.0<br>1.5<br>2.0<br>2.5<br>3.0<br>3.5<br>4.0<br>4.5<br>5.0<br>6.0<br>7.0<br>8.0<br>9.0<br>10.0<br>12.0<br>14.0<br>16.0<br>18.0<br>20.0<br>25.0<br>30.0<br>35.0 | water<br>(m btoc)<br>4.630<br>4.280<br>4.250<br>4.250<br>4.210<br>4.190<br>4.170<br>4.160<br>4.130<br>4.120<br>4.120<br>4.120<br>4.080<br>4.080<br>4.080<br>4.080<br>4.080<br>4.080<br>4.040<br>4.030<br>4.010<br>4.010<br>3.980<br>3.970 | Water, H<br>(m)<br>2.090<br>2.090<br>1.740<br>1.710<br>1.650<br>1.650<br>1.630<br>1.580<br>1.580<br>1.540<br>1.540<br>1.540<br>1.540<br>1.540<br>1.520<br>1.500<br>1.490<br>1.490<br>1.470<br>1.470<br>1.430<br>1.420 | / Ho<br>1.000<br>0.833<br>0.818<br>0.799<br>0.780<br>0.775<br>0.761<br>0.756<br>0.746<br>0.746<br>0.746<br>0.747<br>0.737<br>0.737<br>0.737<br>0.737<br>0.737<br>0.737<br>0.737<br>0.718<br>0.713<br>0.703<br>0.703<br>0.703<br>0.689<br>0.684<br>0.679 |
| 40.0  | 3.950   | 1.410   | 0.675   |
| 50.0  | 3.940   | 1.400   | 0.670   |
| 60.0  | 3.930   | 1.390   | 0.665   |



Remarks



Ref: 19/30896-1

#### PLASTICITY INDEX & MOISTURE CONTENT DETERMINATIONS

#### LOCATION 8a Fawley Road, London, NW6 1SH

| BH/TP<br>No. | Depth | Natural<br>Moisture | Liquid<br>Limit | Plastic<br>Limit | Plasticity<br>Index | Passing<br>425 μm | Modified<br>Plasticity | Class |
|--------------|-------|---------------------|-----------------|------------------|---------------------|-------------------|------------------------|-------|
|              | m     | %                   | %               | %                | %                   | %                 | %                      |       |
| BH1          | 2.00  | 30                  | 67              | 21               | 46                  | 100               | 46                     | СН    |
|              | 3.50  | 26                  | 65              | 21               | 44                  | 100               | 44                     | СН    |
| BH2          | 3.00  | 27                  | 66              | 23               | 43                  | 100               | 43                     | СН    |
|              | 4.00  | 27                  | 68              | 21               | 47                  | 100               | 47                     | СН    |



SAS Site Analytical Services Ltd.

Ref: 19/30896-1

#### SULPHATE & pH DETERMINATIONS

| LOCATION | 8a Fawley Road, London, NW6 1SH |  |
|----------|---------------------------------|--|
|----------|---------------------------------|--|

| BH/TP<br>No. | DEPTH<br>BELOW | SOIL S | ULPHATES<br>S SO4 | WATER SULPHATES<br>AS SO4 | рН  | CLASS | SOIL<br>- 2mm |
|--------------|----------------|--------|-------------------|---------------------------|-----|-------|---------------|
|              | GL<br>M        | %      | g/l               | g/l                       |     |       | %             |
| BH1          | 9.50           |        | 2.72              |                           | 7.6 | DS-3  | 100           |
|              | 10.00          |        | 1.67              |                           | 7.5 | DS-3  | 100           |
| BH2          | 8.00           |        | 2.66              |                           | 7.7 | DS-3  | 100           |

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



Ref: 19/30896-1

#### **GROUNDWATER MONITORING**

#### 8a Fawley Road, London, NW6 1SH LOCATION

| GROUNDWATER MONITORING RECORD |                    |                                      |                              |  |  |  |
|-------------------------------|--------------------|--------------------------------------|------------------------------|--|--|--|
| Date                          | Weather Conditions | Weather Conditions Ground Conditions |                              |  |  |  |
| 24/10/2019                    | Raining Wet        |                                      | 10                           |  |  |  |
| Monitoring<br>Point Location  | Depth to wate      | r (mBGL)                             | Depth to Base of well (mBGL) |  |  |  |
| BH1                           | DRY                | 5.13                                 |                              |  |  |  |
| BH2                           | 2.89               | 4.90                                 |                              |  |  |  |



Ref: 19/30896-1

#### **GROUNDWATER MONITORING**

#### 8a Fawley Road, London, NW6 1SH LOCATION

| GROUNDWATER MONITORING RECORD |                                      |          |                              |  |  |  |
|-------------------------------|--------------------------------------|----------|------------------------------|--|--|--|
| Date                          | Weather Conditions Ground Conditions |          | Temperature (°C)             |  |  |  |
| 5/11/2019                     | Cloudy Dry                           |          | 12                           |  |  |  |
| Monitoring<br>Point Location  | Depth to wate                        | r (mBGL) | Depth to Base of well (mBGL) |  |  |  |
| BH1                           | 4.98                                 | 5.13     |                              |  |  |  |
| BH2                           | 2.54                                 | 4.90     |                              |  |  |  |