



Ground Condition Consultants

5-7 STATION ROAD, HAYLING ISLAND, PO11 0EA

GROUND CONDITION ASSESSMENT

SEPTEMBER 2020

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VERSION CONTROL

Project Name	5-7 Station Road, Hayling Island – GCA
Project No.	J20-033
Report No.	J20-033-R01

Desk Study Assessment	
Prepared by: Antony Platt - Director	Reviewed by: Rasmus Palmgren - Director
Site Investigation Factual Report	
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Generic Quantitative Risk Assessment	
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Geotechnical Design Report	
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Version	Date	Description
1.0	07.09.20	Final

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0. EXECUTIVE SUMMARY

Brief	The brief was to undertake a site investigation and assessment to identify any ground contamination issues and geotechnical conditions that may affect the proposed development.
Current Site Status	The study site is located at 5-7 Station Road in Hayling Island and comprises a few small buildings housing a tyre shop & fitter, vehicle workshops and also a residential bungalow. The bungalow is located in the western end of the site and the tyre shop & fitter is located along Station Road (forming the northern site boundary) and the vehicle workshops located to the rear (southern end) of the site.
Site History	The earliest maps and up to around the 1960's shows a single building to be present on-site, likely to be associated with Ham Farm, which was located to the north of the site (across Station Road). The current site layout is first shown on the 1968 map extract and is identified as a garage in the east. The site is understood to have operated as a petrol filling station as part of the garage operations. The pumps and islands have been removed from the forecourt but the presence and status of the below ground fuel storage tanks is currently unknown. The garage buildings appear to have been converted to the current tyre shop uses.
Geology	Reference to the British Geological Survey (BGS) Map extracts indicate the site to overlie superficial River Terrace Deposits (sand, silt and clay) overlying bedrock geology of the Portsmouth Sand Member And Whitecliff Sand Member (sand).
Hydrogeology	The Environment Agency Groundwater Vulnerability Map extracts indicate the site to be overlying superficial Secondary A Aquifer, interpreted as the River Terrace Deposits, over a bedrock Secondary A Aquifer, interpreted as the Portsmouth Sand Member and Whitecliff Sand Member. The site is not located within a Groundwater Source Protection Zone.
Hydrology	The closest surface water feature to the site are a few inland rivers (unnamed) located more than 250m to the north of the site.
Investigation Scope	The site investigation works were undertaken by GCC between the 23 rd July 2020. The scope and rationale of the site investigation are presented below. 6no. windowless sample boreholes (WS101 to WS106) to a maximum depth of 4.7mbgl.
Conclusions and Recommendations (Contamination)	The conceptual model, based on information obtained as part of the Preliminary Risk Assessment and confirmed by the Generic Quantitative Risk Assessment, has identified the following sources of contamination in relation to the proposed development of the site for residential use. TPH and PAH (diesel) in soil and groundwater in the north of the site, in association with in-ground fuel storage tanks. It is therefore recommended that the tanks are removed and any grossly contaminated soil surrounding the tanks is chased out to address the risks to human health and controlled waters. Following the removal of this primary contaminant source, it is considered that any residual diesel contamination in the soil and groundwater will naturally attenuate prior to reaching a sensitive water course or water body with an anticipated reducing groundwater plume. A discovery strategy and appropriate PPE are recommended during any redevelopment of the site to address any as yet unidentified contamination that may be identified during the works.

Conclusions and Recommendations (Geotechnical)	The ground investigation has revealed ground conditions at the site to comprise Made Ground over River Terrace Deposits (RTD) in turn overlying the Portsmouth Sand Member and Whitecliff Sand Member (PWSM). The RTD comprises a superficial layer of low strength highly compressible silty clay (fine-grained RTD) which persisted to >2.50mbgl in some areas of the site. Coarse grained sandy / very sandy Gravel was encountered immediately beneath the silty Clay (coarse-grained RTD) to a maximum depth of 3.00mbgl where the dense silty fine Sand of the PWSM was encountered and formed the basal unit of the investigation. Groundwater was reported at 3.02m in WS102 and 3.13mbgl in WS104 and has been set at 3.00mbgl for design purposes. The proposed development at the site comprises both 2 and 3 storey domestic dwellings and despite the required depth of foundations, the Client has asked for a shallow foundation solution. The fine-grained RTD (superficial silty Clay) is not suitable as a founding material due to its low strength and high compressibility. Therefore, all foundations should be taken through to the coarse-grained RTD which will require a stepped foundation with a maximum potential depth of >2.50mbgl. A minimum foundation width of 0.60m is recommended but wider foundations may be used if it assists in the excavation of deeper sections of the footings. An ultimate limit state bearing resistance calculation has been undertaken and gives a ULS bearing resistance of 693kN/m² or 415kN/m line load for a 0.60m wide foundation. Based on the wall line loads, supplied by the Client, degrees of utilisation of a 0.60m wide footing all remain well below 100% attesting to the appropriateness of the foundation dimensions. An SLS settlement analysis was carried out for completeness and showed that any settlement will be negligible and immediate. The fine-grained RTD was shown to be of low volume change potential such that no heave precautions are required on the inboard side of the vertical foundation faces of external walls. However, it is recommended that a suspended floor slab design is adopted due to the presence of an impermeable covering and the potential for desiccation of the shallow soils. Void space dimensions should be in accordance with Table 7 of the NHBC Guidance 2020. Laboratory chemical testing of pH and sulphate concentrations indicate a Design Sulphate Classification of DS-1 and an ACEC classification of AC-1s is appropriate for all subsurface concrete.
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This sheet is intended to provide a summary only of the initial indicative assessment study of the site in relation to ground contamination. It does not provide a definitive engineering analysis for the purposes of costing or construction, and is subject to the limitation of the agreed brief.

1. INTRODUCTION

1.1 INSTRUCTION

Ground Condition Consultants Ltd. (GCC) was commissioned by Louis Savage and Dean Shephard in July 2020 to undertake a Ground Condition Assessment of a site located at 5-7 Station Road, Hayling Island, PO11 0EA.

The brief was to undertake a site investigation and assessment to identify any ground contamination issues and geotechnical conditions that may affect the proposed development. This report provides an assessment of the identified and potential ground conditions of the site, with regard to the proposed works in accordance with the Model Procedures for the Management of Land Contamination (CLR 11), published by the Environment Agency. In addition, the geotechnical sections of this report provide a detailed assessment of the materials present beneath the site and present characteristic parameters that should be used in design of all geotechnical facets of the proposed development.

This report is prepared in line with the agreed brief and is subject to the report conditions shown in Appendix 1.

1.2 LEGAL CONTEXT

Part IIA of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995) provides a regime for the control of specific threats to health or the environment from land contamination. In accordance with the Act and the statutory guidance document 'The Contaminated Land (England) Regulations 2000', the definition of contaminated land is intended to embody the concept of risk assessment. Within the meaning of the Act, land is only "contaminated land" where it appears to the Regulatory Authority, by reason of substances within or under the land, that:

- Significant harm is being caused, or there is a significant possibility of such harm being caused; or
- Pollution of controlled waters is being, or is likely to be, caused."

Inherent in this definition is the requirement for contamination risk assessment to be undertaken on a site-specific basis, as the potential for harm is determined by the site's end use and its specific environmental setting.

The guidance defines "risk" as the combination of:

- The probability, or frequency, of occurrence of a defined hazard (for example, exposure of a property to a substance with the potential to cause harm); and

- The magnitude (including the seriousness) of the consequences.

While Part IIA of the Environmental Protection Act provides a risk based approach to the identification and remediation of land where contamination poses an unacceptable risk to human health or the environment, the regime does not take into account future uses. New developments are therefore controlled by the planning regime, with reference to the National Planning Policy Framework (NPPF), rather than directly by Part IIA of the Environmental Protection Act.

The NPPF is based on the principal that the site should be suitable for its new use, taking account of ground conditions, including from natural hazards or former activities and states that “Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner”. The NPPF also links the planning and Part IIA regimes by stating that “after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990”. Key components of the Part IIA regime, such as the definition of Contaminated Land and the associated risk-based assessment approach, are therefore considered to also be applicable to the planning regime.

1.3 METHODOLOGY

This report has been prepared in accordance with published Environment Agency guidance (‘Model Procedures for the Management of Land Contamination – Contaminated Land Report (CLR) 11’). CLR 11 provides the technical framework for structured decision making about land contamination and builds on previous work carried out under the Contaminated Land Research Programme (of the former Department of the Environment). CLR 11 has adopted and refined the well recognised methodology and terminology that has been used in contaminated land risk assessment for a number of years.

1.3.1. Pollutant linkage concept

In the context of land contamination, there are three essential elements to any risk:

- A **contaminant source** – a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters.
- A **receptor** – in general terms, something that could be adversely affected by a contaminant, such as people, an ecological system, property, or a water body.

- A **pathway** – a route or means by which a receptor can be exposed to, or affected by, a contaminant.

Each of these elements can exist independently, but they create a risk only where they are linked together, so that a particular contaminant affects a particular receptor through a particular pathway. This kind of linked combination of contaminant–pathway–receptor is described as a pollutant linkage.

1.3.2. Conceptual model

An important thread throughout the overall process of risk assessment is the need to formulate and develop a **conceptual model** for the site, which supports the identification and assessment of pollutant linkages. A conceptual model represents the characteristics of the site in diagrammatic or written form that shows the possible relationships between contaminants, pathways and receptors (pollutant linkages).

1.3.3. Risk assessment

CLR 11 advocates a phased approach to risk assessment comprising the following in order, as necessary:

Preliminary Risk Assessment – a desk study consisting of a review of documentary, anecdotal and site walk over evidence.

Generic Quantitative Risk Assessment (GQRA) - comparison of contaminant concentrations obtained from site investigation with generic assessment criteria.

Detailed Quantitative Risk Assessment (DQRA) - comparison of contaminant concentrations obtained from site investigation with site-specific assessment criteria.

This document follows on from the GCC Preliminary Risk Assessment (reported in Ground Condition Desk Top Study, dated January 2019) and constitutes a Generic Quantitative Risk Assessment. This report also comprises a Ground Investigation Report and Geotechnical Design Report in accordance with Eurocodes.

1.4 PROPOSED USE

It is currently understood that the site is proposed to be redeveloped for mixed use, comprising an apartment blocks with commercial units and small areas of communal soft landscaping. A change in the site use from that currently proposed may result in the need for re-assessment of risk criteria and the conclusions and recommendations resulting from the risk assessment could therefore significantly change.

1.5 REPORT SCOPE AND LIMITATIONS

This report is based upon a review of readily available historical and current information and the recent site investigation data detailed herein. The report presents an interpretation of the borehole and laboratory data provided by the GCC site investigation undertaken on the 23rd July 2020. In addition, this report outlines the basic ground conditions encountered in the exploratory holes and the results of any monitoring of ground installations.

This information has been collated, processed and used to provide an interpretation of the ground conditions, with recommendations on potential ground contamination risks and foundation design for the proposed development.

The recommendations and opinions expressed in this report are based on the strata observed in the exploratory holes, the results of the site and laboratory tests, and information obtained as part of the desk study or provided by others. GCC takes no responsibility for conditions that have not been revealed by the exploratory holes, or which occur between them.

Whilst every effort has been made to interpret the conditions between investigation locations, such information is only indicative, and liability cannot be accepted for its accuracy. Information provided from other sources is taken in good faith and GCC cannot guarantee its accuracy.

The information contained in this report is intended for the use of Louis Savage and Dean Shephard and GCC can take no responsibility for the use of this information by any other party or for uses other than that described in this report.

2. PRELIMINARY RISK ASSESSMENT

2.1 SITE LOCATION AND DESCRIPTION

- 2.2 The study site is located at 5-7 Station Road in Hayling Island and comprises a few small buildings housing a tyre shop & fitter, vehicle workshops and also a residential bungalow. The bungalow is located in the western end of the site and the tyre shop & fitter is located along Station Road (forming the northern site boundary) and the vehicle workshops is located to the rear (southern end) of the site.

The area immediate to the west of the site is occupied by a public car parking area with public toilet facilities. Hayling Park is located to the south and south-west of the site. A few commercial units & businesses are located to the immediate east of the site with residential properties located to the south-east. A number of residential properties and a public house/restaurant (The Barley Mow Stonehouse) are located across Station Road to the north of the site.

2.3 SITE HISTORY

- 2.4 According to the Ordnance Survey maps provided and reviewed from 1866 to 2014 (scales 1:2,500, 1:10,000, 1:1,250, 1:10,560) the site and surrounding areas have been extensively developed over the period of time.

- 2.5 The earliest maps and up to around the 1960's show a single building to be present on-site, likely to be associated with Ham Farm, which was located to the north of the site (across Station Road). The current site layout is first shown on the 1968 map extract and is identified as a garage in the east. The site is understood to have operated as a petrol filling station as part of the garage operations. The pumps and islands have been removed from the forecourt, but the presence and status of the below ground fuel storage tanks is currently unknown. The garage buildings appear to have been converted to the current tyre shop uses.

The surrounding areas are shown to gradually change from mainly being used as agricultural land with a few farms and associated buildings to a more residential and commercial area, as shown on the more recent maps.

2.6 DOCUMENTATED GROUND CONDITIONS

Ground conditions recorded in readily available sources are summarised below.

2.6.1. Geology

Reference to the British Geological Survey (BGS) Map extracts (see Desk Top Study) indicate the site to overlie superficial River Terrace Deposits (sand, silt and clay) overlying bedrock geology of the Portsmouth Sand Member and Whitecliff Sand Member (sand).

2.6.2. Hydrogeology

The Environment Agency Groundwater Vulnerability Map extracts (see Desk Top Study) indicate the site to be overlying superficial Secondary A Aquifer, interpreted as the River Terrace Deposits, over a bedrock Secondary A Aquifer, interpreted as the Portsmouth Sand Member and Whitecliff Sand Member.

Secondary A Aquifers are Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

The site is not located within a Groundwater Source Protection Zone.

2.6.3. Hydrology

The closest surface water feature to the site are a few inland rivers (unnamed) located more than 250m to the north of the site.

2.6.4. Radon

Radon is a naturally occurring radioactive gas which may be harmful to human health. Radon is generally released into the atmosphere in areas underlain by granite and limestone. Harmful concentrations of radon may build up if it becomes trapped in an enclosed space such as a building.

BGS/Public Health England data presented within the Groundsure Report indicates that the percentage of houses exceeding the Action Levels for Radon in this area is less than 1%. Therefore the property is not in a Radon Affected Area, as defined by the Health Protection Agency (HPA), and radon protection measures are not necessary in new dwellings or extensions.

2.7 ENVIRONMENTAL DATA SEARCH

A search of an environmental database was undertaken together with information from various other organisations as part of the desk study and is summarised in the following sections. The following summary is generally limited to locations within 250m of the site boundaries unless it is considered that installations or activities beyond that range could potentially have an impact on the site or be affected by the redevelopment of the site.

Table 2.1. Data search results

Discharge consents	There are no historical or current discharge consents located within 250m of the site.
Pollution incidents	There are no recorded pollution incidents within 250m of the site.
Water abstractions	There are no recorded surface or groundwater abstractions located within 250m of the site.
Fuel Stations	The site has been previously used as a petrol filling station.
Landfill Sites	There are no historical or current landfill sites within 250m of the site.

2.8 MINING AND NATURAL GROUND HAZARDS

2.8.1. Mining

The site is located in an area which is not affected by mining.

2.8.2. Natural Ground Hazards

The following ground hazards were identified:

Compressible ground stability hazards – Negligible hazard

BGS Notes: No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.

Collapsible ground stability hazards – Low hazard

BGS Notes: Slight possibility for collapsible deposit problems after major changes in loading or groundwater conditions. Normal maintenance to avoid large amounts of water entering the ground through pipe leakage or soak-aways should reduce the likelihood of problems due to collapsible deposits. For new build, assess the possibility of collapsible (loessic) deposits in ground investigation. For existing property, no significant increase in insurance risk from collapsible deposits is likely.

Ground dissolution stability hazards – Negligible hazard

BGS Notes: Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

Landslide ground stability hazard – Very Low hazard

BGS Notes: Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

Shrinking or swelling clay ground stability hazard – Low hazard

BGS Notes: Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building (NBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk during drought where vegetation with high moisture demands is present.

Running sand ground stability hazards – Low hazard

BGS Notes: Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property no significant increase in insurance risk due to running sand problems is likely.

2.9 REGULATOR CONSULTATION

Preliminary enquiries have been made to identify records relating to the presence and condition of the fuel storage tanks associated with the former petrol filling station use of the site. Due to the short timescales involved in preparing this report, a response had not been received at the time of issue. It is recommended that these details are obtained prior to intrusive investigation being undertaken.

2.10 DEPARTMENT OF ENVIRONMENT – INDUSTRY PROFILES

The Department of the Environment Industry Profiles for Road vehicle fuelling, service and repair (garages and filling station) have been reviewed in relation to the use of the site.

As a result of this use, the following potential contaminants have a significant potential to be present:

- Metals and metalloids
- Asbestos
- Inorganic chemicals and ions
- Organic chemicals including oil and fuel hydrocarbons

3. FIELDWORK SUMMARY OF SCOPE AND RATIONALE

3.1 RATIONALE AND SUMMARY OF SCOPE

The site investigation works were undertaken by GCC on the 23rd July 2020. The scope and rationale of the site investigation are presented below.

- 6no. windowless sample boreholes (WS101 to WS106) to a maximum depth of 4.7mbgl.

Table 3.1. Exploratory hole location rationale

Location	Rationale	Max depth (mbgl)
WS101 to WS103	3no windowless sample boreholes positioned within the northern site areas to provide data on the shallow geology and investigate the potential for contamination in the vicinity of the in-ground fuel storage tanks and obtain samples and undertake in-situ testing to inform the geotechnical assessment of the site.	3.80
WS104 to WS106	3no windowless sample boreholes positioned within the southern site areas to provide data on the shallow geology and investigate the potential for contamination migration from the in-ground fuel storage tanks and obtain samples and undertake in-situ testing to inform the geotechnical assessment of the site	4.7

The layout of the exploratory hole positions is presented in Figure 2.

3.2 SAMPLING

Soil and groundwater sampling was undertaken to assess the contamination risks to human health and controlled waters. Soil samples were also taken from various depths in the boreholes for geotechnical testing purposes.

3.3 SITE INVESTIGATION STANDARDS

Methods employed during the site investigation were generally undertaken in accordance with BS10175, BS EN 1997-2 and BS5930.

4. GROUND CONDITIONS ENCOUNTERED

4.1 SOIL CONDITIONS

Ground conditions encountered during the site investigation were broadly in agreement with those presented in the published literature and comprised Made Ground overlying Langley Silt Member over Taplow Gravel Member over Lambeth Group over Chalk Group. Variations in strata thicknesses are summarised in Table 4.1 and engineering logs are presented in Appendix 2.

Table 4.1. Summary of encountered ground conditions

Location	Made Ground		River Terrace Deposits		Portsmouth Sand Member and Whitecliff Sand Member (sand)	
	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)
WS101	GL	0.30	0.30	>2.10	N/E	
WS102	GL	0.20	0.20	2.80	3.00	>0.80
WS103	GL	0.50	0.50	>1.80	N/E	
WS104	GL	0.20	0.20	2.80	3.00	>1.00
WS105	GL	0.15	0.15	2.85	3.00	>1.70
WS106	GL	0.10	0.10	2.70	2.80	>1.20

4.2 MADE GROUND

Made Ground was encountered from surface across the site and comprised 0.07-0.2m of concrete, locally placed over a 0.1m thick granular subbase (WS101 and WS105). No other Made Ground was noted on the site, but it is reasonable to expect Made Ground or reworked natural material to have been placed around the in-ground fuel storage tanks.

4.3 RIVER TERRACE DEPOSITS

The River Terrace Deposits were encountered in all of the investigation locations and comprised an upper silty Clay layer over a granular gravelly Sand/sandy Gravel/very gravelly Clay layer. The upper silty Clay layer was recorded to depth of between 1.2m and 2.1m. The gravelly layer was recorded to extend from the base of the Clay layer to between 2.8mbgl and 3.0mbgl in the locations the penetrated the stratum. The RTD formed the basal stratum in WS101 and WS103 due to refusal in the dense gravel.

4.4 PORTSMOUTH SAND MEMBER AND WHITECLIFF SAND MEMBER

The Portsmouth Sand Member and Whitecliff Sand Member (PSM/WSM) were encountered beneath the RTD with a maximum proven thickness of greater than 1.7m and comprised orange brown and greenish grey silty fine Sand. The PSM/WSM formed the basal stratum in four of the six locations.

4.5 OBSTRUCTIONS

No obstructions were encountered within the ground although two of the windowless sample boreholes were terminated in the River Terrace Deposits due to refusal on the dense sand and gravel.

4.6 GROUNDWATER CONDITIONS

Groundwater was monitored towards the base of the River Terrace Deposits at 3.02m (4.22mAOD) in WS102 and 3.13mbgl (4.16mAOD) in WS104 and evidence of groundwater was also observed at approximately 3.4mbgl in both WS105 and WS106. WS101 and WS103 refused prior to encountering groundwater and the monitoring wells in these locations were noted to be dry to 2.24mbgl and 2.28mbgl, respectively. It should be noted however, that evidence of hydrocarbon contamination in WS103, thought to be representative of the smear zone, indicates that groundwater can rise to approximately 2.0mbgl in this area of the site.

While an accurate groundwater flow direction could not be determined as groundwater was only monitored in two well installations, the water levels in these two locations indicate groundwater flow to be towards the southwest, south or southeast, rather than towards the north. Due to the evidence of smear zone contamination in WS103 from 2.0m and the absence of evidence of contamination in WS101, it is considered more likely that groundwater flow is towards the southeast than the southwest. These general trends in groundwater flow direction fit with the general anticipated local groundwater flow direction being towards the south, the shortest distance to the coast. This is supported by the hydrogeology of the area as bedrock geology to the north is low permeability London Clay so groundwater flow within the permeable bedrock geology beneath the site (PSM/WSM) is likely to be away from the London Clay.

4.7 VISUAL/OLFACTORY EVIDENCE OF CONTAMINATION

A strong diesel type odour was noted in the River Terrace Deposits and underlying PSM/WSM in WS102 and WS103, adjacent to the in-ground fuel storage tanks, from approximately 2.5mbgl in WS102 and from approximately 2.0mbgl in WS103. No evidence of hydrocarbon contamination was noted in WS101, although it did not reach groundwater and but was drilled to a greater depth than the evidence of hydrocarbon contamination noted in WS103.

WS106 was noted to contain a slight heating oil type odour from just below the concrete surfacing to 1.3mbgl with no notable evidence of contamination below this depth.

No evidence of contamination was noted in WS104 or WS105.

5. GENERIC RISK ASSESSMENT

5.1 CONTAMINATION ASSESSMENT METHODOLOGY

In order to assess the human health and environmental risks posed by potential contaminants within the underlying soils and groundwater, GCC undertook an initial screen of the laboratory results from the recent investigation using generic assessment criteria. Generic assessment criteria (GAC) are conservative contaminant concentration values used for comparison purposes to assess the risk associated with contaminant concentrations found on site and are derived using non-site-specific information

5.1.1. Soils

In order to assess the soil analyses results with regard to potential human health risks, GCC has adopted the LQM/CIEH Suitable 4 Use Levels (S4ULs), generic assessment criteria (GACs) derived in accordance with the UK framework set out in the most recent CLR (Contaminated Land Report) documents using the Contaminated Land Exposure Assessment (CLEA) Model.

S4ULs have been published for an extensive suite of contaminants, with assessment criteria derived for each contaminant for four different land use scenarios namely:

- Residential with homegrown produce;
- Residential without homegrown produce
- Allotments; and
- Commercial and industrial.

A full list of the GACs together with an indication of the method used for their derivation is provided in Appendix 3. GACs applicable to residential with homegrown produce end use have been used for the initial assessment of the site with further consideration given to residential without homegrown produce and public open space end uses when appropriate. Contaminant concentrations below the GACs are considered not to warrant further risk assessment. However, concentrations of contaminants above the GACs may require further consideration through statistical analysis, if appropriate, or further detailed assessment using site specific data.

This document does not constitute a Site Assessment Report (SAR) as outlined in the UKWIR Guidance for the Selection of Water Supply Pipes to be Used in Brownfield Sites (Ref: 10/WM/03/21, 2010). As such, the full generic suite of testing recommended in the UKWIR guidance may not have been undertaken for this site and may be required by some water companies. However, consideration has been given to the 'threshold' concentrations presented in Table 3.1 of the UKWIR guidance, where they are applicable to the analysis undertaken, to provide an indication of the potential risks to buried water supply pipes.

5.1.2. Assessment framework

In regards to human health, the CLEA model states that, 'the contamination is assumed to be at or within 1m of the surface' (CLR10 pg10). It is considered that at depths greater than 1m, the probability of human exposure via the direct contact pathways are significantly reduced, leaving inhalation of volatile compounds as the dominant pathway with regard to human health risks. Typically, volatile compounds only significantly affect the indoor inhalation pathway. Therefore, for the purposes of statistical analysis, data from the top 1.0 to 1.5m is used for assessment of risks to human health via direct contact pathways in accordance with the CLEA model, dependant on proposed future site levels.

5.1.3. Groundwater

Groundwater analyses, where undertaken, shall be assessed by direct comparison with the freshwater Environmental Quality Standards (EQS), or, in the absence of EQSs, UK or WHO Drinking Water Standards or other appropriate guidance values. For certain compounds, the EQS is quoted as a range of values based on the alkalinity of the water, where the measured concentration lies within this range, the results are interpreted qualitatively. The guideline values selected as appropriate GACs for each contaminant are presented in Appendix 3.

5.1.4. Leachate

Leachate analyses, where undertaken, shall be assessed in the same manner as the groundwater samples. The guideline values selected as appropriate GACs for each contaminant are presented in Appendix 3.

5.1.5. Ground Gas

The criteria used to assess the ground gas monitoring results, where monitored, have been taken from the following guidance documents:

- Assessing risks posed by ground gases to buildings, CIRIA Report C665, 2007
- Code of practice for the characterisation and remediation from ground gas in affected developments, British Standard BS 8576, 2013
- A Pragmatic Approach to Ground Gas Risk Assessment, CL:AIRE Research Bulletin RB17, 2012

The frequency and period of monitoring is assessed based on the gas generation potential of the source material and the sensitivity of the development, in accordance with Figure 6 of BS8576 and Table 5.5 of CIRIA C665. As BS8576 promotes a risk based approach to ground gas assessment, it recognises that ground gas monitoring might not be necessary if a viable pollutant linkages is not present, e.g. if a 'credible' source with significant ground gas generation potential and/or a 'credible' migration pathway are not present.

5.2 SOIL ASSESSMENT

5.2.1. General

A total of 9no. soil samples collected during the site investigation of soil that could potentially be reused on site at or near surface during the proposed development works were submitted to a UKAS accredited laboratory for analysis for a suite of heavy metals, phenols, speciated polycyclic aromatic hydrocarbons (PAHs), fractionated total petroleum hydrocarbons (TPH), BTEX compounds and several inorganic parameters. The results of the laboratory analyses are summarised in Appendix 4, in which they are compared to the relevant generic assessment criteria. A full set of all the laboratory test certificates is presented as Appendix 5.

The range of potentially hazardous contaminants present on the site can be wide and varied and the suite has been chosen to reflect both commonly found contaminants and others indicated by research to have a significant risk of being present. It is, however, possible that others may exist for which analyses have not been carried out or which were outside the scope of completed exploratory holes.

The decision to recommend acceptability or a requirement for remediation is based on the evaluation of a number of factors which when combined present a statutory or non-statutory risk that may require remedial action.

5.2.2. Heavy metals

The heavy metals included in the analysis of the samples from the site were identified at concentrations below the relevant GACs in all of the samples across the site.

Therefore, heavy metals in the Made Ground are not considered to present a significant source of contamination regarding human health.

5.2.3. Petroleum hydrocarbons

Total petroleum hydrocarbon (TPH) concentrations were generally recorded to be well below GACs in the soil samples across the site and predominantly below the laboratory detection limits with the exception of the sample from WS102 (2.5-3.0m) where hydrocarbon odours were noted below 2.5mbgl during the investigation. This sample is considered to be representative of the smear zone in the granular River Terrace Deposits in close proximity to the in-ground tanks. The concentration of TPH fractions identified were indicative of diesel contamination but were noted to be substantially lower than the GACs for the corresponding TPH fractions.

Therefore, the identified TPH concentrations in the vicinity of the in-ground fuel tanks are not considered to represent a significant source of contamination with regard to human health, although higher concentrations may be present around and beneath the tanks.

That said, the impact is sufficiently deep that the ingestion and dermal contact pathways are not likely to be significant, leaving vapour inhalation as the only potentially significant migration pathway.

Concentrations of TPH C11-C40 fractions were not recorded to exceed the UKWIR 'threshold' values for mineral oil in the near surface soil samples across the site (<1.0m). TPH is therefore not considered to represent a potentially significant source of contamination to proposed PE water supply pipes. However, the designers of the water supply pipes for this site should review the data in this report to inform their decision making process

5.2.4. Polycyclic aromatic hydrocarbons (PAHs)

Polycyclic aromatic hydrocarbons (PAH) compound concentrations were generally recorded to be well below the relevant GACs in the soil samples across the site and predominantly below the laboratory detection limits with the exception of the sample from 2.5-3.0mbgl in WS102, in association with the diesel impact discussed above. While the PAH concentration in this sample exceeded the laboratory detection limits, they were well below the residential with homegrown produce GACs.

Therefore, the identified PAH concentrations in the vicinity of the in-ground fuel tanks are not considered to represent a significant source of contamination with regard to human health, although higher concentrations may be present around and beneath the tanks.

That said, the impact is sufficiently deep that the ingestion and dermal contact pathways are not likely to be significant, leaving vapour inhalation as the only potentially significant migration pathway. The vapour inhalation pathway for the identified PAH compounds associated with diesel is of minor significance and not likely to result in a significant risk.

5.2.5. BTEX compounds and MTBE

BTEX compounds and MTBE were not identified at concentrations in excess of the laboratory detection limits and were well below the relevant GACs in all of the samples from across the site. This supports the understanding that the impact from the in-ground tanks is diesel rather than petrol or a mixture of the two fuel types. Therefore BTEX compounds and MTBE are not considered to represent a significant source of contamination with regard to human health.

Concentrations of BTEX and MTBE were not recorded to exceed the UKWIR 'threshold' values. BTEX and MTBE are therefore not considered to represent a significant source of contamination to proposed water supply pipes.

5.2.6. Inorganics

The concentrations of free cyanide fell below laboratory detection limits in all of the soil samples analysed.

The pH of the soil samples analysed was within the neutral 7-9 range.

No asbestos containing materials or fibres were identified in the soil samples across the site. Such materials, if present, would generally be associated with Made Ground but no notable Made Ground was encountered during the investigation, other than the surfacing concrete and sub-base. However, it is possible that more significant deposits of Made Ground may be encountered on site and asbestos containing material and fibres may be associated with these deposits.

5.3 STATISTICAL ANALYSIS

Statistical analysis on the soil analysis results was not considered to be appropriate for this site.

5.4 LEACHATE ASSESSMENT

5.4.1. General

A total of 4no. samples collected during the site investigation from the unsaturated zone of the granular River Terrace deposits, just above the identified groundwater level (smear zone), across the site were submitted to a UKAS accredited laboratory for analysis for a suite of heavy metals, phenols, speciated polycyclic aromatic hydrocarbons (PAHs), fractionated total petroleum hydrocarbons (TPH), BTEX compounds and several inorganic parameters. The results of the laboratory analyses are summarised in Appendix 4, in which they are compared to the relevant generic assessment criteria. A full set of all the laboratory test certificates is presented as Appendix 5.

The range of potentially hazardous contaminants present on the site can be wide and varied and the suite has been chosen to reflect both commonly found contaminants and others indicated by research to have a significant risk of being present. It is, however, possible that others may exist for which analyses have not been carried out or which were outside the scope of completed exploratory holes.

The decision to recommend acceptability or a requirement for remediation is based on the evaluation of a number of factors which when combined present a statutory or non-statutory risk that may require remedial action.

5.4.2. Heavy metals

The heavy metals included in the analysis of the samples from the site were identified at concentrations well below the adopted GACs in all of the samples. Therefore, heavy metals are not considered to have the potential to leach out at concentrations that could potentially represent a significant source of contamination with regard to environmental receptors.

5.4.3. Petroleum hydrocarbons

Total petroleum hydrocarbon (TPH) concentrations were recorded to be well below GACs and predominantly below the laboratory detection limits in the soil sample tested from WS101, WS104 and WS105 but significantly exceeded the drinking water GACs for multiple fractions in the sample from WS103. Therefore, leachable TPH is considered to represent a significant source of contamination with regard to environmental receptors in the vicinity and to the east of the in-ground diesel tank in the north of the site. However, the data suggest that the impact from the tanks has not extended via groundwater to WS101 (adjacent to the west of the tanks), WS104 (south of the tanks) or WS105 (southeast of the tanks)

5.4.4. Polycyclic aromatic hydrocarbons (PAHs)

Polycyclic aromatic hydrocarbon (PAH) compound concentrations for fluoranthene were recorded to exceed the very conservative Environmental Quality Standard (EQS) GACs in all four samples but no other PAH compounds were noted to exceed the GACs.

PAHs in the soil are therefore not considered to have the potential to leach out PAH concentrations that could potentially represent a significant source of contamination with regard to environmental receptors.

5.4.5. BTEX compounds and MTBE

BTEX compounds and MTBE were not identified at concentrations in excess of the laboratory detection limits and were well below the relevant GACs in all of the samples tested. Therefore, BTEX compounds and MTBE are not considered to represent a significant source of contamination with regard to environmental receptors.

5.4.6. Inorganics

The concentrations of cyanide and phenols were not identified to exceed the laboratory detection limits and concentrations fell below the GAC in all of the soil samples analysed. Chloride and sulphate concentrations also fell below the relevant GACs.

The pH of the soil samples analysed was within the 5-9 range.

5.5 WATER ASSESSMENT

5.5.1. General

A total of 2no. groundwater samples collected during the site investigation from the monitoring wells installed below groundwater level adjacent to the tanks (WS102) and to the south of the tanks (WS104) were submitted to a UKAS accredited laboratory for analysis for a suite of heavy metals, phenols, speciated polycyclic aromatic hydrocarbons (PAHs), fractionated total petroleum hydrocarbons (TPH), BTEX compounds and several inorganic parameters. The results of the laboratory analyses are summarised in Appendix 4, in which they are compared to the relevant generic assessment criteria. A full set of all the laboratory test certificates is presented as Appendix 5.

The range of potentially hazardous contaminants present on the site can be wide and varied and the suite has been chosen to reflect both commonly found contaminants and others indicated by research to have a significant risk of being present. It is, however, possible that others may exist for which analyses have not been carried out or which were outside the scope of completed exploratory holes.

The decision to recommend acceptability or a requirement for remediation is based on the evaluation of a number of factors which when combined present a statutory or non-statutory risk that may require remedial action.

5.5.2. Heavy metals

The heavy metals included in the analysis of the samples from the site were identified at concentrations well below the adopted GACs in all of the samples. Therefore, heavy metals are not considered to represent a significant source of contamination with regard to environmental receptors.

5.5.3. Petroleum hydrocarbons

Total petroleum hydrocarbon (TPH) concentrations were recorded to significantly exceeded the drinking water GACs for multiple fractions in the sample from WS102 and slightly exceed the drinking water GACs in the sample from WS104 for two fractions.

These results indicate that the groundwater in the vicinity of the in-ground tanks is impacted with TPH with several TPH fractions exceeding the aqueous solubility but no free product (LNAPL) or sheen observed during sampling.

Therefore, TPH in groundwater is considered to represent a significant source of contamination with regard to environmental receptors in the vicinity of the in-ground diesel tank.

5.5.4. Polycyclic aromatic hydrocarbons (PAHs)

Polycyclic aromatic hydrocarbon (PAH) compound concentrations for several compounds were recorded to exceed the conservative Environmental Quality Standard (EQS) GACs in the sample from WS102, considered to be associated with the diesel impact. No notably elevated concentrations of PAH compounds were identified in the sample from WS104

PAHs in the groundwater in the vicinity of the in-ground diesel tank are considered to have the potential to represent a significant source of contamination with regard to environmental receptors but should be considered in conjunction with the TPH impact.

5.5.5. BTEX compounds and MTBE

BTEX compounds and MTBE were not identified at concentrations in excess of the laboratory detection limits and were well below the relevant GACs in all of the samples tested. Therefore, BTEX compounds and MTBE are not considered to represent a significant source of contamination with regard to environmental receptors.

5.5.6. Inorganics

The concentrations of cyanide and phenols were not identified to exceed the laboratory detection limits and concentrations fell below the GAC in all of the soil samples analysed. Chloride and sulphate concentrations also fell below the relevant GACs.

The pH of the soil samples analysed was within the 5-9 range.

5.6 GROUND GAS ASSESSMENT

The intrusive investigation of the site has not identified significant thicknesses of Made Ground over the superficial River Terrace Deposits and the desk top study did not identify any other likely sources of significant ground gas generation in the vicinity of the site.

The total organic carbon (TOC) content of the of the natural soil across the site was recorded to be less than 1% w/w in all but one of the samples with that one sample only marginally exceeding 1% w/w. With reference to CL:AIRE Research Bulletin RB17, the natural soil across the site would be classified as having a Characteristic Situation 1 gas regime and would not require ground gas monitoring or gas protection measures.

6. CONCEPTUAL SITE MODEL

6.1 SOURCES

The conceptual model, based on information obtained as part of the preliminary risk assessment and intrusive ground investigation, identified the following potential contaminant sources:

6.1.1. On-Site – Historic and Current

- TPH and PAH in soil and groundwater in the vicinity of the in-ground fuel tanks in the north of the site.

It is apparent that diesel has entered the ground and groundwater in the vicinity of the in-ground tanks but has only been identified in association with the groundwater and groundwater smear zone to date. No evidence of impact to the shallow soils in this area has been identified to date but may be encountered when the surface concrete in the area is removed. The impact appears to be migration in a general south-easterly direction but has only been identified in the north and northeast of the site (WS102 and WS103).

The identified impact in the soil has not been identified at concentrations that would present a significant risk to future site users but the diesel concentrations in the groundwater and the leachable diesel concentrations in the smear zone above the current groundwater level are considered to represent a potentially significant source of contamination with regard to controlled waters. However, it is possible that higher TPH concentrations in soil are present in the vicinity of the tanks.

It should be noted that additional sources of contamination may become apparent during any future investigation and development of the site.

6.1.2. Off-Site – Historic and Current

- None.

6.2 PATHWAYS

The key environmental pathways and exposure routes by which potentially toxic substances can reach the identified receptors are considered to be:

Indirect

- Lateral migration via groundwater flow

Direct

- Inhalation of vapours.

6.3 RECEPTORS

Receptors that may be affected by the potential contamination are:

- Future users
- Adjacent site users
- Secondary A Aquifers

The superficial and bedrock Secondary A Aquifers (River Terraced Deposits and PSM/WSM) are considered to already be locally impacted and no local abstractions from these aquifers have been identified so these receptors are considered in terms of the contaminant plume expanding to impact currently unimpacted parts of the Aquifers.

The sea at the coast has been considered as a potential receptor but is considered to be sufficiently far from the site (900m) that it is not within the zone of influence of contaminant migration from the site.

Construction workers have been excluded from this assessment on the basis that the assessment procedure in this report is for long term rather than short term exposure. They are also subject to health and safety at work regulations and are expected to use appropriate personal protective equipment (PPE).

7. RISK ASSESSMENT

7.1 RISK ASSESSMENT PROCEDURE

By considering the sources, pathways and receptors (pollutant linkages), an assessment of the human health/ environmental risks is made with reference to the significance and degree of the risk. This assessment is based on consideration of whether the source contamination can reach a receptor and hence whether it is of major or minor significance.

The risk assessment has been undertaken with reference to BS10175 and CIRIA Document C552: Contaminated Land Risk assessment 'A Guide to Good Practice'. The risk assessment has been carried out by assessing the severity of the potential consequence, taking into account both the potential magnitude of the hazard and the sensitivity of the target, based on the categories given overleaf.

Table 7.1. Sensitivity of receptor

Category	Examples
High	Residential with gardens/Groundwater Source Protection Zone
Medium	Residential without gardens/Principal (Major) Aquifer/sensitive watercourse
Low	Commercial and industrial use/Secondary (Minor) Aquifer
Very Low	Construction and maintenance workers/non-sensitive watercourse

Table 7.2. Magnitude of impact

Category	Examples
Gross Impact	Heavily contaminated gasworks or industrial site, hazardous waste landfill
Moderate Impact	Major leaks and spills from fuel infrastructure (e.g. petrol stations), domestic waste landfill
Slight Impact	Minor leaks and spills from fuel infrastructure, 'inert' waste landfills
No Impact	No identified or suspected contamination

Table 7.3. Level of severity for potential hazard

	Sensitivity of receptor			
Magnitude of Impact	High	Medium	Low	Very Low
Gross Impact	Severe	Medium	Mild	Minor
Moderate Impact	Medium	Mild	Minor	Minor
Slight Impact	Mild	Minor	Minor	Minor
No Impact	Minor	Minor	Minor	Minor

The likelihood of an event (probability) takes into account both the presence of the hazard and target and the integrity of the pathway and has been assessed based on the categories given below.

Table 7.4. Probability of risk definition

Category	Definition
High likelihood	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term
Low likelihood	Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so
Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable

The potential severity of the risk and the probability of the risk occurring have been combined in accordance with the following matrix in order to give a level of risk for each potential hazard.

Table 7.5. Level of risk for potential hazard definition

Probability of risk	Potential severity			
	Severe	Medium	Mild	Minor
High Likelihood	Very high	High	Moderate	Low/ Moderate
Likely	High	Moderate	Low/ Moderate	Low
Low likelihood	Moderate	Low/ Moderate	Low	Very low
Unlikely	Low/ Moderate	Low	Very low	Very low

The assessment is discussed below in terms of plausible pollutant linkages. A complete assessment of the pollutant linkages is presented in Table 7.6 overleaf.

A description of these risk classifications and likely action required are given in CIRIA 552 as:

Very high risk – High probability that severe harm could arise to a designated receptor from an identified hazard OR there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in substantial liability. Urgent investigation and remediation are likely to be required.

High risk – Harm is likely to arise to a designated receptor from an identified hazard. This risk, if realised, is likely to result in substantial liability. Urgent investigation is required and remedial works may be necessary in the short term and are likely over the long term.

Moderate risk – It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation is normally required to clarify risks and to determine potential liability. Some remedial works may be required in the long term.

Low risk – It is possible that harm could arise to a designated receptor from an identified hazard but it is likely that this harm, if realised, would at worst normally be mild.

Very low risk – It is a low possibility that harm could arise to a designated receptor. In the event of such harm being realised it is not likely to be severe.

7.2 POLLUTANT LINKAGE ASSESSMENT

Table 7.6. Pollutant Linkage Assessment

Source	Pathway	Receptor	Severity	Likelihood	Risk Level
Localised diesel impact in north of site	Direct Contact Ingestion Inhalation	Future users	Minor	Low Likelihood	Very Low
		Adjacent site users	Minor	Unlikely	Very Low
	Vertical leaching and lateral migration in groundwater leading to direct contact	Secondary A Aquifers	Minor	Likely	Low

7.2.1. Diesel Impact

Diesel has been identified in the soil and groundwater in the north of the site, associated with in-ground fuel tanks, at concentration that could present a significant risk to controlled waters.

While the lateral extent of the impact in the unsaturated zone is considered to be localised to the immediate vicinity of the tanks, some uncertainty remains as to the lateral extent of the impact to groundwater. The impact has been identified in association with groundwater and the groundwater smear zone in the north and northeast of the site (WS102 and WS103) but is absent from the remainder of the investigation locations on the site.

Groundwater flow across the site is considered likely to be in a south-easterly direction but it has not been possible to confirm the groundwater flow direction from the monitoring data as only two of the four monitoring wells could be installed below the groundwater level at the time of the investigation and monitoring.

The hydrocarbon impact to groundwater was not evident in the sample from WS104 or in the soils from WS104 or WS105, indicating that migration from the source does not extend as far south or southeast as these locations. However, it is recognised that the available groundwater data points provide a limited picture of the groundwater levels across the site and there is a possibility that these locations are not directly in the flow path from the source area.

With regard to human health, the primary exposure route for the identified TPH fractions in the soil and groundwater would be via vapour ingress to buildings and inhalation, although the primary exposure route for the PAH component of the impact would be via ingestion of soil and dust. With proposed residential flats being the most sensitive receptors in the general vicinity of the impact area, the risks to future users have been assessed to be very low. However, remediation measures are considered to be necessary to address the health risks of potentially higher TPH concentration being present in association with the tanks and the aesthetic concerns of hydrocarbon vapours.

With regard to controlled waters, the leachate testing has identified that diesel contamination remains in the unsaturated smear zone soils with the potential to continue leaching into the groundwater. While this unsaturated zone impact is considered to be limited in its extent and degrading, it is recommended that remediation is undertaken to prevent further deterioration of the groundwater within the Secondary A Aquifers.

Sufficient data is not currently available on the extent of the diesel impact to groundwater to allow a detailed quantitative risk assessment. However, on the basis of the following evidence, the risk to down gradient controlled waters receptors have been assessed to be low:

- The groundwater impact is only associated with a dissolved phase hydrocarbon with no measurable product or sheen noted on the groundwater,
- There are no nearby down gradient surface water bodies,
- There are no identified nearby groundwater abstraction wells,
- No significant TPH was identified in the southern on site monitoring wells.

It is therefore recommended that the tanks are removed and any grossly contaminated soil surrounding the tanks is chased out to address the risks to human health and controlled waters. Following the removal of this primary contaminant source, it is considered that any residual diesel contamination in the soil and groundwater will naturally attenuate prior to reaching a sensitive water course or water body with an anticipated reducing groundwater plume.

8. MATERIAL PROPERTIES

8.1 INTRODUCTION

The geotechnical assessment and the subsequent foundation design recommendations will use the findings of the ground investigation and the results of the in-situ and geotechnical testing carried out in the boreholes and on representative samples of the materials encountered.

8.2 GEOTECHNICAL TESTS

A programme of geotechnical laboratory testing was carried out on representative samples collected from the strata encountered during the ground investigation.

Details of the specific procedure used in each case are shown below in Table 8.1 and the geotechnical test certificates are presented in Appendix 6.

Table 8.1. Summary of Geotechnical Testing

Test	Standard (BS1377:1990) unless otherwise indicated	No.
Classification Tests		
Atterberg Limits	Part 2, Clauses 4.5 & 5.0	6
Particle Size Distribution - Wet Sieve	Part 2, Clause 9.2	7
Total Shear Strength Tests		
Unconsolidated Undrained Triaxial Compression Test	Part 7, Clause 8.4	4
Chemical Tests		
Sulphate Content 2:1 soil water extract	Part 3, Clause 5.3	4
pH value	Part 3, Clause 9.0	4
BRE SD1	Various	2

8.3 GEOTECHNICAL PARAMETERS

This section discusses the key geotechnical characteristics of each encountered stratum as determined from field observations, in-situ and laboratory geotechnical testing.

8.3.1. Made Ground

Made Ground was encountered from ground level at all exploratory hole locations and comprised 0.07- 0.20m of concrete (some reinforced), locally placed over a 0.1m thick granular subbase

No geotechnical laboratory testing was carried out on this material as it will be removed prior to the onset of construction.

8.3.2. River Terrace Deposits

River Terrace Deposits (RTD) were encountered beneath the Made Ground at all exploratory hole locations. The RTD comprised an upper silty clay layer over a very gravelly Sand / very sandy Gravel / Gravel. The distribution of the two components of the RTD is presented in Table 8.2.

Table 8.2. Distribution of the Two Components of the River Terrace Deposits

Location	silty Clay		very gravelly Sand / sandy Gravel / Gravel	
	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)
WS101	0.30	1.80	2.10	>0.30
WS102	0.30	1.30	1.60	0.90
WS103			0.50	0.20
	0.70	0.50	1.20	0.60
	1.80	0.20	2.00	>0.30
WS104	0.20	1.80	2.00	1.00
WS105	0.20	>2.50	Not Encountered	
WS106	0.10	1.20	1.30	1.50

Apart from WS103 where a sequence of interbeds was identified the RTD generally comprises fine-grained silty Clay over coarse-grained gravelly Sand / sandy Gravel. The different composition of these two materials mean that they will behave differently from a geotechnical perspective. Therefore, they will be considered separately in the following sections of this report.

In-Situ Testing

Standard penetration testing was undertaken throughout the RTD. The resultant SPT N values are presented in Table 8.3.

Table 8.3 Results of the Standard Penetration Testing – River Terrace Deposits

BH No.	Depth (mbgl)	SPT N Value	Fine / Coarse	BH No.	Depth (mbgl)	SPT N Value	Major Constituent
WS101	1.00	7	Fine	WS104	1.00	17	Fine
	2.00	55	Coarse		2.00	50	Coarse
WS102	1.00	12	Fine	WS105	1.00	4	Fine
	2.00	33	Coarse		2.00	10	
				WS106	1.00	24	Fine

The results of the standard penetration testing returned N-values of between 4 and 55 with a mean average of 24. Separating the SPT data into fine and coarse-grained sub-sets gives a range of N-values of 4 to 24 for the fine-grained RTD and 33 to 55 for the coarse-grained RTD.

All the N-Values have been included in a plot against depth (Figure 3) which shows no easily identifiable trend. Therefore, characteristic N-values 7 and 37 are considered appropriate for the fine- and coarse-grained RTD respectively.

Classification Testing

Consistency Limits

5no. representative samples of the fine grained RTD underwent Atterberg limits testing to determine its consistency limits. The results of these analyses are presented in Table 8.4 and the laboratory test certificates are in Appendix 6.

Table 8.4 Results of the Atterberg Limits Testing – Fine-Grained RTD

Location	Depth (mbgl)	Natural Water Content, w (%)	Liquid Limit w _L (%)	Plastic Limit w _P (%)	Plasticity Index I _P (%)	Corrected Plasticity Index (%)
WS101	0.30-0.80	24	39	20	19	19
WS102	0.30-0.80	25	41	23	18	18
WS105	0.30-0.80	24	39	21	18	15
	2.00-2.50	11	33	16	17	10
WS106	0.50-1.00	23	43	22	21	20

The results of the Atterberg limits tests give plasticity indices in the range 17 to 21% which after correction, to account for the >425mm content, give a corrected range of plasticity indices of 10 to 20%. These results indicate the fine-grained RTD to be of low to medium volume change potential.

Particle Size Distribution

4no. representative samples of the coarse-grained RTD underwent particle size distribution analyses using the wet sieve method. The results of the particle size distribution analyses are presented in Table 8.5; whilst the grading envelopes are in Appendix 6.

Table 8.5. Results of the particle size distribution analyses – Coarse-Grained RTD

Location	Depth (mbgl)	Granulometric Composition (%)					Uniformity Coefficient	Curvature Coefficient
		Clay	Silt	Sand	Gravel	V Coarse		
WS102	1.80-2.00	7.4		36.2	56.4	0	33	0.16
WS103	1.20-1.80	11.5		11.6	76.9	0	Not Calculated	
WS104	2.00-3.00	13.0		22.1	64.9	0	Not Calculated	
WS106	1.30-2.80	9.3		38.4	52.3	0	65	0.37

The results of the particle size distribution analyses confirm the engineering description of the coarse-grained RTD as a mixture of sand and gravel with only minor amounts of clay and silt.

Shear Strength – Fine-Grained RTD

Undrained Shear Strength

4no. representative samples of the fine-grained RTD underwent laboratory unconsolidated undrained triaxial compression testing. The results of the laboratory tests are presented in Table 8.6; whilst the laboratory test certificates are in Appendix 6.

Table 8.6 Results of the UU Triaxial Compression Testing – Fine-Grained RTD

Location	Depth (mbgl)	Bulk Density (Mg/m ³)	Cell Pressure (kN/m ²)	Undrained Shear Strength c_u (kN/m ²)
WS101	0.30-0.80	1.93	10	33
WS103	0.70-1.00	2.06	18	28
WS104	1.60-2.00	2.07	36	127
WS105	2.00-2.50	2.17	45	63

The results of the UU triaxial tests give c_{uk} values of between 28 and 127kN/m² which are consistent with a low to high strength material.

The laboratory test results have been augmented with c_{uk} values derived from the widely accepted empirical relationship:

$$c_u = f_1 \times SPIN$$

Where f_1 is a correlation factor based on the I_p

Using a correlation factor of 5, all the undrained shear strength data has been plotted and reveals no easily identifiable increase in undrained shear strength with depth. Therefore, a single characteristic undrained shear strength value of 30kN/m² has been applied to the fine-grained RTD (Figure 4).

Drained (Effective) Shear Strength

The widely accepted relationship between drained shear strength and plasticity index for remoulded clays has been used to determine the effective shear strength parameters

Taking the characteristic plasticity index of 20% gives a characteristic effective angle of shearing resistance (ϕ'_k) of 24°.

Other Geotechnical Parameters- Fine-Grained RTD

Modulus of Deformation (E_k)

Butler (1975) showed that good estimates of soil stiffness could be obtained from the relationship:

$$E_{uk} = N$$

CIRIA R 143 suggests that the drained modulus (E'_k) should be taken as $0.75E_{uk}$. Therefore, an E_{uk} of 7MN/m^2 and E'_k of 5MN/m^2 have been attributed to the fine-grained RTD

Coefficient of Volume Compressibility

The coefficient of volume compressibility (m_{vk}) has been determined from the empirical relationship with the plasticity index (I_{Pk}) and published data for similar materials giving an m_{vk} of $0.31\text{m}^2/\text{MN}$ which is indicative of a material of high compressibility.

Shear Strength – Coarse Grained RTD

The shear strength of the coarse-grained RTD has been determined following the procedure recommended in BS8004 (2015); where the characteristic constant volume or critical angle of friction is given by:

$$\phi_{cv,k} = 30 + \phi'_{ang} + \phi'_{psd}$$

Where ϕ'_{ang} = contribution to $\phi'_{cv,k}$ from the angularity of the particles

ϕ'_{psd} = contribution to $\phi'_{cv,k}$ from soil's particle size distribution

and the characteristic peak angle of friction is given by:

$$\phi_{pk,k} = \phi_{cv,k} + \phi_{dil}$$

Where ϕ_{dil} is the contribution to $\phi_{pk,k}$ from soil dilatancy

After normalisation of the SPT N-values to account for overburden pressure and hammer energy, a characteristic $(N_1)_{60}$ of 50 is considered appropriate for the coarse-grained RTD. This correlates to a density index (I_D) of 92% (Table F1, BS EN 1997-2). With reference to Table 1, BS 8004: 2015 a peak angle of shearing resistance ($\phi_{pk,k}$) of 38° is obtained.

Other Geotechnical Parameters

Modulus of deformation (E'_k) Coarse-grained RTD

The characteristic modulus of deformation of the coarse-grained RTD has been determined from data presented in CIRIA R143 Table 11. Using a characteristic N value of 37 gives a lower bound modulus of deformation of 85MN/m².

8.3.3. Portsmouth Sand Member and Whitecliff Sand Member (PWSM)

The PWSM was encountered beneath the RTD and comprised orange brown and greenish grey silty fine Sand.

In-Situ Testing

Standard penetration testing was undertaken within the PSWM where encountered. The resultant SPT N values are presented in Table 8.7 and included in Figure 3.

Table 8.7 Results of the Standard Penetration Testing – PWSM

BH No.	Depth (mbgl)	SPT N Value	Main Constituent	BH No.	Depth (mbgl)	SPT N Value	Major Constituent
WS102	3.00	14	Fine to coarse Sand	WS105	3.00	15	Silty fine Sand
	3.80	43	Fine to medium Sand		4.00	17	
WS104	3.00	6	Fine to coarse Sand	WS106	2.00	55	Silty fine to medium Sand
	4.00	6			3.00	21	
						4.00	

The results of the SPT gave N-values of between 6 and 55 with a mean average of 26. The SPT N-values have been included in the plot of SPT N v depth (Figure 3) and reveals no easily identifiable trend with depth. Therefore, a single characteristic N-value of 26 is considered appropriate for the PWSM.

Classification Testing

Particle Size Distribution

3no. representative samples of the PWSM underwent particle size distribution analyses using the wet sieve method. The results of the particle size distribution analyses are presented in Table 8.8; whilst the grading envelopes are in Appendix 6.

**Table 8.8. Results of the particle size distribution analyses – Coarse-Grained
RTD**

Location	Depth (mbgl)	Granulometric Composition (%)					Uniformity Coefficient	Curvature Coefficient
		Clay	Silt	Sand	Gravel	V Coarse		
WS102	3.00-3.80	6.1		74.5	19.4	0	3.6	1.4
WS104	3.00-4.00	14.9		63.6	21.6	0	Not Calculated	
WS105	3.00-4.00	12.7		75.8	11.6	0	Not Calculated	

The results of the particle size distribution analyses confirm the engineering description of the PWSM with between 63.6 and 75.8% sand-sized particle content being recorded. Based on the shape of the grading envelopes the PWSM appears to comprise a medium graded material.

Shear Strength

Once again, following the procedure presented in BS8004 (2015) where the characteristic constant volume or critical angle of friction is given by:

$$\phi_{cv,k} = 30 + \phi'_{ang} + \phi'_{psd}$$

Where ϕ'_{ang} = contribution to $\phi'_{cv,k}$ from the angularity of the particles

ϕ'_{psd} = contribution to $\phi'_{cv,k}$ from soil's particle size distribution

and the characteristic peak angle of friction is given by:

$$\phi_{pk,k} = \phi_{cv,k} + \phi_{dil}$$

Where ϕ_{dil} is the contribution to $\phi_{pk,k}$ from soil dilatancy

After normalisation of the SPT N-values to account for overburden pressure and hammer energy, a characteristic $(N_1)_{60}$ of 30 is considered appropriate for the PWSM. This correlates to a density index (I_D) of 70% (Table F1, BS EN 1997-2). With reference to Table 1, BS 8004: 2015 a peak angle of shearing resistance ($\phi_{pk,k}$) of 37° is obtained.

Other Geotechnical Parameters- Alluvium

Modulus of Deformation (E_K)

Based on the data presented in Table 11 of CIRIA R143 a lower-bound modulus of deformation of 55MN/m² is considered appropriate for the PWSM.

8.4 AGGRESSIVE GROUND SOIL CHEMISTRY

Chemical testing was carried out on 6no. representative samples of the materials encountered beneath the site in accordance with Box C10, BRE Special Digest 1. The results are summarised in Tables 8.9 and 8.10.

Table 8.9. Summary of the results of chemical testing for concrete classification

Location	Depth (mbgl)	Stratum	pH	SO ₄ (mg/l)
WS102	1.60-2.00	RTD	6.8	7.1
WS104	2.00-3.00	RTD	6.9	16
	3.00-4.00	PWSM	7.2	7.6

Table 8.10. Results of the BRE SD1 testing

BH	Depth (mbgl)	Stratum	pH	Total Sulphate AS (% SO ₄)	Total Sulphur TS (%)	Total Potential Sulphate TPS (%)	Oxidisable (Sulphate) (%)
WS101	1.50-2.00	RTD	7.8	0.011	0.007	0.021	0.010
WS105	1.30-1.70	RTD	7.9	0.014	0.010	0.030	0.016

The amounts of oxidisable sulphides have been determined following the procedure documented in Paragraph C5.1.2 of BRE SD1. The results indicate that pyrite is unlikely to be present in significant amounts within the fine-grained RTD.

Based on the maximum determined total potential sulphate and water-soluble sulphate contents Table C1 of BRE SD1 gives a Design Sulphate Classification of DS-1 and an Aggressive Chemical Environment for Concrete (ACEC) Class of AC-1s assuming static groundwater conditions in the fine-grained RTD.

8.5 CHARACTERISTIC GEOTECHNICAL PARAMETERS

Based on the laboratory test results, in-situ testing and subsequent analysis a range of characteristic geotechnical parameters which should be used in all geotechnical and foundation design calculations are presented in Table 8.11.

Table 8.11. Characteristic Geotechnical Parameters

Stratum		Geotechnical Parameter			Notes	Characteristic Value
Made Ground		Not provided as all foundations will be constructed beneath this stratum				
River Terrace Deposits	fine - grained	Unit Weight γ			BS8004	19kN/m ³
		Shear Strength	Undrained	c_{uk}	UUT & SPT Correlation	30kN/m ²
				ϕ_{uk}		0°
			Drained	c'_k	I_p and SPT Correlation	0 kN/m ²
				ϕ'_k (°)		24°
		Deformation modulus	Undrained	E_{uk}	Butler (1975)	7MN/m ²
			Drained	E'_k	0.75x E_{uk}	5MN/m ²
		Coefficient of Volume Compressibility			m_{vk}	Correlation with SPT
	Coarse-grained	Unit Weight γ			BS8004	18kN/m ³
		Shear Strength	c_k (kN/m ²)		PSD & SPT Correlation	0kN/m ²
			ϕ'_k (°)			38°
		Deformation Modulus	E_{dk} (MN/m ²)		CIRIA R 143 Table 11	85MN/m ²
Portsmouth Sand Member & Whitecliff Sand Member		Unit Weight γ			BS8004	18kN/m ³
		Shear Strength	c_k (kN/m ²)		PSD & SPT Correlation	0kN/m ²
			ϕ'_k (°)			37°
		Deformation Modulus	E'_k (MN/m ²)		CIRIA R 143	55MN/m ²

9. FOUNDATION AND GROUND ENGINEERING

9.1 INTRODUCTION

The geotechnical assessment below relates to the details of the proposed development. It is currently understood that the site is to be redeveloped for mixed use comprising an apartment blocks with commercial units and small areas of communal soft landscaping.

6no windowless sample boreholes were carried out across the site. The ground conditions encountered are presented in Table 4.1 and in brief comprise Made Ground overlying River Terrace Deposits (RTD) in turn overlying Portsmouth Sand Member and Whitecliff Sand Member (PWSM) to the full depth of the ground investigation. The RTD comprised both fine- and coarse-grained materials, with an upper silty Clay overlying a gravelly Sand / sandy Gravel / Gravel (Table 8.2).

Groundwater was recorded towards the base of the RTD at 3.02mbgl in WS102 and 3.13mbgl in WS104. Further evidence of groundwater was also reported at approximately 3.4mbgl in both WS105 and WS106. WS101 and WS103 refused prior to encountering groundwater and the monitoring wells in these locations were noted to be dry to 2.24mbgl and 2.28mbgl, respectively.

At the request of the Client a traditional foundation (Strip / Trench Fill) is to be considered in this Geotechnical Design Report (GDR).

9.2 SHALLOW FOUNDATIONS

The ground investigation and subsequent geotechnical analysis has shown that the fine-grained RTD is not suitable as a founding stratum for the bearing pressures under consideration due to its high compressibility and low strength. Therefore, a stepped foundation should be taken through to the coarse-grained RTD at proven depths of between 1.20 and >2.50mbgl.

9.2.1. Allowable Bearing Resistance

Bearing resistance analysis has been carried out to check the ultimate Limit state (ULS) bearing resistance of the coarse-grained RTD. All ULS bearing resistance calculations have been carried out in accordance with Eurocode 7.

For the ULS bearing resistance calculation, a minimum foundation depth 1.20m has been considered. Groundwater was reported at approximately 3.00mbgl and therefore will not impact on the bearing resistance of a foundation base at 1.20mbgl. However, in areas where the RTD is at greater depth and hence foundation bases are deeper, the groundwater may have some effect on the ULS bearing resistance.

However, as the foundation is deepened the ULS bearing resistance will increase and cancel the effects of the groundwater such that no groundwater reduction is considered necessary.

Table 9.1. Ground Model used in the Bearing Resistance Calculations

Ground Model	Stratum	Depth (mbgl)		Shear Strength Parameters			
				Total		Effective	
		From	To	c_{uk}	ϕ_{uk}	c'_k	ϕ'_k
GM1	MG + FG-RTD	GL	1.20	Not Used			
	CG-RTD	1.20	1.80	Granular		0	38°
Groundwater at 3.00mbgl							

The UK has implemented Design Approach 1 (DA1) of BS EN1997-1:2004 (Eurocode 7: Geotechnical Design), which requires two design combinations to be satisfied:

Combination 1 (C1): A1 “+” M1 “+” R1

Combination 2 (C2): A2 “+” M2 “+” R1

Where A, M and R refer to groups of partial factors relating to actions, materials and resistance respectively.

Table 9.2. Partial Factors Applied to the Bearing Resistance Analysis

	Combination 1			Combination 2		
	A1	M1	R1	A2	M2	R1
Tangent of the Angle of Shearing Resistance ($\tan \phi$)		1.00			1.25	
Cohesion Intercept (c')		1.00			1.25	
Undrained Cohesion c_u		1.00			1.40	
Permanent Action	1.35			1.00		
Variable Action	1.50			1.30		
Resistance						1.00

The summary of the bearing checks is presented in Table 9.3 and the geotechnical calculation sheet is in Appendix 7.

Table 9.3. Summary of ULS Bearing Capacity Checks

EC7 Calculation Method	Foundation Depth	Foundation Material	Design Approach 1	Bearing Resistance (kN/m ²)
Bearing Resistance (kN/m ²)	1.20mbgl	CG-RTD	C1	1571
			C2	693

**results include groundwater reduction factors*

These calculations indicate that combination 2 presents the most critical case. The results given represent the ultimate limit state that is the maximum load that can be supported by the soil without failure occurring within the soil mass. It is recognised that ULS bearing resistance varies with depth; however, for simplicity it is recommended that a ULS bearing resistance of 650kN/m² is adopted across the site regardless of foundation depth.

9.2.2. Foundation Dimensions

Unfactored foundation loads have been supplied by the Client and are presented in Table 9.4.

Table 9.4 Foundation Loads Unfactored and Factored

Structure	Foundation Element	Unfactored Wall Line Load (kN/m)	Factored Loads (kN/m)	
			DA1 C1	DA1 C2
3 Storey	External Wall	110	149	110
	Internal Wall	80	108	80
2 Storey	All Walls	90	122	90

Based on the loads under consideration a minimum foundation width of 0.60m is recommended. To determine whether a foundation breadth of 0.60 is sufficient to support the design bearing pressure the degree of utilisation (Λ) has been calculated under both combination 1 and 2 factoring (Table 9.5)

Table 9.5 Foundation Dimensions and Degree of Utilisation

Element	Foundation Breadth (m)	DA1 Combination	Wall line Load (kN/m)	Design Wall Line Resistance (kN/m)	Degree of Utilisation (%)
3 Storey External	0.60	DA1 C1	149	943	16
		DA1 C2	110	416	26
3 Storey Internal	0.60	DA1 C1	108	943	11
		DA1 C2	80	416	19
2 Storey All Walls	0.60	DA1 C1	122	943	13
		DA1 C2	90	416	22

The results of the foundation dimensioning analysis indicate that a 0.60m wide stepped foundation is suitable for the loads under consideration with a maximum degree of utilisation of 26% being recorded for the external walls of the 3-storey structures under combination 2 factoring.

9.2.3. Serviceability Limit State

Eurocode 7 states that calculations of settlement must always be carried out on footings on soft clays - and should be carried out on footings on firm to stiff clays when the risk is anything other than negligible. Although in strict accordance with EC7 no settlement analysis is required, given the presence of the Portsmouth Sand Member and Whitecliff Sand Member beneath the coarse-grained RTD it is considered appropriate to carry out a full serviceability limit state settlement analysis.

The serviceability limit state (SLS) settlement analysis has been undertaken on a 0.60m wide strip foundation, loaded to the maximum unfactored wall line load of 110kN/m (66kN/m²), founded at 2.50mbgl within the RTD.

Verification of serviceability limit state (SLS) is demonstrated by satisfying the inequality:

$$s_{Ed} = s_0 \leq s_{Cd}$$

where s_{Ed} is the total settlement; and

s_{Cd} is the limiting value of that settlement

Without site / structure specific data a limiting value of settlement (s_{Ed}) of 25mm is considered appropriate for the type of construction under consideration.

The settlement analysis has been carried out using the Rockscience software programme Settle 3D.

For the SLS settlement analysis all partial factors have been taken as 1.00.

The results of the settlement analyses show that, provided foundations are placed below the fine-grained RTD settlements will be negligible ($>1\text{mm}$). Furthermore, all settlements will be immediate and built out during construction.

9.2.4. Heave Precautions

The fine-grained RTD, through which the sub structure will pass has been shown to be low to medium volume change potential. Careful examination of the Atterberg limits testing results indicates for design purposes the fine-grained RTD can be considered as having low volume change potential.

In accordance with Section 4.2 of NHBC 2020 no heave precautions are required along the inside of external wall foundations.

9.3 FLOOR SLABS

Due to the presence of Made Ground, comprising impermeable concrete hardstanding and associated sub-base, there is a possibility that the natural ground may be desiccated, a suspended floor slab is recommended. Dimensions of the void space below the suspended floor slab will be between 50 and 200mm dependent on construction technique (Table 7, NHBC 2020).

9.4 EXCAVATION STABILITY

No excavations have taken place during the ground investigation. However, based on the description of the soils encountered, excavations through the fine-grained RTD are liable to remain stable in the short term. Some overbreak should be expected if excavations are taken into the coarse-grained RTD due to its low fines-content and lack of cohesion.

If groundwater is encountered, it may cause widespread instability and inundation of foundation excavations. In line with good practice, any excavation should be left open for the minimum time possible before the placement of foundation concrete regardless of founding material.

9.5 CHEMICAL ATTACK ON BURIED CONCRETE

Laboratory chemical testing of pH and sulphate concentrations was carried out on samples of all materials encountered beneath the site. For all subsurface concrete, a Design Sulphate Classification of DS-1 has been assigned in accordance with BRE Special Digest 1. Given the assumed low permeability of the fine-grained RTD an ACEC classification of AC-1s has been assigned.

10. CONCLUSIONS AND RECOMMENDATIONS

10.1 CONTAMINATION

The conceptual model, based on information obtained as part of the Preliminary Risk Assessment and confirmed by the Generic Quantitative Risk Assessment, has identified the following sources of contamination in relation to the proposed development of the site for residential use.

- TPH and PAH (diesel) in soil and groundwater in the north of the site, in association with in-ground fuel storage tanks.

It is therefore recommended that the tanks are removed and any grossly contaminated soil surrounding the tanks is chased out to address the risks to human health and controlled waters. Following the removal of this primary contaminant source, it is considered that any residual diesel contamination in the soil and groundwater will naturally attenuate prior to reaching a sensitive water course or water body with an anticipated reducing groundwater plume.

A discovery strategy and appropriate PPE are recommended during any redevelopment of the site to address any as yet unidentified contamination that may be identified during the works.

10.2 GEOTECHNICAL

The ground investigation has shown the site to be underlain by Made Ground over a River Terrace Deposits (RTD) in turn overlying the Portsmouth Sand Member and Whitecliff Sand Member (PWSM).

The RTD comprised a superficial layer of low strength highly compressible silty clay whose base was recorded between 1.20 and >2.50mbgl. Coarse grained sandy / very sandy Gravel was encountered immediately beneath the silty Clay and persisted to 2.80 to 3.00mbgl where the dense silty fine Sand of the PWSM was encountered and formed the basal unit of the investigation.

Groundwater was reported at 3.02m in WS102 and 3.13mbgl in WS104 and has been set at 3.00mbgl for design purposes.

The proposed development at the site comprises both 2 and 3 storey domestic dwellings and despite the required depth of foundations, the Client has asked for a shallow foundation solution.

The fine-grained RTD (superficial silty Clay) is not suitable as a founding material due to its low strength and high compressibility. Furthermore, its variable thickness would lead to potentially damaging differential settlements. Therefore, all foundations should be taken through to the coarse-grained RTD which will require a stepped foundation with a maximum potential depth of >2.50mbgl.

A minimum foundation width of 0.60m is recommended but wider foundations may be used if it assists in the excavation of deeper sections of the footings. An ultimate limit state bearing resistance calculation has been undertaken and gives a ULS bearing resistance of 693kN/m² or 415kN/m line load for a 0.60m wide foundation.

Unfactored wall line loads were supplied by the Client and range between 80 and 110kN/m, which after factoring give a range of degrees of utilisation (Λ) of 11 to 26% demonstrating the appropriateness of the foundation dimensions.

Although in strict accordance with EC7 no serviceability limit state (SLS) settlement analysis is required, one was carried out and showed, using the maximum foundation load supplied by the Client, settlements would be negligible (<1mm). Furthermore, these settlements would be immediate and built out during construction.

The fine-grained RTD was shown to be of low volume change potential such that no heave precautions are required on the inboard side of the vertical foundation faces of external walls. However, it is recommended that a suspended floor slab design is adopted due to the presence of an impermeable covering and the potential for desiccation of the shallow soils. Void space dimensions should be in accordance with Table 7 of the NHBC Guidance 2020.

Laboratory chemical testing of pH and sulphate concentrations indicate a Design Sulphate Classification of DS-1 and an ACEC classification of AC-1s is appropriate for all subsurface concrete.

FIGURE 1: SITE LOCATION PLAN



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client
LOUIS SAVAGE AND DEAN SHEPHEARD

site
5-7 STATION ROAD, HAYLING ISLAND

title
LOCATION PLAN

scale	NTS	drawn by	AP	checked by	RP
date	21 AUG 2020	job no	J20-033		
drawing number	FIGURE 1			rev.	-

FIGURE 2: INVESTIGATION LOCATION PLAN

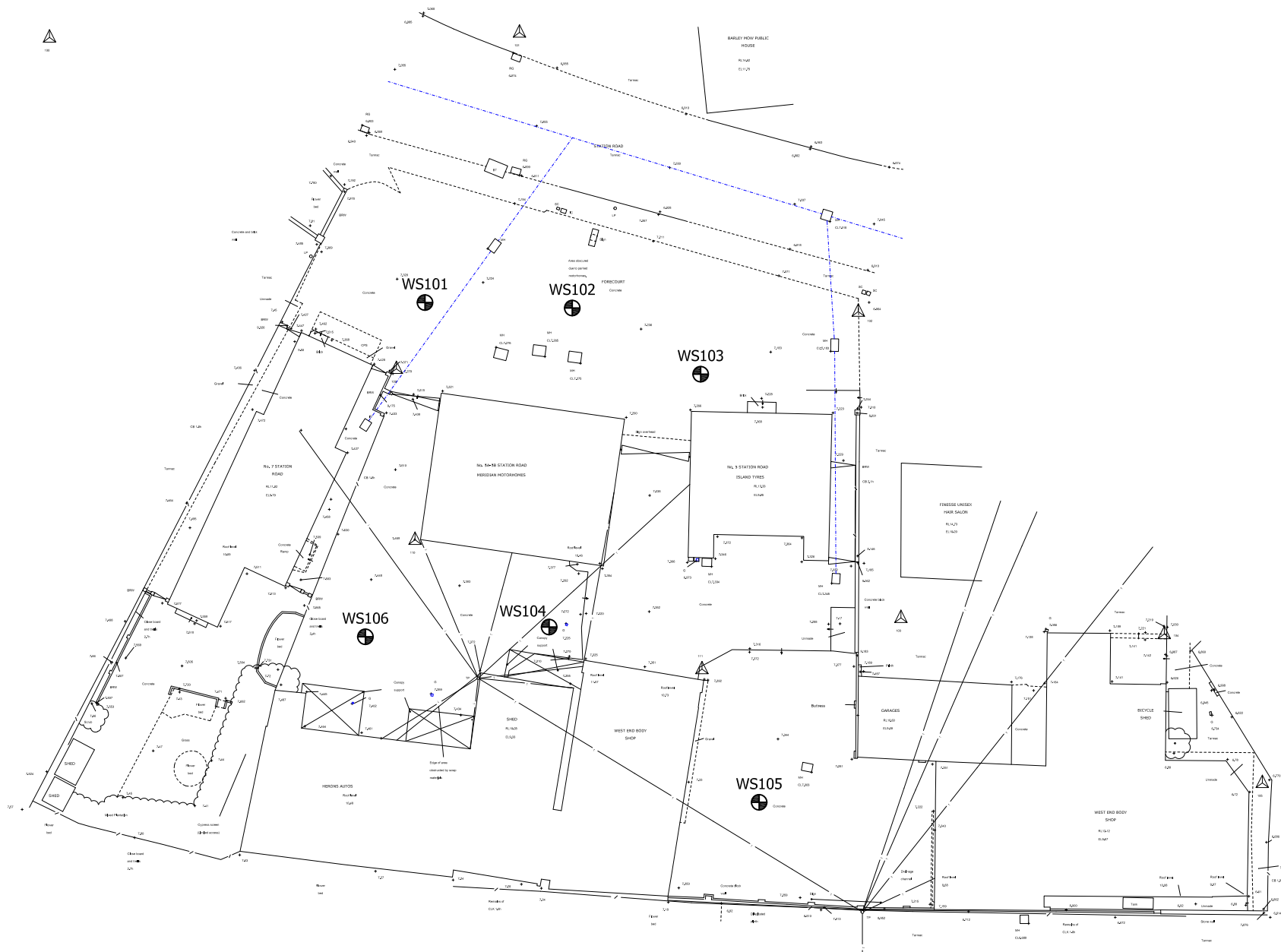


FIGURE 3: SPT N-VALUE V DEPTH

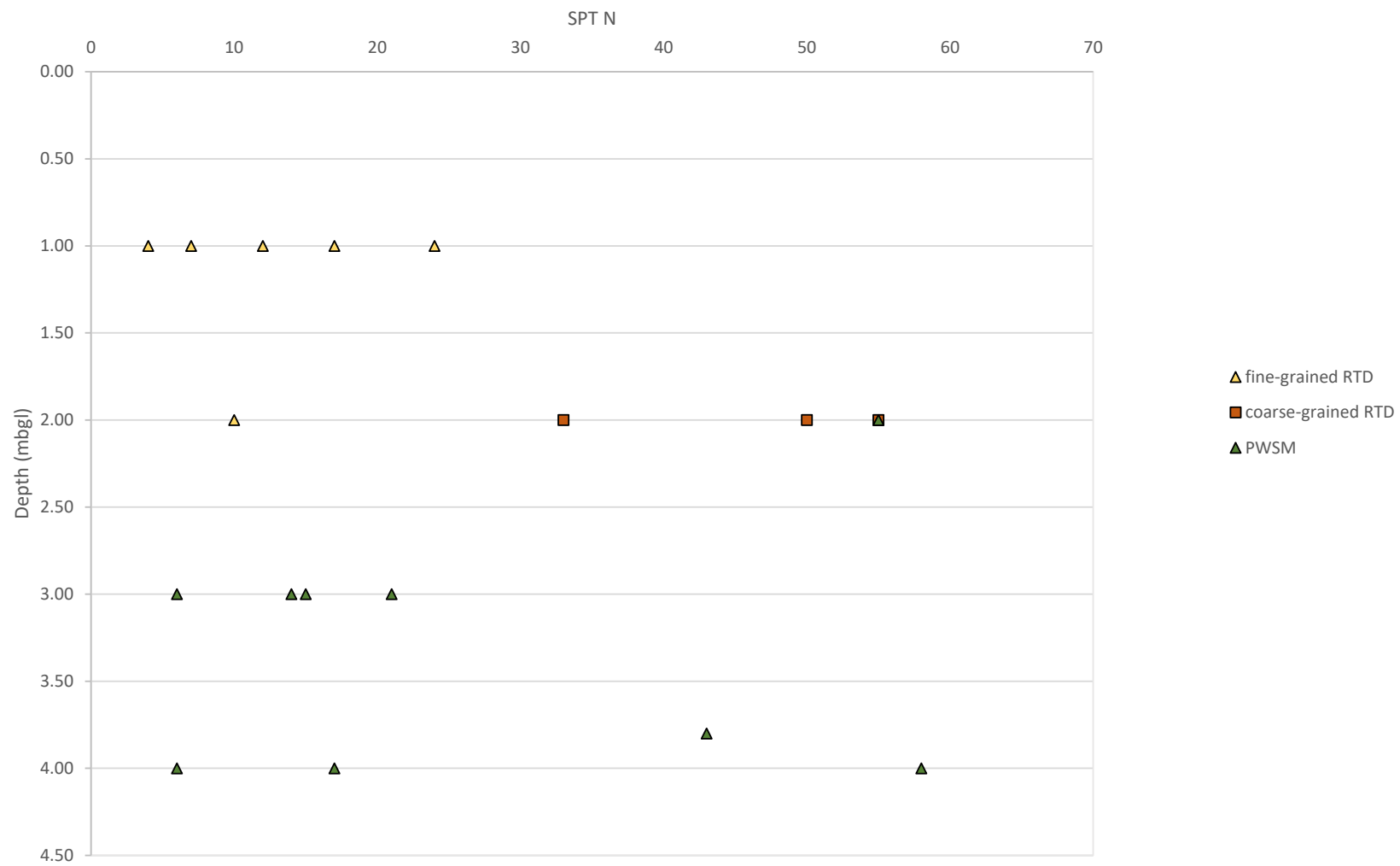
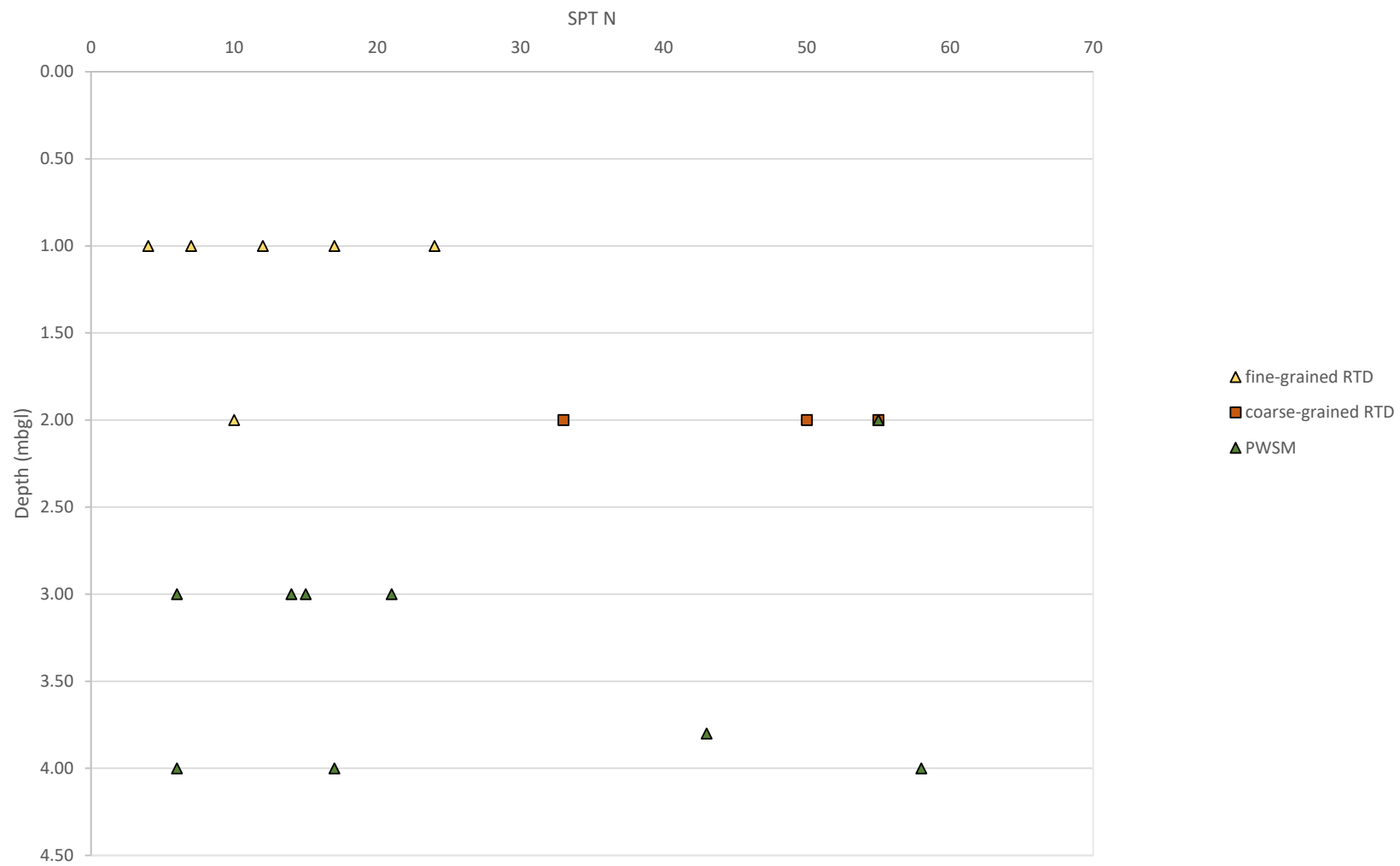


FIGURE 4: UNDRAINED SHEAR STRENGTH V DEPTH



APPENDIX 1: REPORT CONDITIONS

This report is produced solely for the benefit of **Stoke Wharf Development LLP** and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report refers, within the limitations stated, to the condition of the Site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the Site.

This report is based on a visual Site inspection, study of readily accessible referenced historical records, information supplied by those parties noted in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented in good faith without exhaustive clarification. Where ground contamination is suspected but no physical Site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to detailed activities related to the Site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, not revealed by this research cannot be discounted.

Whilst confident in the findings detailed within this report because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categorical assurances that they will be accepted by Authorities or Funds etc. without question, as such bodies may have unpublished, often more stringent objectives. This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to Ground Condition Consultants Ltd. In time improved practices or amended legislation may necessitate a re-assessment.

The report is necessarily limited to those aspects of land contamination specifically reported on and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents that may occur. The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous use and abuse of the Site and adjacent Sites. The report concentrates on the Site as defined in the report and provides an opinion on surrounding Sites. If migrating pollution or contamination (past or present) exists this can only practically be better assessed following extensive on and off Site intrusive investigations and monitoring.

APPENDIX 2: ENGINEERING LOGS

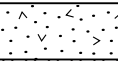
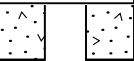
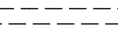
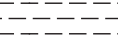
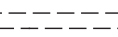
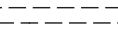
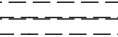
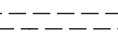
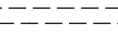
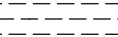
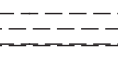
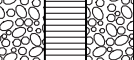
BOREHOLE LOG WS101

PROJECT NUMBER J20-033
PROJECT NAME Station Road
CLIENT Mr Savage
ADDRESS Hayling Island
DATE 23/07/20

DRILLING COMPANY Oakland Site Investigation
DRILLING METHOD Windowless Sampling
DRILLING RIG Terrier
LOGGED BY RP

CASING

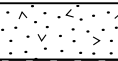
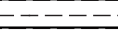
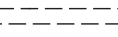
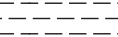
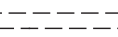
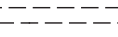
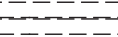
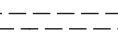
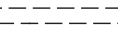
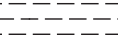
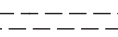
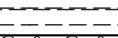
COMMENTS Refusal at 2.4m. Collapse to 2.2m.

Samples	SPT N	Water	Depth (m)	Graphic Log	Material Description	Well Installation
			0.2		Concrete	
ES - 0.3-0.5			0.4		Greenish brown sandy concrete GRAVEL (Made Ground)	
B - 0.3-0.8			0.6		Firm brown silty CLAY	
			0.8			
	N = 7		1.0			
			1.2			
			1.4			
B - 1.5-2.0			1.6			
			1.8			
	N = 55		2.0			
ES - 2.1-2.4			2.2		Orange brown very sandy fine to coarse angular to rounded flint GRAVEL	
			2.4		Termination Depth at: 2.4m	
			2.6			
			2.8			
			3.0			
			3.2			
			3.4			
			3.6			
			3.8			
			4.0			
			4.2			
			4.4			
			4.6			
			4.8			

BOREHOLE LOG WS102

PROJECT NUMBER J20-033 PROJECT NAME Station Road CLIENT Mr Savage ADDRESS Hayling Island DATE 23/07/20	DRILLING COMPANY Oakland Site Investigation DRILLING METHOD Windowless Sampling DRILLING RIG Terrier LOGGED BY RP
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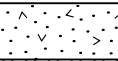
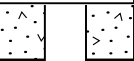
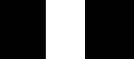
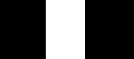
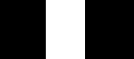
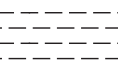
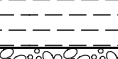
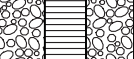
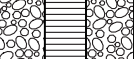
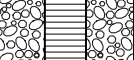
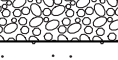
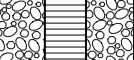
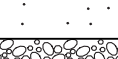
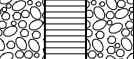
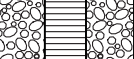
CASING
COMMENTS Collapse to 3.5m.

Samples	SPT N	Water	Depth (m)	Graphic Log	Material Description	Well Installation
			0.2		Reinforced Concrete	
ES - 0.3-0.5			0.4		Firm greenish brown silty CLAY	
B - 0.3-0.8			0.6		Soft to firm brown silty CLAY becoming gravelly from 1.5m	
			0.8			
	N = 12		1.0			
			1.2			
ES - 1.5			1.4			
B - 1.6-2.0			1.6		Orange brown very sandy locally clayey fine to coarse angular to rounded flint GRAVEL	
	N = 33		1.8			
			2.0			
			2.2			
			2.4			
ES - 2.5-3.0			2.6		Grey gravelly fine to coarse SAND with strong hydrocarbon (petrol/diesel) odour. Gravel is fine to coarse angular to rounded flint.	
			2.8			
	N = 14		3.0		Greenish brown silty fine to medium SAND with hydrocarbon (petrol/diesel) odour.	
B - 3.0-3.8			3.2			
			3.4			
			3.6			
	N = 43		3.8			
			4.0		Termination Depth at: 3.8m	
			4.2			
			4.4			
			4.6			
			4.8			

BOREHOLE LOG WS103

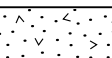
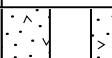
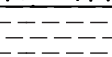
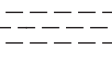
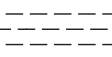
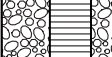
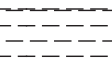
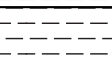
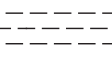
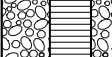
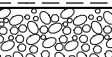
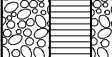
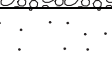
PROJECT NUMBER J20-033 PROJECT NAME Station Road CLIENT Mr Savage ADDRESS Hayling Island DATE 23/07/20	DRILLING COMPANY Oakland Site Investigation DRILLING METHOD Windowless Sampling DRILLING RIG Terrier LOGGED BY RP
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CASING
COMMENTS Refusal at 2.3m

Samples	SPT N	Water	Depth (m)	Graphic Log	Material Description	Well Installation
			0.2		Reinforced Concrete	
ES - 0.2-0.5			0.4		Dark brown gravelly CLAY with brick and concrete fragments (Made Ground)	
B - 0.2-0.5			0.6		Brown clayey fine to medium angular to rounded flint GRAVEL	
B - 0.7-1.0			0.8		Soft to firm brown silty CLAY	
	N = 39		1.0			
B - 1.2-1.8			1.2		Brown very clayey sandy fine to coarse angular to rounded flint GRAVEL	
			1.4			
			1.6			
	N - 66		1.8		Orange brown gravelly fine to coarse SAND	
ES - 2.0-2.3			2.0		Grey very sandy fine to coarse angular to rounded flint GRAVEL with hydrocarbon (petrol/diesel) odour	
			2.2			
			2.4		Termination Depth at: 2.3m	
			2.6			
			2.8			
			3.0			
			3.2			
			3.4			
			3.6			
			3.8			
			4.0			
			4.2			
			4.4			
			4.6			
			4.8			

PROJECT NUMBER J20-033 PROJECT NAME Station Road CLIENT Mr Savage ADDRESS Hayling Island DATE 23/07/20	DRILLING COMPANY Oakland Site Investigation DRILLING METHOD Windowless Sampling DRILLING RIG Terrier LOGGED BY RP
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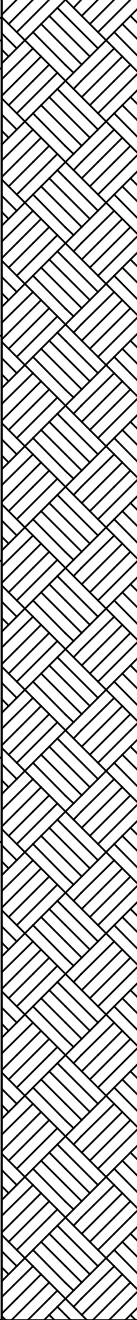
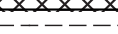
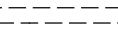
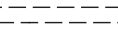
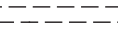
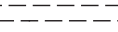
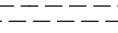
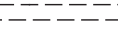
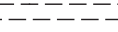
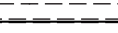
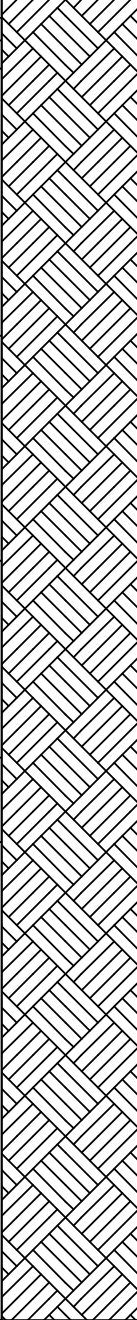
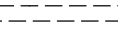
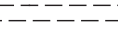
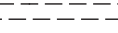
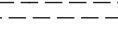
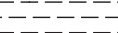
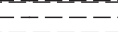
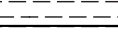
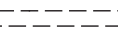
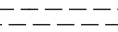
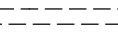
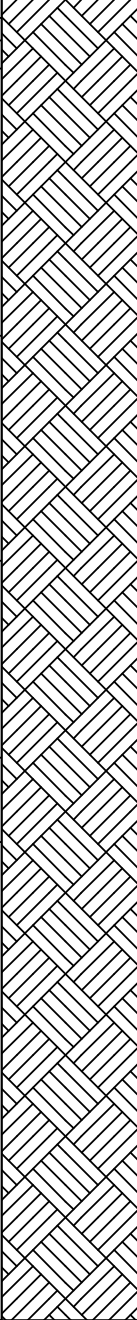
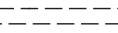
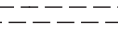
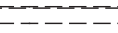
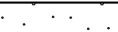
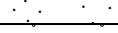
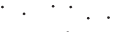
CASING
COMMENTS Collapse to 3.7m.

Samples	SPT N	Water	Depth (m)	Graphic Log	Material Description	Well Installation
			0.2		Concrete	
B - 0.3-0.8			0.4		Soft to firm brown silty CLAY	
ES - 0.5			0.6			
	N = 17		0.8			
			1.0			
			1.2			
			1.4			
B - 1.6-2.0			1.6		Soft to firm orange brown very gravelly CLAY. Gravel is fine to coarse angular to rounded flint.	
	N = 50		1.8			
B - 2.0-3.0			2.0		Orange brown slightly clayey sandy fine to coarse angular to rounded flint GRAVEL	
			2.2			
			2.4			
			2.6			
			2.8			
ES - 2.9	N = 6		3.0		Orange brown and light brown slightly gravelly fine to coarse SAND	
B - 3.0-4.0			3.2			
			3.4			
			3.6			
			3.8			
	N = 6		4.0		Termination Depth at: 4.0m	
			4.2			
			4.4			
			4.6			
			4.8			

BOREHOLE LOG WS105

PROJECT NUMBER J20-033 PROJECT NAME Station Road CLIENT Mr Savage ADDRESS Hayling Island DATE 23/07/20	DRILLING COMPANY Oakland Site Investigation DRILLING METHOD Windowless Sampling DRILLING RIG Terrier LOGGED BY RP
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CASING
COMMENTS Collapse to 3.3m.

Samples	SPT N	Water	Depth (m)	Graphic Log	Material Description	Well Installation
			0.2		Concrete	
B - 0.3-0.8			0.4		Reddish brown very sandy fine to coarse angular GRAVEL (Sub-base))	
ES - 0.5			0.6		Dark brown silty CLAY with concrete, brick, clinker and metal fragments (Made Ground)	
			0.8		Soft to firm brown silty CLAY with occasional shell fragments	
	N = 4		1.0		Stiff orange brown mottled grey silty CLAY	
B - 1.3-1.7			1.2		Stiff orange brown mottled grey silty CLAY	
			1.4		Stiff orange brown mottled grey silty CLAY	
			1.6		Stiff orange brown mottled grey silty CLAY	
			1.8		Stiff orange brown mottled grey silty CLAY	
	N = 10		2.0		Stiff orange brown mottled grey silty CLAY	
B - 2.0-2.5			2.2		Stiff orange brown mottled grey silty CLAY	
			2.4		Stiff orange brown mottled grey silty CLAY	
			2.6		Stiff orange brown mottled grey silty CLAY	
ES - 2.7-3.0			2.8		Light greyish brown very gravelly slightly clayey fine to coarse SAND	
	N = 15		3.0		Light greyish brown very gravelly slightly clayey fine to coarse SAND	
B - 3.0-4.0			3.2		Greenish grey silty fine sand	
			3.4		Greenish grey silty fine sand	
			3.6		Greenish grey silty fine sand	
			3.8		Greenish grey silty fine sand	
	N = 17		4.0		Greenish grey silty fine sand	
			4.2		Greenish grey silty fine sand	
			4.4		Greenish grey silty fine sand	
			4.6		Greenish grey silty fine sand	
			4.8		Termination Depth at: 4.7m	
			4.8		Termination Depth at: 4.7m	
			4.8		Termination Depth at: 4.7m	
			4.8		Termination Depth at: 4.7m	
			4.8		Termination Depth at: 4.7m	
			4.8		Termination Depth at: 4.7m	
			4.8		Termination Depth at: 4.7m	
			4.8		Termination Depth at: 4.7m	

BOREHOLE LOG WS106

PROJECT NUMBER J20-033	DRILLING COMPANY Oakland Site Investigation
PROJECT NAME Station Road	DRILLING METHOD Windowless Sampling
CLIENT Mr Savage	DRILLING RIG Terrier
ADDRESS Hayling Island	LOGGED BY RP
DATE 23/07/20	

CASING

COMMENTS Collapse to 3.3m.

Samples	SPT N	Water	Depth (m)	Graphic Log	Material Description	Well Installation
			0.2		Concrete	
			0.4		firm dark brown silty CLAY with slightly hydrocarbon (heating oil) odour	
ES - 0.5			0.6			
B - 0.5-1.0			0.8			
	N = 24		1.0			
			1.2			
B - 1.3-2.8			1.4		Orange brown very gravelly fine to coarse SAND	
ES - 1.4			1.6			
	N = 55		1.8			
			2.0			
			2.2			
			2.4			
			2.6			
			2.8		Orange brown and greenish grey silty fine to medium SAND	
B - 2.8-3.8	N = 21		3.0			
			3.2			
			3.4			
			3.6			
			3.8			
	N = 58		4.0		Termination Depth at: 4.0m	
			4.2			
			4.4			
			4.6			
			4.8			

APPENDIX 3: GENERIC ASSESSMENT CRITERIA

SOIL - HUMAN HEALTH SCREENING VALUES

Status	End Use	Issue No	Issue Date
ISSUE	Residential with Homegrown Produce	1	June 2015

Determinand	Units	SOIL ORGANIC MATTER			SOURCE
		1%	2.5%	6%	
pH		<5, >9			
Asbestos	%	Presence			
HEAVY METALS/METALLOIDS					
Arsenic	mg/kg	37			S4UL
Cadmium	mg/kg	11			S4UL
Chromium (III)	mg/kg	910			S4UL
Chromium (VI)	mg/kg	6			S4UL
Lead	mg/kg	200			C4SL
Mercury (Elemental)	mg/kg	1.2			S4UL
Mercury (Inorganic)	mg/kg	40			S4UL
Mercury (Methyl)	mg/kg	11			S4UL
Nickel	mg/kg	130			S4UL
Selenium	mg/kg	250			S4UL
Beryllium	mg/kg	1.7			S4UL
Boron	mg/kg	290			S4UL
Vanadium	mg/kg	410			S4UL
Copper	mg/kg	2,400			S4UL
Zinc	mg/kg	3,700			S4UL
GENERAL INORGANICS					
Easily Liberatable Cyanide (free)	mg/kg	36			Acute effects infant 1 dose 3g soil
US EPA PRIORITY PAHs					
Acenaphthene	mg/kg	210	510	1100	S4UL
Acenaphthylene	mg/kg	170	420	920	S4UL
Anthracene	mg/kg	2,400	5,400	11000	S4UL
Benzo(a)Anthracene	mg/kg	72	11	13	S4UL
Benzo(b)fluoranthene	mg/kg	2.6	3.3	3.7	S4UL
Benzo(k)fluoranthene	mg/kg	77	93	100.0	S4UL
Benzo(g,h,i)perylene	mg/kg	320	340	350	S4UL
Benzo(a)Pyrene	mg/kg	2.20	2.7	3	S4UL
Chrysene	mg/kg	15	22	27.0	S4UL
Di-benzo(a,h)anthracene	mg/kg	0.24	0.28	0.30	S4UL
Fluoranthene	mg/kg	280	560	890	S4UL
Fluorene	mg/kg	170	400	860	S4UL
Indeno(1,2,3-cd)pyrene	mg/kg	27.0	36	41.0	S4UL
Naphthalene	mg/kg	2.3	5.6	13.0	S4UL
Phenanthrene	mg/kg	95	220	440	S4UL
Pyrene	mg/kg	620	1200	2000	S4UL
Total PAHs	mg/kg	No Sum	No Sum	No Sum	
Chlorinated Solvents/VOCs					
1,2-Dichloroethane (DCE)	mg/kg	0.0071	0.011	0.019	S4UL
1,1,1-Trichloroethane (111 TCA)	mg/kg	8.8	18	39	S4UL
1,1,1,2-Tetrachloroethane (1112 PCA)	mg/kg	1.2	2.8	6.40	S4UL
1,1,2,2-Tetrachloroethane (1122 PCA)	mg/kg	1.60	3.4	7.5	S4UL
Tetrachloroethene (PCE)	mg/kg	0.18	0.39	0.9	S4UL
Tetrachloromethane (Carbon Tetrachloride)	mg/kg	0.026	0.056	0.13	S4UL
Trichloroethene (TCE)	mg/kg	0.016	0.034	0.075	S4UL
Trichloromethane (Chloroform)	mg/kg	0.91	1.7	3.4	S4UL
Vinyl Chloride	mg/kg	0.00064	0.00087	0.0014	S4UL
Chlorobenzene	mg/kg	0.46	1	2.4	S4UL
1,2-Dichlorobenzene	mg/kg	23	55	130	S4UL
1,3-Dichlorobenzene	mg/kg	0.4	1	2.3	S4UL
1,4-Dichlorobenzene	mg/kg	61	150	350	S4UL
1,2,3-Trichlorobenzene	mg/kg	1.5	3.6	8.6	S4UL
1,2,4-Trichlorobenzene	mg/kg	2.6	6.4	15	S4UL
1,3,5-Trichlorobenzene	mg/kg	0.33	0.81	1.9	S4UL
1,2,3,4-Tetrachlorobenzene	mg/kg	15	36	78	S4UL
1,2,3,5-Tetrachlorobenzene	mg/kg	0.66	1.6	3.7	S4UL
1,2,4,5-Tetrachlorobenzene	mg/kg	0.33	0.77	1.6	S4UL
Pentachlorobenzene	mg/kg	5.8	12	22	S4UL
Hexachlorobenzene	mg/kg	1.8	3.3	4.9	S4UL
Carbon Disulphide	mg/kg	0.14	0.29	0.62	S4UL

Hexachlorobutadiene	mg/kg	0.29	0.7	1.6	S4UL
Phenolics					
Phenol	mg/kg	280	550	1100	S4UL
Chlorophenols	mg/kg	0.87	2.00	4.50	S4UL
Pentachlorophenol	mg/kg	0.22	0.52	1.20	S4UL
Explosives					
2,4,6 Trinitrotoluene (TNT)	mg/kg	1.6	3.7	8.1	S4UL
RDX	mg/kg	120.0	250.0	540.0	S4UL
HMX	mg/kg	5.7	13.0	26.0	S4UL
Insecticides/Herbicides					
Aldrin	mg/kg	5.70	6.60	7.10	S4UL
Dieldrin	mg/kg	0.97	2.00	3.50	S4UL
Atrazine	mg/kg	3.30	7.60	17.40	S4UL
Dichlorvos	mg/kg	0.032	0.066	0.140	S4UL
Alpha-Endosulfan	mg/kg	7.4	18.0	41.0	S4UL
Beta-Endosulfan	mg/kg	7.0	17.0	39.0	S4UL
Alpha-Hexachlorocyclohexane	mg/kg	0.23	0.55	1.20	S4UL
Beta-Hexachlorocyclohexane	mg/kg	0.085	0.200	0.460	S4UL
Gamma-Hexachlorocyclohexanes (Lindane)	mg/kg	0.06	0.14	0.33	S4UL
TPH					
TPH Aliphatic >C5-6	mg/kg	42	78	160	S4UL
TPH Aliphatic >C6-8	mg/kg	100	230	530	S4UL
TPH Aliphatic >C8-10	mg/kg	27	65	150	S4UL
TPH Aliphatic >C10-12	mg/kg	130	330	760	S4UL
TPH Aliphatic >C12-16	mg/kg	1100	2,400	4,300	S4UL
TPH Aliphatic >C16-35	mg/kg	65,000	92,000	110,000	S4UL
TPH Aliphatic >C35-44	mg/kg	65,000	92,000	110,000	S4UL
TPH Aromatic >EC5-7 (Benzene)	mg/kg	70	140.00	300	S4UL
TPH Aromatic >EC7-8	mg/kg	130	290	660	S4UL
TPH Aromatic >EC8-10	mg/kg	34	83	190	S4UL
TPH Aromatic >EC10-12	mg/kg	74	180	380	S4UL
TPH Aromatic >EC12-16	mg/kg	140	330	660	S4UL
TPH Aromatic >EC16-21	mg/kg	260	540	930	S4UL
TPH Aromatic >EC21-35	mg/kg	1100	1,500	1,700	S4UL
TPH Aromatic >EC35-44	mg/kg	1100	1,500	1,700	S4UL
TPH Aliphatic & Aromatic >EC44-70	mg/kg	1,600	1,800	1,900	S4UL
Total TPH	mg/kg	No Sum	No Sum	No Sum	
BTEX					
Benzene	mg/kg	0.087	0.17	0.37	S4UL
Toluene	mg/kg	130	290	660	S4UL
Ethylbenzene	mg/kg	47	110	260	S4UL
m-Xylene	mg/kg	60	140	330	S4UL
o-Xylene	mg/kg	59	140	320	S4UL
p-Xylene	mg/kg	56	130	310	S4UL

NOTES

- 1) Compare individual samples values against Soil Screening Values (SSV). If exceedences are noted consider further in relation to averaging areas and statistical analysis.
- 2) These values are for initial screening for potential **risk to human health only**. They are **not remediation thresholds**. **Screening for other receptors to be done separately as appropriate for the site, e.g. for water, ecology, building materials.**
- 3) Screening criteria denoted with an asterisk (*) were capped at the lower vapour/aqueous saturation limits for Tier 1 human health risk assessment purposes and considered conservative. Where concentrations are recorded at levels greater than the SSV, free phase (NAPL) contamination may be present and should be considered qualitatively. Further information to support the interpretation of assessment criteria that exceed theoretical soil saturation limits is provided in Section 4.12 of the CLEA Software Handbook (SR4).
- 4) Screening criteria denoted with hash (#) were capped at 1000000mg/kg. It is noted that aesthetic (e.g. odour) and other site specific factors may also be relevant when providing advice relating to these compounds.
- 5) LQM/CIEH S4ULs November 2014 - Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3439. All rights reserved.
- 6) SSVs derived for certain constituents may be low in relation to standard laboratory Limits of Detection (LoD). It is the responsibility of the project engineer to check with the laboratory that appropriate detection limits can be achieved. As a target, an LoD would be no larger than 10% of the SSV, but this is not practicable for some constituents. Clearly an LoD greater than the SSV would prevent use of this SSV screening and/or be interpreted as if all samples exceeded the SSV.
- 7) Human Health Soil Screening Values (SSV) were calculated using a Soil Organic Matter (SOM) value of 1.0%, 2.5% and 6%. This is equivalent to an Fraction Organic Carbon (FOC) values of approx. 0.6%, 1.45% and 3.5% respectively (For reference FOC = 0.58*SOM). Note that some soils have different SOM/FOC, which may give require more stringent SSVs for organic compounds. It is the responsibility of the project engineer to check the SOM with the site specific conditions.

- 8) In general, SSVs above 100mg/kg are rounded down to 3 significant figures. Similarly, SSVs below 100mg/kg are rounded down to 2 significant figures

WATER QUALITY STANDARDS

Status	Issue No	Date
ISSUE	3	17/02/2017

Choose water quality standard based on receptors identified at the site.

Eg in groundwater Source Protection Zone or near any drinking water supply, use DWS. If near ecological receptor/river etc, use freshwater EQS, if site is near coast use saline EQS. If more than one applicable use lowest, if in doubt use TSV (defined as lowest of freshwater EQS and UK DWS).

Name of Determinand	TSV freshwater (Tier 1 Screening Value) Defined as most conservative of DWS and freshwater EQS	Origin of TSV	Drinking Water Standards 2000	Fresh water EQS	Marine water EQS
All units µg/l unless otherwise stated			All units µg/l unless otherwise stated		
PH	6-9	EQS	6.5 - 10	6-9	7-8.5
Dissolved O ₂	50% >7-9	Freshwater Fish Directive	-	-	-
Suspended solids	25000	Freshwater Fish Directive	-	-	-
BOD	3000 salmonid, 6000 cyprinid	Freshwater Fish Directive	-	-	-
Abamectin	0.01 (AA)	EQS	-	0.01 (AA)	0.003 (AA)
Acrylamide	0.1	UK Drinking Water Standard	0.1	-	-
Aldrin	0.01 (AA)	EQS	0.03	0.01 (AA)	0.01 (AA)
Aluminium	pH <6.5 then 10 (MAC) > 6.5 then 15 (AA) or 25 (MAC)	EQS	200	pH <6.5 then 10 (MAC) > 6.5 then 15 (AA) or 25 (MAC)	15 (AA)
Ammonium (NH ₄)	300	draft EQS	500	300 (draft wfd report dept on alkalinity & altitude)	-
Anthracene	0.1	EQS	-	0.1 (AA)	0.1 (AA)
Antimony	5	UK Drinking Water Standard	5	-	-
Arsenic	10	UK Drinking Water Standard	10	50 (AA)	25 (AA)
Atrazine	0.6 (AA)	EQS	-	0.6 (AA)	2 (AA)
Azamethiphos	0.02 (AA)	EQS	-	0.02 (AA)	0.02 (AA)
Azinphos-methyl	0.01 (AA)	EQS	-	0.01 (AA)	0.01 (AA)
Barium	100	Surface Water Abstraction Directive - DW1 limit	-	-	-
Bentazone	500 (AA)	EQS	-	500 (AA)	500 (AA)
Benzene	1	UK Drinking Water Standard	1	10 (AA)	8 (AA)
Benzo-a-pyrene	0.01	EQS	0.01	See PAH	See PAH
Biphenyl	25 (AA)	EQS	-	25 (AA)	25 (AA)
Boron	1000	UK Drinking Water Standard	1000	2000 (AA)	7000 (AA)
Bromine	2 (AA)	EQS	-	2 (AA)	10 (MAC)
Bromate	10	UK Drinking Water Standard	10	-	-
Bromoxynil	100 (AA)	EQS	-	100 (AA)	100
Bronopol (Pyceze)	70 (MAC)	SEPA EQS for aquaculture	-	70 (MAC)	-
Cadmium	-	EQS	5	-	0.2 (AA)
	0-40mg CaCO3/l 0.08			0-40mg CaCO3/l 0.08	
	40-50mg CaCO3/l 0.08			40-50mg CaCO3/l 0.08	
	50-100mg CaCO3/l 0.09			50-100mg CaCO3/l 0.09	
	100-200mg CaCO3/l 0.15			100-200mg CaCO3/l 0.15	
	>200mg CaCO3/l 0.25			>200mg CaCO3/l 0.25	
Carbendazim	0.1 (AA)	EQS	-	0.15 (AA)	-
Carbon tetrachloride (CT)	12 (AA)	EQS	-	12 (AA)	12 (AA)
Chloride (Water Soluble)	250000 (AA)	EQS	250000	250000 (AA)	-
Chlorine	2 (AA)	EQS	-	2 (AA)	10 (MAC)
Chlorfenvinphos	0.1 (AA)	EQS	-	0.1 (AA)	0.1 (AA)
Chloroform	12 (AA)	EQS	-	12 (AA)	12 (AA)
4-chloro-3-methyl phenol	40 (AA)	EQS	-	40 (AA)	40 (AA)
Chloronitrotoluenes (Total - all isomers)	10 (AA)	EQS	-	10 (AA)	10 (AA)
2-chlorophenol	50 (AA)	EQS	-	50 (AA)	50 (AA)
Chlorpropham	10 (AA)	EQS	-	10 (AA)	10 (AA)
Chlorothalonil	0.1 (AA)	EQS	-	0.1 (AA)	-
Chlorotoluron	2 (AA)	EQS	-	2 (AA)	2 (AA)
Chlorpyrifos	0.1 (AA)	EQS	-	0.1 (AA)	0.03 (AA)
Chromium (III) - dissolved	4.7 (AA)	EQS	50	4.7 (AA)	-
Chromium (VI) - dissolved	3.4 (AA)	EQS	50	3.4 (AA)	0.6 (AA)
Copper	1 (bioavailable) (AA)	EQS	2000	1 (bioavailable) (AA)	3.76 (AA)
Cobalt (dissolved)	3 (AA)	EQS	-	3 (AA)	3 (AA)
Coumaphos	0.03 (AA)	EQS	-	0.03 (AA)	0.03 (AA)
Cyanide	1	EQS	50	1 (AA)	1 (AA)
Cyfluthrin (total)	0.001 (AA)	EQS	-	0.001 (AA)	0.001 (MAC)
Cypermethrin	0.0001 (AA)	EQS	-	0.0001 (AA)	0.0001 (AA)
2,4-D (ester) (In Statutory Instrument not stated that as 'total')	1 (AA)	EQS	-	1 (AA)	1 (AA)
2,4-D (non-ester) (In Statutory Instrument not stated that as 'total')	40 (AA)	EQS	-	40 (AA)	40 (AA)
DDT (Total- all 4 isomers)	0.025 (AA)	EQS	-	0.025 (AA)	0.025 (AA)
ppDDT (total)	0.01 (AA)	EQS	-	0.01 (AA)	0.01 (AA)
Demetons	0.05 (AA)	EQS	-	0.05 (AA)	0.5 (AA)
Diazinon (sheep dip)	0.01 (AA)	EQS	-	0.01 (AA)	0.01 (AA)
Dichlorobenzenes (sum of all isomers)	20 (AA)	EQS	-	20 (AA)	20 (AA)
1,2-dichloroethane (total)	3 (AA)	UK Drinking Water Standard	3	10 (AA)	10 (AA)
Dichloromethane	20 (AA)	EQS	-	20 (AA)	20 (AA)
2,4-dichlorophenol	4.2 (AA)	EQS	-	4.2 (AA)	0.42 (AA)
Dichlorvos	0.001 (AA)	EQS	-	0.001 (AA)	0.04 (AA)
Dieldrin (total)	0.01 (AA)	EQS	0.03	0.01 (AA)	0.01 (AA)
Diiflubenzuron	0.001 (AA)	EQS	-	0.001 (AA)	0.005 (AA)
Dimethoate	0.48 (AA)	EQS	-	0.48 (AA)	0.48 (AA)
Diuron	0.2 (AA)	EQS	-	0.2 (AA)	0.2 (AA)
Doramectin	0.001 (AA)	EQS	-	0.001 (AA)	0.001 (AA)
EDTA (ethylenediaminetetraacetic acid)	400 (AA)	EQS	-	400 (AA)	400 (AA)
Emamectin benzoate	0.22 (ng/l) (AA)	SEPA EQS for aquaculture	-	0.22 (ng/l) (AA)	0.763 (AA)
Endosulphan	0.005 (AA)	EQS	-	0.005 (AA)	0.0005 (AA)
Endrin (total)	0.005 (AA)	EQS	-	0.005 (AA)	0.005
Epichlorohydrin	0.1	UK Drinking Water Standard	0.1	-	-
17α-Ethinylestradiol	0.0001 n(AA)	PNEC	-	0.0001 n(AA)	0.0001 (AA)
Ethylbenzene	20 (AA)	EQS	-	20 (AA)	20 (AA)
Fenchlorphos	0.03 (AA)	EQS	-	0.03 (AA)	0.03 (AA)
Fenitrothion	0.01 (AA)	EQS	-	0.01 (AA)	0.01 (AA)
Fluocifuron (total)	0.1	UK Drinking Water Standard	-	1	1 (MAC)
Fluoranthene	0.0063 (AA)	EQS	-	0.0063 (AA)	0.0063 (AA)
Fluoride	<50 mg CaCO3/l = 1000 >50 mg CaCO3/l = 5000	EQS	1500	<50 mg CaCO3/l = 1000 >50 mg CaCO3/l = 5000	5000
Formaldehyde	5 (AA)	EQS	-	5 (AA)	-
Heptachlor	0.03	UK Drinking Water Standard	0.03	-	-
Heptachlor epoxide	0.03	UK Drinking Water Standard	0.03	-	-
Hexachlorobenzene (total)	0.03 (AA)	EQS	-	0.05 (MAC)	0.05 (MAC)
Hexachlorobutadiene (total)	0.1 (AA)	EQS	-	0.6 (MAC)	0.6 (MAC)
Hexachlorocyclohexane (total)	0.2 (AA)	EQS	-	0.2 (AA)	0.002 (AA)
Hydrogen sulphide (Undissociated)	0.25 (AA)	EQS	-	0.25 (AA)	10 (MAC)
Ioxynil (total)	10 (AA)	EQS	-	10 (AA)	10 (AA)
Iron (dissolved)	200	EQS	200	1000 (AA)	1000 (AA)
Isodrin (total)	0.005 (AA)	EQS	-	0.005 (AA)	0.005 (AA)
Isoproturon	0.3 (AA)	EQS	-	0.3 (AA)	0.3 (AA)
Ivermectin	0.0001 (AA)	EQS	-	0.0001 (AA)	0.001 (AA)
Lead (Dissolved)	1.2 (bioavailable) (AA)	EQS	10	1.2 (bioavailable) (AA)	1.3 (AA)

Name of Determinand	TSV freshwater (Tier 1 Screening Value) Defined as most conservative of DWS and freshwater EQS	Origin of TSV	Drinking Water Standards 2000	Fresh water EQS	Marine water EQS
All units µg/l unless otherwise stated			All units µg/l unless otherwise stated		
Linuron	0.5 (AA)	EQS	-	0.5 (AA)	2 (AA)
Malathion	0.01 (AA)	EQS	-	0.01 (AA)	0.02 (AA)
Malachite Green	0.5 (AA)	EQS	-	0.5 (AA)	0.5 (AA)
Mancozeb	2 (AA)	EQS	-	2 (AA)	2 (AA)
Manganese (Dissolved)	30 (AA)	EQS	50	123 (AA)	-
Maneb	3 (AA)	EQS	-	3 (AA)	3 (AA)
MCPA (S-ethyl (4-chloro-2-methylphenoxy)ethanethioate)	pH<7 = 12 pH>7 = 80	EQS	-	pH<7 = 12 pH>7 = 80	80 (AA)
Mecoprop	18 (AA)	EQS	-	18 (AA)	18 (AA)
Mercury	1 (AA)	EQS	1	-	0.07 (MAC)
Methiocarb	0.01 (AA)	EQS	-	0.01 (AA)	-
Methylphenols (0.3 2-MP, 0.2 3-MP, 1 4-MP) (=cresols)	100 (AA)	EQS	-	100 (AA)	100 (AA)
Mevinphos	0.02 (MAC)	EQS	-	0.02 (MAC)	-
Naphthalene	2 (AA)	EQS	-	2 (AA)	2 (AA)
Nickel (Dissolved)	4 (bioavailable) (AA)	EQS	20	4 (bioavailable) (AA)	8.6 (AA)
Nitrates (NO ₃)	50000	Surface Water Abstraction Directive - DW1 limit	50000	-	-
Nitrites (NO ₂)	50	UK Drinking Water Standard	50	-	-
Nonyl phenol	0.3 (AA)	EQS	-	0.3 (AA)	0.3 (AA)
NTA (Nitrilotriacetic acid)	1000 (AA)	EQS	-	1000 (AA)	3000 (AA)
Octyl phenol	0.1 (AA)	EQS	-	0.1 (AA)	0.01 (AA)
17β-Oestradiol	0.001 (AA)	PNEC	-	-	-
Omethoate	0.01 (AA)	EQS	-	0.01 (AA)	-
PAH: (Sum of: Benzo(b) fluoranthene Benzo(k)fluoranthene Benzo(ghi)perylene Indeno(1,2,3-cd)pyrene - Drinking Water + Benzo(a)pyrene - EQS)	0.1	UK Drinking Water Standard	0.1	0.00017 (AA)	0.00017 (AA)
PCSDs (flucofuron and sulcofuron) (total)	0.05	EQS	-	0.05	0.05 (MAC)
Pendimethalin	0.1	UK Drinking Water Standard	-	0.3 (AA)	1.5 (AA)
Pentabromodiphenylether	0.5	EQS	-	0.5	0.5
Pentachlorophenol	0.1	UK Drinking Water Standard	-	0.4 (AA)	0.4 (AA)
Permethrin (total)	0.01	EQS	-	0.01	0.0002 (AA)
Pesticides (sum of Parathion, g HCH and Dieldrin)	0.5	UK Drinking Water Standard	0.5	-	-
Phenol	7.7	EQS	-	7.7 (AA)	7.7 (AA)
Dimethyl phthalate (DMP)	800 (AA)	EQS	-	800 (AA)	800 (AA)
Diethyl phthalate (DEP)	200 (AA)	EQS	-	200 (AA)	200 (AA)
Di-butyl phthalates (DBPs)	8 (AA)	EQS	-	8 (AA)	8 (AA)
Butylbenzyl phthalate (BBP)	20 (AA)	EQS	-	20 (AA)	20 (AA)
Di-octyl phthalates (DOPs)	20 (AA)	EQS	-	20 (AA)	20 (AA)
di(Zethylhexyl)phthalate	8	WHO DWS	-	-	-
Phthalates	See above, no total, by individual phthalate only	WHO DWS	-	-	-
Pirimicarb	1 (AA)	EQS	-	1 (AA)	1 (AA)
Pirimiphos-methyl	0.015 (AA)	EQS	-	0.015 (AA)	0.015 (AA)
Prochloraz	4 (AA)	EQS	-	4 (AA)	4 (AA)
Propetamphos	0.03 (AA)	EQS	-	0.03 (AA)	0.03 (AA)
Propyzamide	100 (AA)	EQS	-	100 (AA)	100 (AA)
Silver (Total dissolved)	0.05 (AA)	EQS	-	0.05 (AA)	0.5 (AA)
Selenium	10 (AA)	Surface Water Abstraction Directive - DW1 limit	10	-	-
Simazine	1 (AA)	EQS	-	1 (AA)	1 (AA)
Sulcofuron (total)	25	EQS	-	25 (MAC)	25 (MAC)
Sulphate	250,000	Surface Water Abstraction Directive	-	400000 (AA)	-
Surfactants	200	Surface Water Abstraction Directive - DW1 limit	-	-	-
Styrene	50 (AA)	EQS	-	50 (AA)	50 (AA)
Tecnazene (Total)	1 (AA)	EQS	-	1 (AA)	1 (AA)
Teflubenzuron (Calicide)	6 (ng/l)	SEPA EQS for aquaculture	-	6 (ng/l)	2
Tetrachloroethylene (PCE)	10 (AA)	EQS	-	10 (AA)	10 (AA)
Tetrachloroethene and Trichloroethene	10	UK Drinking Water Standard	10	-	-
Tetrachloromethane	3	UK Drinking Water Standard	3	-	-
Thiabendazole	5 (AA)	EQS	-	5 (AA)	5 (AA)
Tin	25 (AA)	EQS	-	25 (AA)	10 (AA)
Toluene	74 (AA)	EQS	-	74 (AA)	74 (AA)
TPH:					
Aliphatic EC C5-C6	15000	WHO DWS	15000	-	-
Aliphatic EC>C6-C8	15000	WHO DWS	15000	-	-
Aliphatic EC>C8-C10	300	WHO DWS	300	-	-
Aliphatic EC>C10-C12	300	WHO DWS	300	-	-
Aliphatic EC>C12-C16	300	WHO DWS	300	-	-
Aliphatic EC>C16-C21	-	WHO DWS	-	-	-
Aliphatic EC>C21-C35	-	WHO DWS	-	-	-
Aromatic EC C6-C7	1 (Benzene)	UK Drinking Water Standard	1	10 (AA)	8 (AA)
Aromatic EC>C7-C8	74 (Toluene)	EQS	700	74 (AA)	74 (AA)
Aromatic EC>C8-C10	300 (Ethylbenzene)	WHO DWS	300	-	-
Aromatic EC>C10-C12	90	WHO DWS	90	-	-
Aromatic EC>C12-C16	90	WHO DWS	90	-	-
Aromatic EC>C16-C21	90	WHO DWS	90	-	-
Aromatic EC>C21-C35	90	WHO DWS	90	-	-
Triallate	0.25 (AA)	EQS	-	0.25 (AA)	0.25 (AA)
Triazophos	0.005 (AA)	EQS	-	0.005 (AA)	0.005 (AA)
Tributyltin cmpds	0.0002 (AA)	EQS	-	0.0002 (AA)	0.0002 (AA)
Tributyltin	0.0002 (AA)	EQS	-	0.0002 (AA)	0.0002 (AA)
Tributyl phosphate	50 (AA)	EQS	-	50 (AA)	50 (AA)
Trichlorobenzene	0.4 (AA)	EQS	-	0.4 (AA)	0.4 (AA)
1,1,1-trichloroethane	100 (AA)	EQS	-	100 (AA)	100 (AA)
1,1,2-trichloroethane	400 (AA)	EQS	-	400 (AA)	300 (AA)
Trichloroethene	10 (AA)	EQS	-	10 (AA)	10 (AA)
Trifluralin	0.03 (AA)	EQS	-	0.03 (AA)	0.03 (AA)
Trihalomethanes (sum of chloroform, bromoform, dibromochloromethane and bromodichloromethane)	100	UK Drinking Water Standard	100	2.5 (AA)	2.5 (AA)
Triphenyltin cmpds (Total)	0.02 (MAC)	EQS	-	0.02 (MAC)	0.008 (MAC)
Triphenyltin and its derivatives	0.02 (MAC)	EQS	-	0.02 (MAC)	0.008 (MAC)
Vanadium (Total)			-		100 (AA)
	0 - 200mg CaCO3/l 20	EQS		0 - 200mg CaCO3/l 20	
	>200mg CaCO3 /l 60	EQS		>200mg CaCO3 /l 60	
Vinyl Chloride (VC)	0.5	UK Drinking Water Standard	0.5	-	-
Xylenes	30 (AA)	EQS	-	30 (AA)	30 (AA)
Zinc	10.9 (bioavailable) (AA)	EQS	-	10.9 (bioavailable) (AA)	6.8 (AA)

All units µg/l unless otherwise stated
Use these values for initial assessment of all water and leachate results
AA = Annual Average
MAC = Maximum Concentration
TSVs - Tier 1 Screening Values
TSVs listed above defined as most conservative of DWS and EQS assuming potable water supply and river ecosystems are receptors at site.

References.

EQS (Environmental Quality Standards)
Surface water pollution risk assessment for your environmental permit
<https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit#contact>

Surface Water Abstraction Directive
UK EA Website
http://www.environment-agency.gov.uk/yourenv/eff/1190084/water/213872/577394/577773/?version=1&lang=_e

Statutory Instruments: 2016 No. 614 Water, England and Wales: The Water Supply (Water Quality) Regulations 2016
http://www.legislation.gov.uk/uksi/2016/614/pdfs/uksi_20160614_en.pdf

Freshwater Fish Directive: UK government webpage
<http://www.environment-agency.gov.uk/yourenv/eff/1190084/water/213902/576076/>

WHO: World Health Organisation drinking water standards
Petroleum Products in Drinking-water, Background document for development of WHO Guidelines for Drinking-water Quality, WHO (WHO/SDE/WSH/05.08/123)
http://www.who.int/water_sanitation_health/dwg/chemicals/Petroleum%20Productsrev071105.pdf

APPENDIX 4: SOIL, LEACHATE AND WATER SCREENING SUMMARIES

Project Ref: J20-033

GAC Comparison: GCC - Residential with homegrown produce (1% SOM)

[illegible]

Project Name: Station Rd
Project Ref: J20-033
GAC Comparison: EQS/DWS

Sample ID	Units	GAC	WS101	WS103	WS104	WS105
Depth to Top			2.10	2.00	2.90	2.70
Depth to Bottom			2.40	2.30		3.00
Date Sampled			23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20
% Stones >10mm	% w/w		4.7	13.2	3.6	11.9
pH (leachable)	pH	6-9	7.51	7.03	7.19	6.91
Alkalinity (total) (leachable) Colorimetry	mg/l Ca CO3	-	83	111	120	189
Ammoniacal nitrogen as N (leachable)	mg/l	0.5	<0.02	<0.02	<0.02	0.03
Ammonia / Ammoniacal Nitrogen as NH3 (leachable)	mg/l	-	<0.024	<0.024	<0.024	0.037
Chloride (leachable)	mg/l	250	2.79	4.63	4.11	5.18
Nitrate (leachable)	mg/l	-	0.2	<0.1	<0.1	<0.1
Sulphate (leachable)	mg/l	250	14.31	28.18	26.5	40.77
Cyanide (total) (leachable)	mg/l	0.001	<0.005	<0.005	<0.005	<0.005
Phenols (total by HPLC) (leachable)	mg/l	0.0077	<0.01	<0.01	<0.01	<0.01
Antimony (leachable)	µg/l	-	<1	<1	<1	<1
Arsenic (leachable)	µg/l	50	3	5	4	2
Boron (leachable)	µg/l	2000	13	<10	17	14
Barium (leachable)	µg/l	-	30	71	56	76
Cadmium (leachable)	µg/l	0.09	<1	<1	<1	<1
Copper (leachable)	µg/l	28	6	16	7	25
Chromium (leachable)	µg/l	50	2	4	3	3
Lead (leachable)	µg/l	10	4	10	9	12
Mercury (leachable)	µg/l	0.07	<0.1	<0.1	<0.1	<0.1
Nickel (leachable)	µg/l	20	2	6	4	7
Selenium (leachable)	µg/l	-	<1	1	<1	1
Zinc (leachable)	µg/l	125	14	21	69	73
PAH-16MS (leachable)						
Naphthalene (leachable)	µg/l	2	0.37	<0.02	0.24	0.18
Acenaphthylene (leachable)	µg/l	-	<0.02	<0.02	<0.02	<0.02
Acenaphthene (leachable)	µg/l	-	0.2	0.09	0.24	0.23
Fluorene (leachable)	µg/l	-	0.23	<0.02	0.22	0.17
Phenanthrene (leachable)	µg/l	-	0.44	<0.02	0.38	0.24
Anthracene (leachable)	µg/l	0.1	0.07	0.06	0.06	0.03
Fluoranthene (leachable)	µg/l	0.0063	0.09	0.17	0.09	0.1
Pyrene (leachable)	µg/l	-	0.06	0.54	0.06	0.08
Benzo(a)anthracene (leachable)	µg/l	-	<0.02	<0.02	<0.02	<0.02
Chrysene (leachable)	µg/l	-	<0.02	0.1	<0.02	<0.02
Benzo(b)fluoranthene (leachable)*	µg/l	-	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene (leachable)*	µg/l	-	<0.02	<0.02	<0.02	<0.02
Benzo(a)pyrene (leachable)*	µg/l	-	<0.02	<0.02	<0.02	<0.02
Indeno(123-cd)pyrene (leachable)*	µg/l	-	<0.02	<0.02	<0.02	<0.02
Dibenzo(ah)anthracene (leachable)	µg/l	-	<0.02	<0.02	<0.02	<0.02
Benzo(ghi)perylene (leachable)*	µg/l	-	<0.02	<0.02	<0.02	<0.02
PAH (SUM 5*)	µg/l	0.1	<0.1	<0.1	<0.1	<0.1
Total PAH-16MS (leachable)	µg/l	-	1.46	0.96	1.29	1.03
TPH CWG (leachable)						
Ali >C5-C6 (leachable)	µg/l	15000	<1	<1	<1	<1
Ali >C6-C8 (leachable)	µg/l	15000	<1	<1	3	<1
Ali >C8-C10 (leachable)	µg/l	300	<10	21	<10	<10
Ali >C10-C12 (leachable)	µg/l	300	<10	187	<10	<10
Ali >C12-C16 (leachable)	µg/l	300	<10	1079	<10	<10
Ali >C16-C21 (leachable)	µg/l	-	<10	1288	<10	<10
Ali >C21-C35 (leachable)	µg/l	-	<20	791	<20	<20
Total Aliphatics (leachable)	µg/l	-	<10	3366	<10	<10
Aro >C5-C7 (leachable)	µg/l	10	<1	<1	<1	<1
Aro >C7-C8 (leachable)	µg/l	74	<1	<1	<1	<1
Aro >C8-C10 (leachable)	µg/l	300	<10	33	11	<10
Aro >C10-C12 (leachable)	µg/l	90	<10	83	14	<10
Aro >C12-C16 (leachable)	µg/l	90	<10	696	<10	<10
Aro >C16-C21 (leachable)	µg/l	90	<10	959	<10	<10
Aro >C21-C35 (leachable)	µg/l	90	<20	252	<20	<20
Total Aromatics (leachable)	µg/l	-	<20	2024	25	<20
TPH (Ali & Aro >C5-C35) (leachable)	µg/l	-	<20	5390	28	<20
BTEX - Benzene (leachable)	µg/l	10	<1	<1	<1	<1
BTEX - Toluene (leachable)	µg/l	74	<1	<1	<1	<1
BTEX - Ethyl Benzene (leachable)	µg/l	300	<1	<1	<1	<1
BTEX - o Xylene (leachable)	µg/l	30	<1	<1	1	<1
BTEX - m & p Xylene (leachable)	µg/l	30	<1	<1	<1	<1
MTBE (leachable)	µg/l	15	<1	<1	<1	<1

Project Name: Station Rd
Project Ref: J20-033

Sample ID	Units	GAC	WS102	WS104
Date Sampled			28-Jul-20	28-Jul-20
pH (w)	pH	6-9	7.12	7.23
Alkalinity (total) (w) Colorimetry	mg/l Ca CO3	-	226	349
Ammoniacal nitrogen as N (w)	mg/l	0.5	0.3	0.34
Ammonia / Ammoniacal Nitrogen as NH3 (w)	mg/l	-	0.364	0.418
Chloride (w)	mg/l	250	44	163
Nitrate (w)	mg/l	-	0.4	<0.1
Sulphate (w)	mg/l	250	23	21
Cyanide (total) (w)	mg/l	0.001	<0.005	<0.005
Phenols - Total by HPLC (w)	mg/l	0.0077	<0.01	<0.01
Antimony (dissolved)	µg/l	-	<1	<1
Arsenic (dissolved)	µg/l	50	4	1
Boron (dissolved)	µg/l	2000	216	145
Barium (dissolved)	µg/l	-	43	18
Cadmium (dissolved)	µg/l	0.09	<0.2	<0.2
Copper (dissolved)	µg/l	28	<1	2
Chromium (dissolved)	µg/l	50	<1	<1
Lead (dissolved)	µg/l	10	<1	<1
Mercury (dissolved)	µg/l	0.07	<0.1	<0.1
Nickel (dissolved)	µg/l	20	7	2
Selenium (dissolved)	µg/l	-	<1	1
Zinc (dissolved)	µg/l	125	<1	<1
PAH-16MS (w)				
Naphthalene (w)	µg/l	2	5.05	0.02
Acenaphthylene (w)	µg/l	-	0.44	<0.01
Acenaphthene (w)	µg/l	-	49.5	<0.04
Fluorene (w)	µg/l	-	107	0.21
Phenanthrene (w)	µg/l	-	157	0.19
Anthracene (w)	µg/l	0.1	7.8	<0.01
Fluoranthene (w)	µg/l	0.0063	2.62	<0.01
Pyrene (w)	µg/l	-	15.1	0.01
Benzo(a)anthracene (w)	µg/l	-	0.82	<0.01
Chrysene (w)	µg/l	-	3.32	<0.01
Benzo(b)fluoranthene (w)*	µg/l	-	0.25	<0.01
Benzo(k)fluoranthene (w)*	µg/l	-	<0.10	<0.01
Benzo(a)pyrene (w)*	µg/l	-	0.13	<0.01
Indeno(123-cd)pyrene (w)*	µg/l	-	0.11	<0.01
Dibenzo(ah)anthracene (w)	µg/l	-	<0.10	<0.01
Benzo(ghi)perylene (w)*	µg/l	-	0.44	<0.01
PAH (SUM 5*)	µg/l	0.1	0.93	<0.1
Total PAH-16MS (w)	µg/l	-	350	0.43
TPH CWG (w)				
Ali >C5-C6 (w)	µg/l	15000	8	<5
Ali >C6-C8 (w)	µg/l	15000	92	<5
Ali >C8-C10 (w)	µg/l	300	11200	10
Ali >C10-C12 (w)	µg/l	300	15400	12
Ali >C12-C16 (w)	µg/l	300	59200	185
Ali >C16-C21 (w)	µg/l	-	55300	282
Ali >C21-C35 (w)	µg/l	-	16500	115
Total Aliphatics (w)	µg/l	-	158000	604
Aro >C5-C7 (w)	µg/l	10	<5	<5
Aro >C7-C8 (w)	µg/l	74	<5	<5
Aro >C8-C10 (w)	µg/l	300	19600	30
Aro >C10-C12 (w)	µg/l	90	32600	40
Aro >C12-C16 (w)	µg/l	90	93400	120
Aro >C16-C21 (w)	µg/l	90	50300	158
Aro >C21-C35 (w)	µg/l	90	6660	36
Total Aromatics (w)	µg/l	-	203000	384
TPH (Ali & Aro >C5-C35) (w)	µg/l	-	360000	988
BTEX - Benzene (w)	µg/l	10	<5	<5
BTEX - Toluene (w)	µg/l	74	<5	<5
BTEX - Ethyl Benzene (w)	µg/l	300	<5	<5
BTEX - m & p Xylene (w)	µg/l	30	<5	<5
BTEX - o Xylene (w)	µg/l	30	<5	<5
MTBE (w)	µg/l	15	8	<5

APPENDIX 5: CHEMICAL LABORATORY TEST CERTIFICATES

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 20/06134
Issue Number: 1

Date: 04 August, 2020

Client: Ground Condition Consultants Ltd
10 Waldegrave Close
Southampton
SO19 9RY

Project Manager: Antony Platt
Project Name: Station Rd
Project Ref: J20-033
Order No: J20-033
Date Samples Received: 27/07/20
Date Instructions Received: 27/07/20
Date Analysis Completed: 04/08/20

Prepared by:



Sophie France
Client Service Manager

Approved by:



Richard Wong
Client Manager

Envirolab Job Number: 20/06134

Client Project Name: Station Rd

Client Project Ref: J20-033

Lab Sample ID	20/06134/1	20/06134/2	20/06134/3	20/06134/4	20/06134/5	20/06134/6	20/06134/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS101	WS101	WS102	WS102	WS102	WS103	WS103			
Depth to Top	0.30	2.10	0.30	1.50	2.50	0.20	2.00			
Depth To Bottom	0.50	2.40	0.50		3.00	0.50	2.30			
Date Sampled	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	5A	4A	5A	5A	4AE	5AB	6ABE			
% Stones >10mm _A	<0.1	4.7	<0.1	9.6	19.8	21.0	13.2	% w/w	0.1	A-T-044
pH _D ^{M#}	7.90	-	7.62	7.40	7.14	8.80	-	pH	0.01	A-T-031s
Cyanide (free) _A ^{M#}	<1	-	<1	<1	<1	<1	-	mg/kg	1	A-T-042sFCN
Phenols - Total by HPLC _A	<0.2	-	<0.2	<0.2	<0.2	<0.2	-	mg/kg	0.2	A-T-050s
Organic matter _D ^{M#}	0.5	-	0.6	0.3	0.2	2.2	-	% w/w	0.1	A-T-032 OM
Total Organic Carbon _D ^{M#}	0.27	-	0.34	0.14	0.08	1.27	-	% w/w	0.03	A-T-032s
Antimony _D	<5	-	<5	<5	<5	<5	-	mg/kg	5	A-T-024s
Arsenic _D ^{M#}	4	-	5	<1	<1	4	-	mg/kg	1	A-T-024s
Cadmium _D ^{M#}	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	18	-	19	10	2	32	-	mg/kg	1	A-T-024s
Chromium _D ^{M#}	33	-	32	31	4	16	-	mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	-	<1	<1	<1	<1	-	mg/kg	1	A-T-040s
Lead _D ^{M#}	14	-	20	10	2	72	-	mg/kg	1	A-T-024s
Mercury _D	<0.17	-	<0.17	<0.17	<0.17	0.24	-	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	23	-	22	16	5	11	-	mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	-	<1	<1	<1	<1	-	mg/kg	1	A-T-024s
Zinc _D ^{M#}	54	-	59	46	<5	57	-	mg/kg	5	A-T-024s
Leachate Prep BS EN 12457-2 (10:1) _A	-	*	-	-	-	-	*			A-T-001
pH (leachable) _A [#]	-	7.51	-	-	-	-	7.03	pH	0.01	A-T-031w
Alkalinity (total) (leachable) Colorimetry _A	-	83	-	-	-	-	111	mg/l Ca CO3	20	A-T-038w
Ammoniacal nitrogen as N (leachable) _A	-	<0.02	-	-	-	-	<0.02	mg/l	0.02	A-T-033w
Ammonia / Ammoniacal Nitrogen as NH3 (leachable) _A	-	<0.024	-	-	-	-	<0.024	mg/l	0.024	A-T-033w
Chloride (leachable) _A [#]	-	2.79	-	-	-	-	4.63	mg/l	1	A-T-026w
Nitrate (leachable) _A [#]	-	0.2	-	-	-	-	<0.1	mg/l	0.1	A-T-026w
Sulphate (leachable) _A [#]	-	14.31	-	-	-	-	28.18	mg/l	1	A-T-026w
Cyanide (total) (leachable) _A [#]	-	<0.005	-	-	-	-	<0.005	mg/l	0.005	A-T-042wTCN
Phenols (total by HPLC) (leachable) _A	-	<0.01	-	-	-	-	<0.01	mg/l	0.01	A-T-050w
Antimony (leachable) _A [#]	-	<1	-	-	-	-	<1	µg/l	1	A-T-025w
Arsenic (leachable) _A [#]	-	3	-	-	-	-	5	µg/l	1	A-T-025w
Boron (leachable) _A [#]	-	13	-	-	-	-	<10	µg/l	10	A-T-025w
Barium (leachable) _A [#]	-	30	-	-	-	-	71	µg/l	1	A-T-025w
Cadmium (leachable) _A [#]	-	<1	-	-	-	-	<1	µg/l	1	A-T-025w
Copper (leachable) _A [#]	-	6	-	-	-	-	16	µg/l	1	A-T-025w

Envirolab Job Number: 20/06134

Client Project Name: Station Rd

Client Project Ref: J20-033

Lab Sample ID	20/06134/1	20/06134/2	20/06134/3	20/06134/4	20/06134/5	20/06134/6	20/06134/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS101	WS101	WS102	WS102	WS102	WS103	WS103			
Depth to Top	0.30	2.10	0.30	1.50	2.50	0.20	2.00			
Depth To Bottom	0.50	2.40	0.50		3.00	0.50	2.30			
Date Sampled	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	5A	4A	5A	5A	4AE	5AB	6ABE			
Chromium (leachable) _A [#]	-	2	-	-	-	-	4	µg/l	1	A-T-025w
Lead (leachable) _A [#]	-	4	-	-	-	-	10	µg/l	1	A-T-025w
Mercury (leachable) _A [#]	-	<0.1	-	-	-	-	<0.1	µg/l	0.1	A-T-025w
Nickel (leachable) _A [#]	-	2	-	-	-	-	6	µg/l	1	A-T-025w
Selenium (leachable) _A [#]	-	<1	-	-	-	-	1	µg/l	1	A-T-025w
Zinc (leachable) _A [#]	-	14	-	-	-	-	21	µg/l	1	A-T-025w

Envirolab Job Number: 20/06134

Client Project Name: Station Rd

Client Project Ref: J20-033

Lab Sample ID	20/06134/1	20/06134/2	20/06134/3	20/06134/4	20/06134/5	20/06134/6	20/06134/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS101	WS101	WS102	WS102	WS102	WS103	WS103			
Depth to Top	0.30	2.10	0.30	1.50	2.50	0.20	2.00			
Depth To Bottom	0.50	2.40	0.50		3.00	0.50	2.30			
Date Sampled	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	5A	4A	5A	5A	4AE	5AB	6ABE			
Asbestos in Soil (inc. matrix)^ @										
Asbestos in soil [#]	NAD	-	NAD	NAD	NAD	NAD	-			A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	-	N/A	N/A	N/A	N/A	-			A-T-045

Envirolab Job Number: 20/06134

Client Project Name: Station Rd

Client Project Ref: J20-033

Lab Sample ID	20/06134/1	20/06134/2	20/06134/3	20/06134/4	20/06134/5	20/06134/6	20/06134/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS101	WS101	WS102	WS102	WS102	WS103	WS103			
Depth to Top	0.30	2.10	0.30	1.50	2.50	0.20	2.00			
Depth To Bottom	0.50	2.40	0.50		3.00	0.50	2.30			
Date Sampled	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	5A	4A	5A	5A	4AE	5AB	6ABE			
PAH-16MS (leachable)										
Naphthalene (leachable) _A	-	0.37	-	-	-	-	<0.02	µg/l	0.02	A-T-019w
Acenaphthylene (leachable) _A	-	<0.02	-	-	-	-	<0.02	µg/l	0.02	A-T-019w
Acenaphthene (leachable) _A	-	0.20	-	-	-	-	0.09	µg/l	0.02	A-T-019w
Fluorene (leachable) _A	-	0.23	-	-	-	-	<0.02	µg/l	0.02	A-T-019w
Phenanthrene (leachable) _A	-	0.44	-	-	-	-	<0.02	µg/l	0.02	A-T-019w
Anthracene (leachable) _A	-	0.07	-	-	-	-	0.06	µg/l	0.02	A-T-019w
Fluoranthene (leachable) _A	-	0.09	-	-	-	-	0.17	µg/l	0.02	A-T-019w
Pyrene (leachable) _A	-	0.06	-	-	-	-	0.54	µg/l	0.02	A-T-019w
Benzo(a)anthracene (leachable) _A	-	<0.02	-	-	-	-	<0.02	µg/l	0.02	A-T-019w
Chrysene (leachable) _A	-	<0.02	-	-	-	-	0.10	µg/l	0.02	A-T-019w
Benzo(b)fluoranthene (leachable) _A	-	<0.02	-	-	-	-	<0.02	µg/l	0.02	A-T-019w
Benzo(k)fluoranthene (leachable) _A	-	<0.02	-	-	-	-	<0.02	µg/l	0.02	A-T-019w
Benzo(a)pyrene (leachable) _A	-	<0.02	-	-	-	-	<0.02	µg/l	0.02	A-T-019w
Indeno(123-cd)pyrene (leachable) _A	-	<0.02	-	-	-	-	<0.02	µg/l	0.02	A-T-019w
Dibenzo(ah)anthracene (leachable) _A	-	<0.02	-	-	-	-	<0.02	µg/l	0.02	A-T-019w
Benzo(ghi)perylene (leachable) _A	-	<0.02	-	-	-	-	<0.02	µg/l	0.02	A-T-019w
Total PAH-16MS (leachable) _A	-	1.46	-	-	-	-	0.96	µg/l	0.02	A-T-019w

Envirolab Job Number: 20/06134

Client Project Name: Station Rd

Client Project Ref: J20-033

Lab Sample ID	20/06134/1	20/06134/2	20/06134/3	20/06134/4	20/06134/5	20/06134/6	20/06134/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS101	WS101	WS102	WS102	WS102	WS103	WS103			
Depth to Top	0.30	2.10	0.30	1.50	2.50	0.20	2.00			
Depth To Bottom	0.50	2.40	0.50		3.00	0.50	2.30			
Date Sampled	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	5A	4A	5A	5A	4AE	5AB	6ABE			
PAH-16MS (MSD order)										
Naphthalene _A ^{M#}	<0.03	-	<0.03	<0.03	<0.03	<0.03	-	mg/kg	0.03	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	-	<0.01	<0.01	<0.01	<0.01	-	mg/kg	0.01	A-T-019s
Acenaphthene _A ^{M#}	<0.01	-	<0.01	<0.01	<0.10	<0.01	-	mg/kg	0.01	A-T-019s
Fluorene _A ^{M#}	<0.01	-	<0.01	<0.01	0.73	<0.01	-	mg/kg	0.01	A-T-019s
Phenanthrene _A ^{M#}	<0.03	-	<0.03	<0.03	1.00	<0.03	-	mg/kg	0.03	A-T-019s
Anthracene _A ^{M#}	<0.02	-	<0.02	<0.02	0.05	<0.02	-	mg/kg	0.02	A-T-019s
Fluoranthene _A ^{M#}	<0.08	-	<0.08	<0.08	<0.08	<0.08	-	mg/kg	0.08	A-T-019s
Pyrene _A ^{M#}	<0.07	-	<0.07	<0.07	0.10	<0.07	-	mg/kg	0.07	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	-	<0.04	<0.04	<0.04	<0.04	-	mg/kg	0.04	A-T-019s
Chrysene _A ^{M#}	<0.06	-	<0.06	<0.06	<0.06	<0.06	-	mg/kg	0.06	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	-	<0.05	<0.05	<0.05	<0.05	-	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	-	<0.07	<0.07	<0.07	<0.07	-	mg/kg	0.07	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	-	<0.04	<0.04	<0.04	<0.04	-	mg/kg	0.04	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	-	<0.03	<0.03	<0.03	<0.03	-	mg/kg	0.03	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	-	<0.04	<0.04	<0.04	<0.04	-	mg/kg	0.04	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	-	<0.05	<0.05	<0.05	<0.05	-	mg/kg	0.05	A-T-019s
Total PAH-16MS (MSD order) _A ^{M#}	<0.08	-	<0.08	<0.08	1.88	<0.08	-	mg/kg	0.03	A-T-019s

Envirolab Job Number: 20/06134

Client Project Name: Station Rd

Client Project Ref: J20-033

Lab Sample ID	20/06134/1	20/06134/2	20/06134/3	20/06134/4	20/06134/5	20/06134/6	20/06134/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS101	WS101	WS102	WS102	WS102	WS103	WS103			
Depth to Top	0.30	2.10	0.30	1.50	2.50	0.20	2.00			
Depth To Bottom	0.50	2.40	0.50		3.00	0.50	2.30			
Date Sampled	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	5A	4A	5A	5A	4AE	5AB	6ABE			
TPH CWG (leachable)										
Ali >C5-C6 (leachable) _A	-	<1	-	-	-	-	<1	µg/l	1	A-T-022w
Ali >C6-C8 (leachable) _A	-	<1	-	-	-	-	<1	µg/l	1	A-T-022w
Ali >C8-C10 (leachable) _A	-	<10	-	-	-	-	21	µg/l	10	A-T-055w
Ali >C10-C12 (leachable) _A	-	<10	-	-	-	-	187	µg/l	10	A-T-055w
Ali >C12-C16 (leachable) _A	-	<10	-	-	-	-	1079	µg/l	10	A-T-055w
Ali >C16-C21 (leachable) _A	-	<10	-	-	-	-	1288	µg/l	10	A-T-055w
Ali >C21-C35 (leachable) _A	-	<20	-	-	-	-	791	µg/l	20	A-T-055w
Total Aliphatics (leachable) _A	-	<10	-	-	-	-	3366	µg/l	10	A-T-055w
Aro >C5-C7 (leachable) _A	-	<1	-	-	-	-	<1	µg/l	1	A-T-022w
Aro >C7-C8 (leachable) _A	-	<1	-	-	-	-	<1	µg/l	1	A-T-022w
Aro >C8-C10 (leachable) _A	-	<10	-	-	-	-	33	µg/l	10	A-T-055w
Aro >C10-C12 (leachable) _A	-	<10	-	-	-	-	83	µg/l	10	A-T-055w
Aro >C12-C16 (leachable) _A	-	<10	-	-	-	-	696	µg/l	10	A-T-055w
Aro >C16-C21 (leachable) _A	-	<10	-	-	-	-	959	µg/l	10	A-T-055w
Total Aromatics (leachable) _A	-	<20	-	-	-	-	2024	µg/l	20	A-T-055w
TPH (Ali & Aro >C5-C35) (leachable) _A	-	<20	-	-	-	-	5390	µg/l	20	A-T-055w
BTEX - Benzene (leachable) _A	-	<1	-	-	-	-	<1	µg/l	1	A-T-022w
BTEX - Toluene (leachable) _A	-	<1	-	-	-	-	<1	µg/l	1	A-T-022w
BTEX - Ethyl Benzene (leachable) _A	-	<1	-	-	-	-	<1	µg/l	1	A-T-022w
BTEX - o Xylene (leachable) _A	-	<1	-	-	-	-	<1	µg/l	1	A-T-022w
BTEX - m & p Xylene (leachable) _A	-	<1	-	-	-	-	<1	µg/l	1	A-T-022w
MTBE (leachable) _A	-	<1	-	-	-	-	<1	µg/l	1	A-T-022w
Aro >C21-C35 (leachable) _A	-	<20	-	-	-	-	252	µg/l	20	A-T-055w

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Client Project Name: Station Rd

Client Project Ref: J20-033

Lab Sample ID	20/06134/1	20/06134/2	20/06134/3	20/06134/4	20/06134/5	20/06134/6	20/06134/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS101	WS101	WS102	WS102	WS102	WS103	WS103			
Depth to Top	0.30	2.10	0.30	1.50	2.50	0.20	2.00			
Depth To Bottom	0.50	2.40	0.50		3.00	0.50	2.30			
Date Sampled	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	5A	4A	5A	5A	4AE	5AB	6ABE			
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	-	<0.01	<0.01	<0.01	<0.01	-	mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01	-	<0.01	<0.01	<0.01	<0.01	-	mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1	-	<1	<1	4	<1	-	mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	-	<1	<1	16	<1	-	mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	<1	-	<1	<1	87	<1	-	mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	<1	-	<1	<1	97	<1	-	mg/kg	1	A-T-055s
Ali >C21-C35 _A	<1	-	<1	<1	21	<1	-	mg/kg	1	A-T-055s
Total Aliphatics _A	<1	-	<1	<1	225	<1	-	mg/kg	1	A-T-055s
Aro >C5-C7 _A [#]	<0.01	-	<0.01	<0.01	<0.01	<0.01	-	mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	-	<0.01	<0.01	<0.01	<0.01	-	mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	<1	-	<1	<1	3	<1	-	mg/kg	1	A-T-055s
Aro >C10-C12 _A ^{M#}	<1	-	<1	<1	19	<1	-	mg/kg	1	A-T-055s
Aro >C12-C16 _A	<1	-	<1	<1	85	<1	-	mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	<1	-	<1	<1	70	<1	-	mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	<1	-	<1	<1	13	3	-	mg/kg	1	A-T-055s
Total Aromatics _A	<1	-	<1	<1	191	3	-	mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	<1	-	<1	<1	416	4	-	mg/kg	1	A-T-055s
BTEX - Benzene _A [#]	<0.01	-	<0.01	<0.01	<0.01	<0.01	-	mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	-	<0.01	<0.01	<0.01	<0.01	-	mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	-	<0.01	<0.01	<0.01	<0.01	-	mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	-	<0.01	<0.01	<0.01	<0.01	-	mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	-	<0.01	<0.01	<0.01	<0.01	-	mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	-	<0.01	<0.01	<0.01	<0.01	-	mg/kg	0.01	A-T-022s

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Client Project Name: Station Rd

Client Project Ref: J20-033

Lab Sample ID	20/06134/8	20/06134/9	20/06134/10	20/06134/11	20/06134/12	20/06134/13		Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS104	WS104	WS105	WS105	WS106	WS106				
Depth to Top	0.50	2.90	0.50	2.70	0.50	1.40				
Depth To Bottom				3.00						
Date Sampled	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil				
Sample Matrix Code	5A	4A	5A	6AE	5A	4AE				
% Stones >10mm _A	<0.1	3.6	1.4	11.9	6.1	17.1		% w/w	0.1	A-T-044
pH _D ^{M#}	7.90	-	8.00	-	7.25	7.64		pH	0.01	A-T-031s
Cyanide (free) _A ^{M#}	<1	-	<1	-	<1	<1		mg/kg	1	A-T-042sFCN
Phenols - Total by HPLC _A	<0.2	-	<0.2	-	<0.2	<0.2		mg/kg	0.2	A-T-050s
Organic matter _D ^{M#}	0.6	-	1.5	-	0.8	<0.1		% w/w	0.1	A-T-032 OM
Total Organic Carbon _D ^{M#}	0.37	-	0.83	-	0.50	<0.03		% w/w	0.03	A-T-032s
Antimony _D	<5	-	<5	-	<5	<5		mg/kg	5	A-T-024s
Arsenic _D ^{M#}	2	-	2	-	2	<1		mg/kg	1	A-T-024s
Cadmium _D ^{M#}	<0.5	-	<0.5	-	<0.5	<0.5		mg/kg	0.5	A-T-024s
Copper _D ^{M#}	17	-	23	-	20	2		mg/kg	1	A-T-024s
Chromium _D ^{M#}	28	-	24	-	30	5		mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	-	<1	-	<1	<1		mg/kg	1	A-T-040s
Lead _D ^{M#}	46	-	161	-	20	2		mg/kg	1	A-T-024s
Mercury _D	<0.17	-	<0.17	-	<0.17	<0.17		mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	17	-	16	-	19	2		mg/kg	1	A-T-024s
Selenium _D ^{M#}	1	-	2	-	2	<1		mg/kg	1	A-T-024s
Zinc _D ^{M#}	61	-	64	-	62	8		mg/kg	5	A-T-024s
Leachate Prep BS EN 12457-2 (10:1) _A	-	*	-	*	-	-				A-T-001
pH (leachable) _A [#]	-	7.19	-	6.91	-	-		pH	0.01	A-T-031w
Alkalinity (total) (leachable) Colorimetry _A	-	120	-	189	-	-		mg/l Ca CO3	20	A-T-038w
Ammoniacal nitrogen as N (leachable) _A	-	<0.02	-	0.03	-	-		mg/l	0.02	A-T-033w
Ammonia / Ammoniacal Nitrogen as NH3 (leachable) _A	-	<0.024	-	0.037	-	-		mg/l	0.024	A-T-033w
Chloride (leachable) _A [#]	-	4.11	-	5.18	-	-		mg/l	1	A-T-026w
Nitrate (leachable) _A [#]	-	<0.1	-	<0.1	-	-		mg/l	0.1	A-T-026w
Sulphate (leachable) _A [#]	-	26.50	-	40.77	-	-		mg/l	1	A-T-026w
Cyanide (total) (leachable) _A [#]	-	<0.005	-	<0.005	-	-		mg/l	0.005	A-T-042wTCN
Phenols (total by HPLC) (leachable) _A	-	<0.01	-	<0.01	-	-		mg/l	0.01	A-T-050w
Antimony (leachable) _A [#]	-	<1	-	<1	-	-		µg/l	1	A-T-025w
Arsenic (leachable) _A [#]	-	4	-	2	-	-		µg/l	1	A-T-025w
Boron (leachable) _A [#]	-	17	-	14	-	-		µg/l	10	A-T-025w
Barium (leachable) _A [#]	-	56	-	76	-	-		µg/l	1	A-T-025w
Cadmium (leachable) _A [#]	-	<1	-	<1	-	-		µg/l	1	A-T-025w
Copper (leachable) _A [#]	-	7	-	25	-	-		µg/l	1	A-T-025w

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Lab Sample ID	20/06134/8	20/06134/9	20/06134/10	20/06134/11	20/06134/12	20/06134/13		Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS104	WS104	WS105	WS105	WS106	WS106				
Depth to Top	0.50	2.90	0.50	2.70	0.50	1.40				
Depth To Bottom				3.00						
Date Sampled	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil				
Sample Matrix Code	5A	4A	5A	6AE	5A	4AE				
Chromium (leachable) _A [#]	-	3	-	3	-	-		µg/l	1	A-T-025w
Lead (leachable) _A [#]	-	9	-	12	-	-		µg/l	1	A-T-025w
Mercury (leachable) _A [#]	-	<0.1	-	<0.1	-	-		µg/l	0.1	A-T-025w
Nickel (leachable) _A [#]	-	4	-	7	-	-		µg/l	1	A-T-025w
Selenium (leachable) _A [#]	-	<1	-	1	-	-		µg/l	1	A-T-025w
Zinc (leachable) _A [#]	-	69	-	73	-	-		µg/l	1	A-T-025w

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Client Project Name: Station Rd

Client Project Ref: J20-033

Lab Sample ID	20/06134/8	20/06134/9	20/06134/10	20/06134/11	20/06134/12	20/06134/13		Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS104	WS104	WS105	WS105	WS106	WS106				
Depth to Top	0.50	2.90	0.50	2.70	0.50	1.40				
Depth To Bottom				3.00						
Date Sampled	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil				
Sample Matrix Code	5A	4A	5A	6AE	5A	4AE				
Asbestos in Soil (inc. matrix)^ @										
Asbestos in soil [#]	NAD	-	NAD	-	NAD	NAD				A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	-	N/A	-	N/A	N/A				A-T-045

Envirolab Job Number: 20/06134

Client Project Name: Station Rd

Client Project Ref: J20-033

Lab Sample ID	20/06134/8	20/06134/9	20/06134/10	20/06134/11	20/06134/12	20/06134/13		Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS104	WS104	WS105	WS105	WS106	WS106				
Depth to Top	0.50	2.90	0.50	2.70	0.50	1.40				
Depth To Bottom				3.00						
Date Sampled	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil				
Sample Matrix Code	5A	4A	5A	6AE	5A	4AE				
PAH-16MS (leachable)										
Naphthalene (leachable) _A	-	0.24	-	0.18	-	-		µg/l	0.02	A-T-019w
Acenaphthylene (leachable) _A	-	<0.02	-	<0.02	-	-		µg/l	0.02	A-T-019w
Acenaphthene (leachable) _A	-	0.24	-	0.23	-	-		µg/l	0.02	A-T-019w
Fluorene (leachable) _A	-	0.22	-	0.17	-	-		µg/l	0.02	A-T-019w
Phenanthrene (leachable) _A	-	0.38	-	0.24	-	-		µg/l	0.02	A-T-019w
Anthracene (leachable) _A	-	0.06	-	0.03	-	-		µg/l	0.02	A-T-019w
Fluoranthene (leachable) _A	-	0.09	-	0.10	-	-		µg/l	0.02	A-T-019w
Pyrene (leachable) _A	-	0.06	-	0.08	-	-		µg/l	0.02	A-T-019w
Benzo(a)anthracene (leachable) _A	-	<0.02	-	<0.02	-	-		µg/l	0.02	A-T-019w
Chrysene (leachable) _A	-	<0.02	-	<0.02	-	-		µg/l	0.02	A-T-019w
Benzo(b)fluoranthene (leachable) _A	-	<0.02	-	<0.02	-	-		µg/l	0.02	A-T-019w
Benzo(k)fluoranthene (leachable) _A	-	<0.02	-	<0.02	-	-		µg/l	0.02	A-T-019w
Benzo(a)pyrene (leachable) _A	-	<0.02	-	<0.02	-	-		µg/l	0.02	A-T-019w
Indeno(123-cd)pyrene (leachable) _A	-	<0.02	-	<0.02	-	-		µg/l	0.02	A-T-019w
Dibenzo(ah)anthracene (leachable) _A	-	<0.02	-	<0.02	-	-		µg/l	0.02	A-T-019w
Benzo(ghi)perylene (leachable) _A	-	<0.02	-	<0.02	-	-		µg/l	0.02	A-T-019w
Total PAH-16MS (leachable) _A	-	1.29	-	1.03	-	-		µg/l	0.02	A-T-019w

Envirolab Job Number: 20/06134

Client Project Name: Station Rd

Client Project Ref: J20-033

Lab Sample ID	20/06134/8	20/06134/9	20/06134/10	20/06134/11	20/06134/12	20/06134/13		Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS104	WS104	WS105	WS105	WS106	WS106				
Depth to Top	0.50	2.90	0.50	2.70	0.50	1.40				
Depth To Bottom				3.00						
Date Sampled	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil				
Sample Matrix Code	5A	4A	5A	6AE	5A	4AE				
PAH-16MS (MSD order)										
Naphthalene _A ^{M#}	<0.03	-	<0.03	-	<0.03	<0.03		mg/kg	0.03	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	-	<0.01	-	<0.01	<0.01		mg/kg	0.01	A-T-019s
Acenaphthene _A ^{M#}	<0.01	-	<0.01	-	<0.01	<0.01		mg/kg	0.01	A-T-019s
Fluorene _A ^{M#}	<0.01	-	<0.01	-	<0.01	<0.01		mg/kg	0.01	A-T-019s
Phenanthrene _A ^{M#}	<0.03	-	<0.03	-	<0.03	<0.03		mg/kg	0.03	A-T-019s
Anthracene _A ^{M#}	<0.02	-	<0.02	-	<0.02	<0.02		mg/kg	0.02	A-T-019s
Fluoranthene _A ^{M#}	<0.08	-	<0.08	-	<0.08	<0.08		mg/kg	0.08	A-T-019s
Pyrene _A ^{M#}	<0.07	-	<0.07	-	<0.07	<0.07		mg/kg	0.07	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	-	<0.04	-	<0.04	<0.04		mg/kg	0.04	A-T-019s
Chrysene _A ^{M#}	<0.06	-	<0.06	-	<0.06	<0.06		mg/kg	0.06	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	-	<0.05	-	<0.05	<0.05		mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	-	<0.07	-	<0.07	<0.07		mg/kg	0.07	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	-	<0.04	-	<0.04	<0.04		mg/kg	0.04	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	-	<0.03	-	<0.03	<0.03		mg/kg	0.03	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	-	<0.04	-	<0.04	<0.04		mg/kg	0.04	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	-	<0.05	-	<0.05	<0.05		mg/kg	0.05	A-T-019s
Total PAH-16MS (MSD order) _A ^{M#}	<0.08	-	<0.08	-	<0.08	<0.08		mg/kg	0.03	A-T-019s

Envirolab Job Number: 20/06134

Client Project Name: Station Rd

Client Project Ref: J20-033

Lab Sample ID	20/06134/8	20/06134/9	20/06134/10	20/06134/11	20/06134/12	20/06134/13		Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS104	WS104	WS105	WS105	WS106	WS106				
Depth to Top	0.50	2.90	0.50	2.70	0.50	1.40				
Depth To Bottom				3.00						
Date Sampled	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil				
Sample Matrix Code	5A	4A	5A	6AE	5A	4AE				
TPH CWG (leachable)										
Ali >C5-C6 (leachable) _A	-	<1	-	<1	-	-		µg/l	1	A-T-022w
Ali >C6-C8 (leachable) _A	-	3	-	<1	-	-		µg/l	1	A-T-022w
Ali >C8-C10 (leachable) _A	-	<10	-	<10	-	-		µg/l	10	A-T-055w
Ali >C10-C12 (leachable) _A	-	<10	-	<10	-	-		µg/l	10	A-T-055w
Ali >C12-C16 (leachable) _A	-	<10	-	<10	-	-		µg/l	10	A-T-055w
Ali >C16-C21 (leachable) _A	-	<10	-	<10	-	-		µg/l	10	A-T-055w
Ali >C21-C35 (leachable) _A	-	<20	-	<20	-	-		µg/l	20	A-T-055w
Total Aliphatics (leachable) _A	-	<10	-	<10	-	-		µg/l	10	A-T-055w
Aro >C5-C7 (leachable) _A	-	<1	-	<1	-	-		µg/l	1	A-T-022w
Aro >C7-C8 (leachable) _A	-	<1	-	<1	-	-		µg/l	1	A-T-022w
Aro >C8-C10 (leachable) _A	-	11	-	<10	-	-		µg/l	10	A-T-055w
Aro >C10-C12 (leachable) _A	-	14	-	<10	-	-		µg/l	10	A-T-055w
Aro >C12-C16 (leachable) _A	-	<10	-	<10	-	-		µg/l	10	A-T-055w
Aro >C16-C21 (leachable) _A	-	<10	-	<10	-	-		µg/l	10	A-T-055w
Total Aromatics (leachable) _A	-	25	-	<20	-	-		µg/l	20	A-T-055w
TPH (Ali & Aro >C5-C35) (leachable) _A	-	28	-	<20	-	-		µg/l	20	A-T-055w
BTEX - Benzene (leachable) _A	-	<1	-	<1	-	-		µg/l	1	A-T-022w
BTEX - Toluene (leachable) _A	-	<1	-	<1	-	-		µg/l	1	A-T-022w
BTEX - Ethyl Benzene (leachable) _A	-	<1	-	<1	-	-		µg/l	1	A-T-022w
BTEX - o Xylene (leachable) _A	-	1	-	<1	-	-		µg/l	1	A-T-022w
BTEX - m & p Xylene (leachable) _A	-	<1	-	<1	-	-		µg/l	1	A-T-022w
MTBE (leachable) _A	-	<1	-	<1	-	-		µg/l	1	A-T-022w
Aro >C21-C35 (leachable) _A	-	<20	-	<20	-	-		µg/l	20	A-T-055w

Envirolab Job Number: 20/06134

Client Project Name: Station Rd

Client Project Ref: J20-033

Lab Sample ID	20/06134/8	20/06134/9	20/06134/10	20/06134/11	20/06134/12	20/06134/13		Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS104	WS104	WS105	WS105	WS106	WS106				
Depth to Top	0.50	2.90	0.50	2.70	0.50	1.40				
Depth To Bottom				3.00						
Date Sampled	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20	23-Jul-20				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil				
Sample Matrix Code	5A	4A	5A	6AE	5A	4AE				
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	-	<0.01	-	<0.01	<0.01		mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01	-	<0.01	-	<0.01	<0.01		mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1	-	<1	-	<1	<1		mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	-	<1	-	<1	<1		mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	<1	-	<1	-	<1	<1		mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	<1	-	<1	-	<1	<1		mg/kg	1	A-T-055s
Ali >C21-C35 _A	<1	-	<1	-	<1	<1		mg/kg	1	A-T-055s
Total Aliphatics _A	<1	-	<1	-	<1	<1		mg/kg	1	A-T-055s
Aro >C5-C7 _A [#]	<0.01	-	<0.01	-	<0.01	<0.01		mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	-	<0.01	-	<0.01	<0.01		mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	<1	-	<1	-	<1	<1		mg/kg	1	A-T-055s
Aro >C10-C12 _A ^{M#}	<1	-	<1	-	<1	<1		mg/kg	1	A-T-055s
Aro >C12-C16 _A	<1	-	<1	-	<1	<1		mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	<1	-	<1	-	<1	<1		mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	<1	-	<1	-	<1	<1		mg/kg	1	A-T-055s
Total Aromatics _A	<1	-	<1	-	<1	<1		mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	<1	-	<1	-	<1	<1		mg/kg	1	A-T-055s
BTEX - Benzene _A [#]	<0.01	-	<0.01	-	<0.01	<0.01		mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	-	<0.01	-	<0.01	<0.01		mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	-	<0.01	-	<0.01	<0.01		mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	-	<0.01	-	<0.01	<0.01		mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	-	<0.01	-	<0.01	<0.01		mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	-	<0.01	-	<0.01	<0.01		mg/kg	0.01	A-T-022s

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts.

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client:	Ground Condition Consultants Ltd, 10 Waldegrave Close, Southampton, SO19 9RY	Project No:	20/06134
Project:	Station Rd	Date Received:	27/07/2020 (am)
Clients Project No:	J20-033	Cool Box Temperatures (°C):	18.0, 17.8

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 20/06336
Issue Number: 1
Date: 11 August, 2020

Client: Ground Condition Consultants Ltd
10 Waldegrave Close
Southampton
SO19 9RY

Project Manager: Antony Platt
Project Name: Station Rd
Project Ref: J20-033
Order No: J20-033
Date Samples Received: 03/08/20
Date Instructions Received: 03/08/20
Date Analysis Completed: 11/08/20

Prepared by:



Holly Neary-King
Administration & Client Services Supervisor

Approved by:



Sophie France
Client Service Manager

Envirolab Job Number: 20/06336

Client Project Name: Station Rd

Client Project Ref: J20-033

Lab Sample ID	20/06336/1	20/06336/2						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS102	WS104								
Depth to Top										
Depth To Bottom										
Date Sampled	28-Jul-20	28-Jul-20								
Sample Type	Water - EW	Water - EW								
Sample Matrix Code	N/A	N/A								
pH (w) _A [#]	7.12	7.23						pH	0.01	A-T-031w
Alkalinity (total) (w) Colorimetry _A [#]	226	349						mg/l Ca CO ₃	20	A-T-038w
Ammoniacal nitrogen as N (w) _A [#]	0.30	0.34						mg/l	0.02	A-T-033w
Ammonia / Ammoniacal Nitrogen as NH ₃ (w) _A [#]	0.364	0.418						mg/l	0.024	A-T-033w
Chloride (w) _A [#]	44	163						mg/l	1	A-T-026w
Nitrate (w) _A [#]	0.4	<0.1						mg/l	0.1	A-T-026w
Sulphate (w) _A [#]	23	21						mg/l	1	A-T-026w
Cyanide (total) (w) _A [#]	<0.005	<0.005						mg/l	0.005	A-T-042wTCN
Phenols - Total by HPLC (w) _A	<0.01	<0.01						mg/l	0.01	A-T-050w
Antimony (dissolved) _A [#]	<1	<1						µg/l	1	A-T-025w
Arsenic (dissolved) _A [#]	4	1						µg/l	1	A-T-025w
Boron (dissolved) _A [#]	216	145						µg/l	10	A-T-025w
Barium (dissolved) _A [#]	43	18						µg/l	1	A-T-025w
Cadmium (dissolved) _A [#]	<0.2	<0.2						µg/l	0.2	A-T-025w
Copper (dissolved) _A [#]	<1	2						µg/l	1	A-T-025w
Chromium (dissolved) _A [#]	<1	<1						µg/l	1	A-T-025w
Lead (dissolved) _A [#]	<1	<1						µg/l	1	A-T-025w
Mercury (dissolved) _A [#]	<0.1	<0.1						µg/l	0.1	A-T-025w
Nickel (dissolved) _A [#]	7	2						µg/l	1	A-T-025w
Selenium (dissolved) _A [#]	<1	1						µg/l	1	A-T-025w
Zinc (dissolved) _A [#]	<1	<1						µg/l	1	A-T-025w

Envirolab Job Number: 20/06336

Client Project Name: Station Rd

Client Project Ref: J20-033

Lab Sample ID	20/06336/1	20/06336/2						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS102	WS104								
Depth to Top										
Depth To Bottom										
Date Sampled	28-Jul-20	28-Jul-20								
Sample Type	Water - EW	Water - EW								
Sample Matrix Code	N/A	N/A								
PAH-16MS (w)										
Naphthalene (w) _A [#]	5.05	0.02						µg/l	0.01	A-T-019w
Acenaphthylene (w) _A [#]	0.44	<0.01						µg/l	0.01	A-T-019w
Acenaphthene (w) _A [#]	49.5	<0.04						µg/l	0.01	A-T-019w
Fluorene (w) _A [#]	107	0.21						µg/l	0.01	A-T-019w
Phenanthrene (w) _A [#]	157	0.19						µg/l	0.01	A-T-019w
Anthracene (w) _A [#]	7.80	<0.01						µg/l	0.01	A-T-019w
Fluoranthene (w) _A [#]	2.62	<0.01						µg/l	0.01	A-T-019w
Pyrene (w) _A [#]	15.1	0.01						µg/l	0.01	A-T-019w
Benzo(a)anthracene (w) _A [#]	0.82	<0.01						µg/l	0.01	A-T-019w
Chrysene (w) _A [#]	3.32	<0.01						µg/l	0.01	A-T-019w
Benzo(b)fluoranthene (w) _A [#]	0.25	<0.01						µg/l	0.01	A-T-019w
Benzo(k)fluoranthene (w) _A [#]	<0.10	<0.01						µg/l	0.01	A-T-019w
Benzo(a)pyrene (w) _A [#]	0.13	<0.01						µg/l	0.01	A-T-019w
Indeno(123-cd)pyrene (w) _A [#]	0.11	<0.01						µg/l	0.01	A-T-019w
Dibenzo(ah)anthracene (w) _A [#]	<0.10	<0.01						µg/l	0.01	A-T-019w
Benzo(ghi)perylene (w) _A [#]	0.44	<0.01						µg/l	0.01	A-T-019w
Total PAH-16MS (w) _A [#]	350	0.43						µg/l	0.01	A-T-019w

Envirolab Job Number: 20/06336

Client Project Name: Station Rd

Client Project Ref: J20-033

Lab Sample ID	20/06336/1	20/06336/2						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS102	WS104								
Depth to Top										
Depth To Bottom										
Date Sampled	28-Jul-20	28-Jul-20								
Sample Type	Water - EW	Water - EW								
Sample Matrix Code	N/A	N/A								
TPH CWG (w)										
Ali >C5-C6 (w) _A [#]	8	<5						µg/l	1	A-T-022w
Ali >C6-C8 (w) _A [#]	92	<5						µg/l	1	A-T-022w
Ali >C8-C10 (w) _A [#]	11200	10						µg/l	5	A-T-055w
Ali >C10-C12 (w) _A [#]	15400	12						µg/l	5	A-T-055w
Ali >C12-C16 (w) _A [#]	59200	185						µg/l	5	A-T-055w
Ali >C16-C21 (w) _A [#]	55300	282						µg/l	5	A-T-055w
Ali >C21-C35 (w) _A [#]	16500	115						µg/l	5	A-T-055w
Total Aliphatics (w) _A [#]	158000	604						µg/l	5	A-T-055w
Aro >C5-C7 (w) _A [#]	<5	<5						µg/l	1	A-T-022w
Aro >C7-C8 (w) _A [#]	<5	<5						µg/l	1	A-T-022w
Aro >C8-C10 (w) _A	19600	30						µg/l	5	A-T-055w
Aro >C10-C12 (w) _A [#]	32600	40						µg/l	5	A-T-055w
Aro >C12-C16 (w) _A [#]	93400	120						µg/l	5	A-T-055w
Aro >C16-C21 (w) _A [#]	50300	158						µg/l	5	A-T-055w
Aro >C21-C35 (w) _A [#]	6660	36						µg/l	10	A-T-055w
Total Aromatics (w) _A	203000	384						µg/l	10	A-T-055w
TPH (Ali & Aro >C5-C35) (w) _A	360000	988						µg/l	10	A-T-055w
BTEX - Benzene (w) _A [#]	<5	<5						µg/l	1	A-T-022w
BTEX - Toluene (w) _A [#]	<5	<5						µg/l	1	A-T-022w
BTEX - Ethyl Benzene (w) _A [#]	<5	<5						µg/l	1	A-T-022w
BTEX - m & p Xylene (w) _A [#]	<5	<5						µg/l	1	A-T-022w
BTEX - o Xylene (w) _A [#]	<5	<5						µg/l	1	A-T-022w
MTBE (w) _A [#]	8	<5						µg/l	1	A-T-022w

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client: Ground Condition Consultants Ltd, 10 Waldegrave Close, Southampton, SO19 9RY

Project: Station Rd

Clients Project No: J20-033

Project No: 20/06336

Date Received: 03/08/2020 (am)

Cool Box Temperatures (°C): 17.1

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

APPENDIX 6: GEOTECHNICAL TEST CERTIFICATES



TEST CERTIFICATE

Particle Size Distribution

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Tested in Accordance with: BS 1377-2: 1990

Client: Ground Condition Consultants
Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Contact: Antony Platt
Site Address: Station Road, Havant

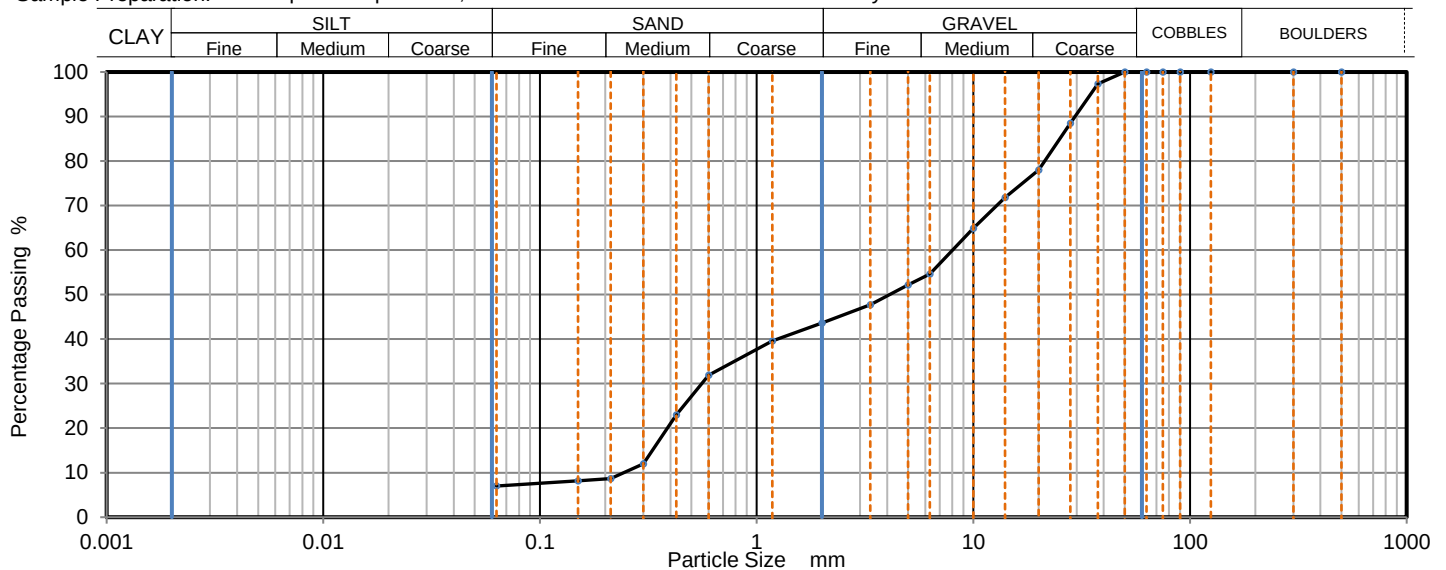
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 20-22163
Job Number: 20-22163
Date Sampled: Not Given
Date Received: 27/07/2020
Date Tested: 04/08/2020
Sampled By: Not Given

Test Results:

Laboratory Reference: 1578040
Hole No.: WS102
Sample Reference: GR
Sample Description: Brown slightly clayey very sandy GRAVEL
Sample Preparation: Sample was quartered, oven dried at 106.1 °C and broken down by hand.

Depth Top [m]: 1.60
Depth Base [m]: 2.00
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	97		
28	89		
20	78		
14	72		
10	65		
6.3	55		
5	52		
3.35	48		
2	44		
1.18	40		
0.6	32		
0.425	23		
0.3	12		
0.212	9		
0.15	8		
0.063	7		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	56.40
Sand	36.20
Fines <0.063mm	7.40

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	33
Curvature Coefficient	0.16

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks: The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3

Signed:

Aleksandra Jurochnik
PL Technical Reviewer
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Particle Size Distribution

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

Tested in Accordance with: BS 1377-2: 1990

4041

Client: Ground Condition Consultants
Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Contact: Antony Platt
Site Address: Station Road, Havant

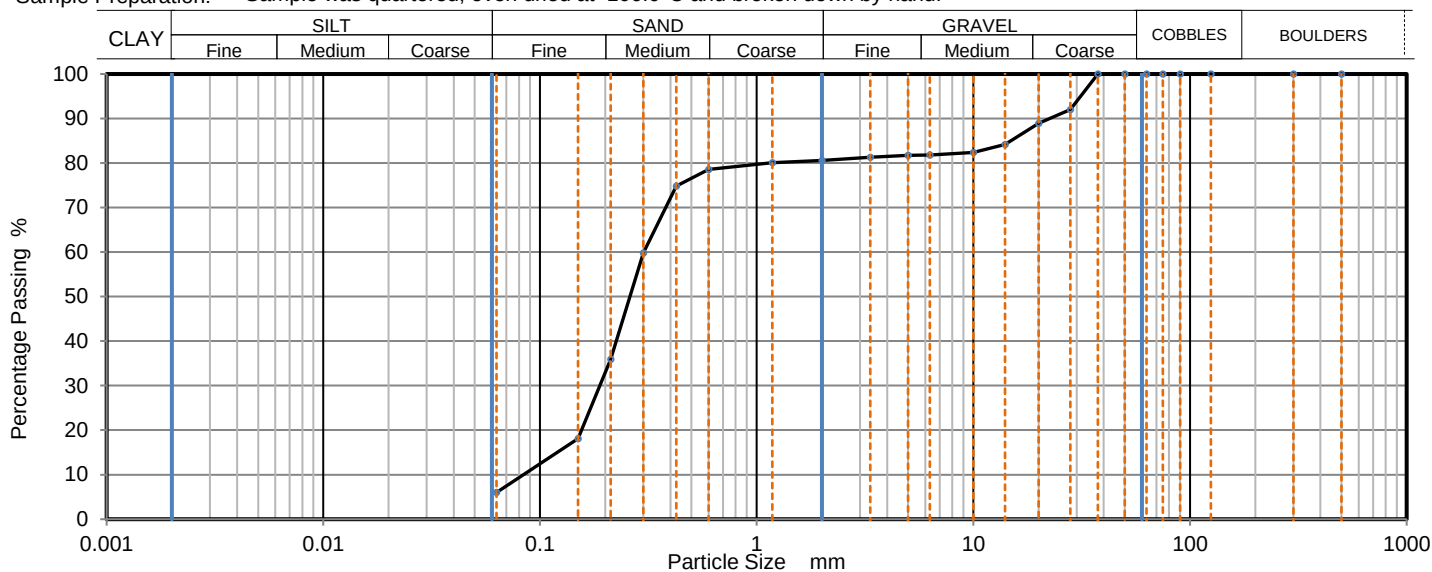
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 20-22163
Job Number: 20-22163
Date Sampled: Not Given
Date Received: 27/07/2020
Date Tested: 04/08/2020
Sampled By: Not Given

Test Results:

Laboratory Reference: 1578041
Hole No.: WS102
Sample Reference: SA
Sample Description: Brown gravelly SAND
Sample Preparation: Sample was quartered, oven dried at 106.0°C and broken down by hand.

Depth Top [m]: 3.00
Depth Base [m]: 3.80
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	92		
20	89		
14	84		
10	82		
6.3	82		
5	82		
3.35	81		
2	81		
1.18	80		
0.6	79		
0.425	75		
0.3	60		
0.212	36		
0.15	18		
0.063	6		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	19.40
Sand	74.50
Fines <0.063mm	6.10

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	3.6
Curvature Coefficient	1.4

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks: The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3

Signed:

Aleksandra Jurochnik
PL Technical Reviewer
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Particle Size Distribution

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Tested in Accordance with: BS 1377-2: 1990

Client: Ground Condition Consultants
Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Contact: Antony Platt
Site Address: Station Road, Havant

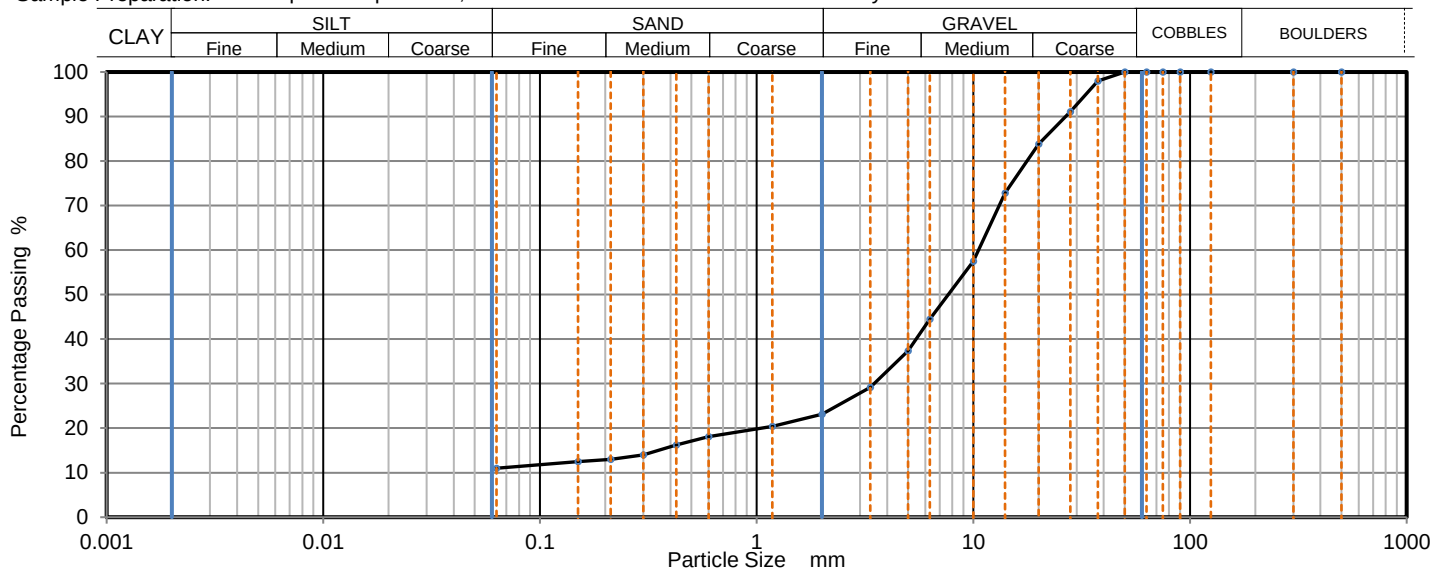
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 20-22163
Job Number: 20-22163
Date Sampled: Not Given
Date Received: 27/07/2020
Date Tested: 04/08/2020
Sampled By: Not Given

Test Results:

Laboratory Reference: 1578043
Hole No.: WS103
Sample Reference: GR
Sample Description: Brown clayey sandy GRAVEL
Sample Preparation: Sample was quartered, oven dried at 106.0 °C and broken down by hand.

Depth Top [m]: 1.20
Depth Base [m]: 1.80
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	98		
28	91		
20	84		
14	73		
10	58		
6.3	45		
5	37		
3.35	29		
2	23		
1.18	20		
0.6	18		
0.425	16		
0.3	14		
0.212	13		
0.15	13		
0.063	12		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	76.90
Sand	11.60
Fines <0.063mm	11.50

Grading Analysis	
D100	mm 50
D60	mm 10.6
D30	mm 3.48
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:

Aleksandra Jurochnik
PL Technical Reviewer
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Particle Size Distribution

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Tested in Accordance with: BS 1377-2: 1990

Client: Ground Condition Consultants
Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Contact: Antony Platt
Site Address: Station Road, Havant

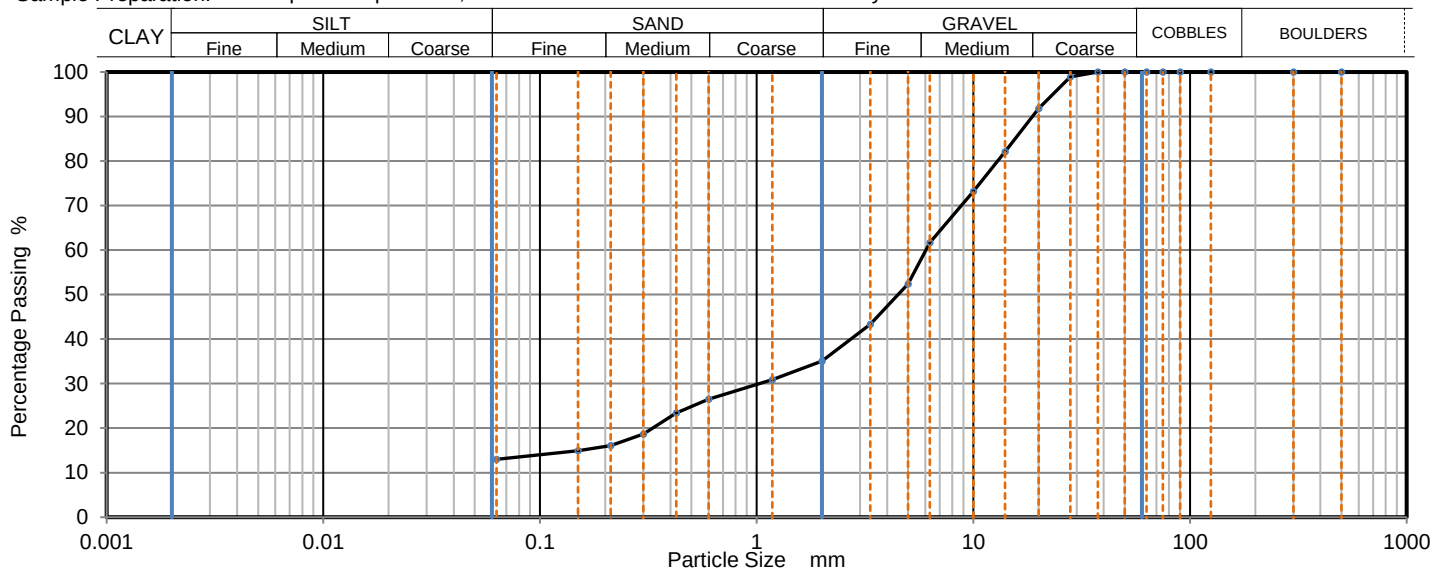
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 20-22163
Job Number: 20-22163
Date Sampled: Not Given
Date Received: 27/07/2020
Date Tested: 04/08/2020
Sampled By: Not Given

Test Results:

Laboratory Reference: 1578045
Hole No.: WS104
Sample Reference: GR
Sample Description: Brown clayey sandy GRAVEL
Sample Preparation: Sample was quartered, oven dried at 106.0 °C and broken down by hand.

Depth Top [m]: 2.00
Depth Base [m]: 3.00
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	99		
20	92		
14	82		
10	73		
6.3	62		
5	52		
3.35	43		
2	35		
1.18	31		
0.6	27		
0.425	23		
0.3	19		
0.212	16		
0.15	15		
0.063	13		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	64.90
Sand	22.10
Fines <0.063mm	13.00

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

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:

Aleksandra Jurochnik
PL Technical Reviewer
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Particle Size Distribution

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Tested in Accordance with: BS 1377-2: 1990

Client: Ground Condition Consultants
Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Contact: Antony Platt
Site Address: Station Road, Havant

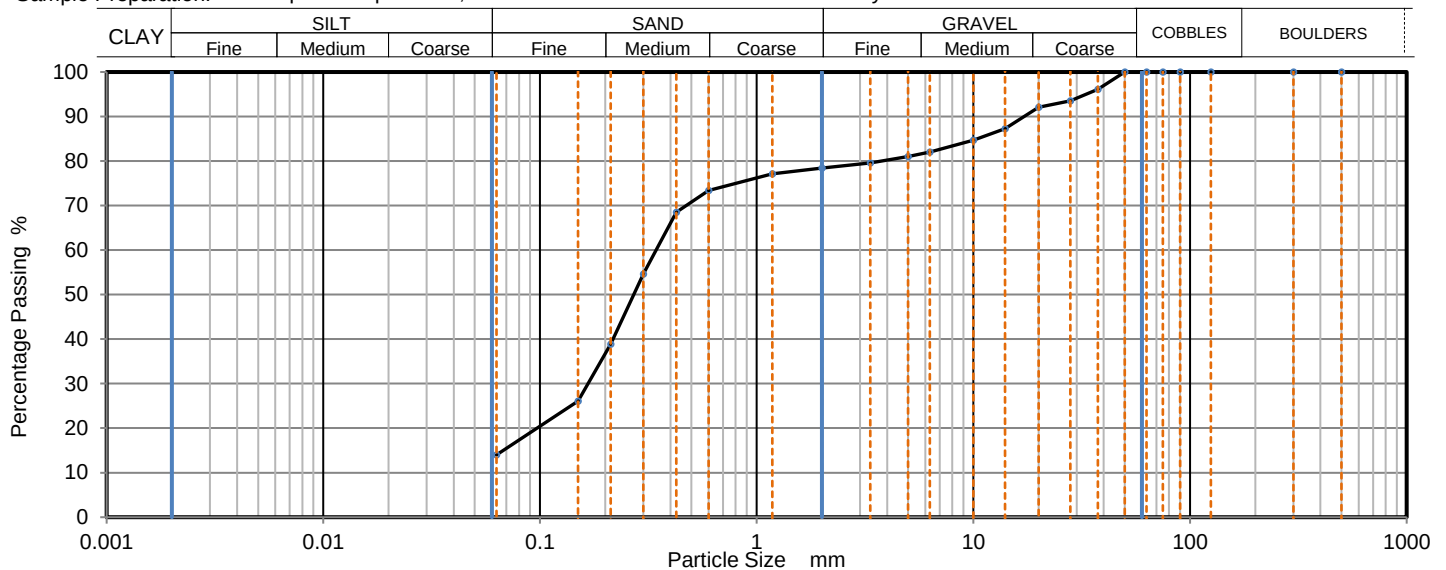
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 20-22163
Job Number: 20-22163
Date Sampled: Not Given
Date Received: 27/07/2020
Date Tested: 04/08/2020
Sampled By: Not Given

Test Results:

Laboratory Reference: 1578046
Hole No.: WS104
Sample Reference: SA
Sample Description: Brown clayey gravelly SAND
Sample Preparation: Sample was quartered, oven dried at 106.0 °C and broken down by hand.

Depth Top [m]: 3.00
Depth Base [m]: 4.00
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	96		
28	94		
20	92		
14	87		
10	85		
6.3	82		
5	81		
3.35	80		
2	78		
1.18	77		
0.6	73		
0.425	69		
0.3	55		
0.212	39		
0.15	26		
0.063	15		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	21.60
Sand	63.60
Fines <0.063mm	14.90

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

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:

Aleksandra Jurochnik
PL Technical Reviewer
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Particle Size Distribution

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Tested in Accordance with: BS 1377-2: 1990

Client: Ground Condition Consultants
Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Contact: Antony Platt
Site Address: Station Road, Havant

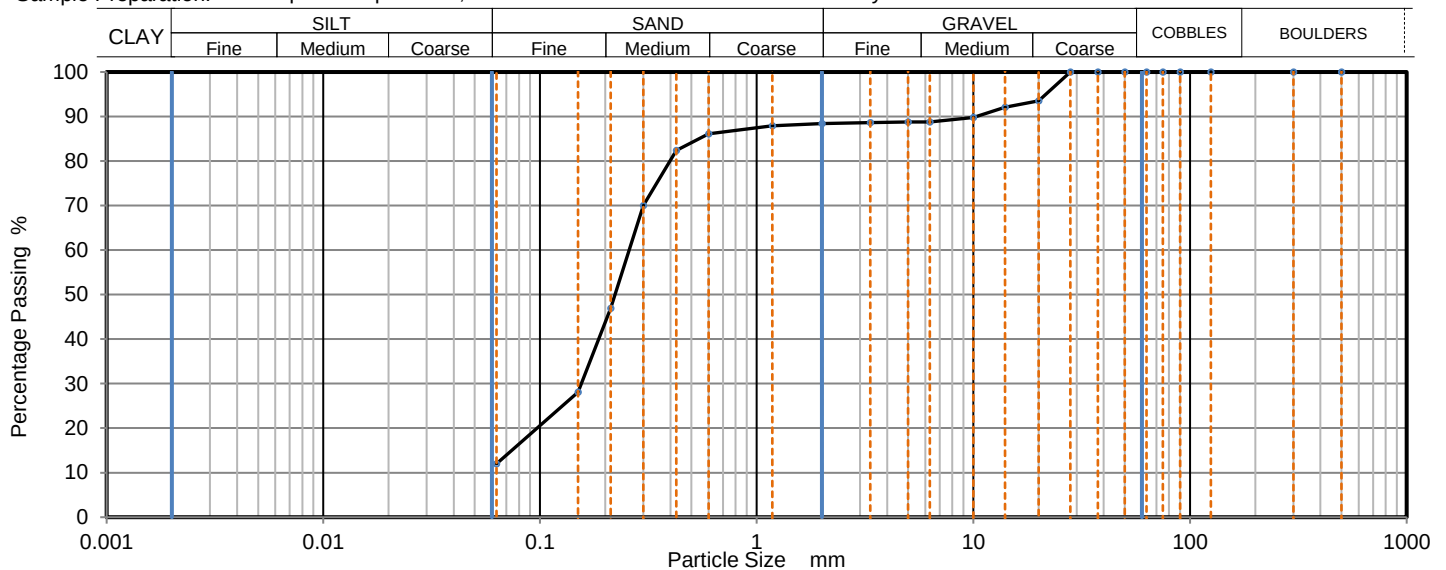
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 20-22163
Job Number: 20-22163
Date Sampled: Not Given
Date Received: 27/07/2020
Date Tested: 04/08/2020
Sampled By: Not Given

Test Results:

Laboratory Reference: 1578049
Hole No.: WS105
Sample Reference: SA
Sample Description: Grey gravelly clayey SAND
Sample Preparation: Sample was quartered, oven dried at 108.2 °C and broken down by hand.

Depth Top [m]: 3.00
Depth Base [m]: 4.00
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	94		
14	92		
10	90		
6.3	89		
5	89		
3.35	89		
2	88		
1.18	88		
0.6	86		
0.425	82		
0.3	70		
0.212	47		
0.15	28		
0.063	13		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	11.60
Sand	75.80
Fines <0.063mm	12.70

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

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:

Aleksandra Jurochnik
PL Technical Reviewer
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Particle Size Distribution

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Tested in Accordance with: BS 1377-2: 1990

Client: Ground Condition Consultants
Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Contact: Antony Platt
Site Address: Station Road, Havant

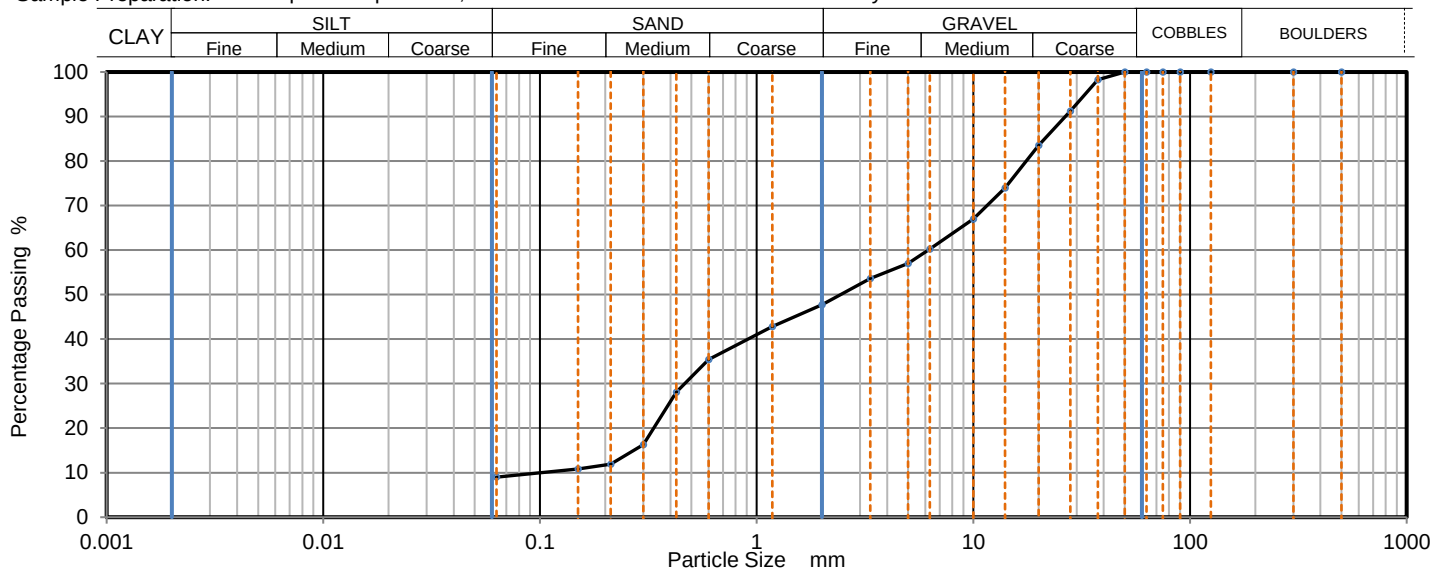
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 20-22163
Job Number: 20-22163
Date Sampled: Not Given
Date Received: 27/07/2020
Date Tested: 04/08/2020
Sampled By: Not Given

Test Results:

Laboratory Reference: 1578051
Hole No.: WS106
Sample Reference: SA
Sample Description: Brown slightly clayey very sandy GRAVEL
Sample Preparation: Sample was quartered, oven dried at 106.1 °C and broken down by hand.

Depth Top [m]: 1.30
Depth Base [m]: 2.80
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	98		
28	91		
20	84		
14	74		
10	67		
6.3	60		
5	57		
3.35	54		
2	48		
1.18	43		
0.6	35		
0.425	28		
0.3	16		
0.212	12		
0.15	11		
0.063	9		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	52.30
Sand	38.40
Fines <0.063mm	9.30

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	65
Curvature Coefficient	0.37

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:

Aleksandra Jurochnik
PL Technical Reviewer
for and on behalf of i2 Analytical Ltd

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.



TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Ground Condition Consultants

Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Contact: Antony Platt

Site Address: Station Road, Havant

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 20-22163

Job Number: 20-22163

Date Sampled: Not Given

Date Received: 27/07/2020

Date Tested: 04/08/2020

Sampled By: Not Given

Test Results:

Laboratory Reference: 1578038

Hole No.: WS101

Sample Reference: CL

Soil Description: Brown sandy CLAY

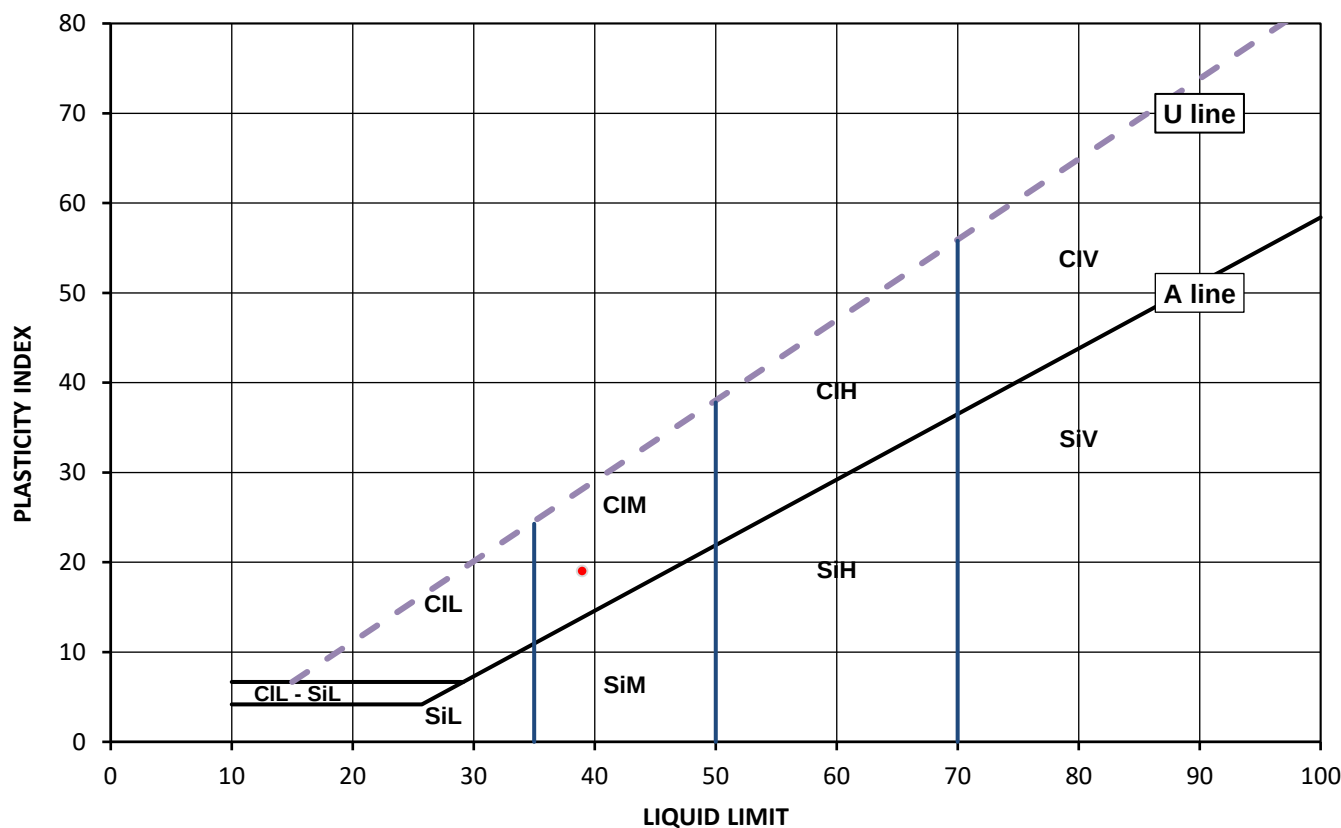
Depth Top [m]: 0.30

Depth Base [m]: 0.80

Sample Type: B

Sample Preparation: Tested in natural condition

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
24	39	20	19	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl Clay	L Low	below 35
Si Silt	M Medium	35 to 50
	H High	50 to 70
	V Very high	exceeding 70
	O Organic	append to classification for organic material (eg CIHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Aleksandra Jurochnik
PL Technical Reviewer
for and on behalf of i2 Analytical Ltd

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Page 1 of 1

Date Reported: 11/08/2020

GF 232.10



TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Ground Condition Consultants
Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Client Reference: 20-22163
Job Number: 20-22163
Date Sampled: Not Given
Date Received: 27/07/2020
Date Tested: 04/08/2020
Sampled By: Not Given

Contact: Antony Platt
Site Address: Station Road, Havant

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

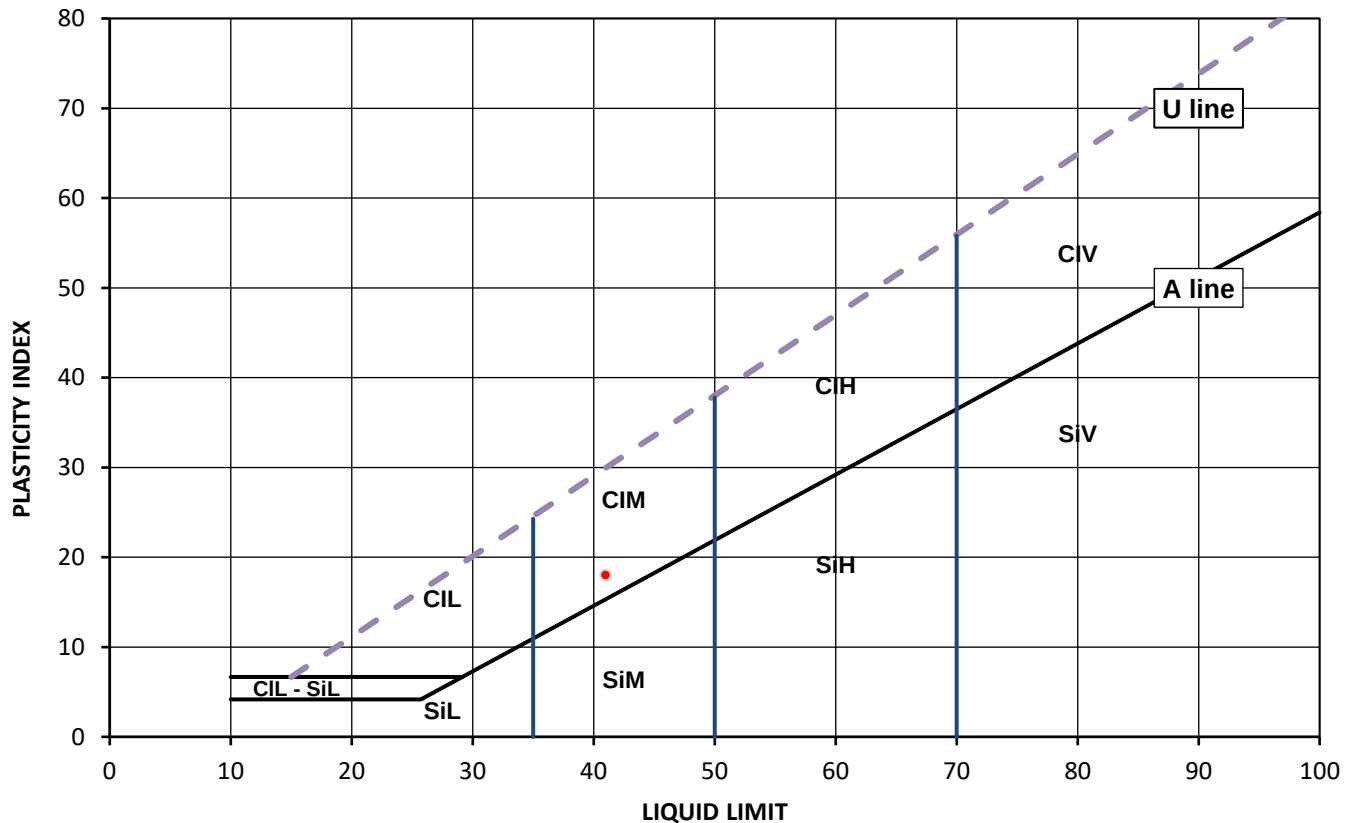
Test Results:

Laboratory Reference: 1578039
Hole No.: WS102
Sample Reference: CL
Soil Description: Brown sandy CLAY

Depth Top [m]: 0.30
Depth Base [m]: 0.80
Sample Type: B

Sample Preparation: Tested in natural condition

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
25	41	23	18	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L Low	50 to 70
	M Medium	exceeding 70
	H High	append to classification for organic material (eg CIHO)
	V Very high	
	O Organic	

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

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TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Ground Condition Consultants

Client Reference: 20-22163

Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Job Number: 20-22163

Date Sampled: Not Given

Date Received: 27/07/2020

Date Tested: 04/08/2020

Sampled By: Not Given

Contact: Antony Platt

Site Address: Station Road, Havant

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 1578044

Hole No.: WS104

Sample Reference: CL

Soil Description: Bluish grey very gravelly slightly sandy CLAY

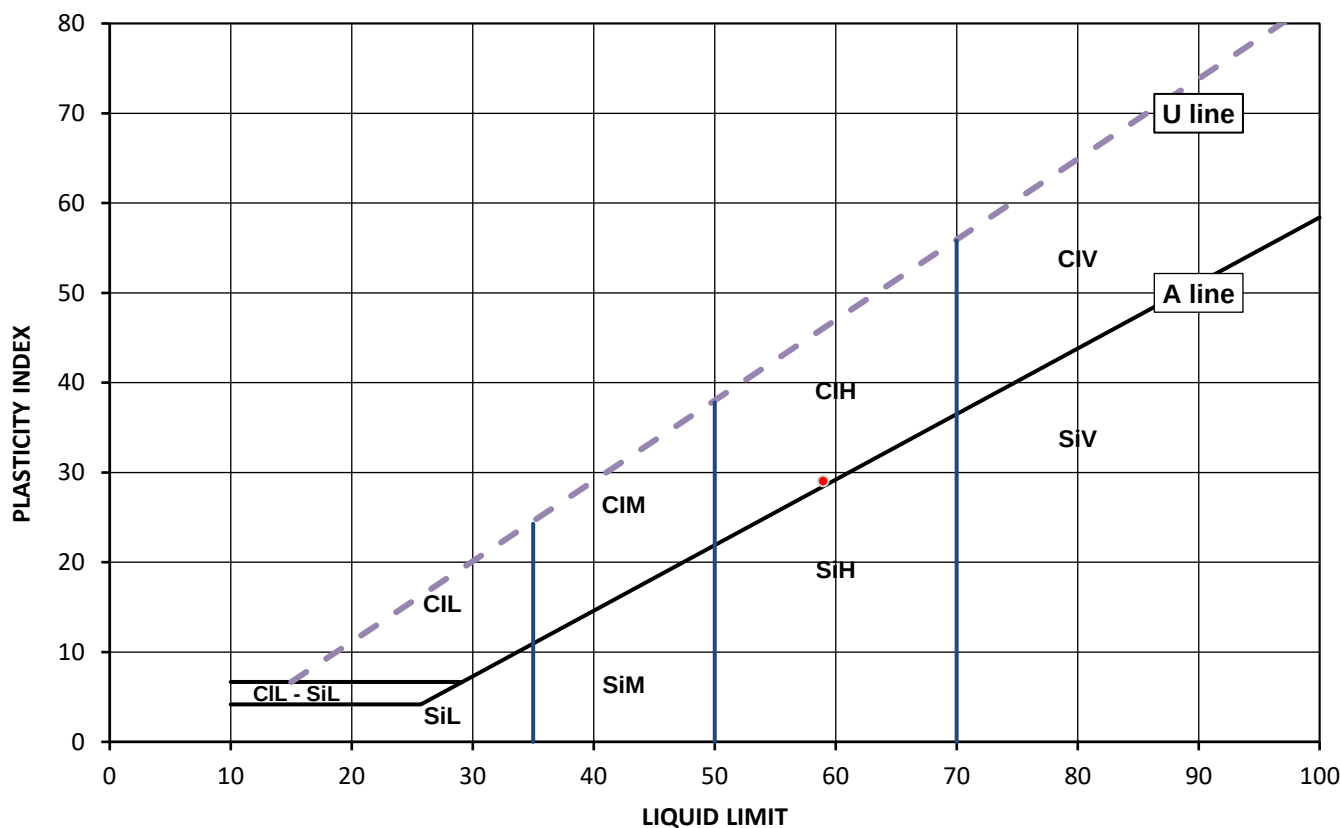
Depth Top [m]: 1.60

Depth Base [m]: 2.00

Sample Type: B

Sample Preparation: Tested after washing to remove >425um

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
13	59	30	29	23



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L Low	50 to 70
	M Medium	exceeding 70
	H High	append to classification for organic material (eg CIHO)
	V Very high	
	O Organic	

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

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PL Technical Reviewer
for and on behalf of i2 Analytical Ltd

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[Signature]

Page 1 of 1

Date Reported: 11/08/2020

GF 232.10



TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Ground Condition Consultants
Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Contact: Antony Platt
Site Address: Station Road, Havant

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 20-22163
Job Number: 20-22163
Date Sampled: Not Given
Date Received: 27/07/2020
Date Tested: 04/08/2020
Sampled By: Not Given

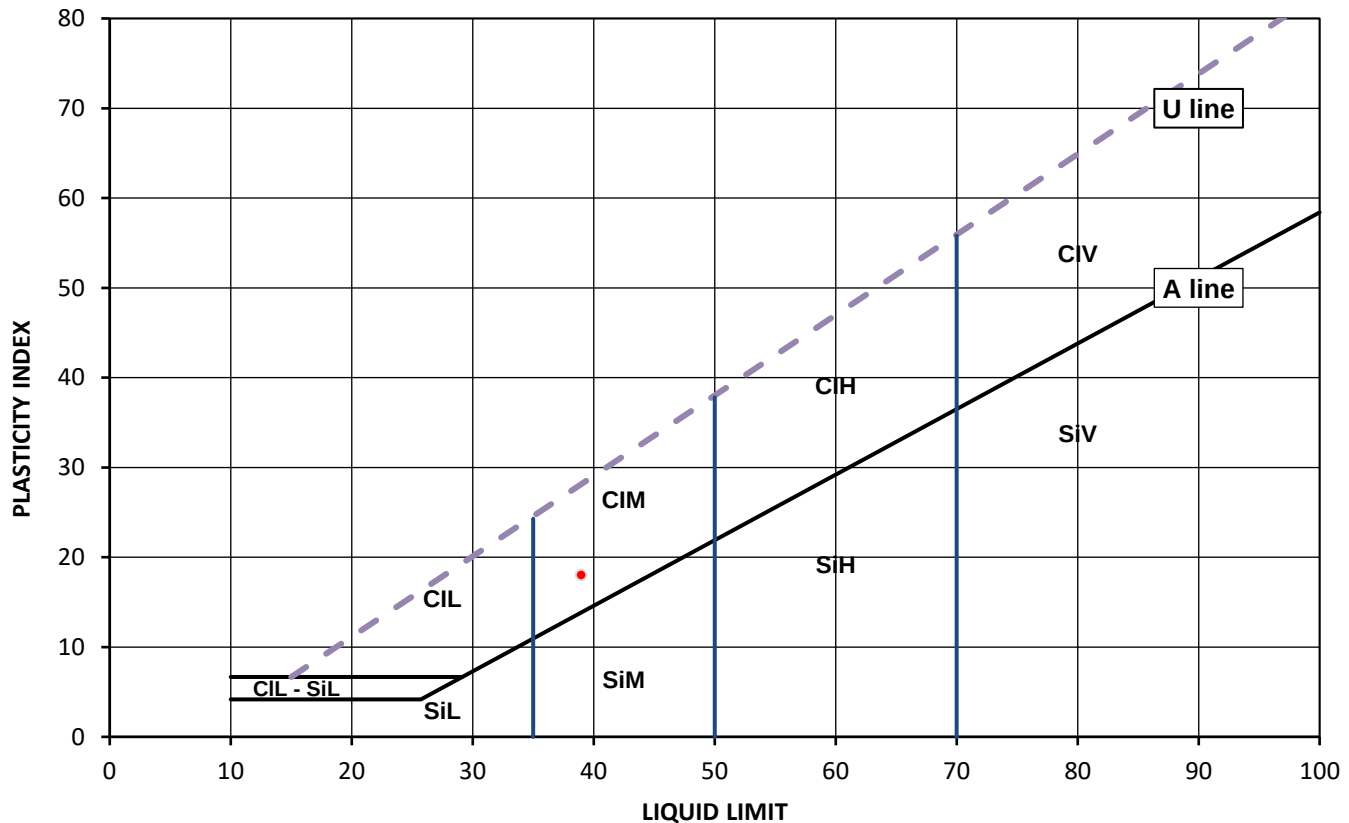
Test Results:

Laboratory Reference: 1578047
Hole No.: WS105
Sample Reference: CL
Soil Description: Brown slightly gravelly sandy CLAY

Depth Top [m]: 0.30
Depth Base [m]: 0.80
Sample Type: B

Sample Preparation: Tested after washing to remove >425um

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425um BS Test Sieve
24	39	21	18	85



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L Low	50 to 70
	M Medium	exceeding 70
	H High	append to classification for organic material (eg CIHO)
	V Very high	
	O Organic	

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

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PL Technical Reviewer
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Page 1 of 1

Date Reported: 11/08/2020

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TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Ground Condition Consultants
Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Contact: Antony Platt
Site Address: Station Road, Havant

Client Reference: 20-22163
Job Number: 20-22163
Date Sampled: Not Given
Date Received: 27/07/2020
Date Tested: 04/08/2020
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

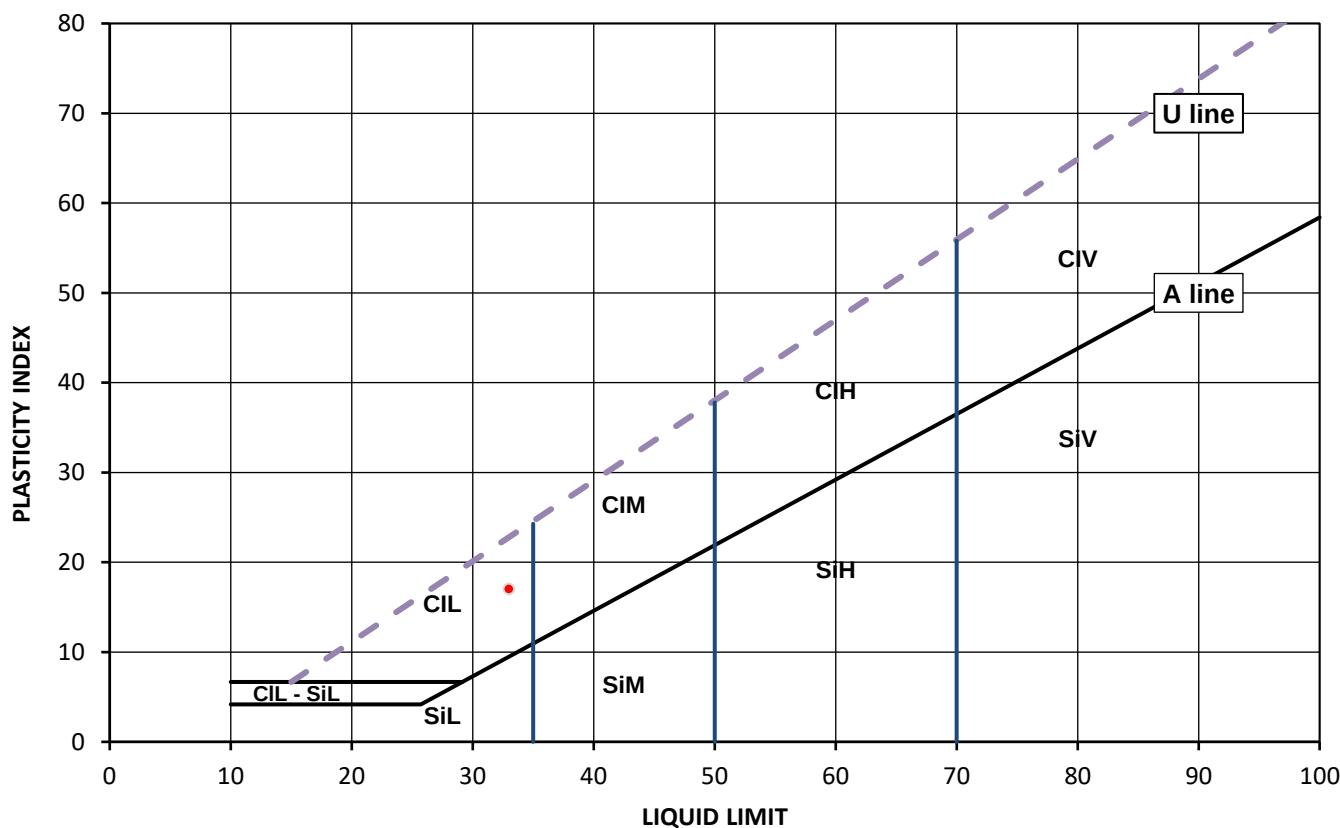
Test Results:

Laboratory Reference: 1578048
Hole No.: WS105
Sample Reference: CL
Soil Description: Brown gravelly very sandy CLAY

Depth Top [m]: 2.00
Depth Base [m]: 2.50
Sample Type: B

Sample Preparation: Tested after washing to remove >425um

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
11	33	16	17	56



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L Low	50 to 70
	M Medium	exceeding 70
	H High	append to classification for organic material (eg CIHO)
	V Very high	
	O Organic	

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

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PL Technical Reviewer
for and on behalf of i2 Analytical Ltd

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[Signature]
Page 1 of 1

Date Reported: 11/08/2020

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TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Ground Condition Consultants

Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Contact: Antony Platt

Site Address: Station Road, Havant

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 20-22163

Job Number: 20-22163

Date Sampled: Not Given

Date Received: 27/07/2020

Date Tested: 04/08/2020

Sampled By: Not Given

Test Results:

Laboratory Reference: 1578050

Hole No.: WS106

Sample Reference: CL

Soil Description: Brown slightly gravelly sandy CLAY

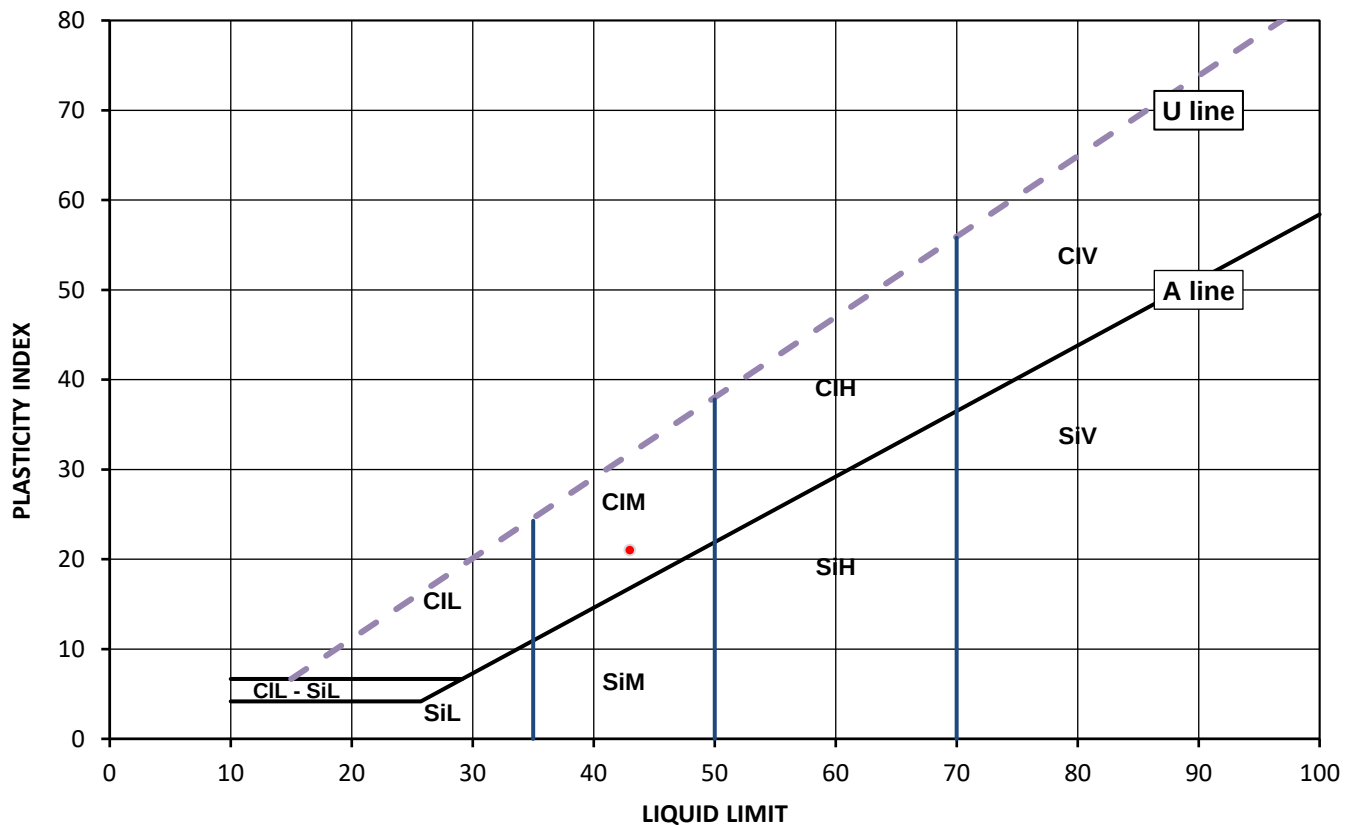
Depth Top [m]: 0.50

Depth Base [m]: 1.00

Sample Type: B

Sample Preparation: Tested after washing to remove >425um

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425um BS Test Sieve
23	43	22	21	97



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L Low	50 to 70
	M Medium	exceeding 70
	H High	append to classification for organic material (eg CIHO)
	V Very high	
	O Organic	

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

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Page 1 of 1

Date Reported: 11/08/2020

GF 232.10



SUMMARY REPORT

Summary of Classification Test Results

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Tested in Accordance with:

Client: Ground Condition Consultants
Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Moisture Content by BS 1377-2: 1990: Clause 3.2; Water Content by BS EN
17892-1: 2014; Atterberg by BS 1377-2: 1990: Clause 4.3 (4 Point Test),
Clause 4.4 (1 Point Test) and 5; PD by BS 1377-2: 1990: Clause 8.2

Client Reference: 20-22163
Job Number: 20-22163
Date Sampled: Not Given
Date Received: 27/07/2020
Date Tested: 04/08/2020
Sampled By: Not Given

Contact: Antony Platt
Site Address: Station Road, Havant

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	Moisture Content [W]	Water Content [W]	Atterberg				Density			Total Porosity#		
		Reference	Depth Top m	Depth Base m	Type					% Passing 425um	WL	Wp	Ip	bulk	dry	PD			
								%	%	%	%	%	%	Mg/m3	Mg/m3	Mg/m3	%		
1578038	WS101	CL	0.30	0.80	B	Brown sandy CLAY	Atterberg 1 Point	24		100	39	20	19						
1578039	WS102	CL	0.30	0.80	B	Brown sandy CLAY	Atterberg 1 Point	25		100	41	23	18						
1578044	WS104	CL	1.60	2.00	B	Bluish grey very gravelly slightly sandy CLAY	Atterberg 1 Point	13		23	59	30	29						
1578047	WS105	CL	0.30	0.80	B	Brown slightly gravelly sandy CLAY	Atterberg 1 Point	24		85	39	21	18						
1578048	WS105	CL	2.00	2.50	B	Brown gravelly very sandy CLAY	Atterberg 1 Point	11		56	33	16	17						
1578050	WS106	CL	0.50	1.00	B	Brown slightly gravelly sandy CLAY	Atterberg 1 Point	23		97	43	22	21						

Note: # Non accredited; NP - Non plastic

Comments:

Signed:

Aleksandra Jurochnik
PL Technical Reviewer
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Client: Ground Condition Consultants
 Client Address: 10 Waldegrave Close, Southampton,
 S019 9RY

Contact: Antony Platt
 Site Address: Station Road, Havant

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

TEST CERTIFICATE
Unconsolidated Undrained
Triaxial Compression
 Tested in Accordance with:
 BS 1377-7: 1990: Clause 8

i2 Analytical Ltd
 Unit 8 Harrowden Road
 Brackmills Industrial Estate
 Northampton NN4 7EB



Client Reference: 20-22163
 Job Number: 20-22163
 Date Sampled: Not Given
 Date Received: 27/07/2020
 Date Tested: 04/08/2020
 Sampled By: Not Given

Test Results:

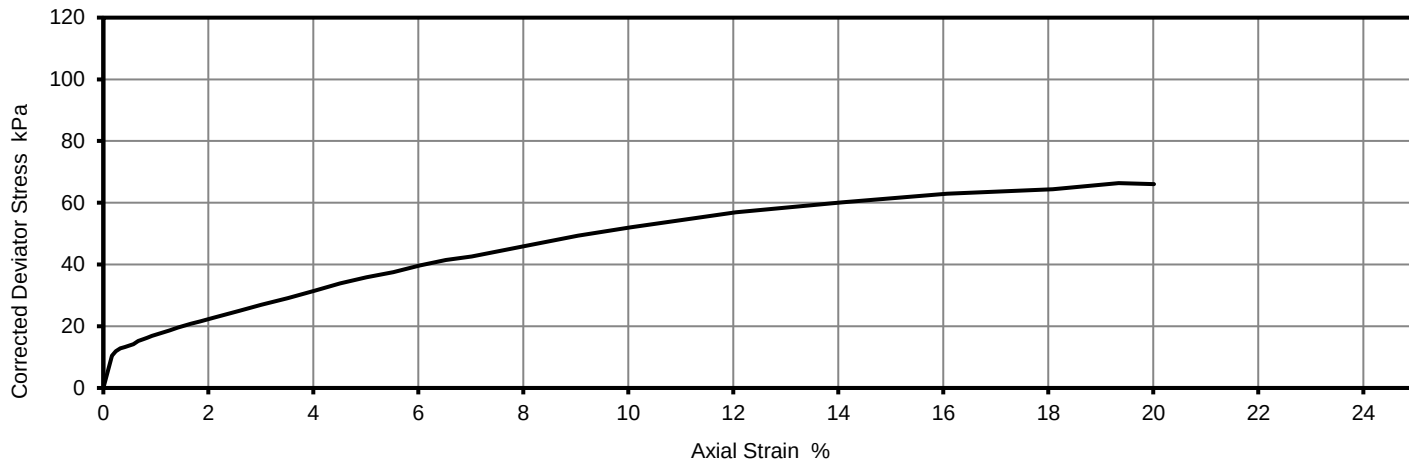
Laboratory Reference: 1578038
 Hole No.: WS101
 Sample Reference: CL
 Sample Description: Brown sandy CLAY

Depth Top [m]: 0.30
 Depth Base [m]: 0.80
 Sample Type: B

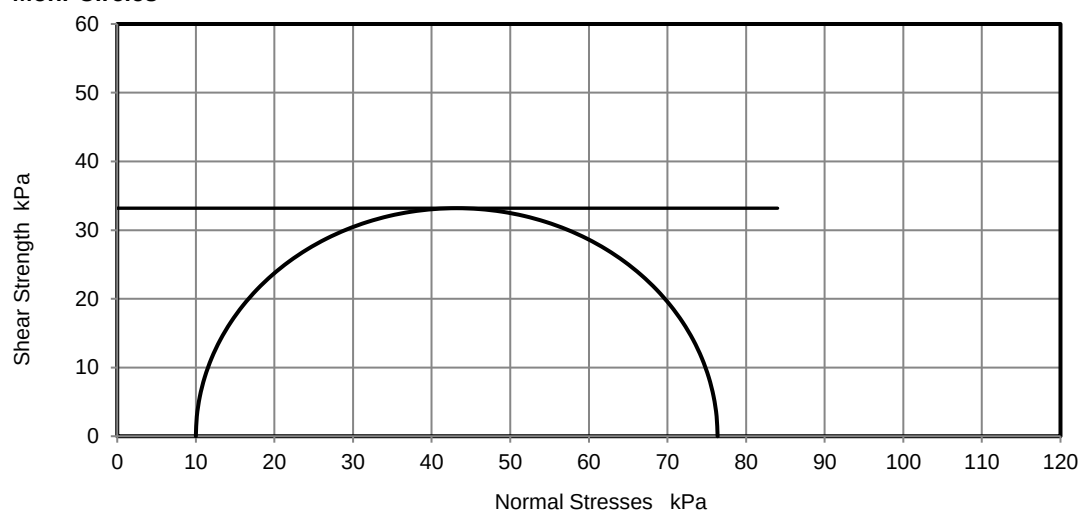
Test Number	1
Length	198.28 mm
Diameter	100.02 mm
Bulk Density	1.93 Mg/m ³
Moisture Content	24 %
Dry Density	1.56 Mg/m ³
Membrane Correction	0.86 kPa

Rate of Strain	1.00 %/min
Cell Pressure	10 kPa
Axial Strain at failure	19.3 %
Deviator Stress, $(\sigma_1 - \sigma_3)_f$	66 kPa
Undrained Shear Strength, c_u	33 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Plastic
Membrane thickness	0.23 mm

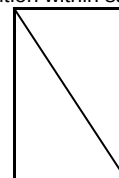
Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Note: Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377.
 This is provided for information only.

Remarks: Recompacted at NMC using 2.5kg (light) rammer

Signed:

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 PL Technical Reviewer
 for and on behalf of i2 Analytical Ltd

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 Client Address: 10 Waldegrave Close, Southampton,
 S019 9RY

Contact: Antony Platt
 Site Address: Station Road, Havant

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

TEST CERTIFICATE
Unconsolidated Undrained
Triaxial Compression
 Tested in Accordance with:
 BS 1377-7: 1990: Clause 8

i2 Analytical Ltd
 Unit 8 Harrowden Road
 Brackmills Industrial Estate
 Northampton NN4 7EB



Client Reference: 20-22163
 Job Number: 20-22163
 Date Sampled: Not Given
 Date Received: 27/07/2020
 Date Tested: 04/08/2020
 Sampled By: Not Given

Test Results:

Laboratory Reference: 1578042
 Hole No.: WS103
 Sample Reference: CL
 Sample Description: Brown sandy gravelly CLAY

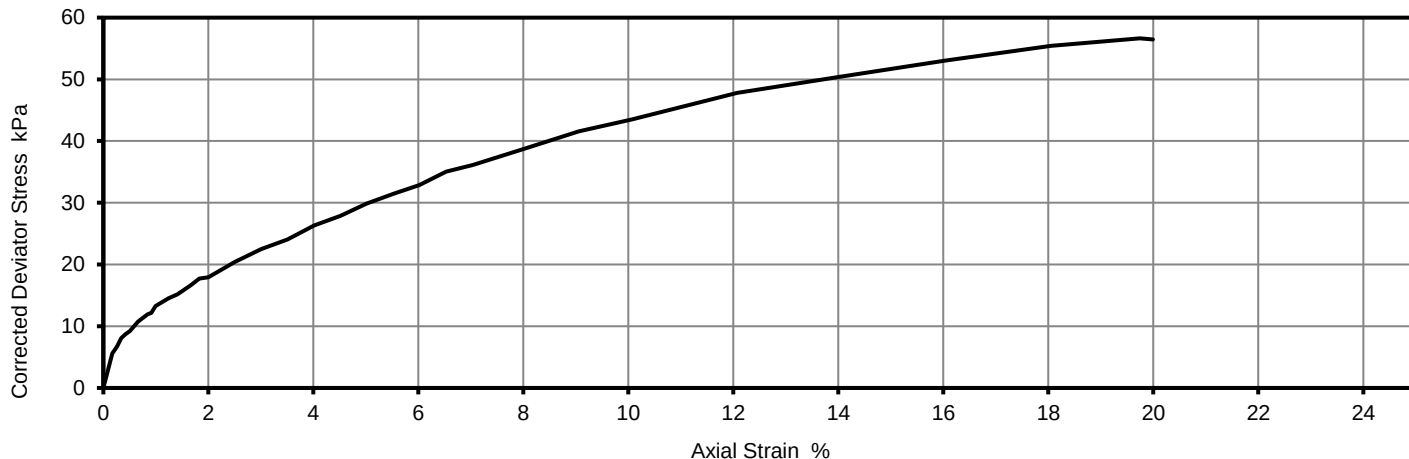
Depth Top [m]: 0.70
 Depth Base [m]: 1.00
 Sample Type: B

Test Number	1
Length	196.83 mm
Diameter	100.03 mm
Bulk Density	2.06 Mg/m ³
Moisture Content	24 %
Dry Density	1.66 Mg/m ³
Membrane Correction	0.95 kPa

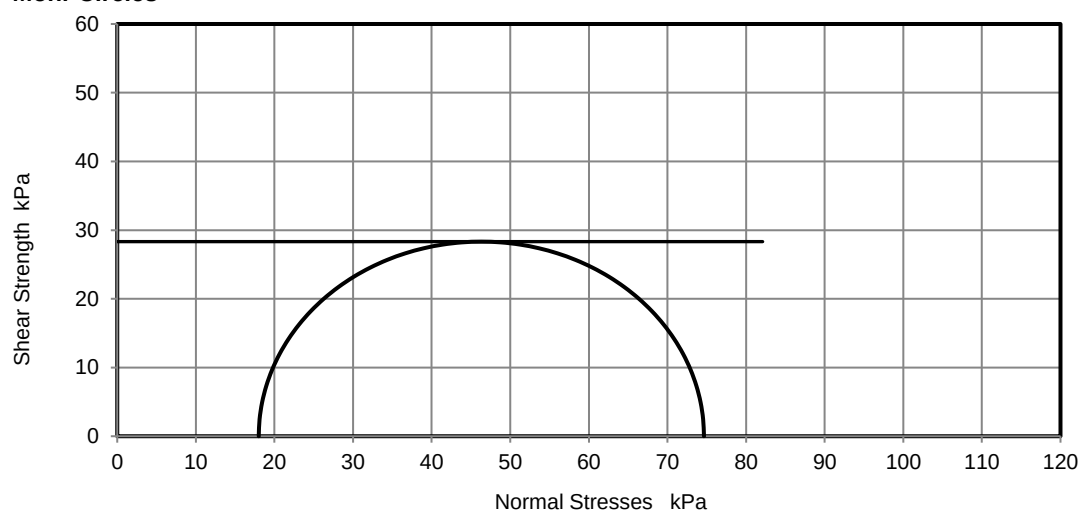
Rate of Strain
 Cell Pressure
 Axial Strain at failure
 Deviator Stress, $(\sigma_1 - \sigma_3)_f$
 Undrained Shear Strength, c_u
 Mode of Failure
 Membrane thickness

1.00	%/min
18	kPa
19.7	%
57	kPa
28	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Plastic	
0.25	mm

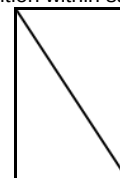
Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Note: Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377.
 This is provided for information only.

Remarks: Recompacted at NMC using 2.5kg (light) rammer

Signed:

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 PL Technical Reviewer
 for and on behalf of i2 Analytical Ltd

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 Client Address: 10 Waldegrave Close, Southampton,
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Contact: Antony Platt
 Site Address: Station Road, Havant

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

TEST CERTIFICATE
Unconsolidated Undrained
Triaxial Compression
 Tested in Accordance with:
 BS 1377-7: 1990: Clause 8

i2 Analytical Ltd
 Unit 8 Harrowden Road
 Brackmills Industrial Estate
 Northampton NN4 7EB



Environmental Science

Client Reference: 20-22163
 Job Number: 20-22163
 Date Sampled: Not Given
 Date Received: 27/07/2020
 Date Tested: 04/08/2020
 Sampled By: Not Given

Test Results:

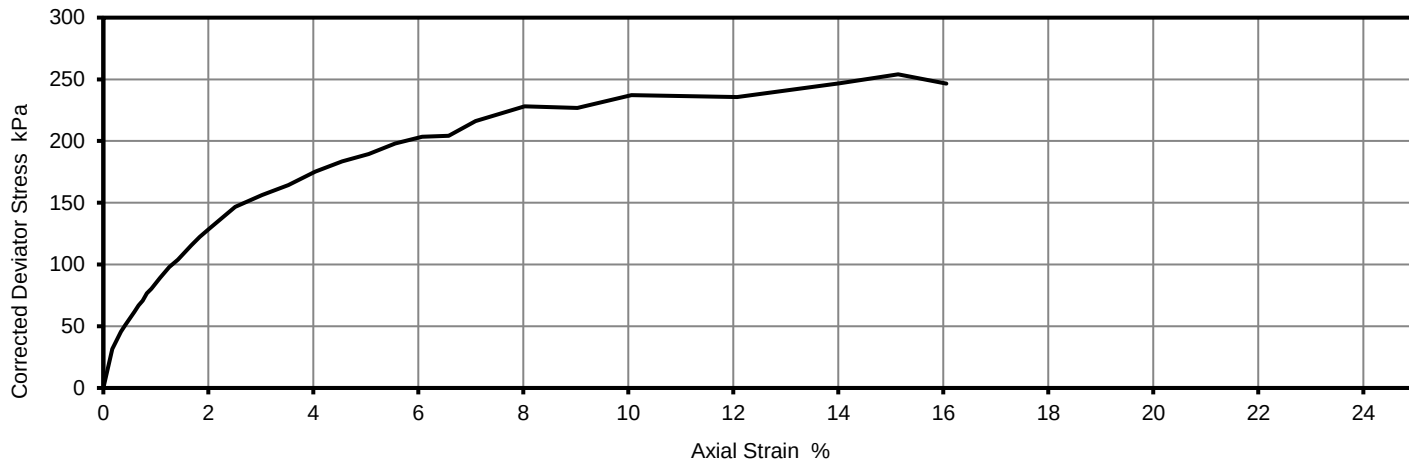
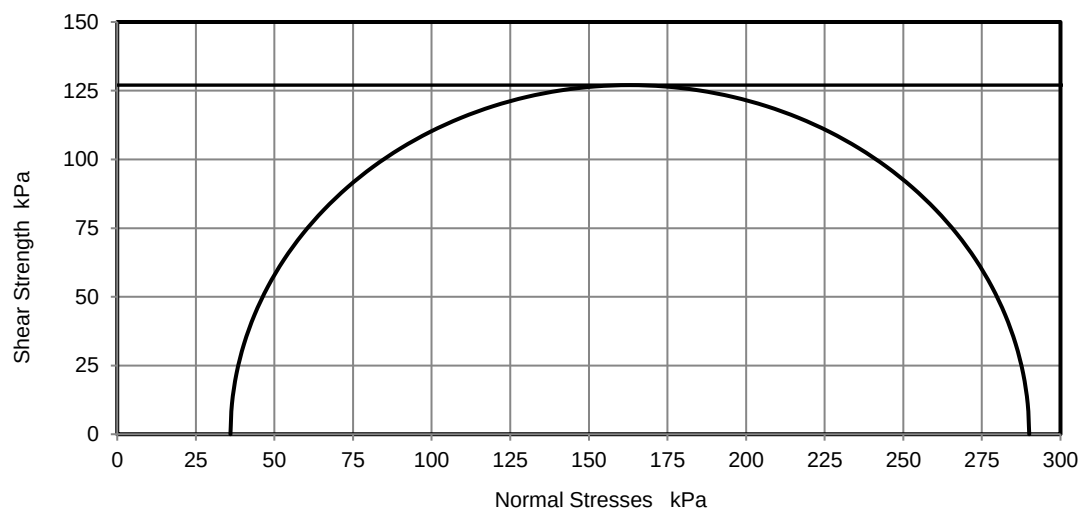
Laboratory Reference: 1578044
 Hole No.: WS104
 Sample Reference: CL
 Sample Description: Bluish grey very gravelly slightly sandy CLAY

Depth Top [m]: 1.60
 Depth Base [m]: 2.00
 Sample Type: B

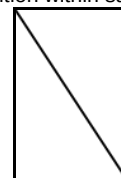
Test Number	1
Length	206.20 mm
Diameter	105.26 mm
Bulk Density	2.07 Mg/m ³
Moisture Content	13 %
Dry Density	1.82 Mg/m ³
Membrane Correction	0.78 kPa

Rate of Strain
 Cell Pressure
 Axial Strain at failure
 Deviator Stress, $(\sigma_1 - \sigma_3)_f$
 Undrained Shear Strength, c_u
 Mode of Failure
 Membrane thickness

1.00	%/min
36	kPa
15.1	%
254	kPa
127	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Compound	
0.27	mm

Deviator Stress v Axial Strain**Mohr Circles**

Position within sample



Note: Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377.
 This is provided for information only.

Remarks: Recompacted at NMC using 2.5kg (light) rammer

Signed:

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 PL Technical Reviewer
 for and on behalf of i2 Analytical Ltd

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Page 1 of 1

Date Reported: 11/08/2020

GF 184.11



4041

Client: Ground Condition Consultants
 Client Address: 10 Waldegrave Close, Southampton,
 S019 9RY

Contact: Antony Platt
 Site Address: Station Road, Havant

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

TEST CERTIFICATE
Unconsolidated Undrained
Triaxial Compression
 Tested in Accordance with:
 BS 1377-7: 1990: Clause 8

i2 Analytical Ltd
 Unit 8 Harrowden Road
 Brackmills Industrial Estate
 Northampton NN4 7EB



Client Reference: 20-22163
 Job Number: 20-22163
 Date Sampled: Not Given
 Date Received: 27/07/2020
 Date Tested: 04/08/2020
 Sampled By: Not Given

Test Results:

Laboratory Reference: 1578048
 Hole No.: WS105
 Sample Reference: CL
 Sample Description: Brown gravelly very sandy CLAY

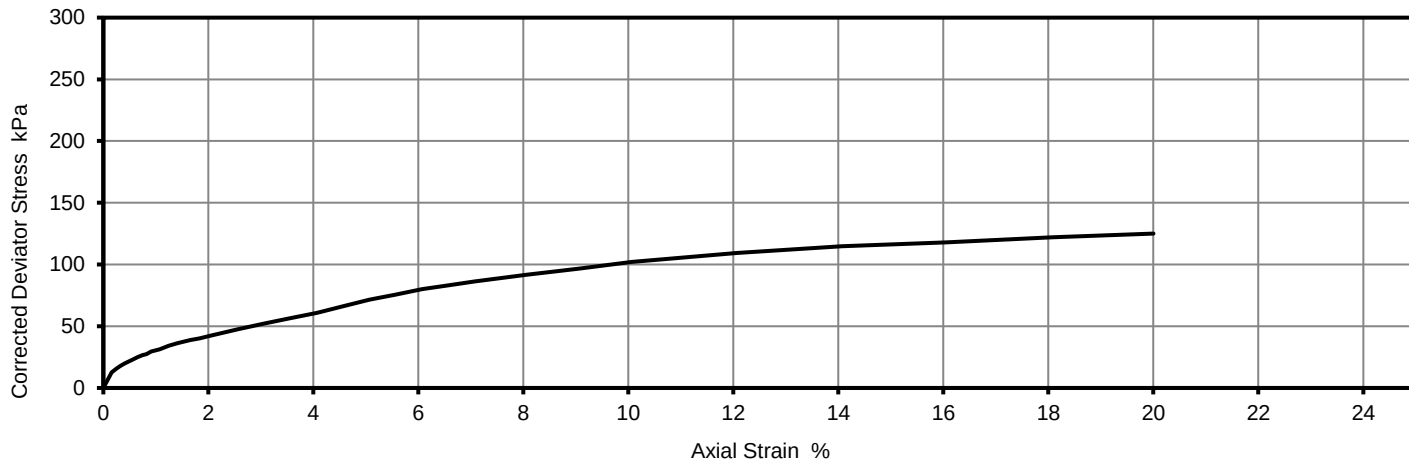
Depth Top [m]: 2.00
 Depth Base [m]: 2.50
 Sample Type: B

Test Number	1
Length	199.87 mm
Diameter	101.07 mm
Bulk Density	2.17 Mg/m ³
Moisture Content	11 %
Dry Density	1.96 Mg/m ³
Membrane Correction	0.99 kPa

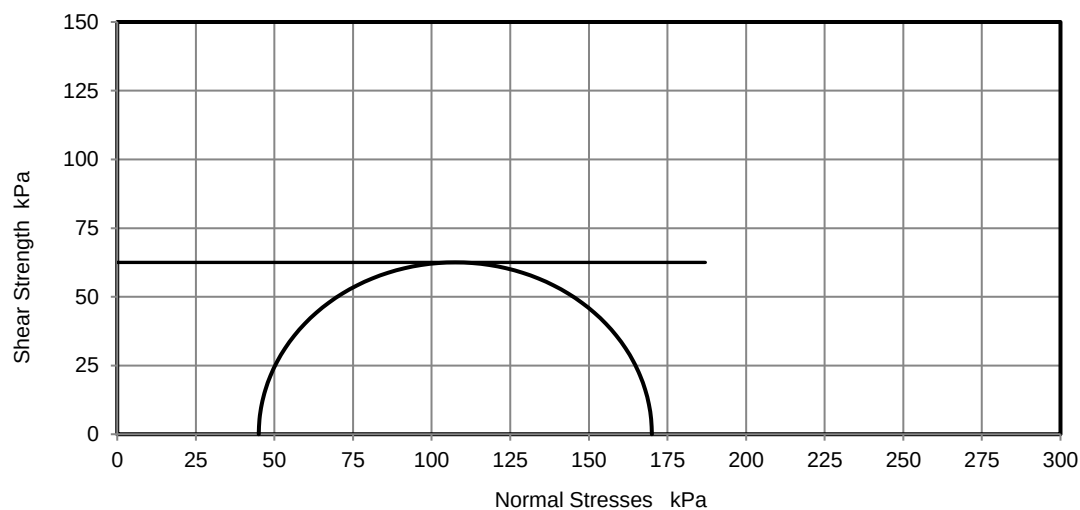
Rate of Strain
 Cell Pressure
 Axial Strain at failure
 Deviator Stress, $(\sigma_1 - \sigma_3)_f$
 Undrained Shear Strength, c_u
 Mode of Failure
 Membrane thickness

1.00	%/min
45	kPa
20.0	%
125	kPa
63	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Compound	
0.26	mm

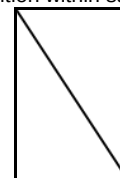
Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Note: Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377.
 This is provided for information only.

Remarks: Recompacted at NMC using 2.5kg (light) rammer

Signed:

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 PL Technical Reviewer
 for and on behalf of i2 Analytical Ltd

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Aleksandra Jurochnik

**Antony Platt**

Ground Condition Consultants
10 Waldegrave Close
Southampton
SO19 9RY

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

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e: aplatt@groundcc.com

Analytical Report Number : 20-22183

Project / Site name:	Station Road, Havant	Samples received on:	27/07/2020
Your job number:		Sample instructed/ Analysis started on:	29/07/2020
Your order number:		Analysis completed by:	11/08/2020
Report Issue Number:	1	Report issued on:	11/08/2020
Samples Analysed:	6 soil samples		

Signed:

Joanna Wawrzeczko
Technical Reviewer (Reporting Team)

For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

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

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

Iss No 20-22183-1 Station Road, Havant.XLS

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The results included within the report relate only to the sample(s) submitted for testing.

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Project / Site name: Station Road, Havant

Lab Sample Number				1578152	1578153	1578154	1578155	1578156
Sample Reference				WS101	WS102	WS104	WS104	WS105
Sample Number				CL	GR	GR	SA	CL
Depth (m)				1.50-2.00	1.60-2.00	2.00-3.00	3.00-4.00	1.30-1.70
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	15	7.0	8.7	11	16
Total mass of sample received	kg	0.001	NONE	0.50	0.50	0.50	0.50	0.50

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.8	6.8	6.9	7.2	7.9
Total Sulphate as SO ₄	%	0.005	MCERTS	0.011	-	-	-	0.014
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0066	0.0071	0.016	0.0076	0.017
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	2.3	-	-	-	4.1
Total Sulphur	%	0.005	MCERTS	0.007	-	-	-	0.010
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0	-	-	-	< 2.0

Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	< 5.0	-	-	-	7.7
Magnesium (leachate equivalent)	mg/l	2.5	NONE	< 2.5	-	-	-	3.9

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Project / Site name: Station Road, Havant

Lab Sample Number				1578157				
Sample Reference				WS106				
Sample Number				SA				
Depth (m)				2.80-3.80				
Date Sampled				Deviating				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1				
Moisture Content	%	N/A	NONE	11				
Total mass of sample received	kg	0.001	NONE	0.50				

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.9				
Total Sulphate as SO ₄	%	0.005	MCERTS	-				
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.012				
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-				
Total Sulphur	%	0.005	MCERTS	-				
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-				

Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	-				
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-				



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Project / Site name: Station Road, Havant

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1578152	WS101	CL	1.50-2.00	Light brown clay.
1578153	WS102	GR	1.60-2.00	Light brown sand with gravel.
1578154	WS104	GR	2.00-3.00	Light brown sand with gravel.
1578155	WS104	SA	3.00-4.00	Light brown clay and sand with gravel.
1578156	WS105	CL	1.30-1.70	Brown sandy clay.
1578157	WS106	SA	2.80-3.80	Brown sand with gravel.

Analytical Report Number : 20-22183

Project / Site name: Station Road, Havant

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In house method.	L082-PL	D	MCERTS
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE

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

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

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

Sample Deviation Report



Sample ID	Other ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
WS101	CL	S	20-22183	1578152	a			
WS102	GR	S	20-22183	1578153	a			
WS104	GR	S	20-22183	1578154	a			
WS104	SA	S	20-22183	1578155	a			
WS105	CL	S	20-22183	1578156	a			
WS106	SA	S	20-22183	1578157	a			

APPENDIX 7: SHALLOW FOUNDATION CALCULATIONS

Project Title:		Station Road		 Ground Condition Consultants	
Shallow Foundation		Strip / Trench Fill			
Determination of Bearing Resistance		Calcs by	DF	Checked by	RP

<u>Design Approach 1</u>	<u>Characteristic Geotechnical Parameters</u>	
Combination 1 A1 + M1 + R1	Unit Weight	18
	Shearing Resistance	38
	Cohesion	0

<u>Material Properties and Resistance</u>	<u>Foundation Size</u>	
Partial factors set M1: $\gamma_\phi = 1$ and $\gamma_c = 1$	depth	1.2
	breadth	0.6
	length	10

Design shearing resistance is $\phi_d = \tan^{-1} \left(\frac{\tan \phi_K}{\gamma_\phi} \right) = 38$

Design cohesion is $c'_d = \frac{c_k}{\gamma_c} = 0$

Bearing Capacity Factors

For overburden $N_q = \left[e^{(\pi \times \tan(\phi_d))} \times \left(\tan \left(45 + \frac{\phi_d}{2} \right) \right)^2 \right] = 48.9$

For cohesion $N_c = [(N_q - 1) \times \cot(\phi_d)] = 61.3$

For self-weight $N_\gamma = [2(N_q - 1) \times \tan(\phi_d)] = 74.8$

Shape Factors

For overburden $s_q = \left[1 + \left(\frac{B}{L} \right) \times \sin(\phi_d) \right] = 1.04$

For cohesion $s_c = \frac{(s_q \times N_q - 1)}{(N_q - 1)} = 1.04$

For self weight $s_\gamma = 1 - 0.3 \times \left(\frac{B}{L} \right) = 0.982$

if load inclined see end of calculation sheet

<u>Bearing Resistance</u>	<u>Groundwater Depth</u>	3.00
----------------------------------	---------------------------------	------

Total overburden at foundation base is $\sigma_{vk,b} = \gamma_k \times d = 21.6$

Partial factors set R1: $\gamma_{Rv} = 1$

From overburden $q_{ult1} = N_q \times s_q \times i_q \times \sigma_{vk,b} = 1095$

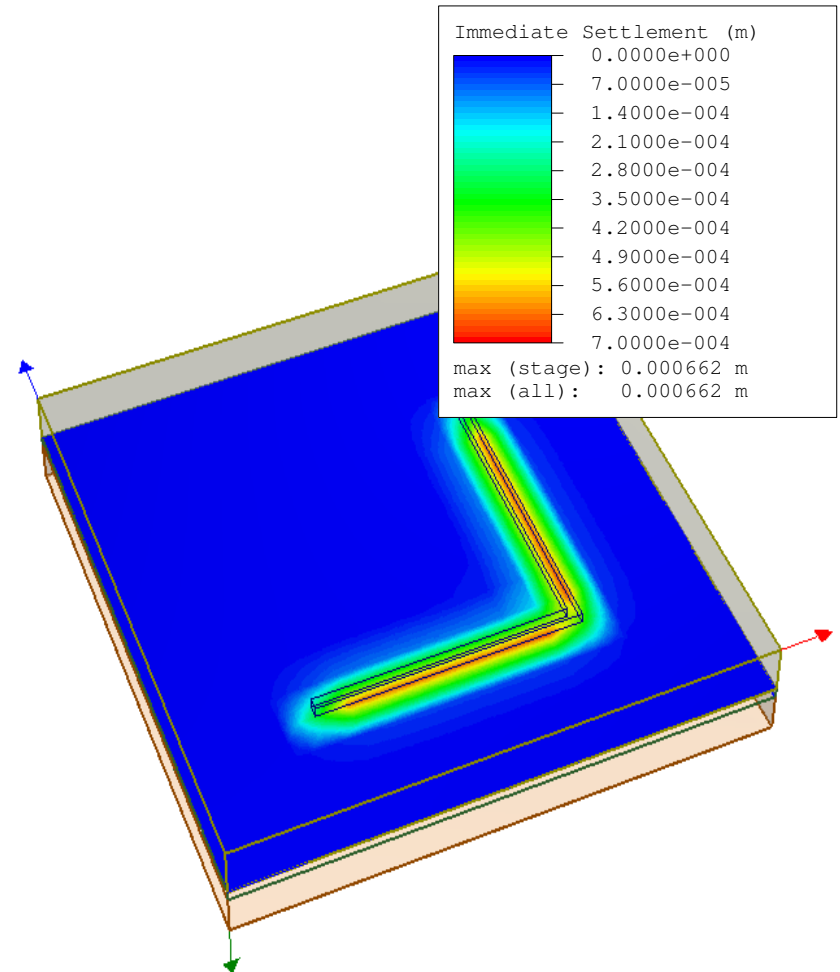
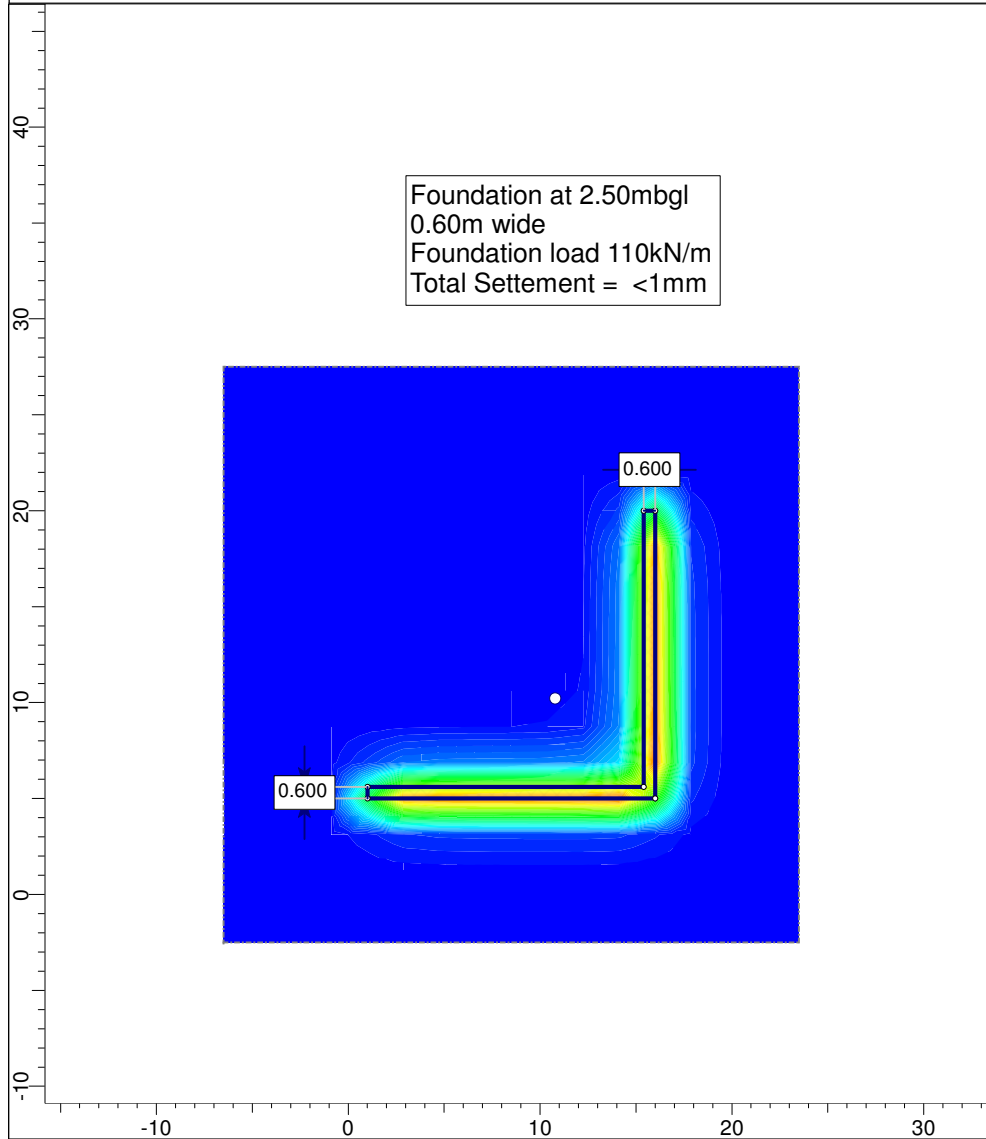
From cohesion $q_{ult2} = N_c \times s_c \times i_c \times c_d = 0$

Project Title:		Station Road		 Ground Condition Consultants						
Shallow Foundation		Strip / Trench Fill								
Determination of Bearing Resistance		Calcs by	DF	Checked by	RP					
						From self-weight	$q_{ult_3} = \left(N_\gamma \times s_\gamma \times i_\gamma \times \gamma_k \times \frac{B}{2} \right) = 476$			
						Total resistance is	$q_{ult} = \sum_{i=1}^3 q_{ult} = 1571$			
						Design resistance is	$q_{Rd} = \frac{q_{ult}}{\gamma_{Rv}} = 1571$			
						<u>Design Approach 1</u>				
						Combination 2 A2 + M2 + R1				
						<u>Material Properties and Resistance</u>				
						Partial factors set M2: $\gamma_\phi = 1.25$ and $\gamma_c = 1.25$				
						Design shearing resistance is	$\phi_d = \tan^{-1} \left(\frac{\tan \phi_k}{\gamma_\phi} \right) = 32.0$			
						Design cohesion is	$c'_d = \frac{c_k}{\gamma_c} = 0$			
<u>Bearing Capacity Factors</u>										
For overburden	$N_q = \left[e^{(\pi \times \tan(\phi_d))} \times \left(\tan \left(45 + \frac{\phi_d}{2} \right) \right)^2 \right] = 23.2$									
For cohesion	$N_c = [(N_q - 1) \times \cot(\phi_d)] = 35.5$									
For self-weight	$N_\gamma = [2(N_q - 1) \times \tan(\phi_d)] = 27.7$									
<u>Shape Factors</u>										
For overburden	$s_q = \left[1 + \left(\frac{B}{L} \right) \times \sin(\phi_d) \right] = 1.03$									
For cohesion	$s_c = \frac{(s_q \times N_q - 1)}{(N_q - 1)} = 1.03$									
For self weight	$s_\gamma = 1 - 0.3 \times \left(\frac{B}{L} \right) = 0.982$									

Project Title:		Station Road		 Ground Condition Consultants						
Shallow Foundation		Trench Fill								
Determination of Bearing Resistance		Calcs by	DF	Checked by	RP					
<u>Bearing Resistance</u> Total overburden at foundation base is $\sigma_{vk,b} = \gamma_k \times d = 21.6$ Partial factors set R1: $\gamma_{Rv} = 1$ From overburden $q_{ult1} = N_q \times s_q \times i_q \times \sigma_{vk,b} = 516$ From cohesion $q_{ult2} = N_c \times s_c \times i_c \times c_d = 0$ From self-weight $q_{ult3} = \left(N_\gamma \times s_\gamma \times \gamma_k \times i_\gamma \times \frac{B}{2} \right) = 176$ Total resistance is $q_{ult} = \sum_{i=1}^3 q_{ult_i} = 693$ Design resistance is $q_{Rd} = \frac{q_{ult}}{\gamma_{Rv}} = 693$ Load Inclination (Angle to the Vertical) 0					Note Vertical Load					
<table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td>ic</td><td>1.00</td></tr> <tr><td>iq</td><td>1.00</td></tr> <tr><td>iγ</td><td>1.00</td></tr> </table>		ic	1.00	iq		1.00	i γ	1.00		
ic	1.00									
iq	1.00									
i γ	1.00									
Design Approach	Combination	Design Resistance (kN/m ²)								
DA1	Combination 1	1571								
	Combination 2	693								

Stage 1

Data Type: Immediate Settlement



Project	Station Road		
Analysis Description	Strip Foundation		
Drawn By	Dr David Fall	Company	Ground Conditons Consultants
Date	28/08/2020, 10:49:04	File Name	Settlement 1.s3z